PROGRESS REPORT NO. 2

COAL HYDROGASIFICATION PILOT PLANT

FOR

INSTITUTE OF GAS TECHNOLOGY

CHICAGO, ILLINOIS

W-1784

TABLE OF CONTENTS

Progress Report No. 2

W-1784

COAL HYDROGASIFICATION PILOT PLANT

I. SUMMARY

A. DEVELOPMENT OF THE GUARANTEED MAXIMUM PRICE - W - 1784 - X - 1

Piping and Instrument Diagrams for the Coal Handling and Pretreating, Reaction, Gas Purification and Methanation Sections have been completed with the exception of line sizing which is fifty percent (50%) complete. The P&ID for Blowdown and Disposal is complete except for exact methods of incineration and char disposal. The Superheated H_2/ Steam P&ID is underway.

Specifications for the Matherial Handling Equipment Package have been completed and will be sent to IGT for approval the week of September 16th.

The general equipment arragnement and piping study will begin September 16th. A one-eight inch block model will be initated October 1st.

Revisions to the Project Coordination Procedure were issued September 9, 1968. Purchasing and Accounting Procedures will be finalized and issued shortly.

This first phase of the project in which the Guaranteed Maximum Price will be established is estimated to be twenty percent (20%) complete.

B. DESIGN ENGINEERING - W - 1784

Quotations for the Hydrogasifier Reactor are due September 16th. Discussions have been held with one of the vessel fabrications and further discussions with the other fabricators will be held during the next month to review the quotations received.

Design and construction of the Control House has been postponed until the design basis has been more completely established.

It is anticipated that the following construction work will be done this year:

1) Erection of the Warehouse Building as a complete subcontracted package.
2) Foundation, fencing, etc., as required for the main electrical substation in which Edison Company will install their high voltage transformer and electrical gear.
3) Subgrade work for the roadways and parking lots.
4) Required plant perimeter fencing.
5) Major foundations that can be located and defined by the general arrangement study.

II. BAR CHART SCHEDULE

The schedule for establishing the Guaranteed Maximum Price has been revised and will be the basis for Procon's activity during this first phase of the project. These schedules indicate performance to date and will be updated each month to show performance and any anticipated schedule changes. These bar charts reflect only "early start" and "late finish" dates for the work to be done.

SCHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION

A - APPROVAL
PO - PLACE PURCHASE ORDER

PROTON

SCHEDULE
PROGRESS

Sheet 1 Rev. 1
Date 9-15-68
By
Job No. W-1784

E – Engineering & Drafting
P – Procurement of Materials
C – Field Construction Work

CONSTRUCTION ACTIVITY THIS YEAR

	DESCRIPTION OF WORK		TIME IN WKS FROM STARTING DATE OF: 7-15-68 — COMPLETE
			7/15 1 2/2 2 3/4 3 4/5 4 5/12 5 6/19 6 7/26 7 8/2 8 9/9 9 10/16 10 11/23 11 12/30 12 13/7 13 14/14 14 15/21 15 16/28 16 17/4 17 18/11 18 19/18 19 20/25 21 22/2 22 23 (%)
01	PLOT PLAN	E	PRELIM — GENERAL ARRANGEMENT STUDY — REVISIONS
		P	
		C	
	FOUNDATIONS	E	
		P	
		C	
10	BUILDINGS WAREHOUSE	E	PO — DEL
		P	
		C	
12	ELECTRICAL DISTRIBUTION	E	
		P	
		C	
20	PRELIMINARY SITE WORK	E	
		P	
		C	
		E	
		P	
		C	
		E	
		P	
		C	
		E	
		P	
		C	
		E	
		P	
		C	
		E	
		P	
		C	
		E	
		P	
		C	
		E	
		P	
		C	
		E	
		P	

SCHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION

A-APPROVAL
PO-PLACE PURCHASE ORDER

PROJON

SCHEDULE
PROGRESS

Sheet 2 Rev. 1
Date 9-15-68
By
Job No. W-1784

E – ~~Engineering~~ Drafting WRITE REQ./DWG.
P – ~~Procurement~~ of Materials OBTAIN QUOTES & REVIEW BIDS
C – ~~Field Construction Work~~ ESTIMATE

GENERAL-10

	DESCRIPTION OF WORK		TIME IN MONTHS FROM STARTING DATE OF: 7-15-68	COMPLETE (%)
01	PLOT PLAN	E E E	PRELIM; BLOCK MODEL; GEN. ARRANGEMENT STUDY; REVISIONS	
03	STEEL STRUCTURES	E P C		
10	BUILDINGS	E P C		
11	PIPING. STUDY	E P C	LINE STUDY; A; REV.; PIPING TAKE-OFF	
12	ELECTRICAL DISTRIBUTION	E P C	PARTIAL	
13	CONTROL BOARD	E P C		
18	FIRE PROTECTION	E P C	PARTIAL	
25	COMMUNICATION	E P C	PARTIAL	
29	PAVING & FINAL GRADING	E P C		
		E P C		
		E P C		
		E P C		
		E P C		
		E P C		

SCHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION

A.- APPROVAL
PO- PLACE PURCHASE ORDER

Sheet 3 Rev. 1
Date 9-15-68
By
Job No. W-1784

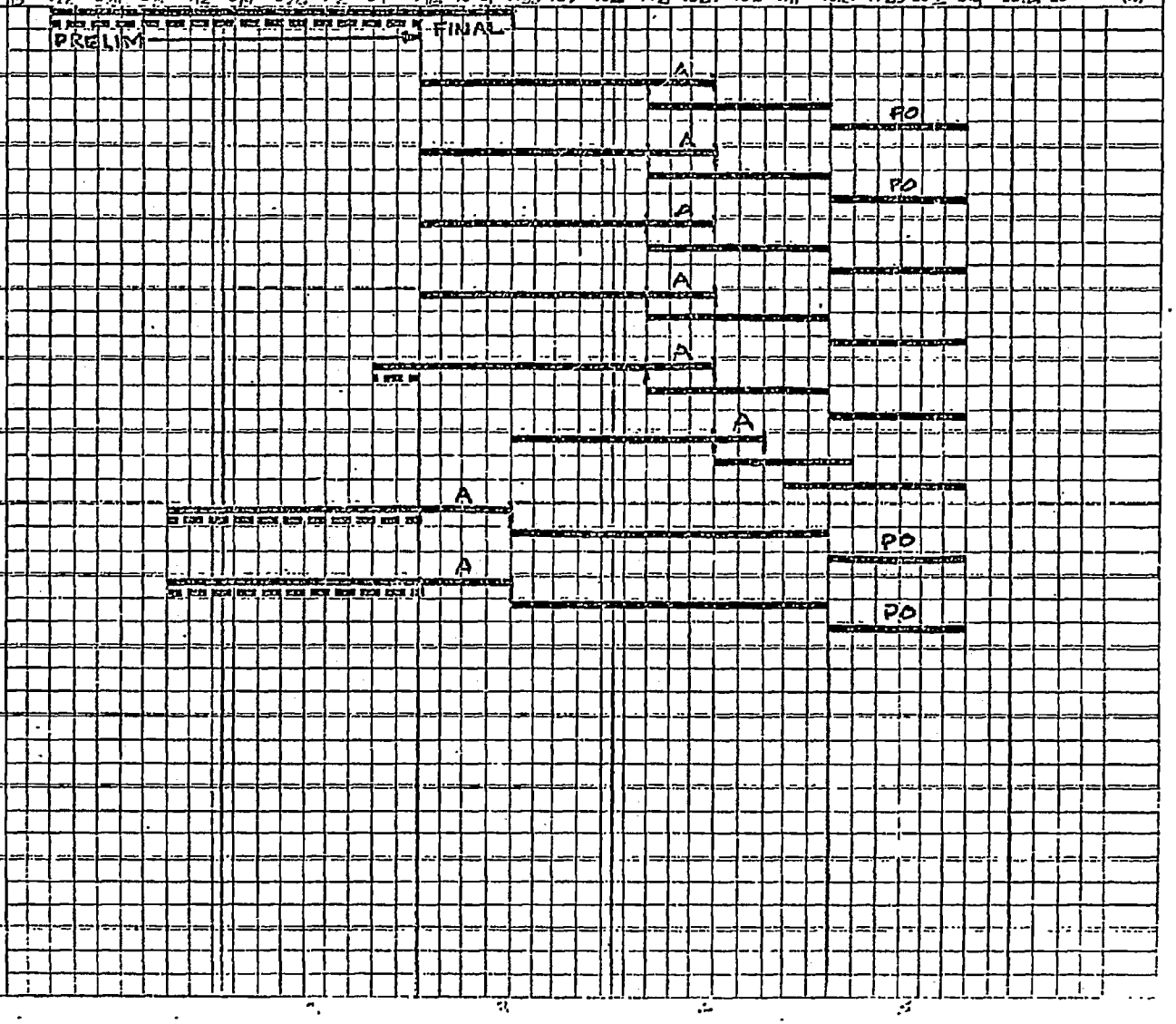
SCHEDULE
PROGRESS

E - ~~Engineering & Drafting~~ WRITE REQ./DWG.
P - ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C - ~~Field Construction Work~~ ESTIMATE

COAL HANDLING-1 & PRETREATING-2

TIME IN WKS FROM STARTING DATE OF: 7-15-68

	DESCRIPTION OF WORK		COMPLETE (%)
00	P & I D	E E E	
05	HEATERS	E P C	
06	VESSELS	E P C	
07	EXCHANGERS	E P C	
08	PUMPS	E P C	
09	COMPRESSORS	E P C	
18	INSTRU-MENTATION	E P C	
17	MATERIAL HANDLING EQUIPMENT	E P C	
31	HOPPERS	E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	



SCHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION

A-APPROVAL
PO-PLACE PURCHASE ORDER

PROCON

SCHEDULE
PROGRESS

Sheet 4 Rev. 1
Date 9-15-68
By
Job No. W-1784

E ~~Engineering & Drafting~~ WRITE REQ./DWG.
P ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C ~~Field Construction Work~~ ESTIMATE WKS

REACTION SECTION-3

	DESCRIPTION OF WORK		TIME IN ~~WEEKS~~ FROM STARTING DATE OF: 7-15-68 (7/15 1 22 2 29 3 5 4 12 5 19 6 26 7 3 8 9 9 16 10 24 11 30 12 7 13 14 14 21 15 29 16 4 17 11 18 18 19 25 20 2 21 9 22 16 23 30)	COMPLETE (%)
00	P & ID	E E E	PRELIM — FINAL	
05	HEATERS	E P C	A	
06	VESSELS	E P C	A	
06	REACTOR 3.06-01	E P C	BIDS DUE — REVIEW BIDS — PO — A	
07	EXCHANGERS	E P C	A	
08	PUMPS	E P C	A	
13	INSTRU-MENTATION	E P C	A	
13	REACTOR VALVES	E P C		
32	MIXER	E P C		
		E P C		
		E P C		
		E P C		
		E P C		
		E P C		

REVIEW ESTIMATES

CHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION

A-APPROVAL
PO-PLACE PURCHASE ORDER

SCHEDULE
PROGRESS

Sheet 5 Rev. 1
Date 9-16-63
By
Job No. W-1784

E – ~~Engineering & Drafting~~ WRITE REQ./DWG.
P – ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C – ~~Field Construction Work~~ ESTIMATE

GAS PURIFICATION - 4

	DESCRIPTION OF WORK		TIME IN WEEKS FROM STARTING DATE OF: 7-15-68	COMPLETE (%)
00	P&ID:	E E E	PREL IM — FINAL	
06	VESSELS	E P C	A — PO	
07	EXCHANGERS	E P C	A	
08	PUMPS	E P C	A	
13	INSTRU-MENTATION	E P C		
32	MIXER	E P C		
28	PROCESS FILTER	E P C		
24	CHEMICALS & CATALYST	E P C		
		E P C		
		E P C		
		E P C		
		E P C		
		E P C		
		E P C		

HEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION
A - APPROVAL
PO - PLACE PURCHASE ORDER

SCHEDULE
PROGRESS

Sheet 6 Rev. 1
Date 9-15-68
By
Job No. W-1784

E - ~~Engineering & Drafting~~ WRITE REQ./DWG.
P - ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C - ~~Field Construction Work~~ ESTIMATE

METHANATION SECTION - 5

	DESCRIPTION OF WORK		TIME IN WEEKS FROM STARTING DATE OF: 7-15-68	COMPLETE (%)
00	P & I D.	E E E	PRELIM — FINAL —	
05	HEATERS	E P C	A — PO	
06	VESSELS	E P C	A — PO	
07	EXCHANGERS	E P C	A	
		E P C		
09	COMPRESSORS	E P C	A — PO	
13	INSTRUMENTATION	E P C	A	
24	CHEMICALS & CATALYST	E P C		
		E P C		
		E P C		
		E P C		
		E P C		
		E P C		
		E P C		

SCHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION

A-APPROVAL
PO-PLACE PURCHASE ORDER

SCHEDULE
PROGRESS

Sheet 7 Rev. 1
Date 9-15-68
By
Job No. W-1784

E – Engineering & Drafting WRITE REQ./DWG.
P – Procurement of Materials OBTAIN QUOTES & REVIEW BIDS
C – Field Construction Work ESTIMATES

BLOWDOWN & DISPOSAL-6

	DESCRIPTION OF WORK		TIME IN ~~DAYS~~ WKS FROM STARTING DATE OF: 7-15-68 — COMPLETE
00	P&ID:	E E E	PRELIM → FINAL; A
06	VESSELS	E P C	A
07	EXCHANGERS	E P C	A
08	PUMPS	E P C	A
13	INSTRU-MENTATION	E P C	A
22	INCINERATOR	E P C	A; PO
	ENGINEERED PACKAGE SYSTEMS	E P C	PO
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	

CHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION
A- APPROVAL
PO- PLACE PURCHASE ORDER

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SCHEDULE
PROGRESS

Sheet 8 Rev. 1
Date 9-15-68
By
Job No. W-1784

E – ~~Engineering & Drafting~~ WRITE REQ. / DWG.
P – ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C – ~~Field Construction Work~~ ESTIMATE

UTILITY PLANT-7

	DESCRIPTION OF WORK		TIME IN WEEKS FROM STARTING DATE OF: 7-15-68	COMPLETE
			7/15 1/22 2/29 3/8 4/12 5/19 6/26 7/31 8/1 9/6 10/27 11/30 12/7 13/14 14/21 15/28 16/11 17/11 18/18 19/25 20/2 21/9 22/16 23	(%)
00	UTILITY FLOW DIAGRAMS	E E E		
00	WATER BOILER P & ID	E P C	PRELIM	
00	H_2 STEAM CONTROL P&ID	E P C	PRELIM FINAL	
05	HEATERS	E P C	A P.O.	
06	VESSELS	E P C	A	
08	PUMPS	E P C	A	
09	COMPRESSORS	E P C	A P.O.	
13	INSTRU-MENTATION	E P C	A	
19	BOILERS	E P C	P.O.	
22	INSTRUMENT AIR PACKAGE	E P C		
22	COOLING WATER TREATMENT	E P C		
22	H_2 PLANT	E P C	P.O.	
22	BW TREATMENT	E P C	A	
27	TANKS	E P C		

CONTRACT FINANCIAL REPORT (Dollars in thousands) (See instructions before preparation)	1 For Month Ended	2 No. of Work Days	3 Contract No.	Form Approved Budget Bureau No. 80R0178 Sheet _____ of _____
4 To:	5 From:		6 Contract Value $	7 Contract Type
			8 Funded Contract Amount $	9 Amounts Billed $
10 Program/Scope of Work	11 Signature and Title of Authorized Representative		12 Preparation Date	13 Payments Received $

14 Appropriation (or Fund Citation) and/or Reporting Category	15 Cost Incurred/Contract Earnings			16 Planning Data (For Agency use only)			
	Cum. Actual End of Prior Mo. a	Actual/ Estimated Current Month b	Cumulative Actual/ Estimated To Date c	a	b	c	d
	$	$	$				
Procon Incorporated W-1784	1	1	2				
" " W-1784 X-1	2	9	11				
17 Total							

"The undersigned certifies that the amount is due and payable to Procon, in accordance with the ter-s of the contract up to the date of this Certificate and that Contractor has fully complied with the terms and conditions of the con-contract."

Progress Report No. 2
September 16, 1968

T. A. Taylor

IGT-MPR--10/68

DEVELOPMENT OF IGT HYDROGASIFICATION PROCESS

Progress Report - October 1968

to

Office of Coal Research

Contract No. 14-01-0001-381 (1)

Summary

- Two successful hydrogasification tests were performed.
- Three runs were made in the 300-kW electrothermal gasifier test unit.
- Work required by Procon to arrive at the guaranteed maximum price for construction of the pilot plant is forty percent (40%) complete.

Hydrogasification Test Program

We conducted two successful hydrogasification tests this month in the balanced-pressure development unit (Runs HT-213 and HT-214). These tests are a continuation of our studies started last month on the hydrogasification behavior of a dried, but otherwise untreated, Montana subbituminous coal. One other test (Run HT-215) was also started with the same coal feed but had to be terminated before steady-state operation could be reached when a reactor shell vent valve developed an excessive leak, upsetting the pressure balance between the reactor tube and the shell.

In Run HT-213 the Montana subbituminous coal was reacted in a 3-1/2-ft fluidized bed with a mixture of hydrogen and steam. Feed rates were adjusted so that the hydrogen/coal ratio was 8 SCF/lb and the steam concentration in the feed gas was 50 mole percent. Temperatures in the coal bed were controlled to 1700°F, and those above the coal bed to 1300°F. Carbon gasification in this test was over 38%, reflecting the relatively high reactivity of subbituminous coal.

The hydrogasification behavior of the Montana subbituminous coal with synthesis gas and steam was tested in Run HT-214. The coal reacted in a 3-1/2-ft fluidized bed with a synthesis gas of standard composition (54% hydrogen, 41% carbon monoxide, and 5% carbon dioxide) and with steam. The ratio of $H_2 + CO$ to coal was 8 SCF/lb, and the steam concentration in the feed gas was 50 mole percent. Reactor temperatures were similar to those of Run HT-214. We found that the feeding and solids flow through the reactor were not significantly different from that when the feed gas was hydrogen. This indicates that the lower hydrogen partial pressure in the feed gas did not have an effect on the agglomerating characteristics of this coal. Carbon gasification in Run HT-214 was about 30%. This, as in tests with bituminous coal, indicates that the use of snythesis gas reduces the carbon gasification rate more than hydrogen does at similar gas/coal ratios.

In Run HT-215, which was shut down prematurely because of a mechanical valve failure, the Montana subbituminous coal was reacting with a mixture of hydrogen and steam. Steam concentration in the feed gas was 30 mole percent. Other operating conditions were similar to those of Run HT-213.

Methanation

We continue to investigate the reaction order of H_2, CH_4, and H_2O. The rate of methane formation was found to be 71 times slower at 450°F and 600 psig than at 575°F and the same pressure. The activity of catalysts had decreased when duplicate runs were made at 575°F. This may indicate that the catalyst activity is destroyed at 450°F and that such conditions are not suitable for methanation in our system.

Engineering Economics

We have looked into the various factors involved in making an estimate for a lignite mining operation. Equipment and operating costs will be incorporated into the recently completed pipeline gas-from-lignite plant study as part of the utilitiy financing. We have asked a mining consultant for a proposal to assist us in estimating costs.

Electrothermal Gasification

Three tests, E.G.-2A, 2B, and 2C, were conducted in the electrothermal test gasifier during the month. Nominal conditions for the tests were the same as for Run No. E.G.-1:

Char Feed Rate, lb/hr	30
Steam Feed Rate, lb/hr	30
Reactor Temp, °F	1800
Bed Height, ft	4.5
Electrode Immersion, in.	18
Reactor Press., psig	75

A larger purge rate was applied to the reactor top (200 SCF) to prevent the flow of solids into the area where the electrode enters the reactor. The reactor heat-up period for the three tests was attained by fluidizing hydrogasified char with nitrogen while applying a d-c voltage across the bed to supply the necessary power.

During Run E. G. 2-A the overall resistance decreased to less than 0. 5 ohm when the bed temperature reached 1800°F. The applied voltage was lowered from 100 to 50 V to keep the power input constant. The reactor temperature reached 1950°F before the steam generator was at operating conditions.

As soon as the steam entered the reactor, the overall resistance decreased to about 0.1 ohm and the current flow increased to 2000 A. The d-c generator was turned off manually and the run terminated.

After removing the electrode from the reactor, we observed a buildup of fused char and ash 6-10 inches from the bottom of the electrode, which caused a low-resistance high-current flow condition. Poor fluidization during the nitrogen-to-steam changeover period was believed to be the cause.

During the heat-up period of Run E. G. -2B. the unit pressure rose continuously because of a plug in the product gas exit line at the reactor top. This was caused by a bayonet filter which had slid from the reactor outlet to an elbow in the line and prevented the flow of gas. At 130 psig the run was terminated. The filter insert was rearranged to prevent this from occurring in future tests.

The nitrogen flow to the reactor during the heat-up period of Run E. G. -2C was erratic, indicating a possible leak. Several pressure upsets occurred between the reactor and feed hopper which caused solids to unload into the reactor. This condition would decrease the overall resistance of the bed to below 0. 5 ohm and necessitate the lowering of the d-c voltage applied to the reactor in order to maintain a moderate heat-up rate. The bed level

was lowered to increase the overall resistance. Bed resistance then began to increase uncontrolled, indicating a lower bed level. When the resistance reached 10 ohms, the char feed rate was increased to raise the bed level. The resistance then decreased to 1 ohm, held steady for several minutes, then increased to 10 ohms in 3-4 minutes. After repeating this cycle several times, the run was terminated.

Dismantling of the reactor revealed a plug which began at the electrode tip and extended 12 inches into the reactor. The plug consisted of melted metal dispersed with char particles; it extended from the electrode to the reactor wall. A measurement of the electrode length showed that 13 inches had been melted from the tip. The electrode used at the time was of Type 316 stainless steel. The plug was removed from the reactor. No damage had occurred at the reactor wall.

Inspection of the steam superheater showed that there was a leak in the coil which had caused the fluctuations in gas flows to the unit. The steam superheater was dismantled. The damage to the coil will necessitate replacement. Examination of gas flow rates from previous tests indicate that the leak was present prior to inspection and probably caused irregular and periodic loss of fluidization of the bed. This would have caused the decreases in resistance and high current flow conditions that melted the electrode.

To expedite the tests begun in the electrogasifier, we have started the construction of a gas-fired furnace to replace the superheater while the tube is being replaced by the manufacturer. The superheater will be completed in 1-2 weeks and further testing will resume.

Hydrogasification Pilot Plant

Progress Report No. 3 is attached and covers the various phases of the work on the pilot plant. We are now identifying critical delivery times so that such equipment can be ordered in sufficient time to prevent construction delay.

During the month, no new inventions were made in the course of the work.

