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Ohio Coal Development Office

Final Report

Volume II: Appendices

"Slurry Combustion"

Project #R-86-034-01-OH

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APPENDIX A

COAL ANALYSES AND SLURRYABILITY CHARACTERISTICS

TABLES	First: Raw Coal Analyses Second: Clean Concentrate Analysis
GRAPHS	Washability Flotation Recovery PSD Cumulative Rheology

(1) Lower Kittanning #5
Clinton Township
Sands Hill Coal CO.

INTRINSIC COAL CHARACTERISTICS

COAL NAME: Lower Kittanning #5 Clinton Township (Washed Raw Coal)

SOURCE: Sands Hill Coal Company
Wellston, Ohio

PROXIMATE ANALYSIS

	As Rec'd	Dry
Fixed Carbon	46.07	49.16
Volatile Matter	37.08	39.57
Ash	10.55	11.27
Moisture	6.30	—
TOTAL	100.00	100.00

ASH FUSION

Temperatures, °F

	Red	Oxid
Initial Deform	2051	2585
Soft Temp, Sph	2258	2620
Fluid Temp	2582	2761

ULTIMATE ANALYSIS

	As Rec'd	Dry
Carbon	64.99	69.36
Hydrogen	5.66	5.28
Oxygen	14.36	9.34
Nitrogen	1.26	1.35
Sulfur	3.18	3.40
Ash	10.55	11.27
TOTAL	100.00	100.00
HHV (BTU)	11,701	12,489
CALCULATED	11,948	

ASH ANALYSIS

Element	% As Oxide
SiO_2	38.20
Al_2O_3	28.40
TiO_2	0.90
Fe_2O_3	26.40
CaO	3.00
MgO	1.10
Na_2O	0.00 (<.30)
K_2O	1.10
SO_3	0.60
P_2O_5	0.30

SULFUR FORMS ANALYSIS

Total Sulfur	3.66	3.91
Sulfate	0.02	0.02
Pyritic	1.55	1.65
Organic	2.09	2.24

EQ. Moisture = 6.42%
Air Dry Loss = 0.84%

INTRINSIC COAL CHARACTERISTICS

COAL NAME: Lower Kittanning #5 Clinton Township (Clean Concentrate)

SOURCE: Sands Hill Coal Company
Wellston, Ohio

PROXIMATE ANALYSIS

	As Rec'd	Dry
Fixed Carbon	51.87	52.68
Volatile Matter	39.67	40.26
Ash	6.96	7.06
Moisture	1.50	—
TOTAL	100.00	100.00

ASH FUSION

Temperatures, °F

	Red	Oxid
Initial Deform	2628	2631
Soft Temp, Sph	2679	2684
Fluid Temp	72800	72800
Hemisph. Temp.	2702	2714

ULTIMATE ANALYSIS

	As Rec'd	Dry
Carbon	70.74	71.78
Hydrogen	5.41	5.32
Oxygen	13.37	12.25
Nitrogen	1.32	1.33
Sulfur	2.20	2.23
Ash	6.96	7.06
TOTAL	100.00	100.00
HHV (BTU)	12,820	13,009
CALCULATED	12,707	

ASH ANALYSIS

Element	% As Oxide
SiO_2	39.20
Al_2O_3	29.50
TiO_2	1.30
Fe_2O_3	22.80
CaO	2.40
MgO	1.50
Na_2O	0.00 (<.30)
K_2O	1.40
SO_3	1.50
P_2O_5	0.50

