

CONTENTS

	<u>Page</u>
Summary.....	1
Introduction	2
Acknowledgments.....	3
Description of pilot plant and the coal gasification process.....	3
Coals gasified.....	3
Sampling of gases and residues produced during gasification.....	3
Experimental plan.....	6
Method of calculating results.....	8
Accuracy of results.....	10
Flow measurement of reactants and product gas.....	10
Calculations and graphs.....	11
Results--discussion and analysis.....	11
Effect of changes in operating conditions on essential variables in the process.....	11
Percentage of carbon gasified.....	12
Oxygen and coal requirement.....	13
Evaluation of fraction of heat loss equivalent to decrease in $\text{CO} + \text{H}_2$ in product gas.....	16
Optimum capacity of the gasifier.....	17
Estimation of oxygen and coal requirements at lower levels of heat loss.....	18
Determination of temperature of gas from the gasifier	20
Appendix A.--Method of calculating results.....	22
Appendix B.--Determination of fraction of heat loss equivalent to $\text{CO} + \text{H}_2$	26
Appendix C.--Derivation of slopes of curves showing change in coal and oxygen requirements with change in heat loss	27
Appendix D.--Mathematical derivation of values for optimum capacity of the gasifier.....	28
Appendix E.--Calculation of exit-gas temperatures.....	29

ILLUSTRATIONS

Fig.

1. Flowsheet of pressure-gasification process.....	4
2. Pressure gasifier.....	6
3. Gasifier with water-cooled lining.....	7
4. Gasifier with refractory lining.....	8
5. Refractory-lined gasifier modified by addition of upper support coil.....	10

ILLUSTRATIONS (Con.)

<u>Fig.</u>		<u>Page</u>
6.	Scatter of data about the correlation; oxygen requirement.....	11
7.	Effect of oxygen-to-coal ratio on carbon gasified, in percent.....	11
8.	Effect of oxygen-to-coal ratio on heat loss.....	12
9.	Effect of oxygen-to-coal ratio on percentage of carbon gasified at constant heat loss.....	12
10.	Effect of oxygen-to-coal ratio on oxygen requirement at constant heat loss and at variable heat loss....	14
11.	Effect of oxygen-to-coal ratio on coal requirement at constant heat loss and at variable heat loss.....	14
12.	Oxygen and coal requirement as a function of heat loss at coal rate of 1,150 pounds per hour.....	15
13.	Oxygen and coal requirement as a function of heat loss at operating pressure of 225 pounds per square inch gage.....	16
14.	Heat loss factor as function of heat loss and oxygen-to-coal ratio at constant operating pressure and constant coal rate.....	17
15.	Effect of heat loss on exit-gas temperature.....	20

TABLES

1.	Analysis of high-volatile A bituminous coal.....	5
2.	Typical analyses of gases produced by different gasifiers at various combinations of pressure, oxygen-to-coal ratio, and steam-to-coal ratio.....	5
3.	Operating conditions and principal results, gasifier 3 with refractory lining.....	9
4.	Optimum gasifier capacity.....	19
5.	Estimated coal and oxygen requirements at optimum gasifier capacity projected to a constant heat loss of 100 B.t.u./lb. of coal.....	19
6.	Exit-gas temperatures at conditions of optimum gasifier capacity.....	21
A-1.	Coding equations for variables.....	22
A-2.	Coefficients and their standard deviations for runs with the refractory-lined gasifiers, 92 to 104.....	23
A-3.	Coefficients and their standard deviations for combined results, runs 39 to 68 and 92 to 104.....	24
A-4.	Analysis of variance.....	24
A-5.	Difference between measured and calculated values of the material requirements.....	25