Approved Jack Huebler
Jack Huebler
Research Director

Signed Frank C. Schora
Frank C. Schora
Associate Director

PROGRESS REPORT

PROJECT:	INSTITUTE OF GAS TECHNOLOGY Chicago, Illinois Coal Hydrogasification Pilot Plant Procon Job No. W-1784
REPORT NO:	3
DATE:	October 15, 1968
PROCON PROJECT MANAGER:	T. A. Taylor

Distribution:

Institute of Gas Technology

Mr. F. C. Schora - 10

Procon Incorporated

Mr. M. D. Gilchrist	(1)
Mr. J. C. Reed	
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Mr. W. R. Fredrick	
Mr. W. J. Taylor	
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Mr. P. N. Sicuro	(1)
Mr. R. P. Cousins	(1)
Mr. G. J. Landsberg	(1)
Mr. T. A. Taylor	(1)
Field	(1)

PROGRESS REPORT NO. 3

COAL HYDROGASIFICATION PILOT PLANT

FOR

INSTITUTE OF GAS TECHNOLOGY

CHICAGO, ILLINOIS

W-1784

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W-1784

COAL HYDROGASIFICATION PILOT PLANT

I. SUMMARY

A. DEVELOPMENT OF THE GUARANTEED MAXIMUM PRICE - W-1784-X-1

All Piping and Instrument Diagrams are complete and will be issued for final approval during the week of October 14.

Site and plot plan, elevations and the line study are being finalized and will be issued during the week of October 21.

The one-eight inch block model was rescheduled to begin October 14 to allow for further site and plot plan development.

This phase of the project in which the Guaranteed Maximum Price will be established is forty percent (40%) complete.

The major project areas to be finalized are:

1. Reactor
2. Char Disposal System
3. Material Handling Design and Layout
4. Electrical Distribution and Substation size and location.
5. Reactor Valves

B. DESIGN ENGINEERING - W-1784

Proposals from the Reactor Fabricators are being evaluated. Quoted deliveries are longer than anticipated and vendor meetings are scheduled to completely review their proposals.

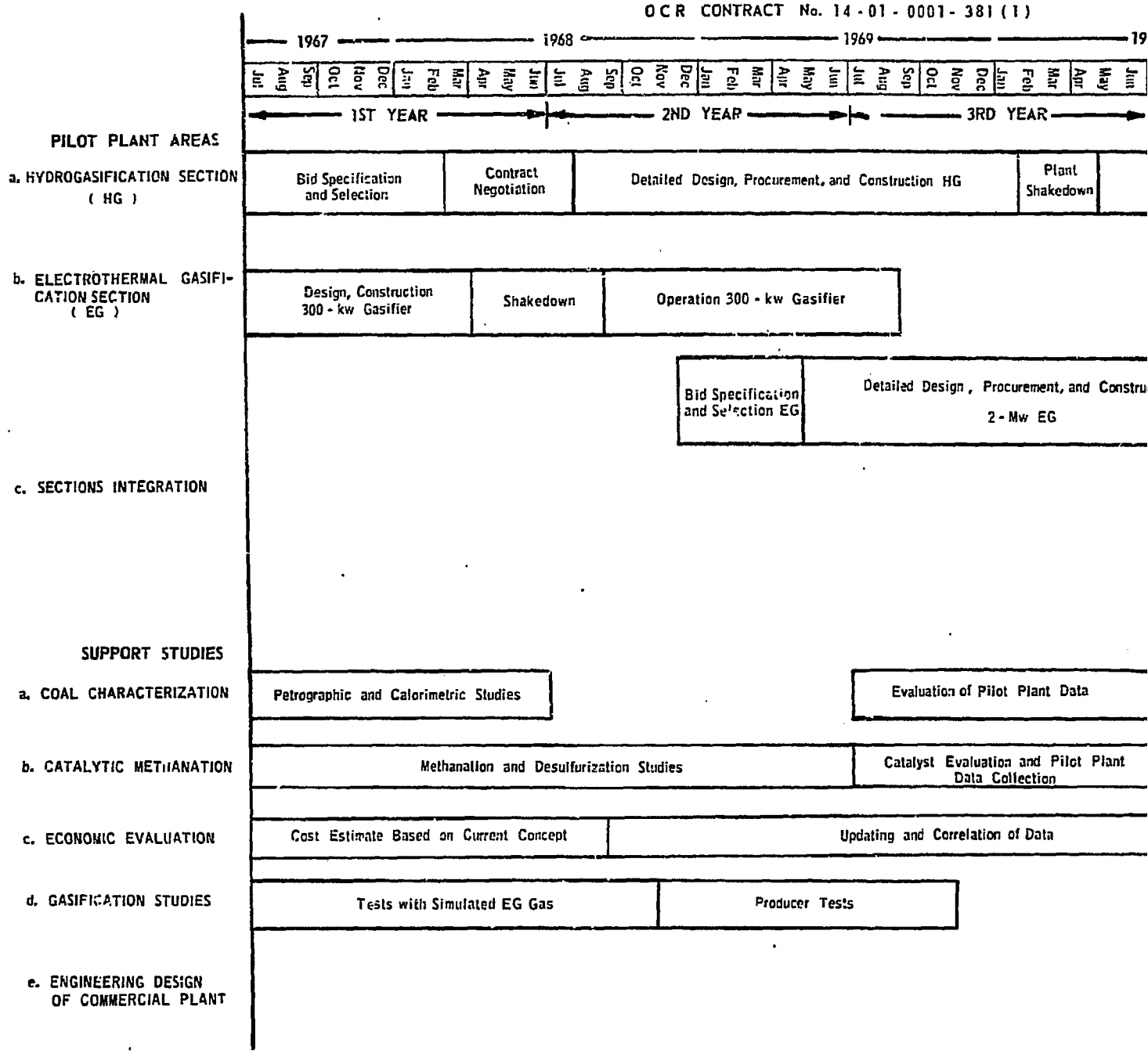
Meetings with refractory manufacturers have been held and proposals are due during the week of November 4.

Construction drawings will be initiated during the week of October 21 for the site preparation, sub-grade and foundation work anticipated for this year.

The specification for the warehouse building is complete and will be issued this week for approval and for quotation.

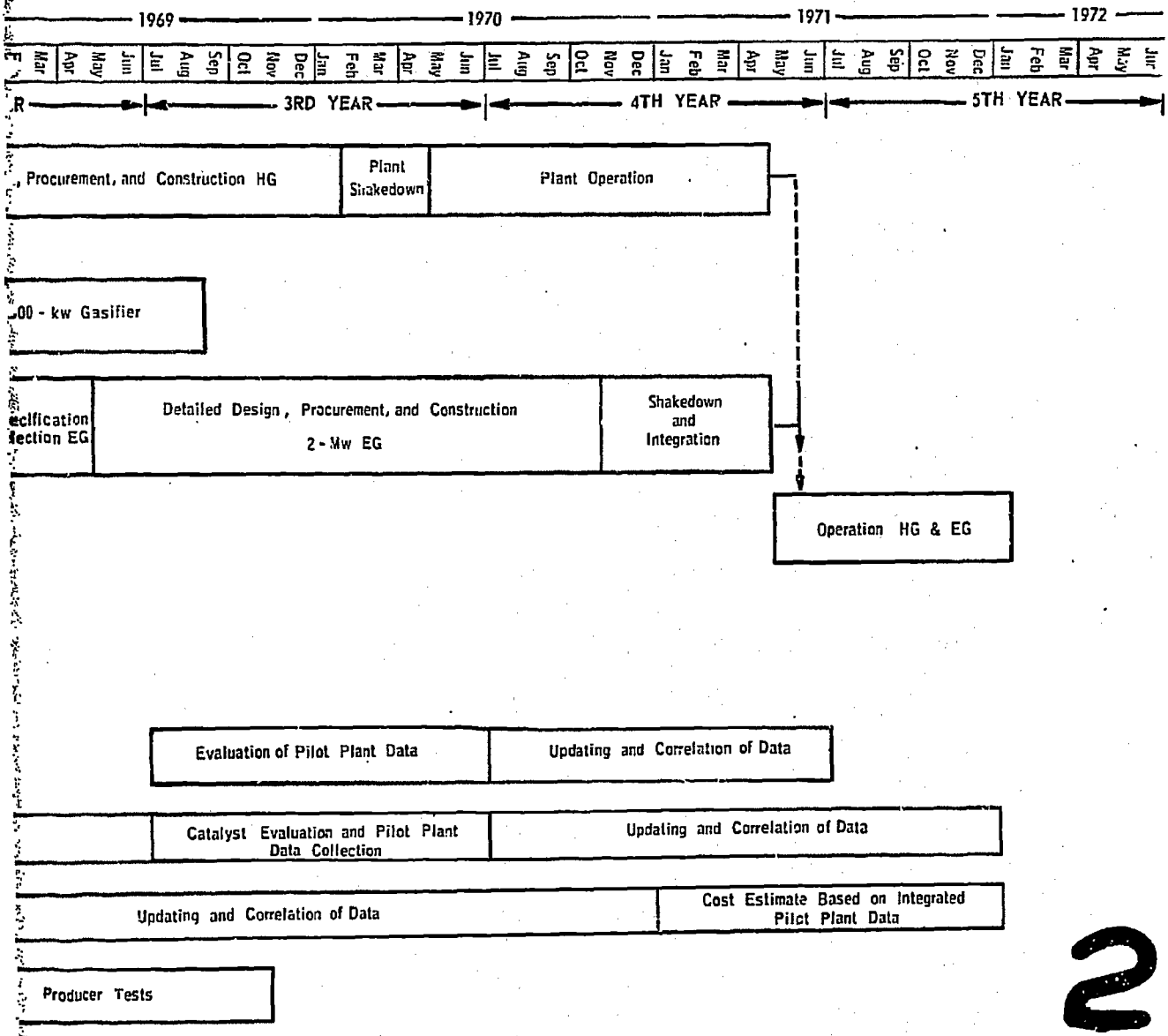
PILOT PLANT PROGRAM OF IGT HYDROGAS

OCR CONTRACT No. 14-01-0001-381 (1)



NT PROGRAM OF IGT HYDROGASIFICATION PROCESS

TRACT No. 14-01-0001-381(1) AGA: IU-4-1



E-881094

II. BAR CHART SCHEDULE

The schedule for establishing the Guaranteed Maximum Price has been up-dated to reflect progress and schedule changes.

SCHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION

A-APPROVAL
P.O.-PLACE PURCHASE ORDER

SCHEDULE
PROGRESS
REVISED SCHEDULE

Sheet 1 Rev.
Date 9-15-68
By
Job No. W-1754

E – Engineering & Drafting
P – Procurement of Materials
C – Field Construction Work

CONSTRUCTION ACTIVITY THIS YEAR

TIME IN WKS FROM STARTING DATE OF: 7-15-68

	DESCRIPTION OF WORK		COMPLETE (%)
01	PLOT PLAN	E E E	
	FOUNDATIONS	E P C	
10	BUILDINGS WAREHOUSE	E P C	
12	ELECTRICAL DISTRIBUTION	E P C	
20	PRELIMINARY SITE WORK	E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	

SCHEDULE AND STATUS OF ENGINEERING
PROCURLMENT AND CONSTRUCTION

A-APPROVAL
PO-PLACE PURCHASE ORDER

SCHEDULE
PROGRESS
REVISED SCHEDULE

Sheet 2 Rev. 1
Date 9-15-68
By
Job No. W-1784

E – ~~Engineering & Drafting~~ WRITE REQ./DWG.
P – ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C – ~~Field Construction Work~~ ESTIMATE

GENERAL-10

	DESCRIPTION OF WORK		TIME IN MONTHS FROM STARTING DATE OF: 7-15-68	COMPLETE
01	PLOT PLAN	E E E	PRELIM; BLOCK MODEL; CRANE AREA STUDY; REVISIONS	
03	STEEL STRUCTURES	E P C		
10	BUILDINGS	E P C		
11	PIPING STUDY	E P C	STUDY; REV.; PIPING TAKE-OFF	
12	ELECTRICAL DISTRIBUTION	E P C	PARTIAL	
13	CONTROL BOARD	E P C		
18	FIRE PROTECTION	E P C	PARTIAL	
25	COMMUNICATIONS	E P C	PARTIAL	
29	PAVING & FINAL GRADING	E P C		
		E P C		
		E P C		
		E P C		
		E P C		
		E P C		