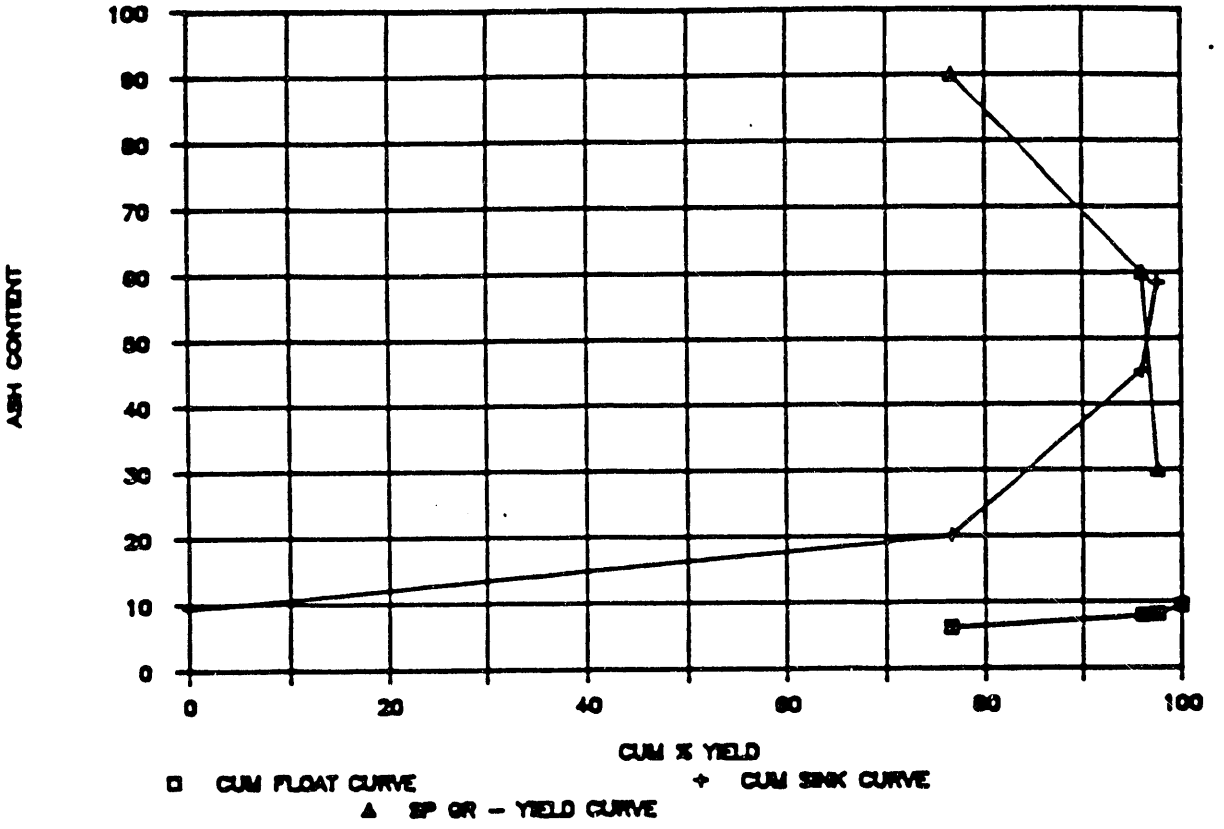
SULFUR FORMS ANALYSIS

Total Sulfur
Sulfate
Pyritic
Organic

EQ. Moisture
Air Dry Loss

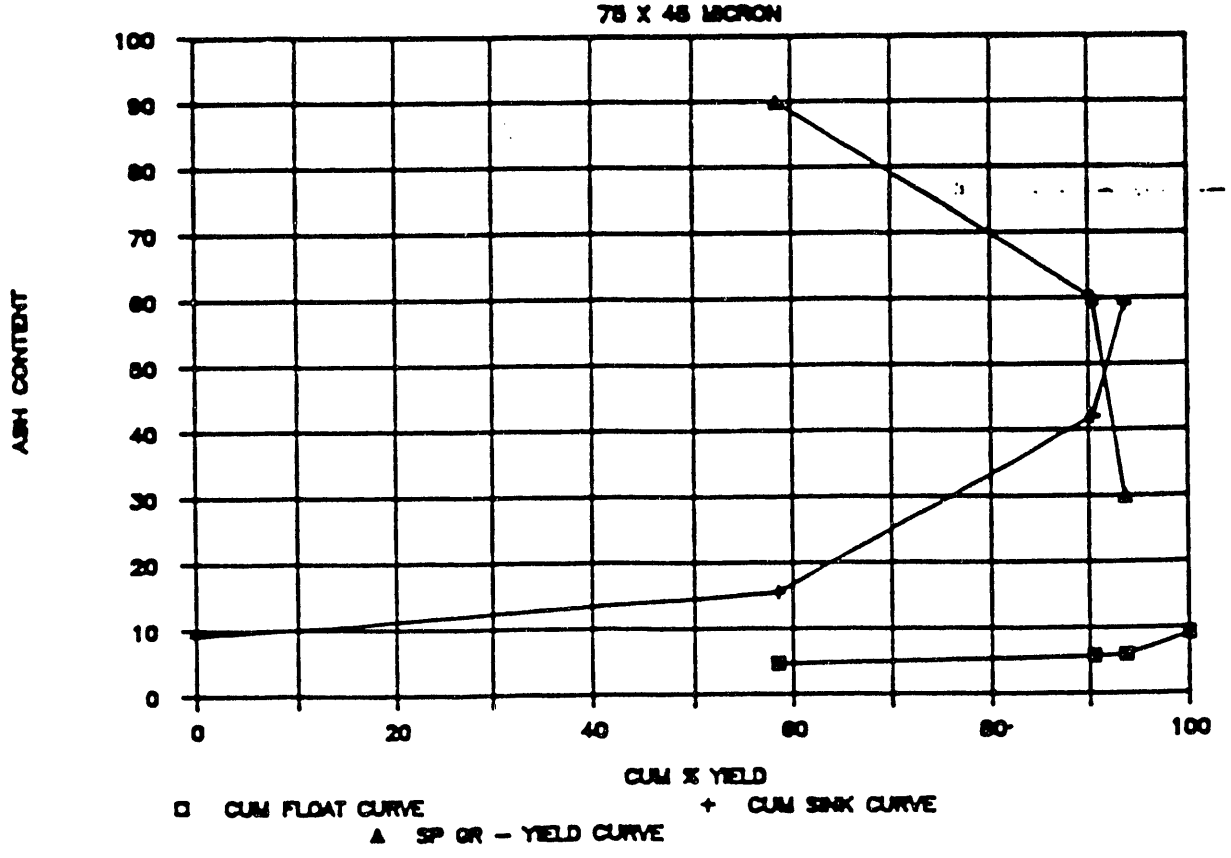
SANDS HILL
WASHABILITY CURVE

210 X 75 MICRON



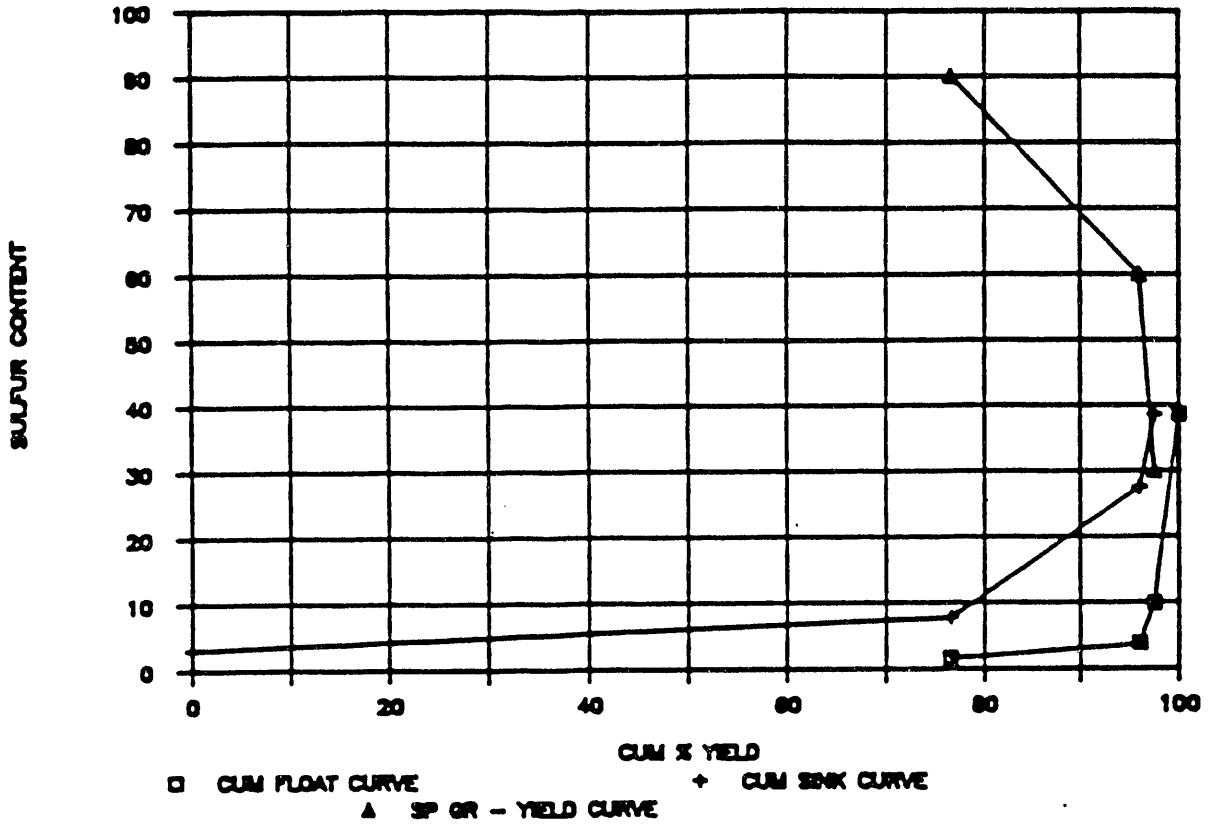
WASHABILITY CURVE

75 X 45 MICRON



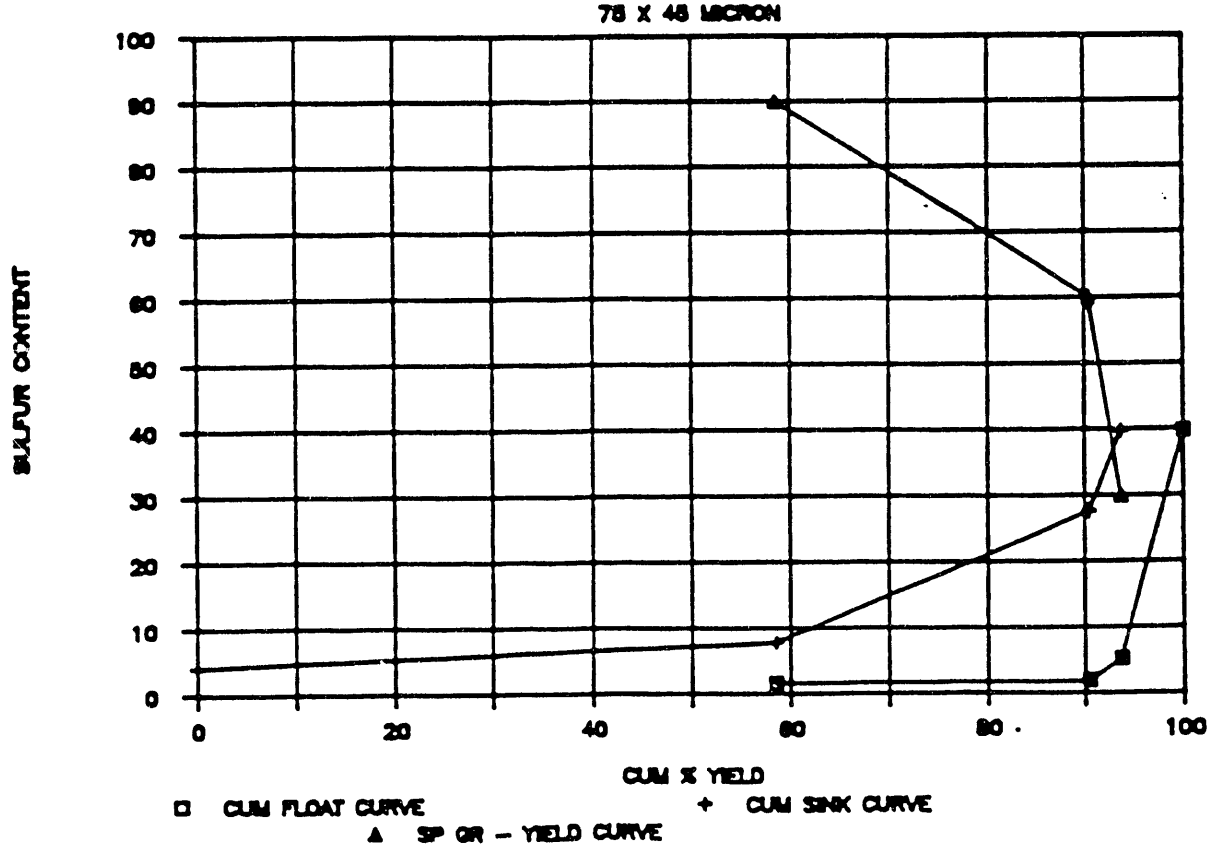
SANDS HILL
WASHABILITY CURVE

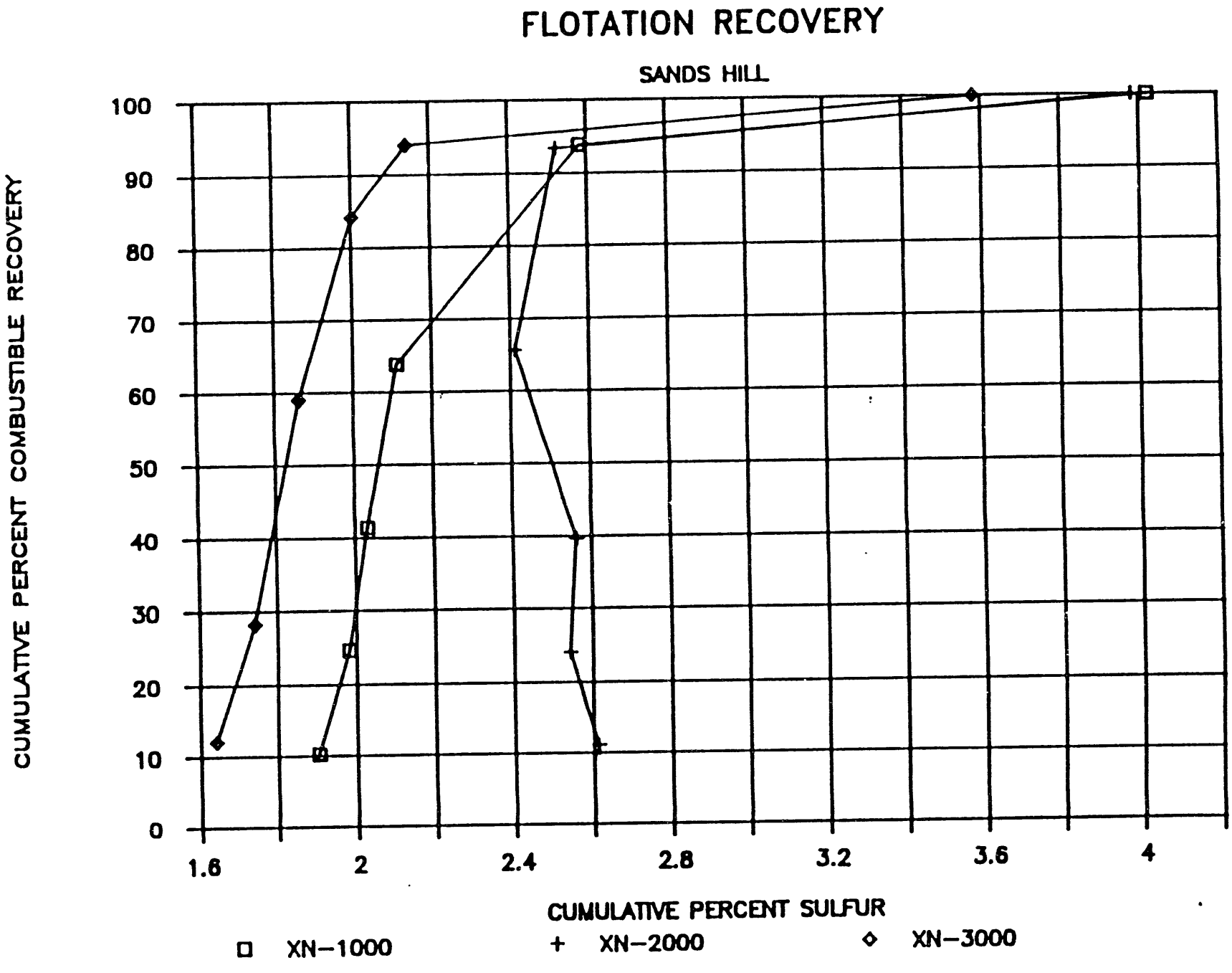
210 X 75 MICRON

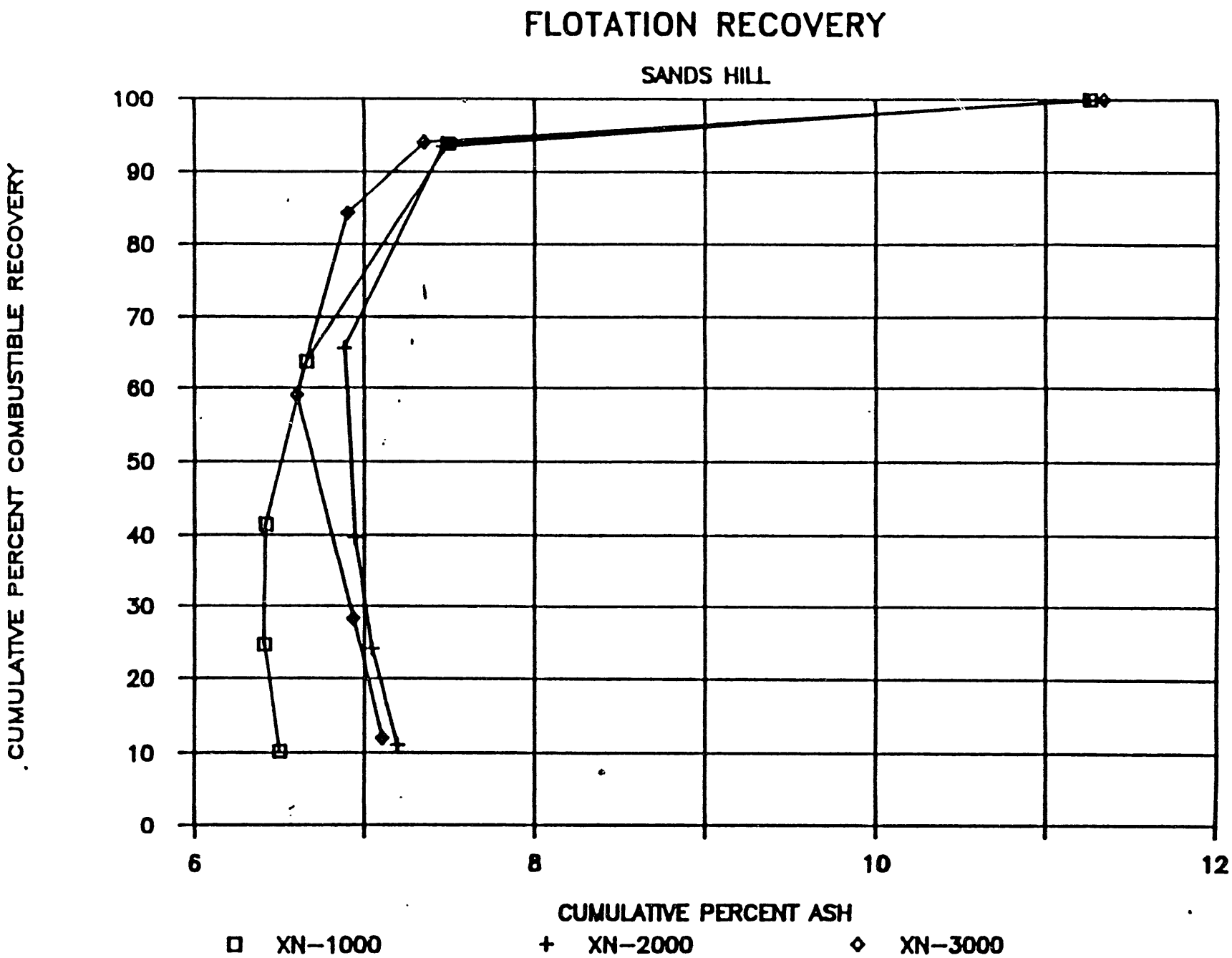


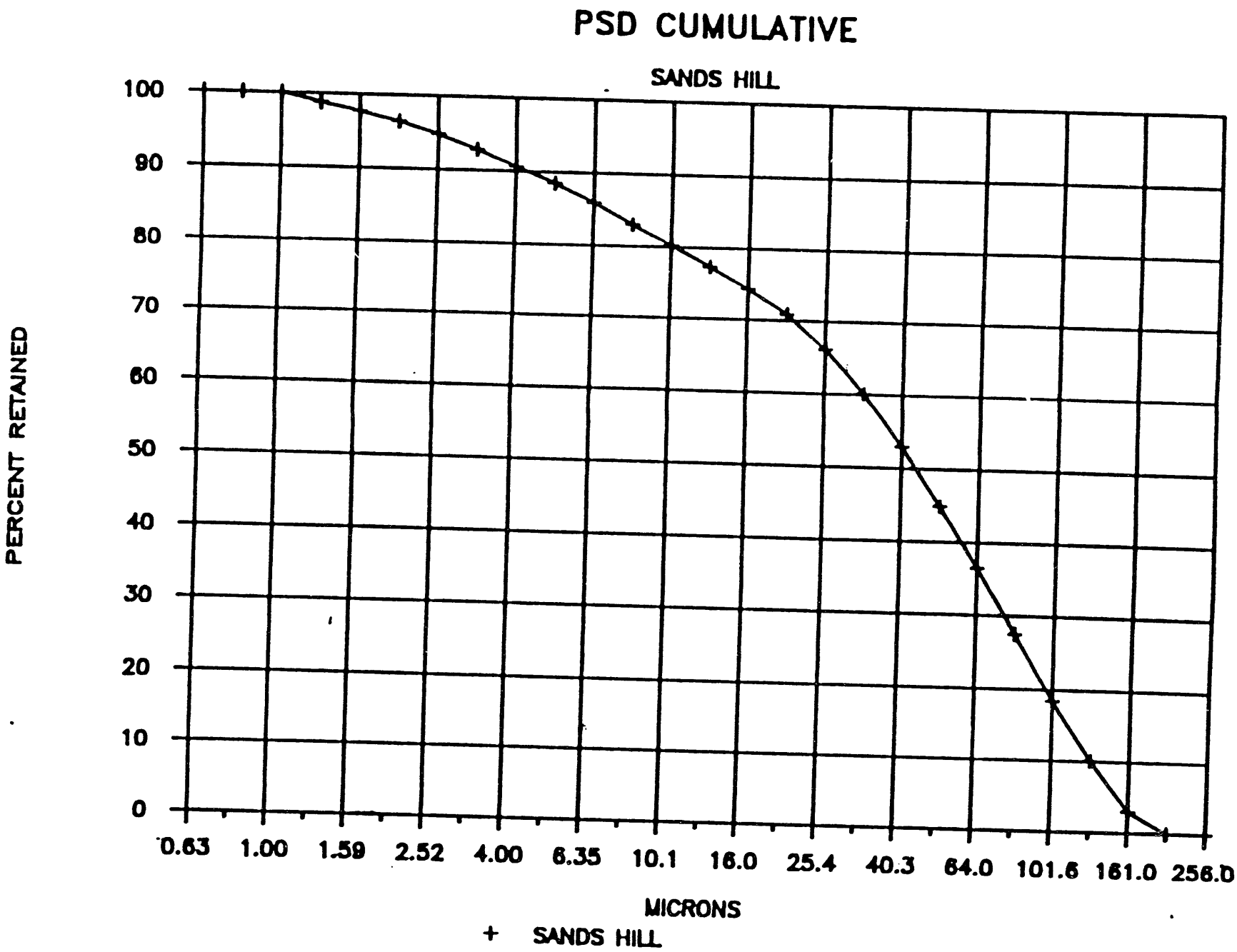
WASHABILITY CURVE

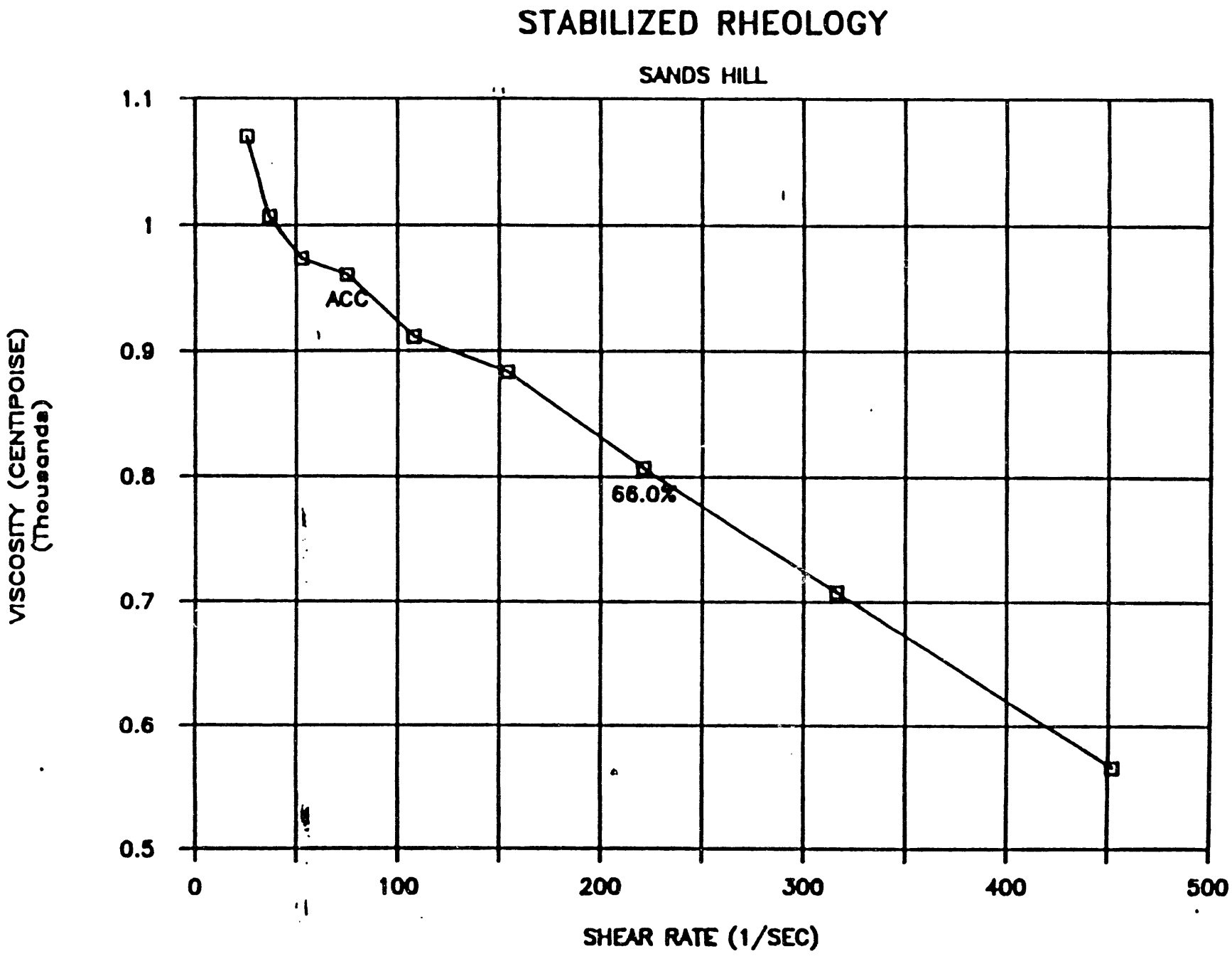
75 X 45 MICRON




FLOTATION RECOVERY
SANDS HILL
CUMULATIVE PERCENT COMBUSTIBLE RECOVERY
100
90
80
70
60
50
40
30
20
10
0
1.6
2
2.4
2.8
3.2
3.6
4
CUMULATIVE PERCENT SULFUR
XN-1000
XN-2000
XN-3000


FLOTATION RECOVERY
SANDS HILL
CUMULATIVE PERCENT COMBUSTIBLE RECOVERY
100
90
80
70
60
50
40
30
20
10
0
6
8
10
12
CUMULATIVE PERCENT ASH
XN-1000
XN-2000
XN-3000


PSD CUMULATIVE
SANDS HILL
PERCENT RETAINED
100
90
80
70
60
50
40
30
20
10
0
0.63
1.00
1.59
2.52
4.00
6.35
10.1
16.0
25.4
40.3
64.0
101.6
161.0
256.0
MICRONS
+ SANDS HILL


STABILIZED RHEOLOGY
SANDS HILL
VISCOSITY (CENTIPOISE)
(Thousands)
1.1
1
0.9
0.8
0.7
0.6
0.5
ACC
66.0%
0
100
200
300
400
500
SHEAR RATE (1/SEC)

(2) Pittsburgh #8
Barnesville Area
Cravat Coal CO.