10/15

SCHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION

A.- APPROVAL
PO- PLACE PURCHASE ORDER

Sheet 3 Rev. 1
Date 9-15-68
By
Job No. W-1784

SCHEDULE
PROGRESS
//////// REVISED SCHEDULE

E – ~~Engineering & Drafting~~ WRITE REQ./DWG.
P – ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C – ~~Field Construction Work~~ ESTIMATE

COAL HANDLING-1 & PRETREATING-2

TIME IN WKS FROM STARTING DATE OF: 7-15-68

	DESCRIPTION OF WORK		COMPLETE (%)
00	P & I D	E E E	
05	HEATERS	E P C	
06	VESSELS	E P C	
07	EXCHANGERS	E P C	
08	PUMPS	E P C	
09	COMPRESSORS	E P C	
13	INSTRUMENTATION	E P C	
17	MATERIAL HANDLING EQUIPMENT	E P C	
31	HOPPERS	E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	

'HEDULE AND STATUS OF ENGINEERING
. ROCUREMENT AND CONSTRUCTION

SCHEDULE
PROGRESS
REVISED SCHEDULE

Sheet 4 Rev. 1
Date 9-15-68
By
Job No. W-1734

A-APPROVAL
PO-PLACE PURCHASE ORDER

E ~~Engineering & Drafting~~ WRITE REQ/DWG.
P ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C ~~Field Construction Work~~ ESTIMATE

REACTION SECTION-3

	DESCRIPTION OF WORK		TIME IN WKS FROM STARTING DATE OF: 7-15-68 — COMPLETE
00	P&ID	E E E	PRELIM — FINAL
05	HEATERS	E P C	A A
06	VESSELS	E P C	
06	REACTOR 3.06-01	E P C	BIDS DUE — REVIEW BIDS — PO — A A
07	EXCHANGERS	E P C	A
08	PUMPS	E P C	A
13	INSTRU-MENTATION	E P C	
13	REACTOR VALVES	E P C	
32	MIXER	E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	

REVIEW ESTIMATES

CHEDULE A..D STATUS OF ENGINEERING
PROCUREME IT AND CONSTRUCTION
A-AF, ROVAL
PO-PLACE PURCHASE ORDER

SCHEDULE
PROGRESS
REVISED SCHEDULE

Sheet 5 Rev. 1
Date 9-15-68
By
Job No. W-1764

E – ~~Engineering & Drafting~~ WRITE REQ./DWG.
P – ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C – ~~Field Construction Work~~ ESTIMATE WKS

GAS PURIFICATION - 4

	DESCRIPTION OF WORK		TIME IN WKS FROM STARTING DATE OF: 7-15-68 (1 7/15 … 23)	COMPLETE (%)
00	P&ID:	E E E	PREL'M → FINAL	
06	VESSELS	E P C		
07	EXCHANGERS	E P C		
08	PUMPS	E P C		
13	INSTRU-MENTATION	E P C		
32	MIXERS	E P C		
28	PROCESS FILTER	E P C		
24	CHEMICALS & CATALYST	E P C		
		E P C		
		E P C		
		E P C		
		E P C		
		E P C		
		E P C		

10/15

SCHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION
A - APPROVAL
PO - PLACE PURCHASE ORDER

Sheet 6 Rev. 1
Date 9-15-68
By
Job No. W-1784

SCHEDULE
PROGRESS
REVISED SCHEDULE

E - ~~Engineering & Drafting~~ WRITE REQ./DWG.
P - ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C - ~~Field Construction Work~~ ESTIMATE

METHANATION SECTION - 5

TIME IN WKS FROM STARTING DATE OF: 7-15-68

	DESCRIPTION OF WORK		COMPLETE (%)
00	P & I D.	E E E	
05	~~HEATERS~~	E P C	
06	VESSELS	E P C	
07	EXCHANGERS	E P C	
		E P C	
09	COMPRESSORS	E P C	
13	INSTRUMENTATION	E P C	
24	CHEMICALS & CATALYST	E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	

IEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION
A-APPROVAL
PO-PLACE PURCHASE ORDER

SCHEDULE
PROGRESS
REVISED SCHEDULE

Sheet 7 Rev. 1
Date 9-15-68
By
Job No. W-1784

E – ~~Engineering & Drafting~~ WRITE REQ./DWG.
P – ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C – ~~Field Construction Work~~ ESTIMATES

BLOWDOWN & DISPOSAL-6

	DESCRIPTION OF WORK		TIME IN WKS FROM STARTING DATE OF: 7-15-68 (1 3/5 1 22 2 29 3 35 4 42 5 49 6 56 7 63 8 1 9 11 10 12 11 13 12 14 13 15 14 16 15 17 16 18 17 19 18 20 19 21 20 22 21 23) COMPLETE (%)
00	P & ID :	E E E	
06	VESSELS	E P C	
07	EXCHANGERS	E P C	
08	PUMPS	E P C	
13	INSTRU-MENTATION	E P C	
22	INCINERATOR & FLARE	E P C	
	ENGINEERED PACKAGE SYSTEMS	E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	

10/15

SCHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION
A- APPROVAL
PO- PLACE PURCHASE ORDER

SCHEDULE
PROGRESS
REVISED SCHEDULE

Sheet 8 Rev. 1
Date 9-15-68
By
Job No. W-1784

E – ~~Engineering or Drafting~~ WRITE REQ. / DWG.
P – ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C – ~~Field Construction Work~~ ESTIMATE

UTILITY PLANT-7

	DESCRIPTION OF WORK		TIME IN WEEKS FROM STARTING DATE OF: 7-15-68	COMPLETE
00	UTILITY FLOW DIAGRAMS	E E E		
00	WATER BOILER P & ID	E P C		
00	H_2 STEAM CONTRO. P&ID	E P C		
05	HEATERS	E P C		
36	VESSELS	E P C		
08	PUMPS	E P C		
09	COMPRESSORS	E C		
13	INSTRU-MENTATION	E P C		
19	BOILERS	E P C		
22	INSTRUMENT AIR PACKAGE	E P C		
22	COOLING WATER TREATMENT	E P C		
22	H_2 PLANT	E P C		
22	BW TREATMENT	E P C		
27	TANKS	E P C		

III. CONTRACT FINANCIAL REPORT

Procon's portion of Form No. 8OR0178 has been completed and reflects actual costs incurred through the last calendar month; estimated costs during this month; and the estimated total cumulative cost through this month. All costs have been rounded off to the nearest thousand dollars.

CONTRACT FINANCIAL REPORT (Dollars in thousands) (See instructions before preparation)	1 For Month Ended	2 No. of Work Days	3 Contract No.	Form Approved Budget Bureau No. 80R0178 Sheet ____ of ____

4 To:	5 From:	6 Contract Value $	7 Contract Type
		8 Funded Contract Amount $	9 Amounts Billed $

10 Program/Scope of Work	11 Signature and Title of Authorized Representative	12 Preparation Date	13 Payments Received $

14 Appropriation (or Fund Citation) and/or Reporting Category	15 Cost Incurred/Contract Earnings			16 Planning Data (For Agency use only)			
	Cum. Actual End of Prior Mo. a	Actual/ Estimated Current Month b	Cumulative Actual/ Estimated To Date c	a	b	c	d
Procon Incorporated W-1784	$ 2	$ 3	$ 5				
Procon Incorporated W-1784 X-1	12	7	19				
Less 10% Retention	1	1	2				
	11	6	17				

"The undersigned certifies that the amount is due and payable to Procon, in accordance with the terms of the contract up to the date of this Certificate and that the Contractor has fully complied with the terms and conditions of the contract.

Progress Report No. 3
October 15, 1968

T. A. Taylor

17 Total							

IGT-MPR--11/68

DEVELOPMENT OF IGT HYDROGASIFICATION PROCESS

Progress Report — November 1968
to
Office of Coal Research
Contract No. 14-01-0001 (1)

SUMMARY

1. Two successful hydrogasification tests were conducted during the month, one with Montana subbituminous coal and the other with Montana lignite. Both materials were untreated.
2. Two successful tests were conducted in the electrothermal test reactor at pressures around 100 psi and temperatures of 1750°-1800°F.
3. Low-temperature methanation (450°-500°F) is detrimental to nickel catalyst activity and life when operating at high pressure (1000 psi).
4. Eighty percent of the major equipment specifications have been completed and are out for quotations.
5. The work by Procon leading to the guaranteed maximum price of the pilot plant is 70% complete.

Hydrogasification Test Program

We conducted two successful hydrogasification tests this month in the balanced-pressure development unit (Runs HT-216 and HT-217). The first of these tests was conducted with a dried, but otherwise untreated, Montana subbituminous coal as a part of our study of the hydrogasification behavior of this coal. In the second test, we began the study of the hydrogasification behavior of a Montana lignite. It was not necessary to pretreat the lignite for hydrogasification use, but drying was required. The subbituminous coal and the lignite both reacted with a mixture of hydrogen and steam in a fluidized bed at a nominal temperature of 1700°F and a pressure of 1000 psig.

In Run HT-216, we fed the subbituminous coal at a nominal rate of 55 lb/hr and reacted it with 460 SCF/hr of hydrogen and 11.8 lb/hr of steam. At these conditions, the hydrogen to coal ratio was 25% of the stoichiometric ratio and the steam concentration in the feed gas was 35%. In this 4-hour test, we gasified 43% of the carbon in the coal, and reacted 53% of the moisture- and ash-free coal.

Lignite feed for Run HT-217 was prepared by pulverizing as-received 1-1/2 to 3 in. lumps in a swing hammer mill to a −10+80 mesh size. The lignite was supplied by the Knife River Coal Co. from its mine at Sidney, Montana. After crushing and screening, the lignite was dried with air at 240°F in the fluid-bed coal pretreatment unit. The moisture content was reduced from the as-received level of 35% to 3.5%.

The dried lignite was screened to remove the −80 mesh particles not removed in the first screening.

The lignite was fed at a nominal rate of 75 lb/hr in Run HT-217 and reacted with 475 SCF/hr of hydrogen and 25 lb/hr of steam. At these flow rates, the hydrogen-to-lignite ratio was a nominal 20% of the stoichiometric ratio, and the steam concentration in the feed gas was 50 mole percent. There were no difficulties in feeding the lignite or in discharging it from the reactor.

Flow of the lignite through the reactor tube was generally smooth. The test lasted 5 hours, with over 2-1/2 hours of this time at steady-state conditions. It is estimated that 45% of the carbon was gasified.

Electrothermal Gasifier Test Program

Construction of the temporary steam superheater was completed, and testing in the pilot unit has resumed. Four runs were conducted during the month. Because of operational failure of the steam-flow control valve in the steam feed line, the first two tests were terminated before steady-state conditions were attained. In the other two tests continuous operation at steady-state conditions was accomplished. Nominal conditions for the tests are given below.

		Char Feed Rate, lb/hr	Steam Feed Rate, lb/hr	Bed Temp, °F	Reactor Press., psig	Make Gas Rate, SC/hr	Char Residence Time, min.	Steam Conversion Vol,%
Run EG-5		34.2	29.3	1710	94.0	589	29.9	36.8
Run EG-6	A	16.5	24.2	1737	120.0	670	61.9	43.3
	B	25.0	24.2	1780	137.0	748	40.8	47.4

Testing will continue in the range of reactant feed rates shown above in an attempt to reach higher bed temperatures and increased conversions and to establish a sound operating procedure for the pilot unit.

Methanation Test Program

Investigations of the H_2 order in the methanation reaction indicate that the H_2 order is close to 1 for H_2 concentrations up to 35%. The rate of formation of methane gradually levels off at a hydrogen concentration greater than 35%. Low-temperature runs at 450° and 500°F indicated that the rate of methane formation is almost nil and there is a loss of catalyst activity. There is also a loss of catalyst weight after low-temperature runs amounting to about 1.4% weight loss.