INTRINSIC COAL CHARACTERISTICS

COAL NAME: Pittsburgh #8 Barnsville Area (Unwashed Raw Coal)

SOURCE: Cravat Coal Company
Cadiz, Ohio

PROXIMATE ANALYSIS

	As Rec'd	Dry
Fixed Carbon	44.04	45.36
Volatile Matter	39.91	41.10
Ash	13.15	13.54
Moisture	2.90	—
TOTAL	100.00	100.00

ASH FUSION

	Temperatures, °F Red	Oxid
Initial Deform	2037	2534
Soft Temp, Sph	2086	2575
Fluid Temp	2256	2755

ULTIMATE ANALYSIS

	As Rec'd	Dry
Carbon	65.57	67.51
Hydrogen	5.24	5.07
Oxygen	8.34	5.95
Nitrogen	1.11	1.14
Sulfur	6.59	6.79
Ash	13.15	13.54
TOTAL	100.00	100.00

HHV BTU	12,114	12,473
CALCULATED	12,200	

ASH ANALYSIS

Element	% As Oxide
SiO_2	32.2
Al_2O_3	15.2
TiO_2	0.8
Fe_2O_3	35.8
CaO	7.6
MgO	0.8
Na_2O	0.00 (<.3)
K_2O	1.2
SO_3	6.2
P_2O_5	0.2

SULFUR FORMS ANALYSIS

Total Sulfur	6.57	6.77
Sulfate	0.13	0.13
Pyritic	2.62	2.70
Organic	3.82	3.94
EQ. Moisture		= 2.77%
Air Dry Loss		= 0.73%
FSI	4.5	

INTRINSIC COAL CHARACTERISTICS

COAL NAME: Pittsburgh #8 Barnsville Area (Clean Concentrate)

SOURCE: Cravat Coal Company
Cadiz, Ohio

PROXIMATE ANALYSIS

	As Rec'd	Dry
Fixed Carbon	44.04	50.70
Volatile Matter	41.46	41.86
Ash	7.36	7.44
Moisture	1.00	—
TOTAL	100.00	100.00

ASH FUSION

	Temperatures, °F	
	Red	Oxid
Initial Deform	2573	2665
Soft Temp, Sph	2632	2675
Hemisph. Temp.	2674	2708
Fluid Temp	2800	2800

ULTIMATE ANALYSIS

	As Rec'd	Dry
Carbon	71.82	72.00
Hydrogen	5.46	5.40
Oxygen	9.27	8.50
Nitrogen	1.18	1.19
Sulfur	5.40	5.45
Ash	7.36	7.44
TOTAL	100.00	100.00
HHV BTU	13,357	13,485
CALCULATED	13,131	

ASH ANALYSIS

Element	% As Oxide
SiO_2	30.70
Al_2O_3	18.20
TiO_2	1.10
Fe_2O_3	42.60
CaO	2.70
MgO	1.30
Na_2O	0.00 (<.3)
K_2O	1.60
SO_3	1.70
P_2O_5	0.20

SULFUR FORMS ANALYSIS

Total Sulfur
Sulfate
Pyritic
Organic

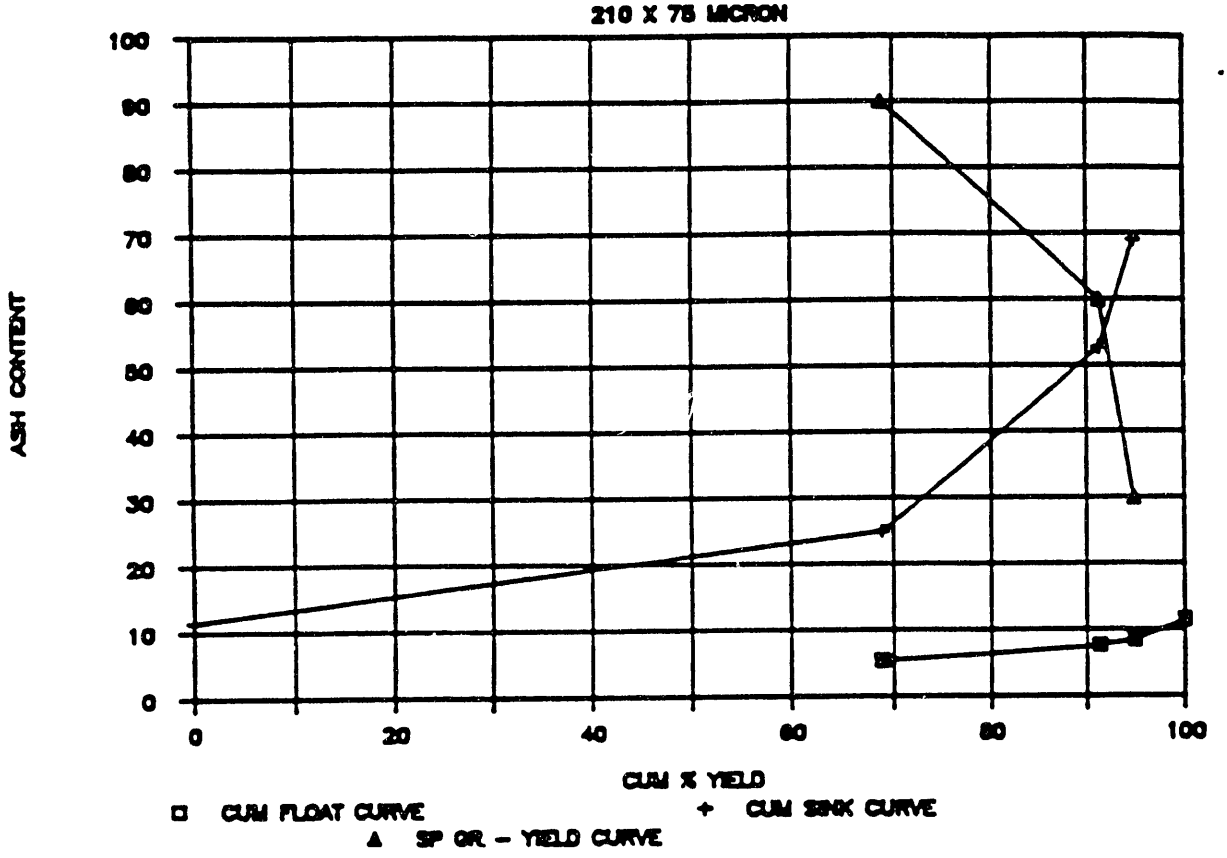
EQ. Moisture = 2.77%
Air Dry Loss = 0.73%

TABLE 4

CRAVAT COAL

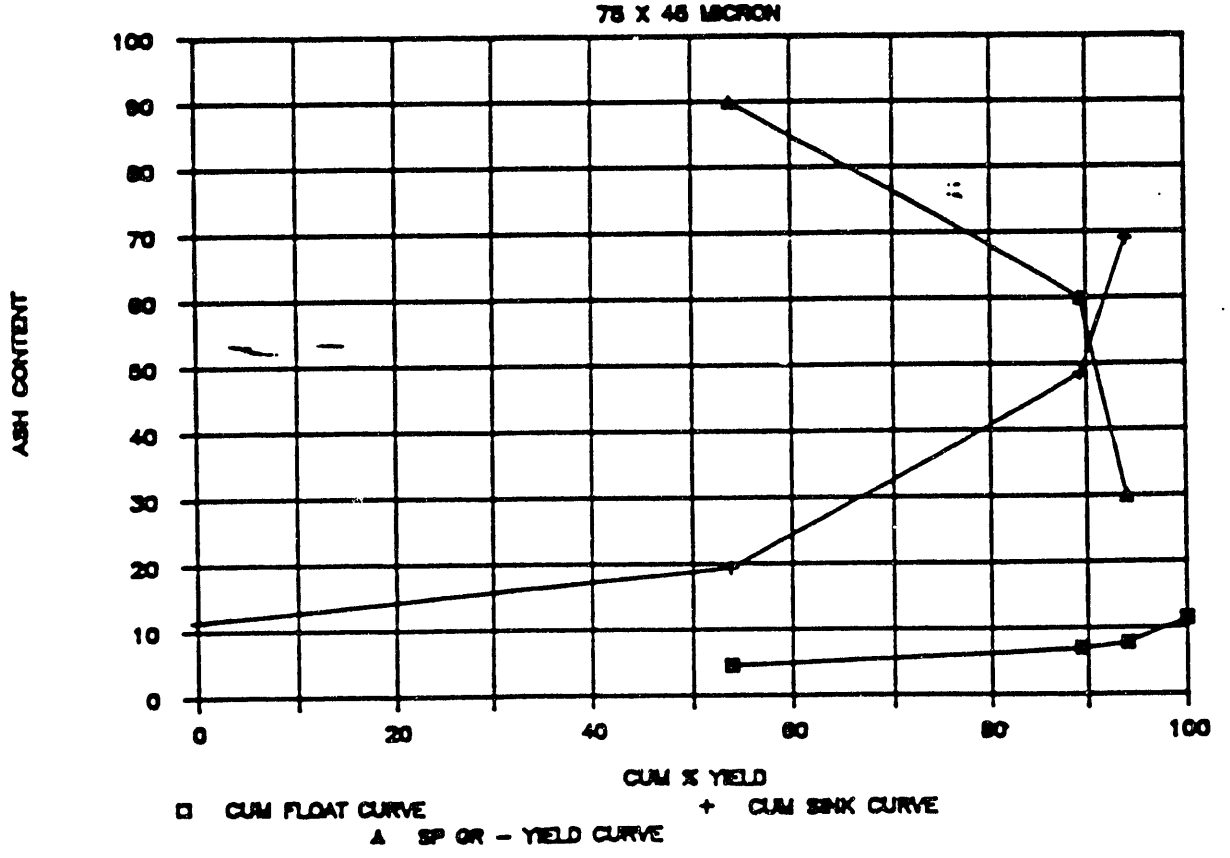
WASHABILITY CURVE

210 X 75 MICRON



WASHABILITY CURVE

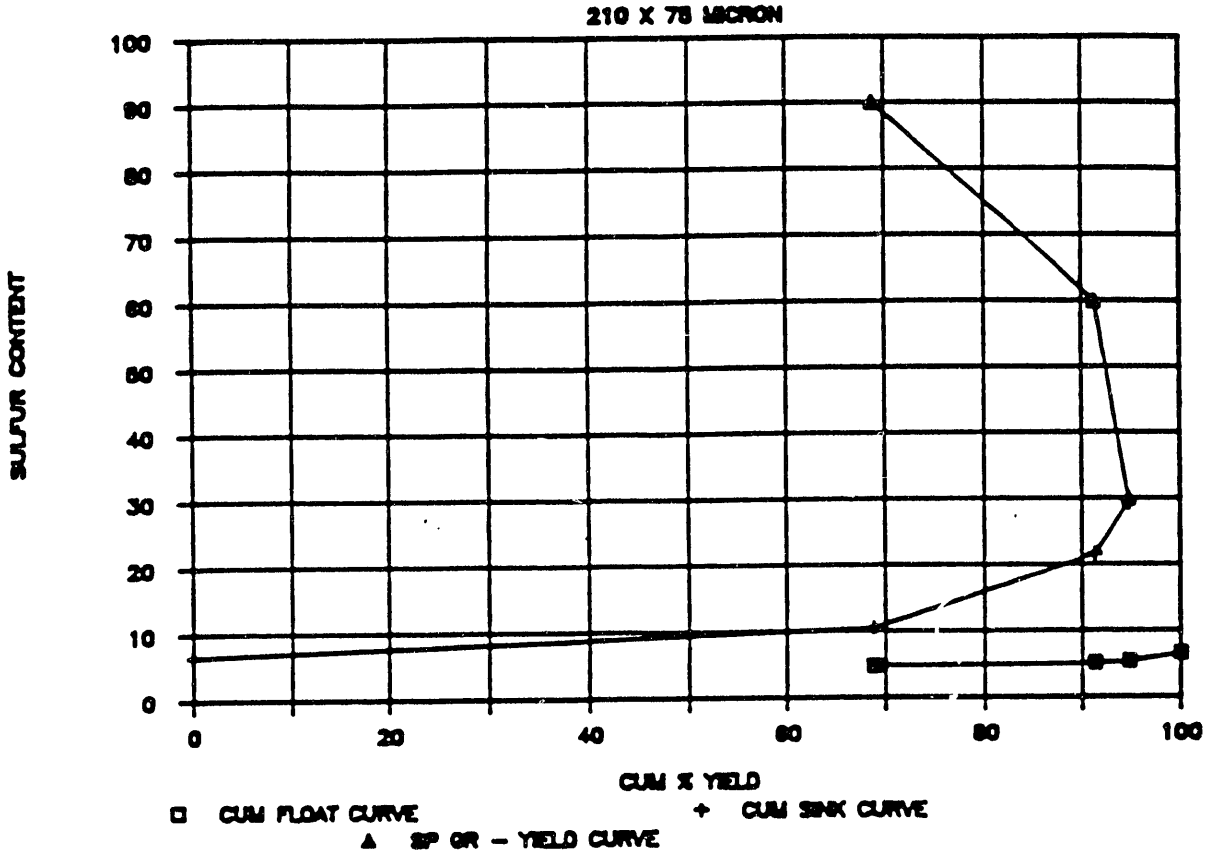
75 X 45 MICRON



CRAVAT COAL

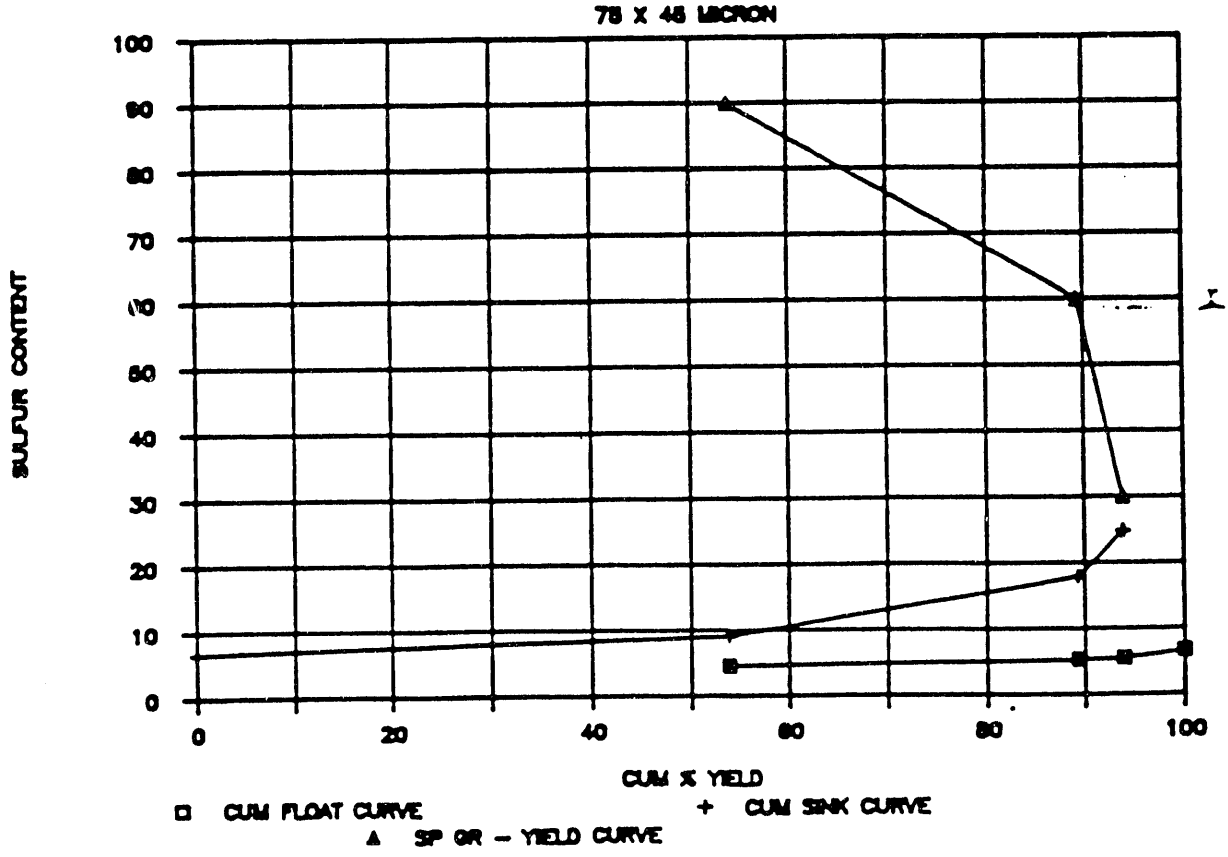
WASHABILITY CURVE

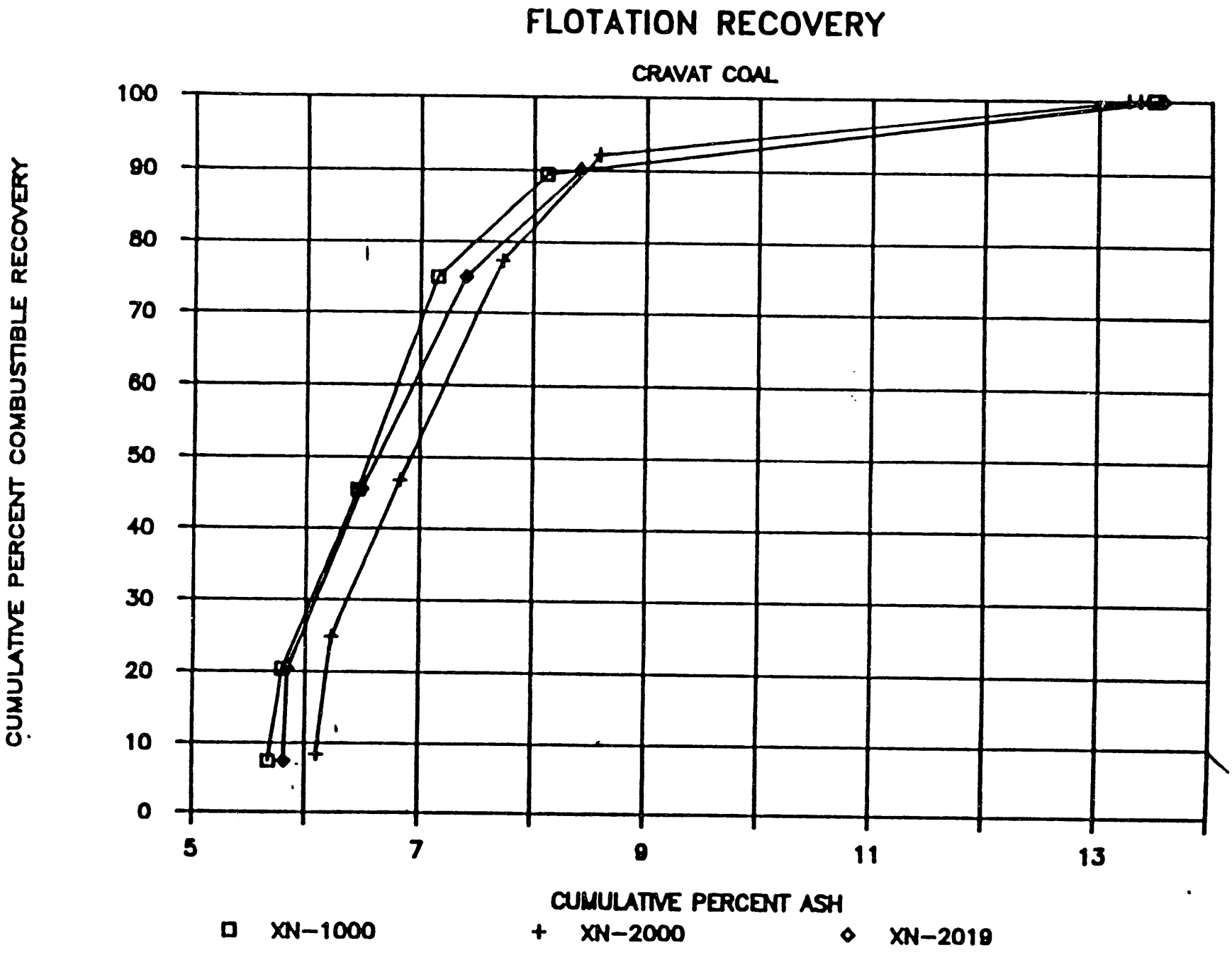
210 X 75 MICRON



WASHABILITY CURVE

75 X 45 MICRON




FLOTATION RECOVERY
CRAVAT COAL
CUMULATIVE PERCENT COMBUSTIBLE RECOVERY
100
90
80
70
60
50
40
30
20
10
0
5
7
9
11
13
CUMULATIVE PERCENT ASH
XN-1000
XN-2000
XN-2019