Economic Evaluations

A small program has been initiated with the Paul Weir Co. of Chicago to develop capital and operating costs for mining lignite in association with the economic analysis just completed on the 500 million Btu coal to gas plant. In this analysis the mining operation will be capitalized along with the plant. Operating costs will be established using the surplus electrical power produced by the plant.

Pilot Plant Program

Status of the construction of the pilot plant is covered in Procon's Progress Report No. 4. We have been reviewing the hot-solids valve and expansion joint designs. We now believe suitable valves and expansion joints can be obtained without any development work. We are now studying slurry letdown in orifices and valves to establish wear rates.

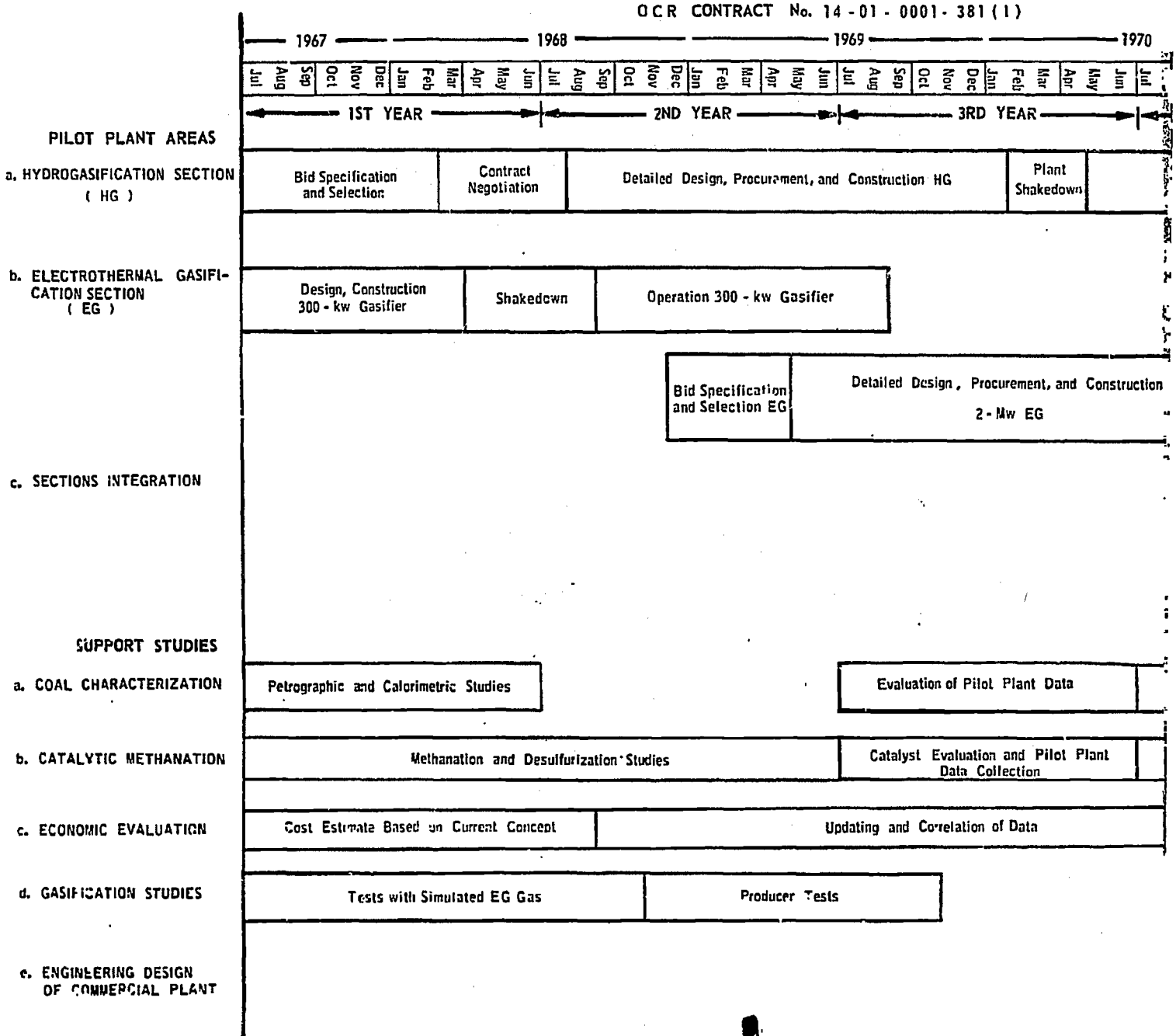
During the month no new inventions were made in the program.

Jack Huebler, Research Director

Frank Schora, Associate Director

PILOT PLANT PROGRAM OF IGT HYDROGASIF

OCR CONTRACT No. 14-01-0001-381(1)



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PROGRAM OF IGT HYDROGASIFICATION PROCESS

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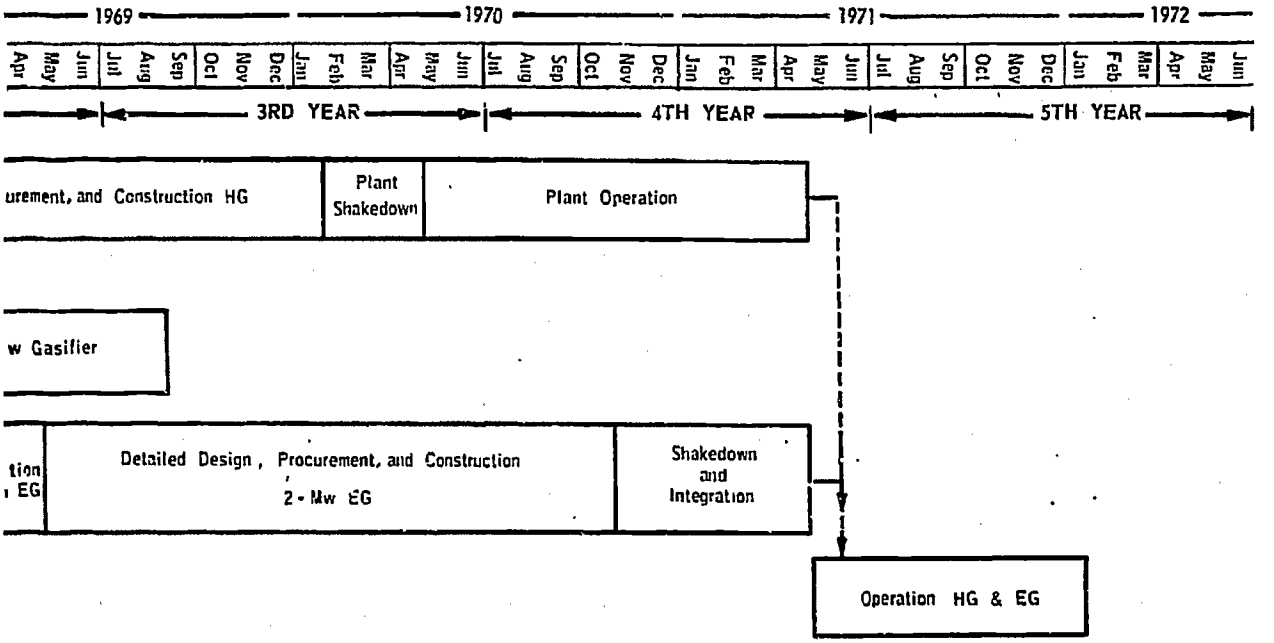

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PROGRESS REPORT

PROJECT:	INSTITUTE OF GAS TECHNOLOGY Chicago, Illinois Coal Hydrogasification Pilot Plant Procon Job No. W-1784
REPORT NO:	4
DATE:	November 15, 1968
PROCON PROJECT MANAGER:	T. A. Taylor

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PROGRESS REPORT NO. 4

COAL HYDROGASIFICATION PILOT PLANT

for

INSTITUTE OF GAS TECHNOLOGY

CHICAGO, ILLINOIS

W-1784

TABLE OF CONTENTS

Progress Report No. 4

W-1784

CCAL HYDROGASIFICATION PILOT PLANT

I. SUMMARY

A. DEVELOPMENT OF THE GUARANTEED MAXIMUM PRICE - W-1784 X-1

All Piping and Instrument Diagrams were revised (dated October 31) and issued as "approved for basis of estimate". Additional changes were issued in our Letter No. P-84-8 to IGT on November 13, 1968.

Revised site and plot plans will be sent to IGT for "approval for basis of estimate" this week.

The one-eighth inch block model was completed but will be up-dated per latest plot plan revisions.

Approximately eighty percent (80%) of the major equipment specifications have been completed and are out for quotations. The remainder will be complete by November 22. All quotations should be received and evaluated by December 15. The Guaranteed Maximum Price is scheduled to be established before January 15, 1969.

This phase of the project in which the Guaranteed Maximum Price will be established is seventy percent (70%) complete.

The major project areas to be finalized are:

1. Char Disposal System.
2. Material Handling Design and Layout.
3. Reactor Valves and Char Letdown System.

B. DESIGN ENGINEERING - W-1784

Reactor Fabricator proposals were reviewed by Procon and IGT and a purchase order was issued to Struthers-Wells Corporation. We anticipate delivery at the site by December 15, 1969. A scheduling and coordination meeting has been tentatively set for December 9, 1968 at the Struthers plant.

Refractory proposals will be evaluated and a supplier and applicator selected next week.

The subcontract for the warehouse has been let and erection will begin in early December.

Equipment delivery will be reviewed to determine those items that will require early purchase to meet the anticipated construction schedule.

II. BAR CHART SCHEDULE

The schedule for establishing the Guaranteed Maximum Price has been up-dated to reflect progress and schedule changes.

SCHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION

A-APPROVAL
P.O.-PLACE PURCHASE ORDER

SCHEDULE
PROGRESS
REVISED SCHEDULE

Sheet 1 Rev. 1
Date 8-15-66
By
Job No. W-1780

E – Engineering & Drafting
P – Procurement of Materials
C – Field Construction Work

CONSTRUCTION ACTIVITY THIS YEAR

	DESCRIPTION OF WORK		TIME IN WKS FROM STARTING DATE OF: 7-15-66 — COMPLETE
01	PLOT PLAN	E E E	PRELIM — GENERAL ARRANGEMENT STUDY — REVISIONS
	FOUNDATIONS	E P C	
10	BUILDINGS WAREHOUSE	E P C	
12	ELECTRICAL DISTRIBUTION	E P C	
20	PRELIMINARY SITE WORK	E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	

HEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION

A-APPROVAL
PO-PLACE PURCHASE ORDER

SCHEDULE
PROGRESS
REVISED SCHEDULE

Sheet 2 Rev. 1
Date 9-15-68
By
Job No. W-1754

E – Engineering & Drafting WRITE REQ./DWG.
P – Procurement & Materials OBTAIN QUOTES & REVIEW BIDS
C – Field Construction Work ESTIMATE

GENERAL-10

	DESCRIPTION OF WORK		TIME IN MONTHS FROM STARTING DATE OF: 7-15-68	COMPLETE
01	PLOT PLAN	E E E	PRELIM. BLOCK MODEL	
03	STEEL STRUCTURES	E P C		
10	BUILDINGS	E P C		
11	PIPING STUDY	E P C	STUDY PIPING TAKE-OFF	
12	ELECTRICAL DISTRIBUTION	E P C	PARTIAL	
13	CONTROL BOARD	E P C		
18	FIRE PROTECTION	E P C	PARTIAL	
25	COMMUNICATIONS	E P C	PARTIAL	
29	PAVING & FINAL GRADING	E P C		
		E P C		
		E P C		
		E P C		
		E P C		

SCHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION

A - APPROVAL
PO - PLACE PURCHASE ORDER

SCHEDULE
PROGRESS
REVISED SCHEDULE

Sheet ___ Rev. ___
Date 9-15-68
By ___
Job No. W-1764

E - Engineering & Drafting WRITE REQ./DWG.
P - Procurement of Materials OBTAIN QUOTES & REVIEW BIDS
C - Field Construction Work ESTIMATE