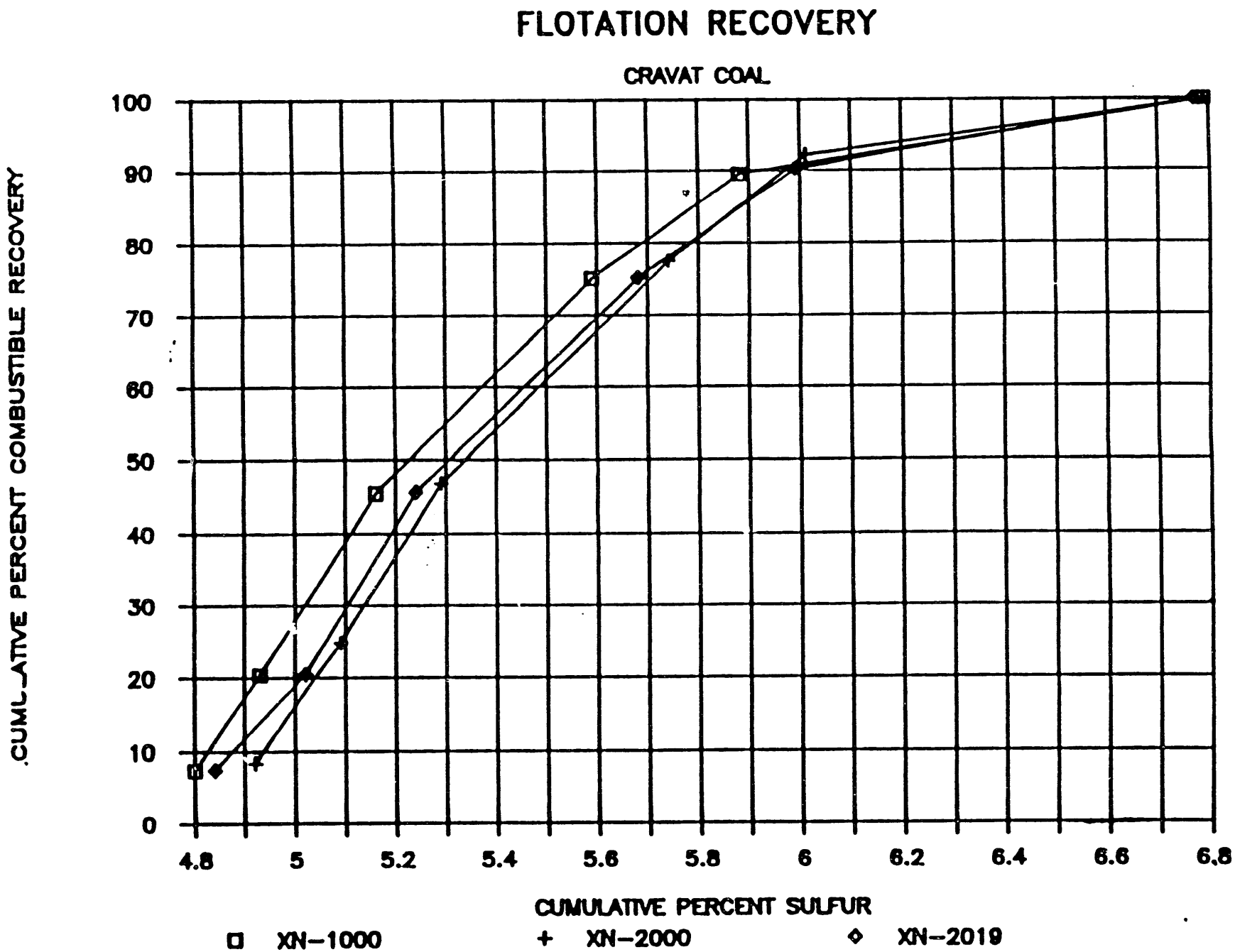
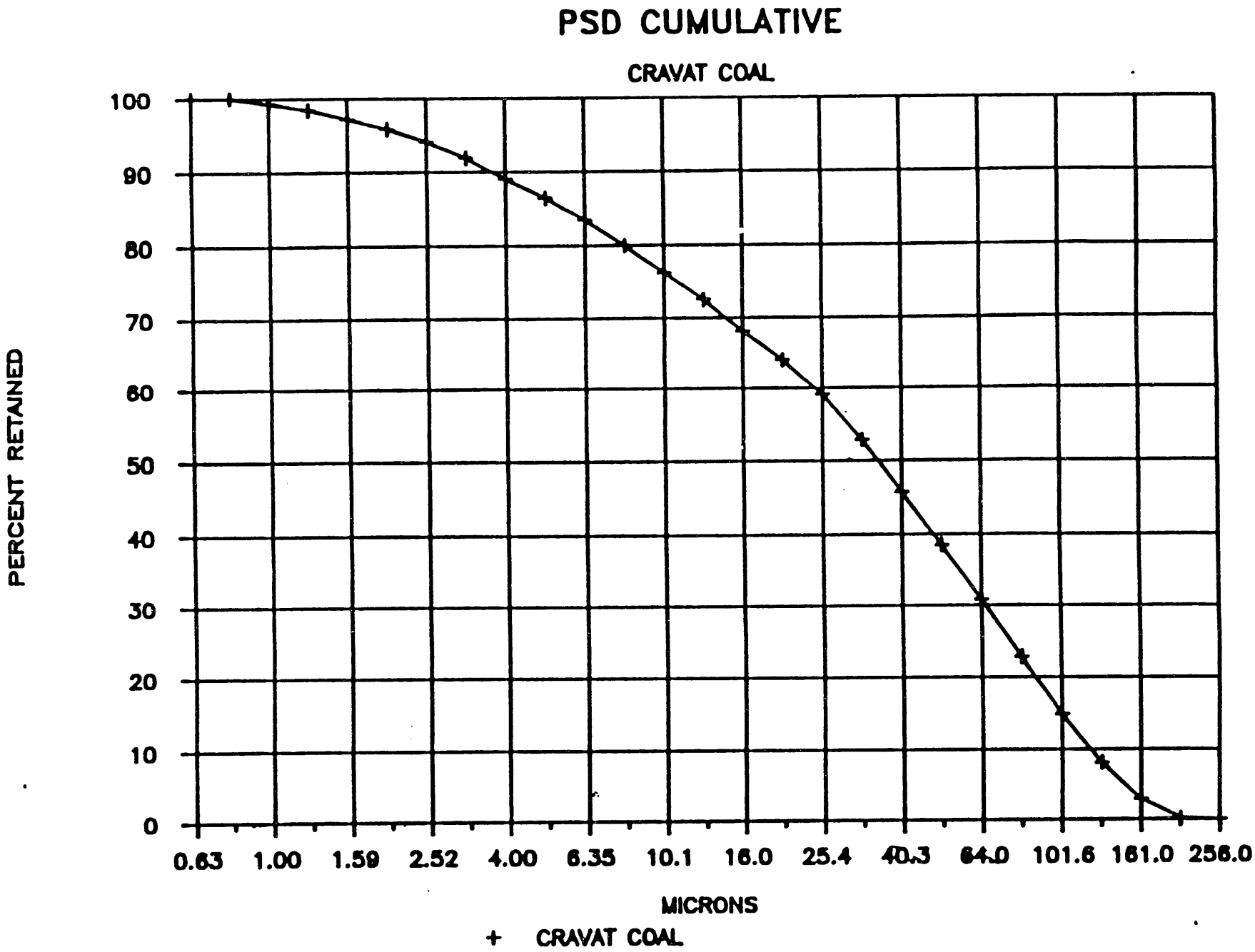
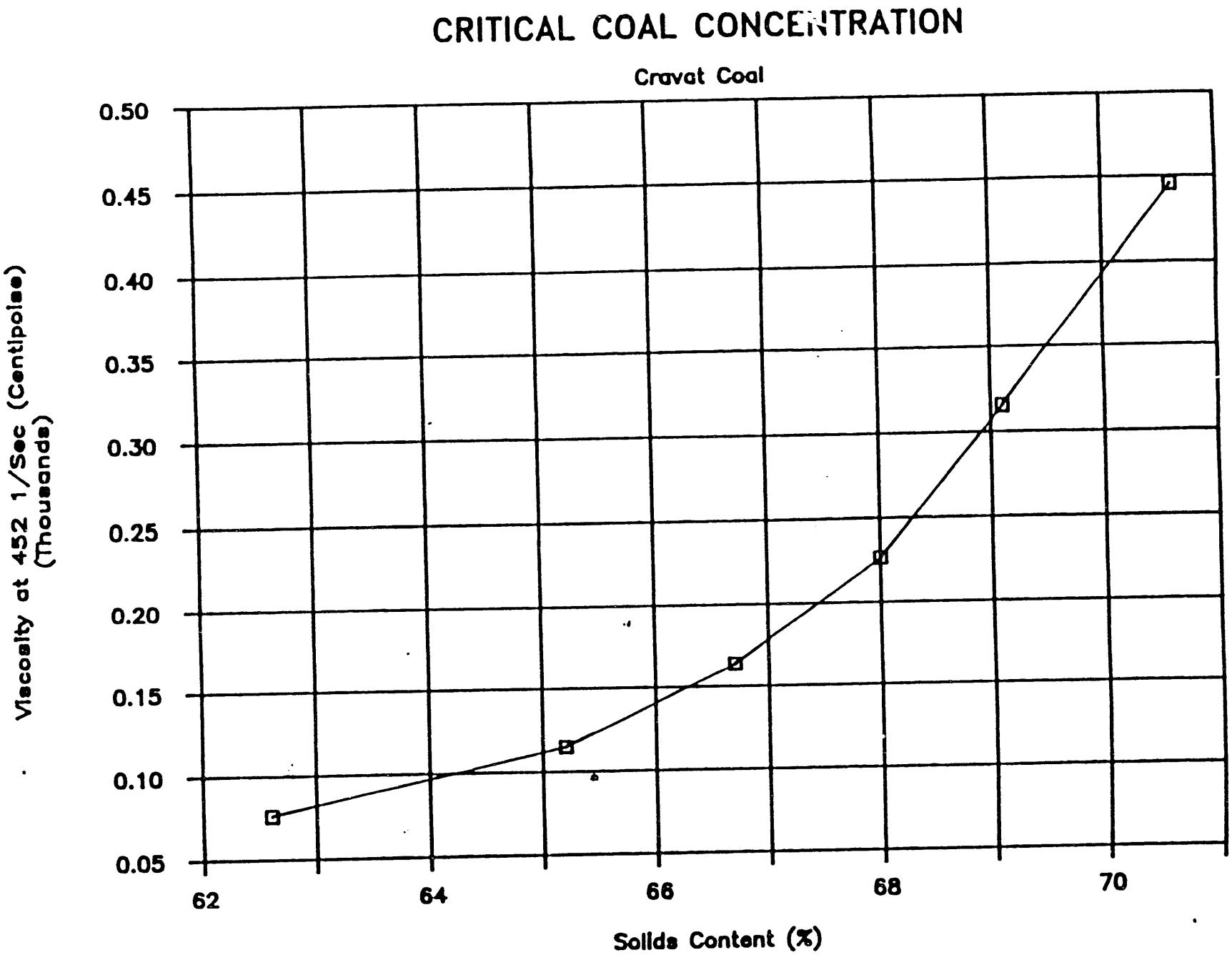
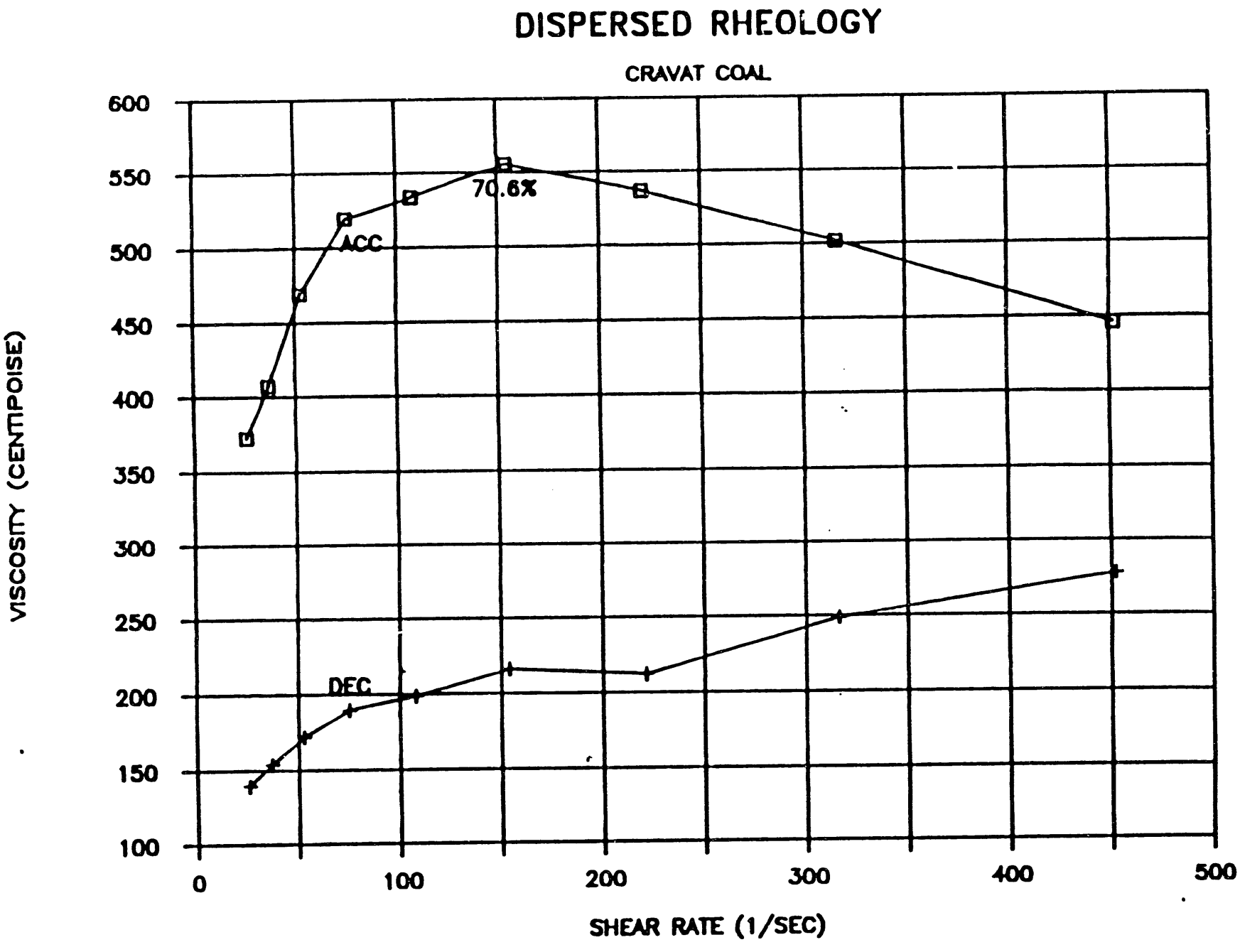
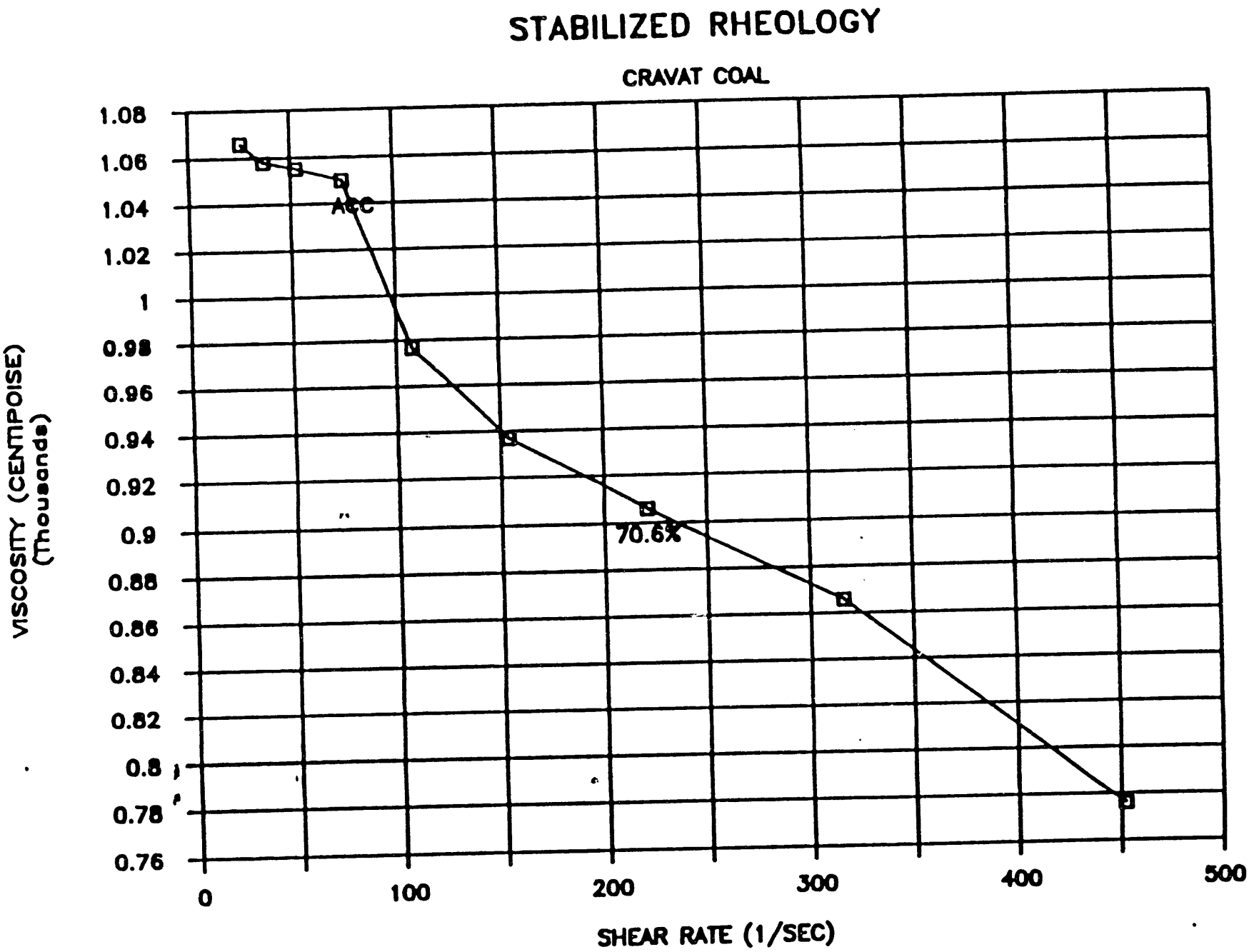