COAL HANDLING-1 & PRETREATING-2

	DESCRIPTION OF WORK		TIME IN WKS FROM STARTING DATE OF: 7-15-68 — COMPLETE
00	P & I D	E E E	PRELIM
05	HEATERS	E P C	A
06	VESSELS	E P C	A
07	EXCHANGERS	E P C	A
08	PUMPS	E P C	A
09	COMPRESSORS	E P C	A
13	INSTRUMENTATION	E P C	A
17	MATERIAL HANDLING EQUIPMENT	E P C	A PO
31	HOPPERS	E P C	PO
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	

SCHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION

A-APPROVAL
PO-PLACE PURCHASE ORDER

SCHEDULE
PROGRESS
REVISED SCHEDULE

Sheet 4 Rev. 1
Date 9-13-68
By
Job No. W-1786

E—~~Engineering~~ ~~Detailing~~ WRITE REQ./DWG.
P—~~Procurement/Material~~ OBTAIN QUOTES & REVIEW BIDS
C—~~Field Construction Work~~ ESTIMATE

REACTION SECTION-3

	DESCRIPTION OF WORK		TIME IN WKS FROM STARTING DATE OF: 7-15-68	COMPLETE
00	P&ID	E E E	PRELIM FINAL	
05	HEATERS	E P C		
06	VESSELS	E P C		
06	REACTOR 3.06-01	E P C	BIDS DUE REVIEW BIDS PO	
07	EXCHANGERS	E P C		
08	PUMPS	E P C		
13	INSTRU-MENTATION	E P C		
13	REACTOR VALVES	E P C		
32	MIXER	E P C		
		E P C		
		E P C		
		E P C		
		E P C		
		E P		

REVISED ESTIMATES

'HEDULE A' D STATUS OF ENGINEERING
PROCUREMI'S AND CONSTRUCTION
A-APPROVAL
PO-PLACE PURCHASE ORDER

SCHEDULE
PROGRESS
REVISED SCHEDULE

Sheet ___ Rev. ___
Date 9-15-68
By ___
Job No. W-1784

E – Engineering & Drafting WRITE REQ./DWG.
P – Procurement of Materials OBTAIN QUOTES & REVIEW BIDS
C – Field Construction Work ESTIMATE

GAS PURIFICATION - 4

	DESCRIPTION OF WORK		TIME IN WEEKS FROM STARTING DATE OF: 7-15-68 — COMPLETE
00	P&I D:	E E E	PRELIM → FINAL
06	VESSELS	E P C	A
07	EXCHANGERS	E P C	A
03	PUMPS	E P C	A
13	INSTRU-MENTATION	E P C	
32	MIXER	E P C	
28	PROCESS FILTER	E P C	
24	CHEMICALS & CATALYST	E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	

SCHEDULE AND STATUS OF ENGINEERING
DOCUMENT AND CONSTRUCTION

A - APPROVAL

PO - PLACE PURCHASE ORDER

SCHEDULE
PROGRESS
REVISED SCHEDULE

Sheet 6 Rev. 1
Date 8-15-68
By
Job No. W-1764

E - Engineering & Drafting WRITE REQ./DWG.
P - Procurement & Materials OBTAIN QUOTES & REVIEW BIDS
C - Field Construction Work ESTIMATE

METHANATION SECTION - 5

TIME IN WEEKS FROM STARTING DATE OF: 7-15-68

	DESCRIPTION OF WORK		COMPLETE
00	P & I D.	E E E	
05	HEATERS	E P C	
06	VESSELS	E P C	
07	EXCHANGERS	E P C	
		E P C	
09	COMPRESSORS	E P C	
13	INSTRUMENTATION	E P C	
24	CHEMICALS & CATALYST	E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P	

JCUREM[illegible]T AND CONSTRUCTION

A - APPROVAL

PO - PLACE PURCHASE ORDER

SCHEDULE

PROGRESS

REVISED SCHEDULE

Date 9-15-68

By

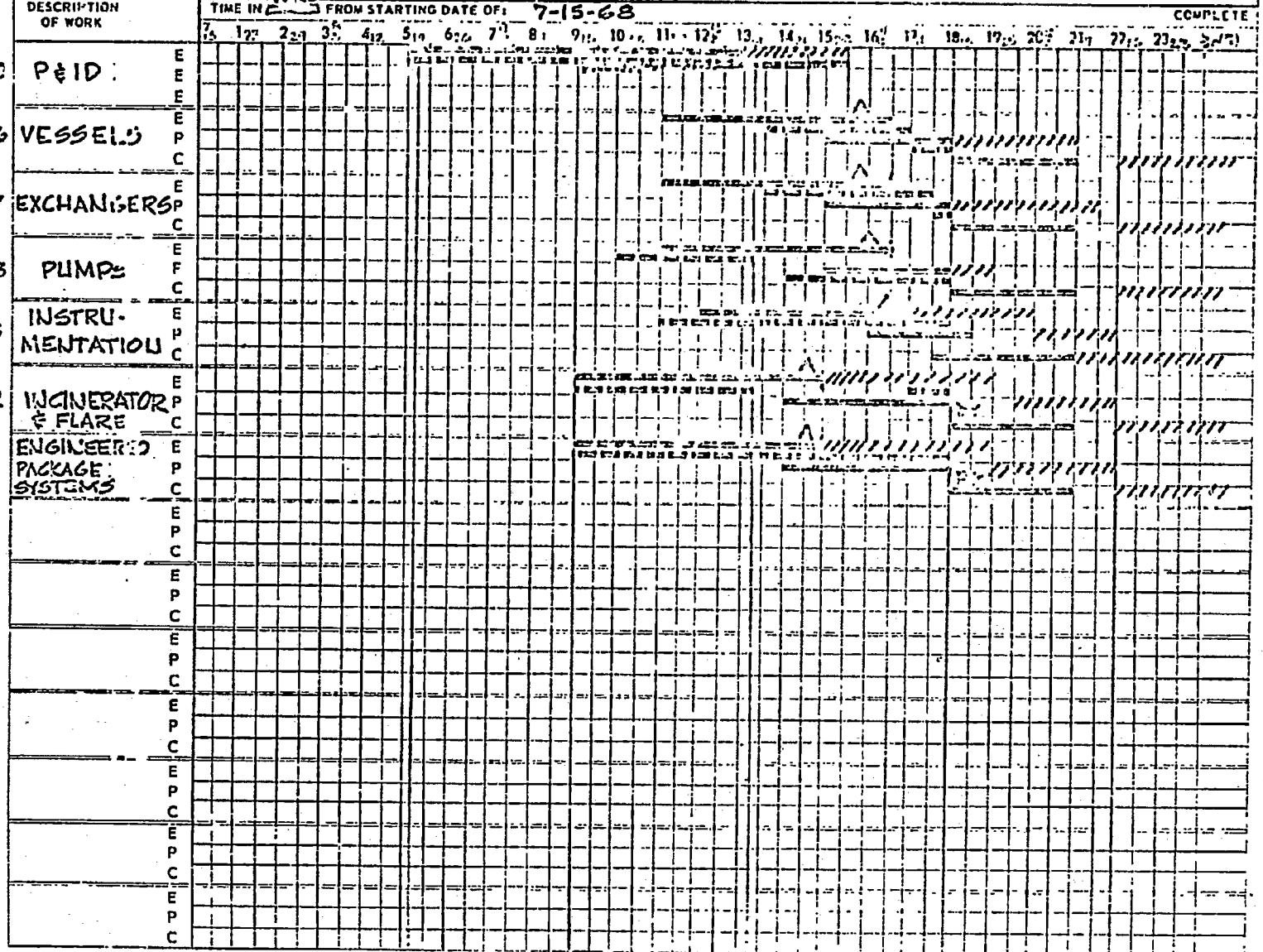
Job No. 1784

E – Engineering & Drafting WRITE REQ./DWG.

P – Procurement of Materials OBTAIN QUOTES & REVIEW BIDS

C – Field Construction Work ESTIMATES

BLOWDOWN & DISPOSAL-6



SCHEDULE AND STATUS OF ENGINEERING
PROCURFMENT AND CONSTRUCTION
A- APPROVAL
PO- PLACE PURCHASE ORDER

SCHEDULE
PROGRESS
REVISED SCHEDULE

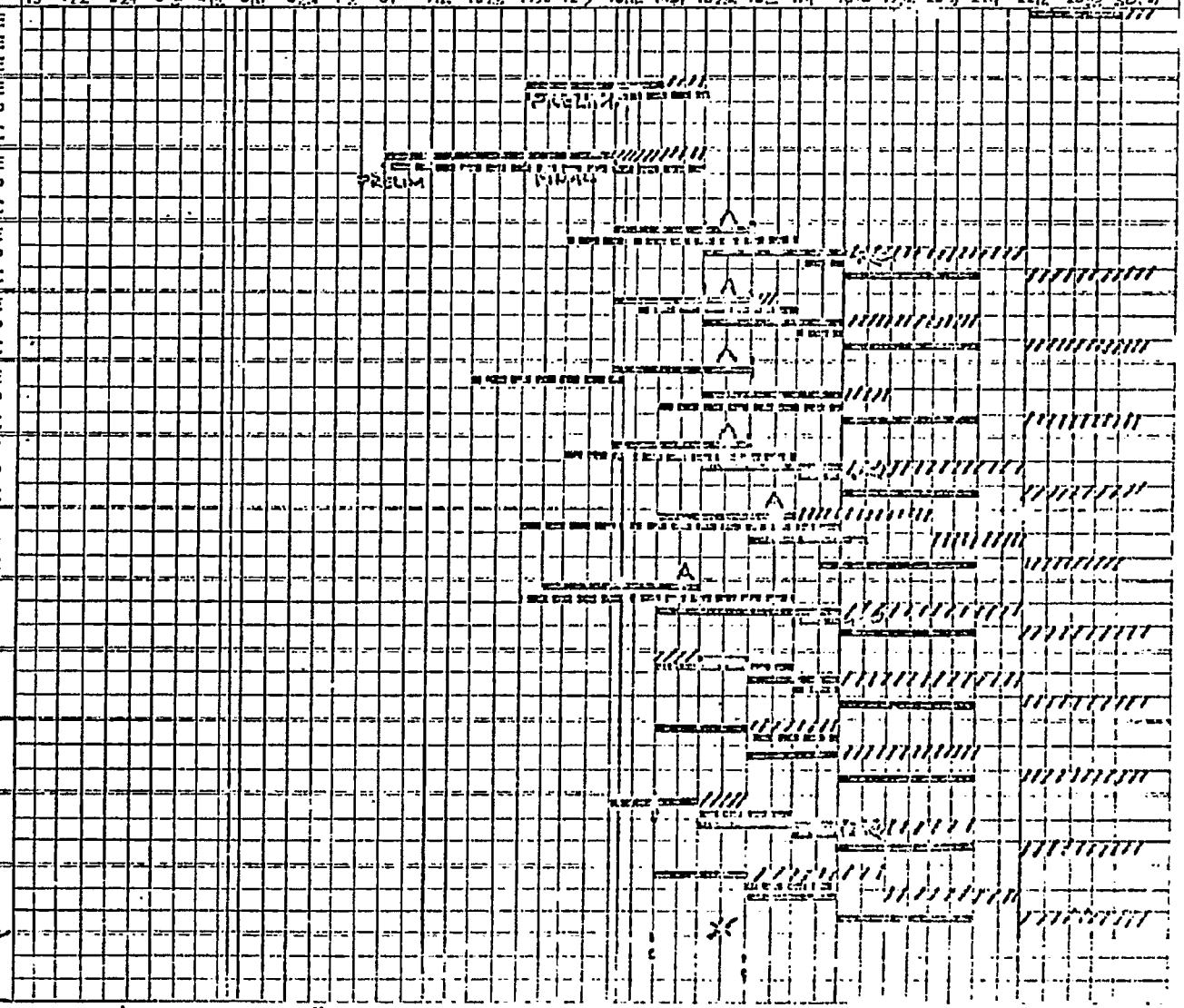
Sheet 8 Rev. 1
Date 9-15-6
By
Job No. W-1784