FLOTATION RECOVERY
CRAVAT COAL
CUMULATIVE PERCENT COMBUSTIBLE RECOVERY
100
90
80
70
60
50
40
30
20
10
0
4.8
5
5.2
5.4
5.6
5.8
6
6.2
6.4
6.6
6.8
CUMULATIVE PERCENT SULFUR
XN-1000
XN-2000
XN-2019

FIGURE 2


PSD CUMULATIVE
CRAVAT COAL
PERCENT RETAINED
100
90
80
70
60
50
40
30
20
10
0
0.63
1.00
1.59
2.52
4.00
6.35
10.1
16.0
25.4
40.3
64.0
101.6
161.0
256.0
MICRONS
+ CRAVAT COAL


CRITICAL COAL CONCENTRATION
Cravat Coal
Viscosity at 452 1/Sec (Centipoise)
(Thousands)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
62
64
66
68
70
Solids Content (%)


DISPERSED RHEOLOGY
CRAVAT COAL
VISCOSITY (CENTIPOISE)
600
550
500
450
400
350
300
250
200
150
100
0
100
200
300
400
500
SHEAR RATE (1/SEC)
70.6%
ACC
DEC


STABILIZED RHEOLOGY
CRAVAT COAL
VISCOSITY (CENTIPOISE)
(Thousands)
1.08
1.06
1.04
1.02
1
0.98
0.96
0.94
0.92
0.9
0.88
0.86
0.84
0.82
0.8
0.78
0.76
ACC
70.6%
0
100
200
300
400
500
SHEAR RATE (1/SEC)

(3) Seam #6

Empire Coal CO.

INTRINSIC COAL CHARACTERISTICS

COAL NAME: Empire Coal Feed

SOURCE: Ohio State University

PROXIMATE ANALYSIS

	As Rec'd	Dry
Fixed Carbon	50.89	52.56
Volatile Matter	38.68	39.94
Ash	7.26	7.50
Moisture	3.17	—
TOTAL	100.00	100.00

ASH FUSION

Temperatures, °F

	Red	Oxid
Initial Deform	2133	2504
Soft Temp, Sph	2201	2549
Soft Temp, Hemi	2277	2570
Fluid Temp	2364	2598

ULTIMATE ANALYSIS

	As Rec'd	Dry	
Carbon	69.73	72.01	
Hydrogen	5.16	5.33	
Oxygen	10.24	10.58	
Nitrogen	1.64	1.69	
Sulfur	2.80	2.89	
Ash	7.26	7.50	
Moisture	3.17	—	
TOTAL	100.00	100.00	100.00

ASH ANALYSIS

Element	% As Oxide
SiO_2	40.0
Al_2O_3	28.4
TiO_2	1.3
Fe_2O_3	23.4
CaO	1.8
MgO	1.0
Na_2O	0.5
K_2O	2.0
SO_3	2.1
P_2O_5	0.04

HHV	11,972	12,364	BTU/LB

HGI N/A

FSI 2

INTRINSIC COAL CHARACTERISTICS

COAL NAME: Empire Coal Clean Concentrate

SOURCE: Ohio State University

PROXIMATE ANALYSIS

	As Rec'd	Dry
Fixed Carbon	54.61	56.45
Volatile Matter	38.51	39.81
Ash	3.62	3.74
Moisture	3.26	—
TOTAL	100.00	100.00

ASH FUSION

Temperatures, °F

	Red	Oxid
Initial Deform	2068	2444
Soft Temp, Sph	2147	2491
Soft Temp, Hemi	2175	2508
Fluid Temp	2176	2509

ULTIMATE ANALYSIS

	As Rec'd	Dry
Carbon	73.16	75.63
Hydrogen	5.30	5.48
Oxygen	10.78	11.14
Nitrogen	1.71	1.77
Sulfur	2.17	2.24
Ash	3.62	3.74
Moisture	3.26	—
TOTAL	100.00	100.00

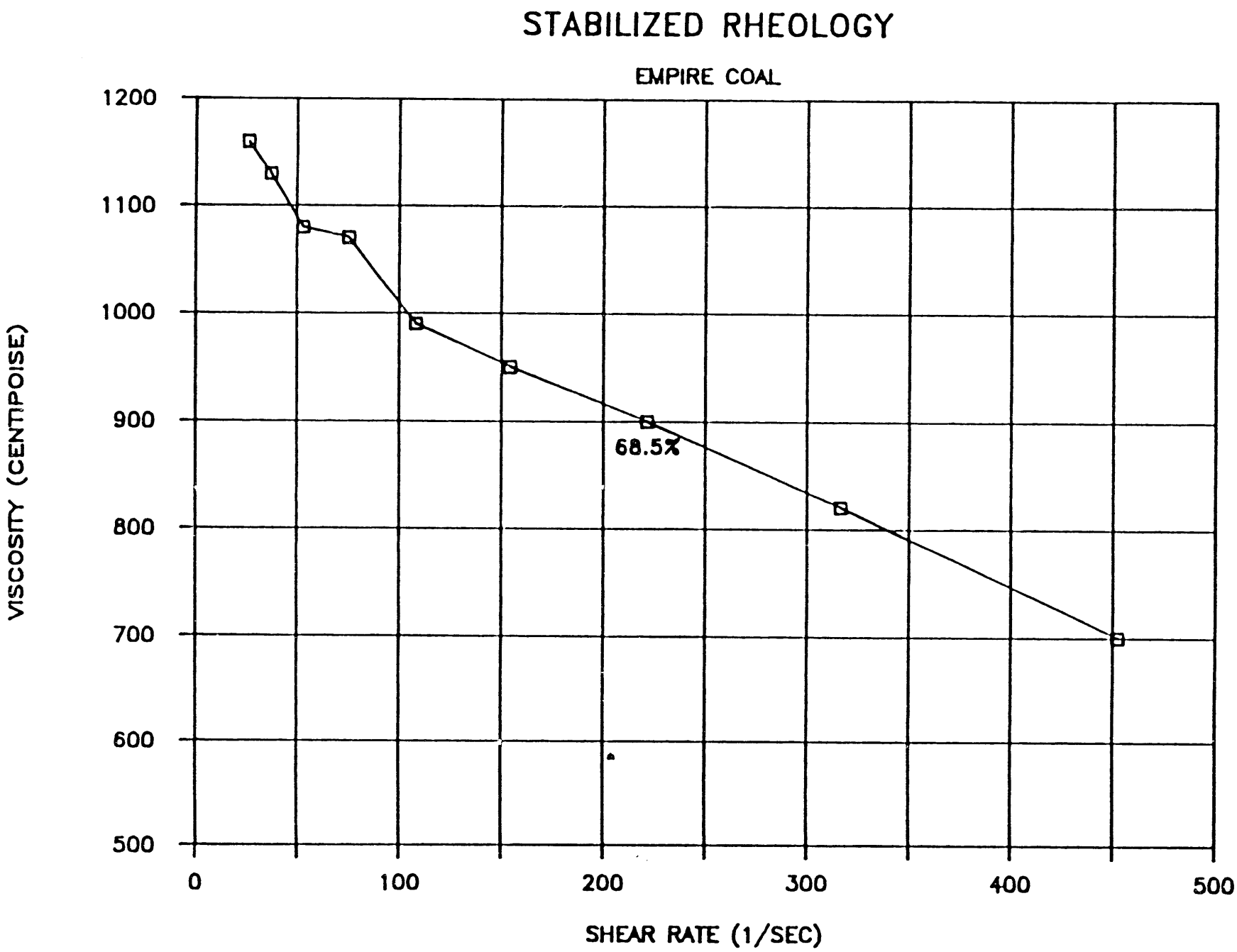
ASH ANALYSIS

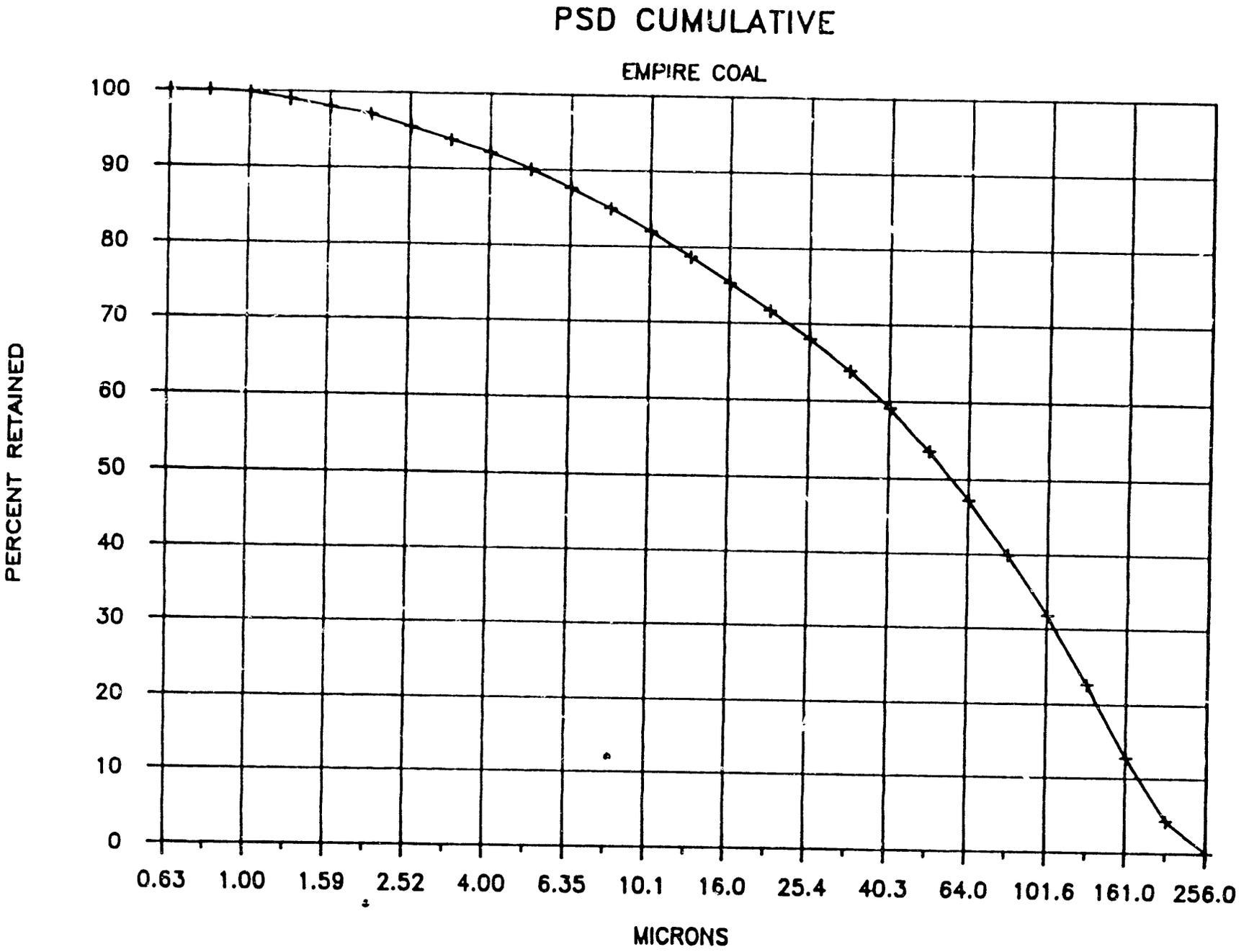
Element	% As Oxide
SiO_2	30.6
Al_2O_3	24.6
TiO_2	1.7
Fe_2O_3	34.0
CaO	3.1
MgO	1.1
Na_2O	0.7
K_2O	1.6
SO_3	2.2
P_2O_5	0.1