E – ~~Engineering & Drafting~~ WRITE REQ./DWG.
P – ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C – ~~Field Construction Work~~ ESTIMATE W/S

UTILITY PLANT-7

TIME IN ~~WEEKS~~ FROM STARTING DATE OF: 7-15-68

	DESCRIPTION OF WORK		COMPLETE
00	UTILITY FLOW DIAGRAMS	E E E	
00	WATER BOILER P & ID	E P C	
00	H_2 STEAM CONTROL P&ID	E P C	
05	HEATERS	E P C	
06	VESSELS	E P C	
08	PUMPS	E P C	
09	COMPRESSORS	E P C	
13	INSTRUMENTATION	E P C	
19	BOILERS	E P C	
22	INSTRUMENT AIR PACKAGE	E P C	
22	COOLING WATER TREATMENT	E P C	
22	H_2 PLANT	E P C	
22	BW TREATMENT	E P C	
27	TANKS	E P C	



CONTRACT FINANCIAL REPORT (Dollars in thousands) (See instructions before preparation)	1 For Month Ended	2 No. of Work Days	3 Contract No.	Form Approved Budget Bureau No. 80R0178 Sheet _____ of _____
4 To:	5 From:		6 Contract Value $	7 Contract Type
			8 Funded Contract Amount $	9 Amounts Billed $
10 Program/Scope of Work	11 Signature and Title of Authorized Representative		12 Preparation Date	13 Payments Received $

14 Appropriation (or Fund Citation) and/or Reporting Category	15 Cost Incurred/Contract Earnings			16 Planning Data (For Agency use only)			
	Cum. Actual End of Prior Mo. a	Actual/ Estimated Current Month b	Cumulative Actual/ Estimated To Date c	a	b	c	d
Procon Incorporated W-1784	$ 3	$ 2	$ 5				
Procon Incorporated W-1784 X-1	21	10	31				
Less 10% Retention	2	1	3				
	19	9	28				
17 Total							

"The undersigned certifies that the amount is due and payable to Procon, in accordance with the terms of the contract up to the date of this Certificate and that the Contractor has fully complied with the terms and conditions of the contract."

Progress Report No. 4
November 15, 1968

T. A. Taylor

IGT-MPR-12/68

DEVELOPMENT OF IGT HYDROGASIFICATION PROCESS
Progress Report - December 1968
to
Office of Coal Research
Contract No. 14-01-0001-381 (1)

Hydrogasification Test Program

During the month of December general maintenance was performed on the hydrogasifier reactor. Approximately 400 lbs of Montana lignite was dried in the fluidized coal pretreatment unit. Drying was carried out in two stages using air at 240°F. The lignite was dried from an as-received moisture level of 35 percent to 10 percent in the first pass, and then further reduced to 4% in the second pass.

Electrothermal Gasification

Three runs were conducted during the month in the electrothermal gasification test unit but steady state conditions were not attained because of various operating difficulties.

During run E.G. -7, after switching from fluidizing nitrogen to process steam at the desired run conditions, a short-circuit occurred at the reactor top accompanied by a rapid loss of unit pressure causing the test to be terminated.

The short-circuit occurred at the seal ring in the pressure closure through which the electrode enters the reactor and caused the failure of the pressure seal. The probable cause of the short-circuit was moisture on dust particles collecting between the exterior closure surfaces or a break in the coat of electrical insulation on the seal ring. The surface of the

closure was re-machined and a teflon filler placed around a new ring to prevent accumulation of foreign matter. After a successful pressure test, testing was resumed.

Runs E.G. 8 and E.G. 9 were terminated due to a malfunction of the silicon control rectifier of the d.c. generator. As the overall resistance of the system decreased during heat-up, the current increased to above the current limit setting of 200 amperes.

In normal operation the SCR unit should limit the current to the 200 ampere setting by decreasing the generator voltage output. In these tests however, the voltage increased as the current exceeded the limit set. This loss of control forced the tests to be terminated.

A representative of the motor generator supplier was on hand d ring Run E.G. -9. After sending the SCR unit to the manufacturer, who tested it and proved it to be alright, the problem was traced to armature reaction voltage which was being fed back to the controller giving an incorrect signal. A low value resistor was placed in series with the armature interpoles to serve as a current sensor for the control circuit. Several heat-up tests have been performed since the system is now operating properly.

Pressurization-Depressurization Test Program

The water-char slurry system proposed for discharging the char from the hydrogasifier is undergoing tests to establish the specifications for the slurry pressure letdown device. A 25-30 gpm loop was built and tests were initiated using a fixed orifice. Initial results indicate that wear on the orifice will be small and that this approach to char letdown is quite feasible.

Engineering Economics

A preliminary draft of a report by Paul Weir Company on lignite mining costs has been received and reviewed. Suggested changes were outlined and discussed with the consultants, and the final

report will be received by the end of January.

Pilot Plant Design and Construction

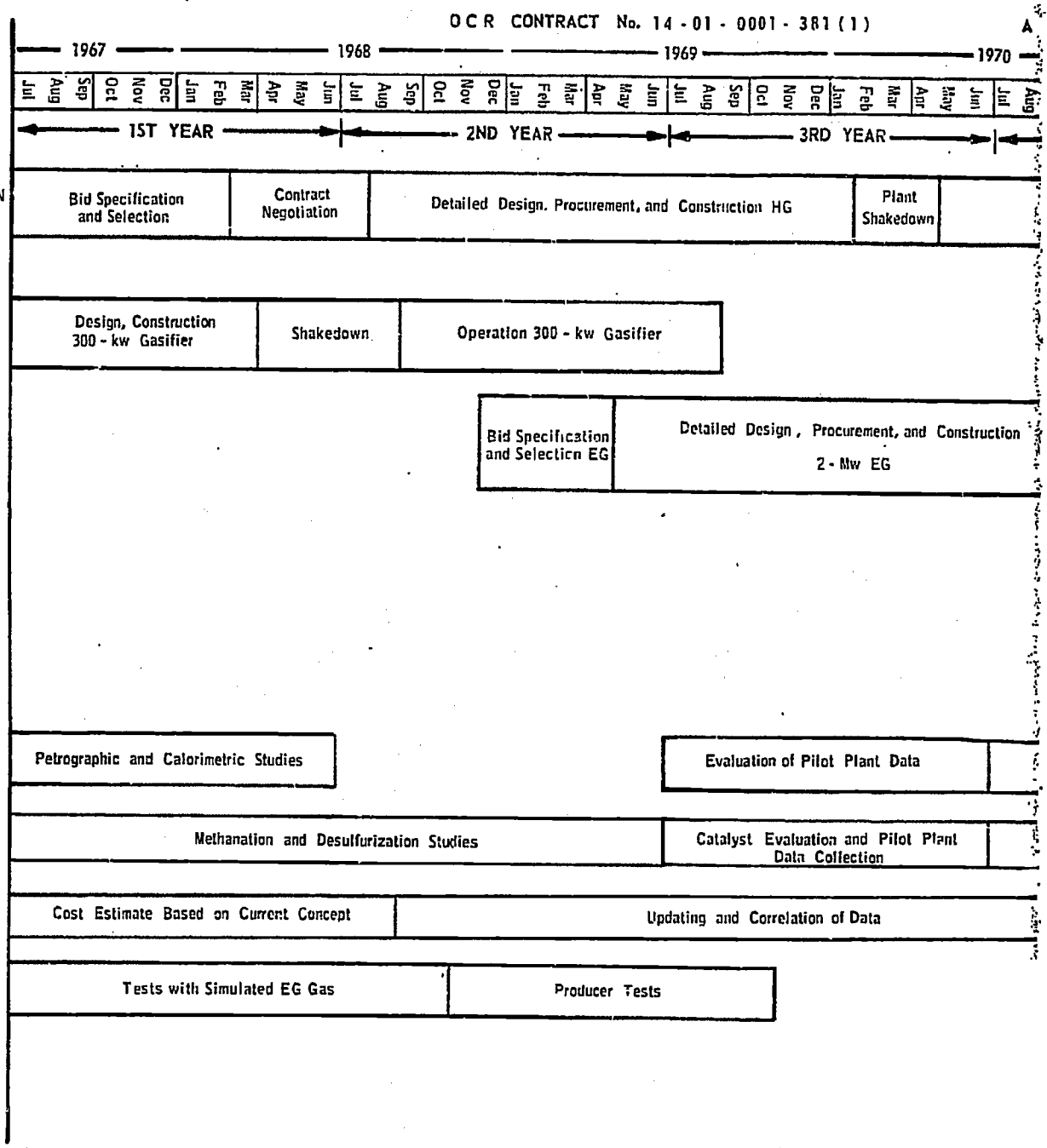
This phase of the work is covered in the enclosed Procon Progress Report No. 5. IGT efforts in this area in addition to general process work have been to develop an adequate disposal system for char and the oils produced.

Work to establish a guaranteed maximum price is estimated to be 85% complete.

During the month, no new inventions were made in the course of the work.

PILOT PLANT PROGRAM OF IGT HYDROGASIF

OCR CONTRACT No. 14-01-0001-381(1)



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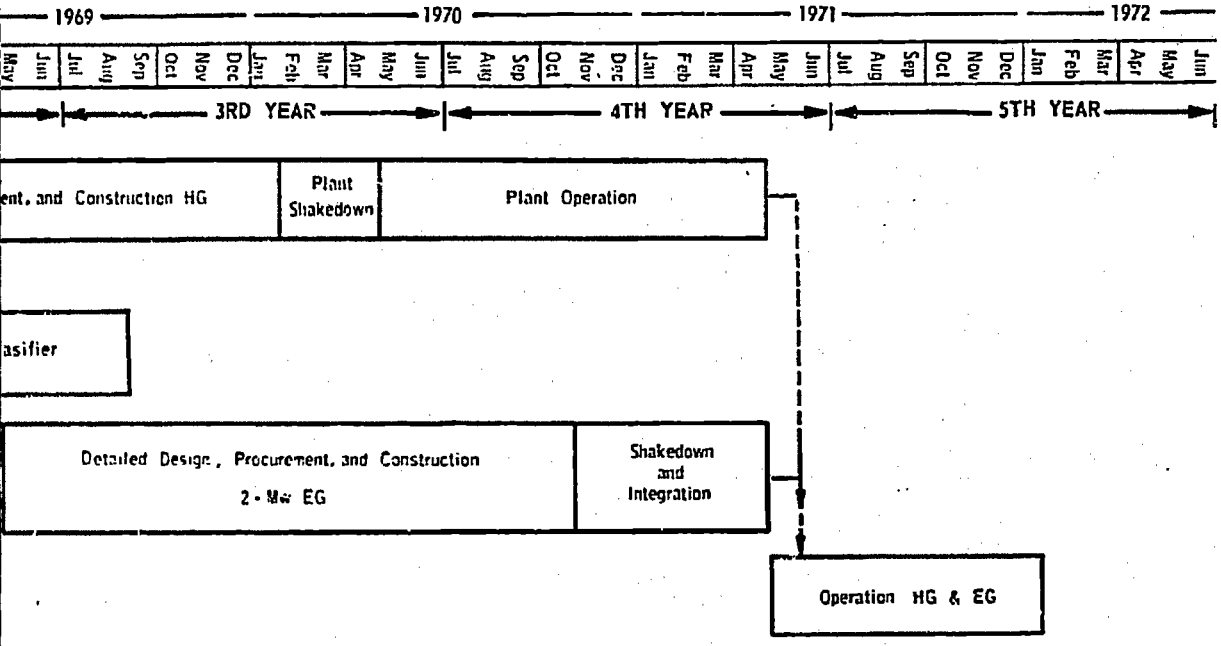
ROGRAM OF IGT HYDROGASIFICATION PROCESS

No. 14-01-0001-381(1) AGA: IU-4-1



E-881094

2

PROGRESS REPORT NO. 5

COAL HDROGASIFICATION PILOT PLANT

FOR

INSTITUTE OF GAS TECHNOLOGY

CHICAGO, ILLINOIS

W-1784

TABLE OF CONTENTS

PROGRESS REPORT

PROJECT:	Institute of Gas Technology Chicago, Illinois Coal Hydrogasification Pilot Plant Procon Job No. W-1784
REPORT NO.:	5
DATE:	December 15, 1968
PROCON PROJECT MANAGER:	T. A. Taylor

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Progress Report No. 5

W-1784

Coal Hydrogasfication Pilot Plant

I. SUMMARY

A. DEVELOPMENT OF THE GUARANTEED MAXIMUM PRICE W-1784 X-1

All major equipment specifications are complete and out for quotations. Quotations have been received for about sixty percent of the equipment. The remaining quotations will be received by December 24, 1968. Evaluation will be complete on this equipment by December 31st and the Guaranteed Maximum Price complete by January 15th.