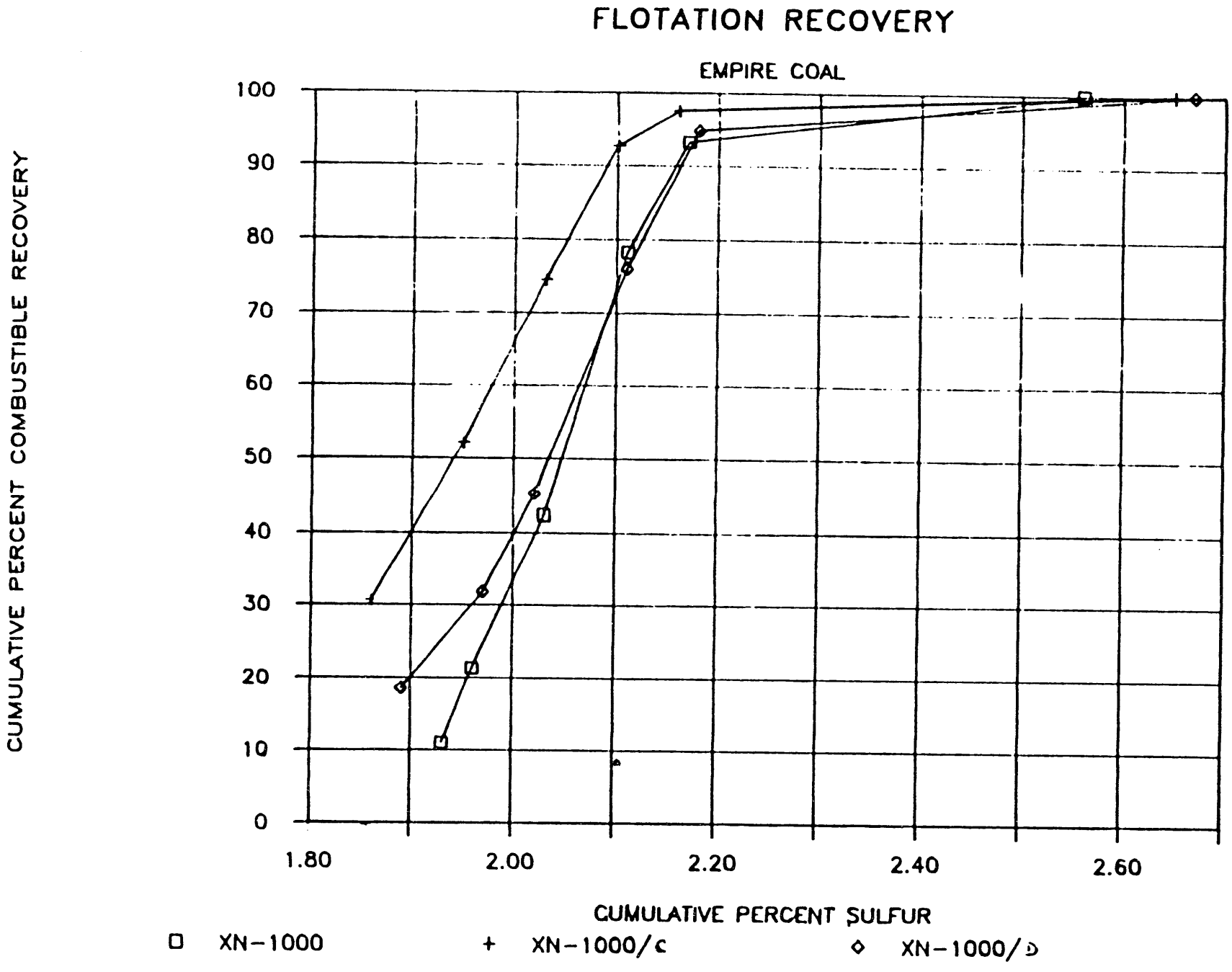
HHV	13,106	13,547	BTU/LB

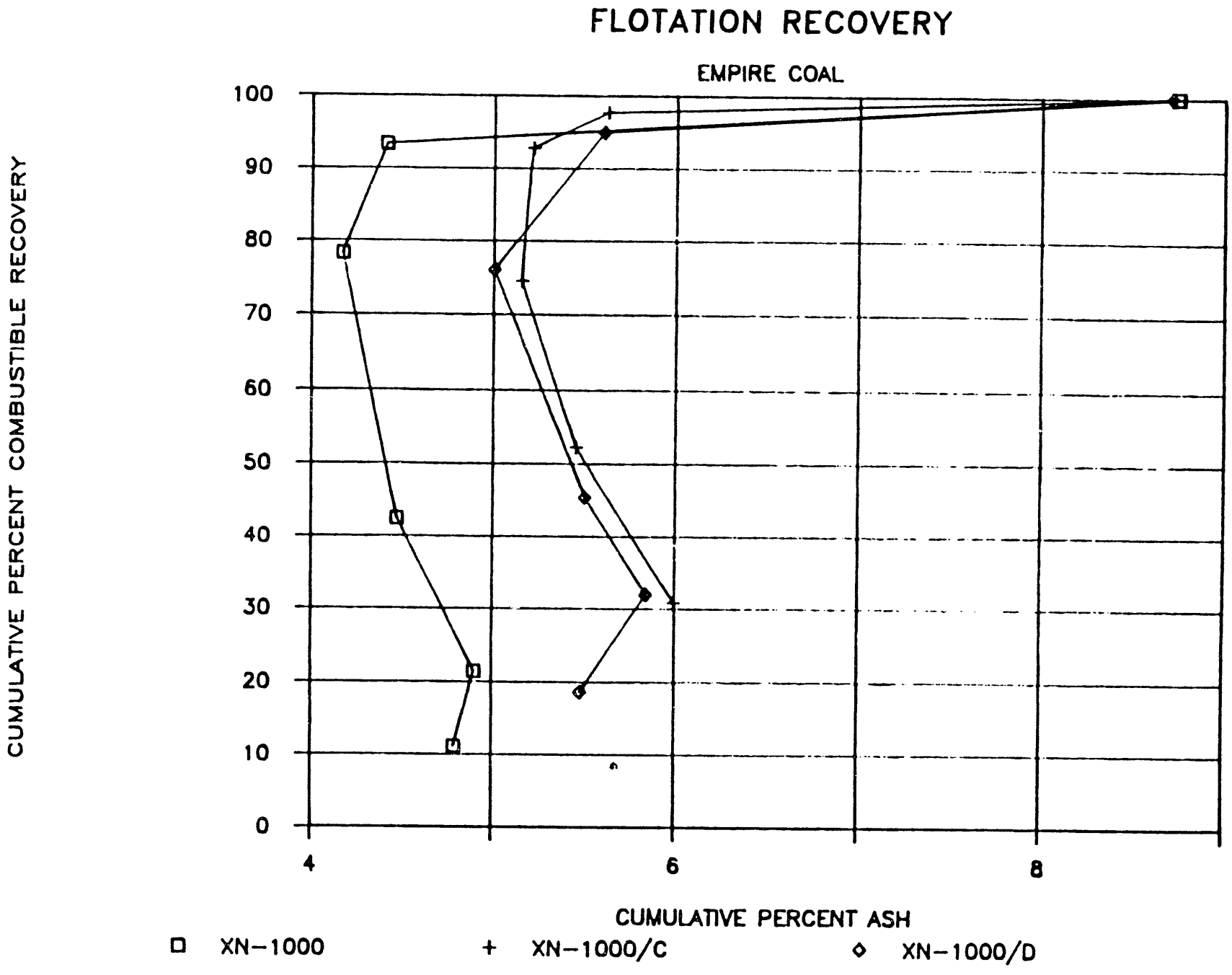
HGI N/A

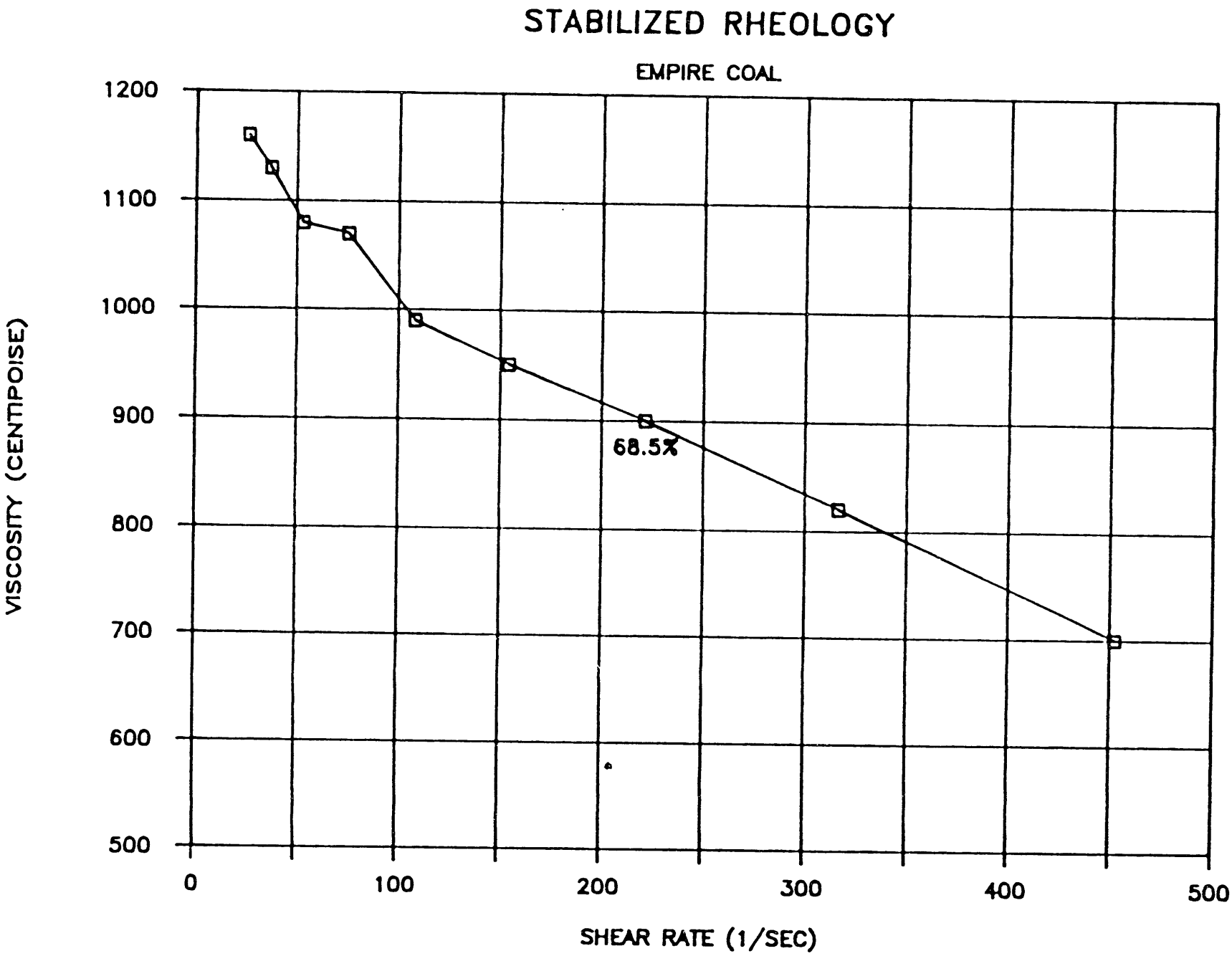
FSI 1.5


STABILIZED RHEOLOGY
EMPIRE COAL
VISCOSITY (CENTIPOISE)
1200
1100
1000
900
800
700
600
500
68.5%
0
100
200
300
400
500
SHEAR RATE (1/SEC)


PSD CUMULATIVE
EMPIRE COAL
PERCENT RETAINED
100
90
80
70
60
50
40
30
20
10
0
0.63
1.00
1.59
2.52
4.00
6.35
10.1
16.0
25.4
40.3
64.0
101.6
161.0
256.0
MICRONS


FLOTATION RECOVERY
EMPIRE COAL
CUMULATIVE PERCENT COMBUSTIBLE RECOVERY
100
90
80
70
60
50
40
30
20
10
0
1.80
2.00
2.20
2.40
2.60
CUMULATIVE PERCENT SULFUR
XN-1000
XN-1000/c
XN-1000/D


FLOTATION RECOVERY
EMPIRE COAL
CUMULATIVE PERCENT COMBUSTIBLE RECOVERY
100
90
80
70
60
50
40
30
20
10
0
4
6
8
CUMULATIVE PERCENT ASH
XN-1000
XN-1000/C
XN-1000/D


STABILIZED RHEOLOGY
EMPIRE COAL
VISCOSITY (CENTIPOISE)
1200
1100
1000
900
800
700
600
500
68.5%
0
100
200
300
400
500
SHEAR RATE (1/SEC)

INTRINSIC COAL CHARACTERISTICS

COAL NAME: Ohio Coal Feed

SOURCE: Ohio State University

PROXIMATE ANALYSIS

	As Rec'd	Dry
Fixed Carbon	49.28	50.61
Volatile Matter	34.06	34.98
Ash	14.04	14.41
Moisture	2.62	—
TOTAL	100.00	100.00

ASH FUSION

Temperatures, °F

	Red	Oxid
Initial Deform	2340	2526
Soft Temp, Sph	2440	2624
Soft Temp, Hemi	2472	2644
Fluid Temp	2473	2650

ULTIMATE ANALYSIS

	As Rec'd	Dry
Carbon	65.97	67.74
Hydrogen	4.80	4.93
Oxygen	8.68	8.92
Nitrogen	1.55	1.59
Sulfur	2.34	2.41
Ash	14.04	14.41
Moisture	2.62	—
TOTAL	100.02	100.00

ASH ANALYSIS

Element	% As Oxide
SiO_2	54.8
Al_2O_3	25.2
TiO_2	1.4
Fe_2O_3	15.4
CaO	0.6
MgO	0.7
Na_2O	0.3
K_2O	2.4
SO_3	0.5
P_2O_5	0.03

HHV	11,937	12,285	BTU/LB

HGI N/A

FSI 2

INTRINSIC COAL CHARACTERISTICS

COAL NAME: Ohio Coal Clean Concentrate

SOURCE: Ohio State University

PROXIMATE ANALYSIS

	As Rec'd	Dry
Fixed Carbon	53.94	54.34
Volatile Matter	36.83	37.10
Ash	8.50	8.56
Moisture	0.73	—
TOTAL	100.00	100.00

ASH FUSION

Temperatures, °F

	Red	Oxid
Initial Deform	2381	2520
Soft Temp, Sph	2412	2616
Soft Temp, Hemi	2452	2663
Fluid Temp	2480	2704

ULTIMATE ANALYSIS

	As Rec'd	Dry
Carbon	72.59	73.12
Hydrogen	5.27	5.31
Oxygen	9.51	9.59
Nitrogen	4.68	1.69
Sulfur	1.72	1.73
Ash	8.50	8.56
Moisture	0.73	—
TOTAL	100.00	100.00

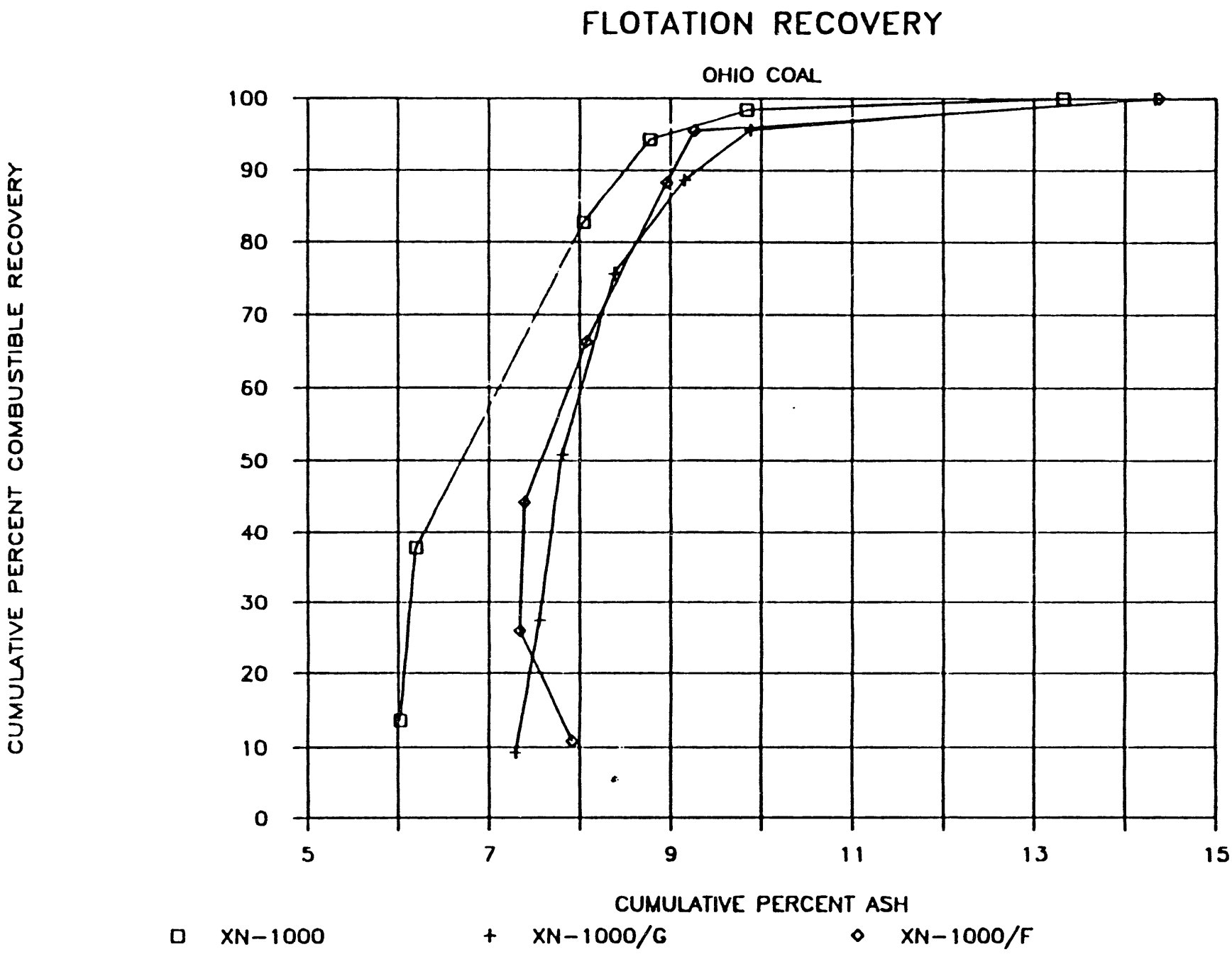
ASH ANALYSIS

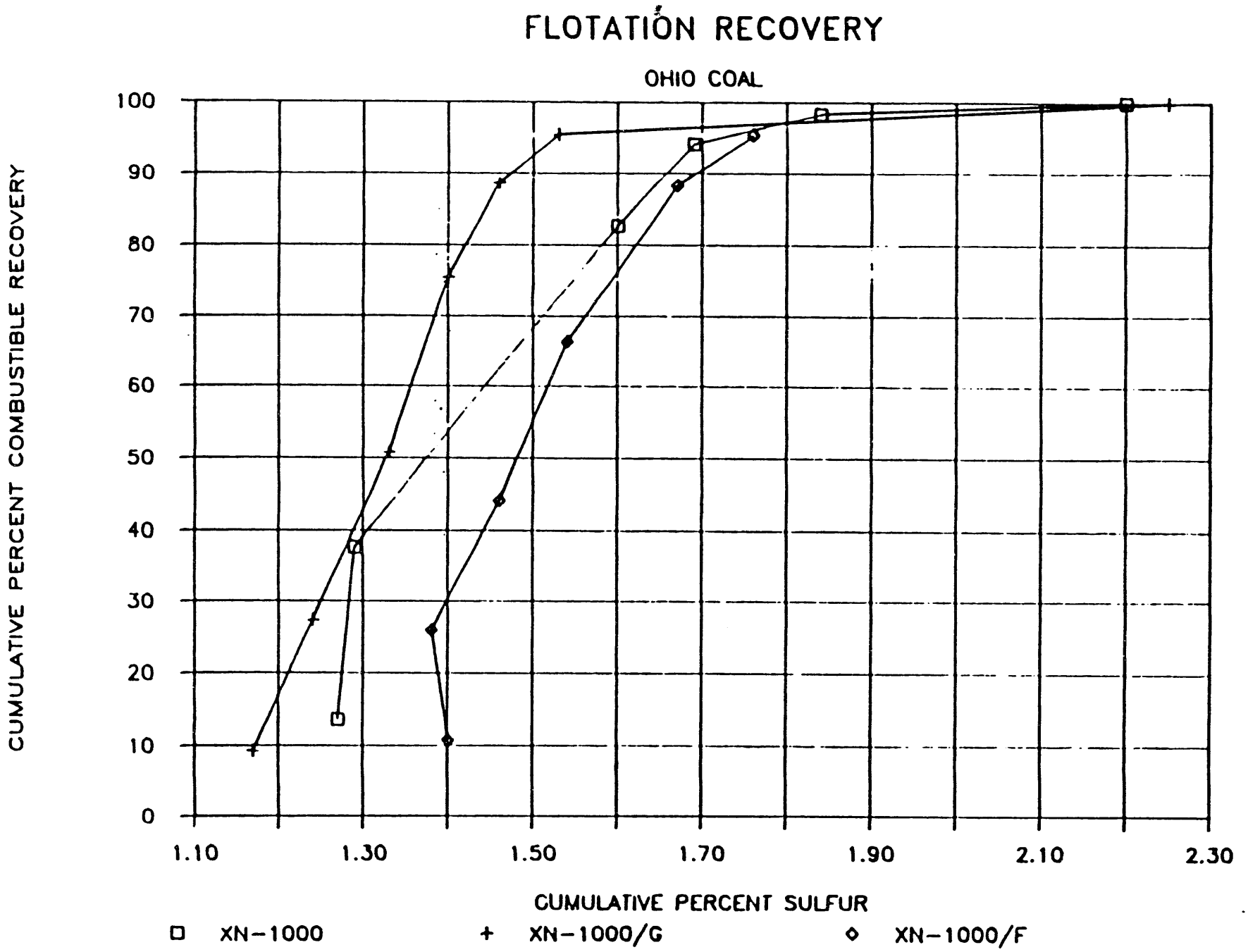
Element	% As Oxide
SiO_2	54.1
Al_2O_3	25.5
TiO_2	2.0
Fe_2O_3	15.3
CaO	0.8
MgO	0.8
Na_2O	0.3
K_2O	2.3
SO_3	0.4
P_2O_5	0.04