Estimating has begun on the "back-up" (general) items for the project. A specific cost study is being done to determine the most economical utility scheme.

This phase of the project is (eighty-five percent complete).

B. DESIGN ENGINEERING W-1784

Various reactor design and fabrication problems are being discussed with Struthers-Wells. The initial scheduling and coordination meeting has been rescheduled to between the 19th and the end of the month.

Supplementary refractory proposals have been submitted and are being evaluated.

B. DESIGN ENGINEERING W-1784 (continued)

The erection of the warehouse is expected to begin the week of the 23rd or sooner depending on the building permit. The Edison transformer foundation pad will also be installed.

Layout details will be finalized for the material handling equipment by the end of the month.

II. BAR CHART SCHEDULE

The schedule for establishing the Guaranteed Maximum Price has been up-dated to reflect progress and schedule changes.

III. CONTRACT FINANCIAL REPORT

Procon's portion of Form No. 8CR0178 has been completed and reflects actual costs incurred through the last calendar month; estimated costs during this month; and the estimated total cumulative cost through this month. All costs have been rounded off to the nearest thousand dollars.

12/15

SCHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION

A-APPROVAL
P.O.-PLACE PURCHASE ORDER

SCHEDULE
PROGRESS
REVISED SCHEDULE

Sheet 1 Rev. —
Date 9-15-68
By —
Job No. W-1764

E – Engineering & Drafting
P – Procurement of Materials
C – Field Construction Work

CONSTRUCTION ACTIVITY THIS YEAR

	DESCRIPTION OF WORK		TIME IN WKS FROM STARTING DATE OF: 7-15-68 — COMPLETE
01	PLOT PLAN	E E E	PRELIM — GENERAL ARRANGEMENT STUDY — REVISIONS
	FOUNDATIONS	E P C	
10	BUILDINGS WAREHOUSE	E P C	P.O.
12	ELECTRICAL DISTRIBUTION	E P C	START CONST.
20	PRELIMINARY SITE WORK	E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	

HEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION

A-APPROVAL
PO-PLACE PURCHASE ORDER

SCHEDULE
PROGRESS
REVISED SCHEDULE

Sheet 2 Rev. 1
Date 9-15-68
By
Job No. V-1784

E – Engineering & Drafting WRITE REQ./DWG.
P – Procurement of Materials OBTAIN QUOTES & REVIEW BIDS
C – Field Construction Work ESTIMATE

GENERAL-10

	DESCRIPTION OF WORK		TIME IN MONTHS FROM STARTING DATE OF: 7-15-68 — COMPLETE
01	PLOT PLAN	E E E	PRELIM. — BLOCK MODEL — FINAL
03	STEEL STRUCTURES	E P C	
10	BUILDINGS	E P C	
11	PIPING STUDY	E P C	STUDY — PIPING TAKE-OFF
12	ELECTRICAL DISTRIBUTION	E P C	PARTIAL
13	CONTROL BOARD	E P C	
18	FIRE PROTECTION	E P C	PARTIAL
25	COMMUNICATIONS	E P C	PARTIAL
29	PAVING & FINAL GRADING	E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	

10/15 11/15
12/16

SCHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION

A.- APPROVAL
PO- PLACE PURCHASE ORDER

Sheet 3 Rev. 1
Date 9-15-68
By
Job No. W-1784

SCHEDULE
PROGRESS
REVISED SCHEDULE

E – ~~Engineering & Drafting~~ WRITE REQ./DWG.
P – ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C – ~~Field Construction Work~~ ESTIMATE

COAL HANDLING-1 & PRETREATING-2

TIME IN ~~WEEKS~~ MONTHS FROM STARTING DATE OF: 7-15-68

	DESCRIPTION OF WORK		COMPLETE
00	P & I D	E E E	
05	HEATERS	E P C	
06	VESSELS	E P C	
07	EXCHANGERS	E P C	
08	PUMPS	E P C	
09	COMPRESSORS	E P C	
13	INSTRU-MENTATION	E P C	
17	MATERIAL HANDLING EQUIPMENT	E P C	
31	HOPPERS	E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	

PROCUREMENT AND CONSTRUCTION

A-APPROVAL
PO-PLACE PURCHASE ORDER

SCHEDULE
PROGRESS
REVISED SCHEDULE

Date 9-15-68
By
Job No. W-1784

E ~~Engineering & Drafting~~ WRITE REQ./DWG.
P – ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C – ~~Field Construction Work~~ ESTIMATE

REACTION SECTION-3

TIME IN WKS FROM STARTING DATE OF: 7-15-68

	DESCRIPTION OF WORK		COMPLETE
00	P&ID	E E E	
05	~~HEATERS~~	E P C	
06	VESSELS	E P C	
06	REACTOR 3.06-01	E P C	
07	EXCHANGERS	E P C	
08	PUMPS	E P C	
13	INSTRU-MENTATION	E P C	
13	REACTOR VALVES	E P C	
32	MIXER	E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	

PRELIM
FINAL
BIDS DUE
REVIEW BIDS
PO
REVISED MATLS

SCHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION.

A-APPROVAL
PO-PLACE PURCHASE ORDER

12/13

SCHEDULE
PROGRESS
REVISED SCHEDULE

Sheet 5 Rev. 1
Date 9-15-68
By
Job No. W-1784

E – ~~Engineering & Drafting~~ WRITE REQ./DWG.
P – ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C – ~~Field Construction Work~~ ESTIMATE WKS

GAS PURIFICATION - 4

TIME IN ~~WEEKS~~ FROM STARTING DATE OF: 7-15-68

	DESCRIPTION OF WORK		COMPLETE
00	P & I D :	E E E	PREL IM → FINAL
06	VESSELS	E P C	DK A
07	EXCHANGERS	E P C	DK A
08	PUMPS	E P C	A
13	INSTRU-MENTATIOU	E P C	
32	MIXER	E P C	
28	PROCESS FILTER	E P C	
24	CHEMICALS & CATALYST	E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	

A - APPROVAL

PO - PLACE PURCHASE ORDER

PROGRESS

REVISED SCHEDULE

Job No. W-1736

E - ~~Engineering & Drafting~~ WRITE REQ./DWG.

P - ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS

C - ~~Field Construction Work~~ ESTIMATE

METHANATION SECTION - 5

	DESCRIPTION OF WORK		TIME IN WKS FROM STARTING DATE OF: 7-15-68 — COMPLETE
			½ 1 1½ 2 2½ 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 30 (%)
00	P & I D.	E E E	
05	~~HEATERS~~	E P C	
06	VESSELS	E P C	
07	EXCHANGERS	E P C	
		E P C	
09	COMPRESSORS	E P C	
13	INSTRUMENTATION	E P C	
24	CHEMICALS & CATALYST	E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	

10/15 11/15
12/15

SCHEDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION
A-APPROVAL
PO-PLACE PURCHASE ORDER

Fluor

SCHEDULE
PROGRESS
REVISED SCHEDULE

Sheet 7 Rev. 1
Date 9-15-68
By
Job No. W-1784

E – ~~Engineering & Drafting~~ WRITE REQ./DWG.
P – ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C – ~~Field Construction Work~~ ESTIMATES W16

BLOWDOWN & DISPOSAL-6

	DESCRIPTION OF WORK		TIME IN WEEKS FROM STARTING DATE OF: 7-15-68 — COMPLETE
00	P&ID:	E E E	
06	VESSELS	E P C	
07	EXCHANGERS	E P C	
08	PUMPS	E P C	
13	INSTRU-MENTATION	E P C	
22	INCINERATOR & FLARE	E P C	
	ENGINEERED PACKAGE SYSTEMS	E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	
		E P C	

EDULE AND STATUS OF ENGINEERING
PROCUREMENT AND CONSTRUCTION
A- APPROVAL
PO- PLACE PURCHASE ORDER

PRELIM

PROGRESS
REVISED SCHEDULE

Sheet 8 Rev. 1
Date 9-15-68
By
Job No. W-1784

E – ~~Engineering & Drafting~~ WRITE REQ. / DWG.
P – ~~Procurement of Materials~~ OBTAIN QUOTES & REVIEW BIDS
C – ~~Field Construction Work~~ ESTIMATE

UTILITY PLANT-7

	DESCRIPTION OF WORK		TIME IN MONTHS FROM STARTING DATE OF: 7-15-68	COMPLETE
			7/15 1/22 2/29 3/8 4/12 5/19 6/26 7/3 8/1 9/16 10/23 11/30 12/7 13/14 14/21 15/28 16/4 17/11 18/18 19/25 20/2 21/9 22/16 23/23	
00	UTILITY FLOW DIAGRAMS	E E E		
00	WATER BOILER P & ID	E P C	PRELIM	
00	H_2 STEAM CONTROL P&ID	E P C	PRELIM FINAL	
05	HEATERS	E P C	A	
06	VESSELS	E P C	A	
08	PUMPS	E P C	A	
09	COMPRESSORS	E P C	A	
13	INSTRU-MENTATION	E P C	A	
19	BOILERS	E P C	A	
22	INSTRUMENT AIR PACKAGE	E P C		
22	COOLING WATER TREATMENT	E P C		
22	H_2 PLANT	E P C		
22	BW TREATMENT	E P C		
27	TANKS	E P C		

CONTRACT FINANCIAL REPORT (Dollars in thousands) (See instructions before preparation)	1 For Month Ended	2 No. of Work Days	3 Contract No.	Form Approved Budget Bureau No. 80R0178 Sheet ____ of ____
4 To:	5 From:		6 Contract Value $	7 Contract Type
			8 Funded Contract Amount $	9 Amounts Billed $
10 Program/Scope of Work	11 Signature and Title of Authorized Representative		12 Preparation Date	13 Payments Received $

14 Appropriation (or Fund Citation) and/or Reporting Category	15 Cost Incurred/Contract Earnings			16 Planning Data (For Agency use only)			
	Cum. Actual End of Prior Mo. a	Actual/ Estimated Current Month b	Cumulative Actual/ Estimated To Date c	a	b	c	d
	$	$	$				
Procon Incorporated W-1784	4	1	5				
Procon Incorporated W-1784X-1	34	14	48				
Less 10% Retention	3	1	4				
	31	13	44				
17 Total							

"The undersigned certifies that the amount is due and payable to Procon, in accordance with the terms of the contract up to the date of this Certificate and that the Contractor has fully complied with the terms and conditions of the contract."

Progress Report No. 5, December 15, 1968

T. A. Taylor

U.S. DEPARTMENT OF COMMERCE
Technology Administration
National Technical Information Service
Springfield, VA 22161 (703) 605-6000