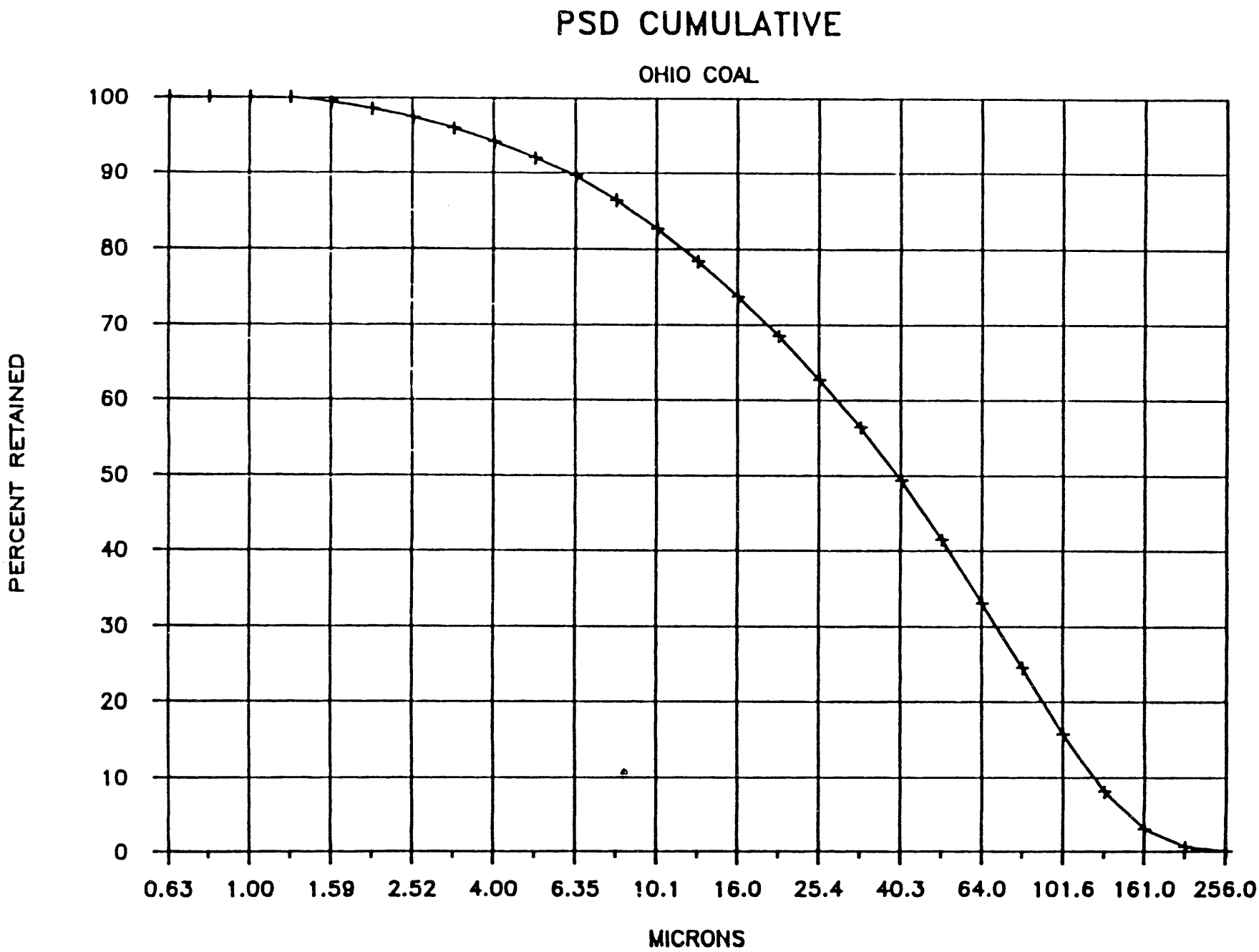
HHV	13,071	13,167	BTU/LB

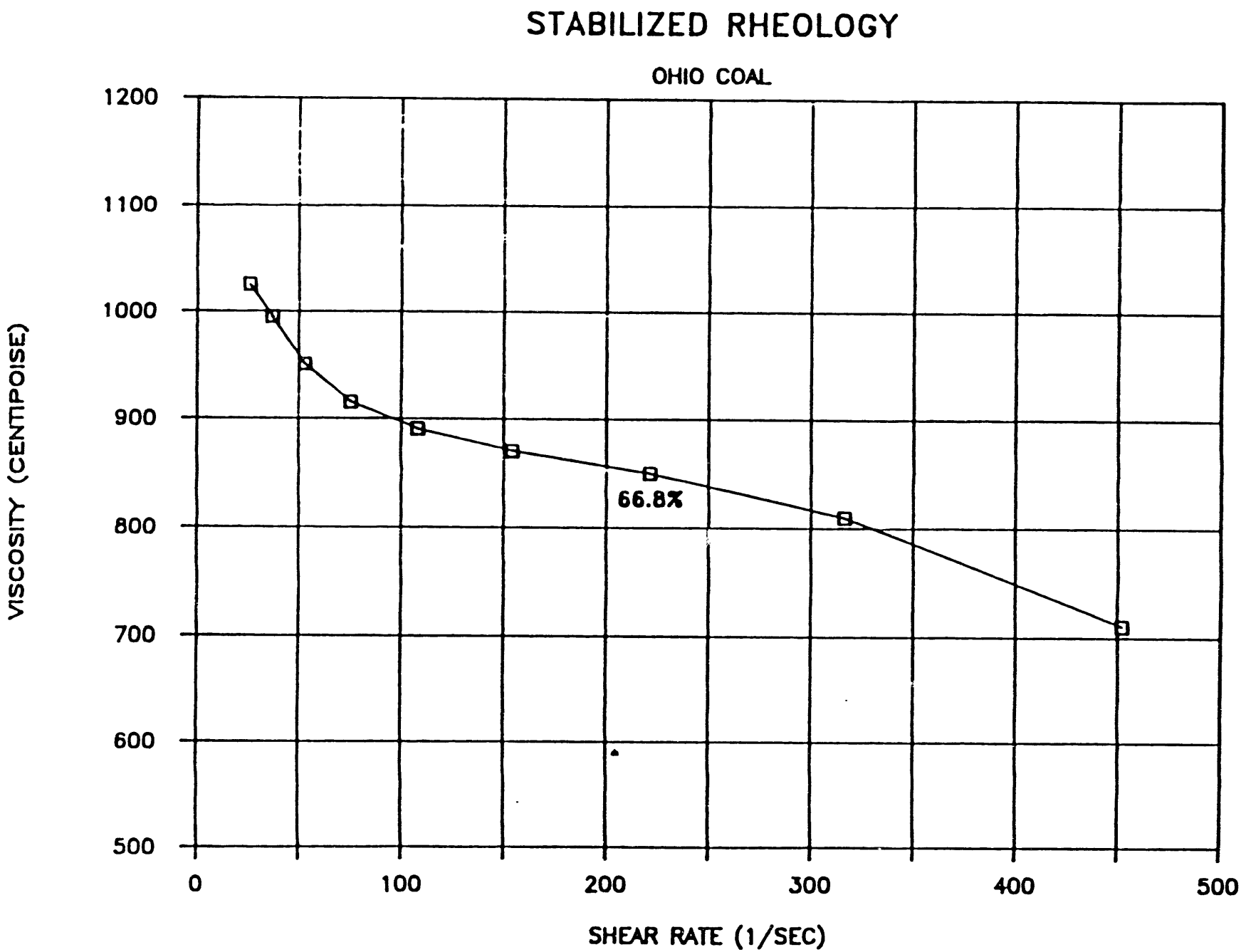
HGI N/A

FSI 4.5


FLOTATION RECOVERY
OHIO COAL
CUMULATIVE PERCENT COMBUSTIBLE RECOVERY
100
90
80
70
60
50
40
30
20
10
0
5
7
9
11
13
15
CUMULATIVE PERCENT ASH
XN-1000
XN-1000/G
XN-1000/F


FLOTATION RECOVERY
OHIO COAL
CUMULATIVE PERCENT COMBUSTIBLE RECOVERY
100
90
80
70
60
50
40
30
20
10
0
1.10
1.30
1.50
1.70
1.90
2.10
2.30
CUMULATIVE PERCENT SULFUR
XN-1000
XN-1000/G
XN-1000/F


PSD CUMULATIVE
OHIO COAL
PERCENT RETAINED
100
90
80
70
60
50
40
30
20
10
0
0.63
1.00
1.59
2.52
4.00
6.35
10.1
16.0
25.4
40.3
64.0
101.6
161.0
256.0
MICRONS


STABILIZED RHEOLOGY
OHIO COAL
VISCOSITY (CENTIPOISE)
1200
1100
1000
900
800
700
600
500
66.8%
0
100
200
300
400
500
SHEAR RATE (1/SEC)

APPENDIX B

PROGRAM LISTINGS

LISTINGS OF PROGRAMS USED TO CALL AND FILE EXPERIMENTAL DATA, AND TO REDUCE DATA IN ENTHALPY AND EFFICIENCY CALCULATIONS

```
      PROGRAM INIT
C
C
C*****************************************************
C
C           PROGRAM INIT
C
C
C            BY DOUGLAS McALLISTER
C       MODIFIED BY Arnab K. Mallik
C
C*****************************************************
C
C
C            THIS PROGRAM INITALIZES PROGRAM DATCOM BY
C            ASSIGNING THE NUMBER OF READS AND WHICH
C            FILE IS TO BE USED.
C       THIS PROGRAM ALSO ENSURES THAT THERMIS.DAT
C       AND GASFLO.DAT ARE TWO DIRECT ACCESS FILES.
C       THIS USES PLOT10
C       ==========================================================
C
            CHARACTER*10 NAME1
        INTEGER ID
        CALL INITT(960)
        CALL TERM(2,4096)
        CALL CHRSIZ(2)
        CALL ANMODE
104     CALL NEWPAG
        CALL CHRSIZ(2)
        CALL ANMODE
        WRITE(5,100)
100     FORMAT(//,5X,' WELCOME TO INIT.FOR')
        WRITE(5,102)
102     FORMAT(/,5X,' PRESS RETURN TO CONTINUE')
        READ(5,44,ERR=104)IDUM
        CALL NEWPAG
        CALL CHRSIZ(2)
        CALL ANMODE
42      WRITE(5,41)
41      FORMAT(/,5X,' THE MASTER PROGRAM REQUIRES THE')
        WRITE(5,62)
62      FORMAT(/,5X,' PRESENCE OF TWO DATA FILES: ',/,5X,
     &  ' 1. THERMIS.DAT',/,5X,' 2. GASFLO.DAT')
        WRITE(5,43)
43      FORMAT(/,5X,' PRESS RETURN TO CONTINUE')
        READ(5,44,ERR= 42)IDUM
44      FORMAT(A1)
49      CALL NEWPAG
        CALL CHRSIZ(2)
        CALL ANMODE
        WRITE(5,45)
45      FORMAT(/,5X,' DO YOU WISH TO MODIFY THERMIS.DAT')
        WRITE(5,46)
46      FORMAT(5X,' INPUT [1] FOR YES ; [2] FOR NO  ',$)
        READ(5,*)ID
        IF(ID .EQ. 1) GO TO 47
        IF(ID .EQ. 2) GO TO 48
```

```
      GO TO 49
47    CONTINUE
      CALL TFILER
48    CONTINUE
54    CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
      WRITE(5,60)
60    FORMAT(/,5X,' DO YOU WISH TO MODIFY GASFLO.DAT')
      WRITE(5,51)
51    FORMAT(5X,' INPUT [1] FOR YES ; [2] FOR NO  ',$)
      READ(5,*)ID
      IF(ID .EQ. 1) GO TO 52
      IF(ID .EQ. 2) GO TO 53
      GO TO 54
52    CONTINUE
      CALL GFILER
53    CONTINUE
          OPEN(UNIT=1,NAME='INITAL.DAT',TYPE='NEW')
          WRITE(5,10)
 10   FORMAT(2X,' ENTER DATA FILE NAME [6 CHARACTERS].DAT :',$)
      READ(5,20)NAME1
 20   FORMAT(A10)
          WRITE(5,30)
 30   FORMAT('  HOW MANY HOURS DO YOU WISH THE DATALOGER',
     1 ' TO RECORD ?  ',$)
          READ(5,40) HRS
 40   FORMAT(F4.0)
      HRS=HRS*3600
      WRITE(1,50)NAME1,HRS
 50     FORMAT(A10,F8.0)
      CLOSE(UNIT=1)
    END
C
C     ***************************************************************
C     *                                                             *
C                          SUBROUTINE TFILER
C     *                                                             *
C     ***************************************************************
C
C     TFILER- thermistor data file operations
C
C     AUTHOR: A. K. MALLIK            DATE: JAN 15,1988
C
C     GENERAL DESCRIPTION OF PROGRAM
C     ==============================
C
C     This programs performs file operations on the thermistor interpulation
C
C     coefficient data file THERMIS.DAT .  The program may be used for the
C
C     following operations:
C
C                    1. Enter a new coefficient set
C
C                    2. Rewrite a set
C
C                    3. List the sets in the file
C
C                    4. Modify a channel data set
```

```
C
C                          stored in the file.
C
C                       5. Open THERMIS.DAT data file
C
C
C
C        ACCESS
C        ======
C
C
C         NOTE: File THERMIS.DAT (ACCESS=DIRECT) should exist in the directory
C               when this program is run. This file may be opened using
C               this program. The first line of the file are the seven coeff.
C               are obtained by performing a fifth order polynomial fit
C               of the data in the DATALOGGER (used to convert the temperature
C               into resistances for each thermister. The remaining 32 rows
C               are the calibration coefficients (6th Order Polynomial Fit)
C               for each thermister.
C
C
C       LOCAL VARIABLES
C       ===============
C
C       COEFF    : array containing the thermistor coefficients
C       CO       : array containing the seven coefficients after
C                  performing a 6th order polynomial curve fit.
C       ------------------------------------------------------------------
C
C       Declaration of variables and arrays
C
        SUBROUTINE TFILER
        CHARACTER DUMMY,ANS
        CHARACTER*3 B
        LOGICAL A
        INTEGER ID,K
        REAL COEFF(7),CO(7)
C
C       ------------------------------------------------------------
C       Checks if the data file exists
C       ------------------------------------------------------------
C
        INQUIRE(FILE='THERMIS.DAT',EXIST=A,DIRECT=B)
        IF(.NOT.A)THEN
601     CALL NEWPAG
        CALL CHRSIZ(2)
        CALL ANMODE
605     WRITE(5,621)
621     FORMAT(//,'** THERE IS NO FILE ''THERMIS.DAT'' **',//,2X,
     &          'DO YOU WANT A NEW FILE OPENED ? [Y/N]: ',$)
        READ(5,'(A1)')ANS
        IF(ANS.EQ.'Y')THEN
        OPEN(10,FILE='THERMIS.DAT',ACCESS='DIRECT',STATUS='NEW',
     &           FORM='FORMATTED',RECL=75)
             GOTO 615
        ENDIF
        IF(ANS.NE.'N')GOTO 501
        GO TO 601
        ENDIF
        IF(B.NE.'YES')THEN
        WRITE(5,620)
```

```
620     FORMAT(//,'** FILE IS NOT DIRECT ACCESS **',//)
        GO TO 601
        ENDIF
C
C       ------------------------------------------------------------
C       Open the thermistor coefficient data file
C       ------------------------------------------------------------
C
615     OPEN(10,FILE='THERMIS.DAT',ACCESS='DIRECT',STATUS='OLD',
     &       FORM='FORMATTED',RECL=75)
C
C       ------------------------------------------------------------------------
C
C                                DATA ENTRY
C
C       ------------------------------------------------------------------------
C
100     CALL NEWPAG
        CALL CHRSIZ(2)
        CALL ANMODE
        WRITE(5,110)
110     FORMAT(///,20X,'<<<  M E N U  >>>',//,20X,'1. ENTER NEW',
     &          ' RECORD',//,20X,'2. LIST RECORDS',//,20X,
     &          '3. DISPLAY/MODIFY RECORDS BY #',//,20X,'4. EXIT PROGRAM'
     &          ,//, 20X,'5. ENTER DATALOGGER COEFFICIENTS',//,
     &          20X,'SELECT OPTION -> ',$)
        READ(5,*)IOPT
        GOTO(200,300,400,500,600),IOPT
        GO TO 100
C
C       ---------------------------------------------------------------
C
C                        ENTRY OF A NEW DATA SET
C
C       ---------------------------------------------------------------
200     CALL NEWPAG
        CALL CHRSIZ(2)
        CALL ANMODE
        WRITE(5,30)
30      FORMAT(/,' ENTER CHANNEL NUMBER [100-131]: ',$)
        READ(5,*)NUM
             IF((NUM.LT.100).OR.(NUM.GT.131))GOTO 200
403     CONTINUE
        WRITE(5,31)
        WRITE(5,32)
        WRITE(5,33)
58      READ(5,*)NU
             IF(NU .EQ. 1)GOTO 56
        IF(NU .EQ. 2)GOTO 57
        GO TO 58
56      CONTINUE
        DO 67 I=1,7
        WRITE(5,50)I-1
        READ(5,70)COEFF(I)
67      CONTINUE
        GO TO 59
57      CONTINUE
        CALL CURFIT(CO)
        DO 68 I=1,7
68      COEFF(I)=CO(I)
```

```
59      CONTINUE
50      FORMAT(/,2X,'C(',I1,')=',$)
70      FORMAT(F10.0)
        WRITE(10,90,REC=NUM-98)(COEFF(I),I=1,7)
90      FORMAT(7F10.3)
        GOTO 100
C
C       ------------------------------------------------------------------
C
C                        LISTING OF ALL THE CHANNELS IN THE FILE
C
C       ------------------------------------------------------------------
C
300     CALL NEWPAG
        CALL CHRSIZ(2)
        CALL ANMODE
        WRITE(5,210)
210     FORMAT(///,2X,'LISTING OF ALL RECORDS',/,2X,22('-'),/)
        READ(10,90,REC=1)(COEFF(K),K=1,7)
        WRITE(5,241)(J-1,COEFF(J),J=1,7)
241     FORMAT(/,2X,' DATALOGGER COEFF.:',3X,3('C(',I1,')=',F10.3,3X),
     &          //,24X,4('C(',I1,')=',F10.3,3X),3X)
        DO 290 I=2,33
        READ(10,90,REC=I)(COEFF(K),K=1,7)
        WRITE(5,240)I+98,(J-1,COEFF(J),J=1,7)
240     FORMAT(/,2X,'CHANNEL # ',I3,':',T20,3('C(',I1,')=',F10.3,3X),
     &          //,T20,4('C(',I1,')=',F10.3,3X))
290     CONTINUE
        GOTO 100
C
C       ------------------------------------------------------------------
C
C               LISTING CHANNELS BY NUMBERS / MODIFYING COEFFICIENTS
C
C       ------------------------------------------------------------------
C
454     CONTINUE
400     CALL NEWPAG
        CALL CHRSIZ(2)
        CALL ANMODE
        WRITE(5,410)
410     FORMAT(///,2X,'CHANNEL NUMBER ? [100-131]: ',$)
        READ(5,*)IANS
        IF((IANS.LT.100).OR.(IANS.GT.131))GOTO 400
        READ(10,90,REC=IANS-98)(COEFF(K),K=1,7)
        WRITE(5,240)IANS,(I-1,COEFF(I),I=1,7)
425     WRITE(5,430)
430     FORMAT(//,2X,'REWRITE THIS CHANNEL ? [Y/N]: ',$)
        READ(5,'(A1)')ANS
        IF(ANS.EQ.'Y')THEN
        NUM=IANS
        GOTO 403
        ENDIF
453     CALL NEWPAG
        CALL CHRSIZ(2)
        CALL ANMODE
        WRITE(5,431)
431     FORMAT(/,5X,' DO YOU WISH TO LIST ANY OTHER CHANNEL',/,5X,
     &  'INPUT [1] FOR YES ; [2] FOR NO  ',$)
        READ(5,*)ID
```

```
      IF( ID .EQ. 1) GO TO 451
      IF(ID .EQ. 2) GO TO 452
      GO TO 453
451   CONTINUE
      GO TO 454
452   CONTINUE
      GO TO 100
C     ------------------------------------------------------------------
C
C                     CHANGE THE UPLOT TABLE OF THE DATALOGGER
C
C     ------------------------------------------------------------------
C
600   CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
      WRITE(5,31)
31    FORMAT(/,5X,' DO YOU HAVE THE COEFFICIENTS ')
      WRITE(5,32)
32    FORMAT(5X,' AFTER PERFORMING A POLYNOMIAL FIT ON THE DATA')
      WRITE(5,33)
33    FORMAT(5X,' INPUT [1] FOR YES : [2] FOR NO  ',$)
38    READ(5,*)NU
           IF(NU .EQ. 1)GOTO 36
      IF(NU .EQ. 2)GOTO 37
      GO TO 38
36    CONTINUE
46    DO 47 I=1,7
      WRITE(5,50)I-1
      READ(5,70)COEFF(I)
47    CONTINUE
      GO TO 39
37    CONTINUE
      CALL CURFIT(CO)
      DO 48 I=1,7
48    COEFF(I)=CO(I)
39    CONTINUE
      WRITE(10,90,REC=1)(COEFF(I),I=1,7)
      GOTO 100
C
C     ------------------------------------------------------------------
C
C            CLOSE THE FILE
C
C     ------------------------------------------------------------
500   CLOSE(UNIT=10,STATUS='KEEP')
501    CONTINUE
      RETURN
      END
C
C     ************************************************************
C     *                                                          *
C                          SUBROUTINE GFILER
C     *                                                          *
C     ************************************************************
C
C     GFILER- gasflo data file operations
C
C     AUTHOR: A. K. MALLIK            DATE: JAN 15,1988
C
```

```
C       GENERAL DESCRIPTION OF PROGRAM
C       ==============================
C
C       This programs performs file operations on the gas analyzer and air
C       flow meter  ( calibration ) coefficient data file GASFLO.DAT . The
C       program may be used for following operations:
C
C                       1. Enter a new coefficient set
C
C                       2. Rewrite a set
C
C                       3. List the sets in the file
C
C                       4. Modify a channel data set
C
C                          stored in the file.
C
C                       5. Open GASFLO.DAT data file
C
C
C       ACCESS
C       ======
C
C
C         NOTE: File GASFLO.DAT (ACCESS=DIRECT) should exist in the directory
C               when this program is run. This file may be opened using
C               this program. The first three rows contain four coefficients
C               obtained after performing a third or lower order polynomial
C               curve fit on the calibration data of CO, O2, and CO2
C               analyzers. The next row is blank. The next two rows are
C               for the atomized, main air flow meters respectively.The
C               last two rows have the calibration data for the NO-NOX,
C               and SO2 analyzers respectively.
C
C
C       LOCAL VARIABLES
C       ===============
C
C       COEFF    : array containing the thermistor coefficients
C       CO       : array containing the seven coefficients after
C                  performing a 6th order polynomial curve fit.
C       ------------------------------------------------------------------
C
C       Declaration of variables and arrays
C
        SUBROUTINE GFILER
        CHARACTER DUMMY,ANS
        CHARACTER*3 B
        LOGICAL A
        REAL COEFF(7),CO(7)
        INTEGER ID
C
C       ------------------------------------------------------------------
C       Checks if the data file exists
C       ------------------------------------------------------------------
C
        INQUIRE(FILE='GASFLO.DAT',EXIST=A,DIRECT=B)
        IF(.NOT.A)THEN
601     CALL NEWPAG
        CALL CHRSIZ(2)
```

```
      CALL ANMODE
605   WRITE(5,600)
600   FORMAT(//,'** THERE IS NO FILE ''GASFLO.DAT'' **',//,2X,
     &       'DO YOU WANT A NEW FILE OPENED ? [Y/N]: ',$)
      READ(5,'(A1)')ANS
      IF(ANS.EQ.'Y')THEN
      OPEN(11,FILE='GASFLO.DAT',ACCESS='DIRECT',STATUS='NEW',
     &        FORM='FORMATTED',RECL=55)
          GOTO 615
      ENDIF
      IF(ANS.NE.'N')GOTO 501
      GO TO 601
      ENDIF
      IF(B.NE.'YES')THEN
      WRITE(5,620)
620   FORMAT(//,'** FILE IS NOT DIRECT ACCESS **',//)
      GO TO 601
      ENDIF
C
C     ------------------------------------------------------------
C     Open the GASFLO coefficient data file
C     ------------------------------------------------------------
C
615   OPEN(11,FILE='GASFLO.DAT',ACCESS='DIRECT',STATUS='OLD',
     &     FORM='FORMATTED',RECL=55)
C
C     ------------------------------------------------------------------
C
C                              DATA ENTRY
C
C     ------------------------------------------------------------------
C
100   CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
      WRITE(5,110)
110   FORMAT(///,20X,'<<<  M E N U  >>>',///,20X,'1. ENTER NEW',
     &       ' RECORD',//,20X,'2. LIST RECORDS',//,20X,
     &       '3. DISPLAY RECORDS BY #',//,20X,'4. EXIT PROGRAM',//,
     &       2X,'SELECT OPTION -> ',$)
      READ(5,*)IOPT
      GOTO(200,300,400,500),IOPT
      GOTO 100
C
C     ------------------------------------------------------------------
C
C                       ENTRY OF A NEW DATA SET
C
C     ------------------------------------------------------------------
200   CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
      WRITE(5,30)
30    FORMAT(/,'  ENTER CHANNEL NUMBER [31-38]: ',$)
      READ(5,*)NUM
          IF((NUM.LT.31).OR.(NUM.GT.38))GOTO 200
403   CONTINUE
      WRITE(5,31)
      WRITE(5,32)
      WRITE(5,33)
```

```
58      READ(5,*)NU
             IF(NU .EQ. 1)GOTO 56
        IF(NU .EQ. 2)GOTO 57
        GO TO 58
56      CONTINUE
        DO 67 I=1,5
        WRITE(5,50)I-1
        READ(5,70)COEFF(I)
67      CONTINUE
        GO TO 59
57      CONTINUE
        CALL CURFIT(CO)
        DO 68 I=1,5
68      COEFF(I)=CO(I)
59      CONTINUE
50      FORMAT(/,2X,'C(',I1,')=',$)
70      FORMAT(F10.0)
        WRITE(11,90,REC=NUM-30)(COEFF(I),I=1,5)
90      FORMAT(5F10.3)
        GOTO 100
C
C       ------------------------------------------------------------------
C
C            LISTING/ MODIFICATION OF ALL THE CHANNELS IN THE FILE
C
C       ------------------------------------------------------------------
C
300     CALL NEWPAG
        CALL CHRSIZ(2)
        CALL ANMODE
        WRITE(5,210)
210     FORMAT(///,2X,'LISTING OF ALL RECORDS',/,2X,22('-'),/)
        DO 290 I=1,8
        READ(11,90,REC=I)(COEFF(K),K=1,5)
        WRITE(5,240)I+30,(J-1,COEFF(J),J=1,5)
240     FORMAT(/,2X,'CHANNEL # ',I3,':',T20,3('C(',I1,')=',F10.3,3X),
     &          //,T20,2('C(',I1,')=',F10.3,3X))
290     CONTINUE
        GOTO 100
C
C       ------------------------------------------------------------------
C
C               LISTING CHANNELS BY NUMBERS / MODIFYING COEFFICIENTS
C
C       ------------------------------------------------------------------
C
454     CONTINUE
400     CALL ANMODE
        CALL CHRSIZ(2)
        CALL ANMODE
        WRITE(5,410)
410     FORMAT(///,2X,'CHANNEL NUMBER ? [31-38]: ',$)
        READ(5,*)IANS
        IF((IANS.LT.31).OR.(IANS.GT.38))GOTO 400
        READ(11,90,REC=IANS-30)(COEFF(K),K=1,5)
        WRITE(5,240)IANS,(I-1,COEFF(I),I=1,5)
425     WRITE(5,430)
430     FORMAT(//,2X,'REWRITE THIS CHANNEL ? [Y/N]: ',$)
        READ(5,'(A1)')ANS
        IF(ANS.EQ.'Y')THEN
```

```
      NUM=IANS
      GOTO 403
      ENDIF
453   CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
      WRITE(5,431)
431   FORMAT(/,5X,' DO YOU WISH TO LIST ANY OTHER CHANNEL',/,5X
     & 'INPUT [1] FOR YES ; [2] FOR NO  ',$)
      READ(5,*)ID
      IF( ID .EQ. 1) GO TO 451
      IF(ID .EQ. 2) GO TO 452
      GO TO 453
451   CONTINUE
      GO TO 454
452   CONTINUE
      GO TO 100
31    FORMAT(/,5X,' DO YOU HAVE THE COEFFICIENTS ')
32    FORMAT(5X,' AFTER PERFORMING A POLYNOMIAL FIT ON THE DATA')
33    FORMAT(5X,' INPUT [1] FOR YES : [2] FOR NO  ',$)
C
C     ------------------------------------------------------------
C     CLOSE THE FILE
C     ------------------------------------------------------------
C
500   CLOSE(11,STATUS='KEEP')
501    CONTINUE
      RETURN
      END
C     ------------------------------------------------------------
C                              SUBROUTINE CURFIT
C                              =================
C
C     AUTHOR  : Menachem Amir          OCT  6, 1983
C
C     MODIFIED: Arnab K. Mallik        JAN  11, 1988
C
C     PROGRAM DESCRIPTION
C     -------------------
C
C     This program is used to determine the coefficients of a sixth
C     order or lower curve fit on the calibration data.
C     The calibration curve is described by:
C
C                                          2         3
C             Y = C(0) + C(1)*X + C(2)*X + C(3)*X + .....
C
C     Where,
C             Y    - Dependent variable
C
C             C(I) - Coefficients computed by the program.
C
C             X    - Independent variable
C
C     The program checks a range of degrees specified by the user
C
C     and calculates the coefficients for the degree that fits the
C
C     data best.
C
```

```
C       INSTRUCTIONS FOR USING THE PROGRAM
C       ----------------------------------
C
C       1. The program input consists of calibration data
C
C       2. Recomanded range of degrees to be computed is 2-6. This
C
C          requires at least 8 data points.
C
C       3. If the maximum degree to be checked is M, then M+2 data
C
C          points will be required.
C
C
C       PROGRAM PARAMETERS
C       ------------------
C
C       X, Y              : ARRAYS OF X AND Y VALUES [USD]
C
C       N                 : NUMBER OF DATA POINTS [USD]
C
C       MS, MF            : THE RANGE OF DEGREES OF POLYNOMIALS
C
C                           TO BE COMPUTED [USD]
C
C       A                 : AUGMENTED ARRAY OF THE COEFFICIENTS OF
C
C                           THE LEAST SQUARES POLYNOMIAL [RTD]
C
C       C                 : VECTOR OF COEFFICIENTS OF THE LEAST
C
C                           SQUARES [RTD]
C
C
C                                 ***
C
C
C==================================================================
C
C                         SUBROUTINE CURFIT(CO)
C
C==================================================================
C
        SUBROUTINE CURFIT(CO)
        DIMENSION X(50),Y(50),A(50,11),C(10),XN(50),CSMALL(10)
C
C       DATA ENTRY
C
        CHARACTER*1 ANS
        REAL  CO(7)
        CHARACTER*6 NM1
        SMALL=1E6
191     CALL NEWPAG
        CALL CHRSIZ(2)
        CALL ANMODE
        WRITE(5,300)
300     FORMAT(//,' WELCOME TO THERMO !')
        WRITE(5,190)
190     FORMAT(/,5X,'DO YOU WISH TO READ THE DATA',/,5X,'1. FROM THE ',
     &  'DATA FILE',/,5X,'2. INPUT THE DATA & CREATE A FILE',/,5X,
```

```
     &  'SELECT [1] OR [2] ->',$)
C
C       ==============================================================
C       The data file to be used for the curvefit program should have
C       have the following format. The number of data points should be
C       greater than 4 and less than 51. The first entry should have the
C       number of data points. The other entries are X(I), Y(I) each
C       occupying 10 columns. The first entry for number of data points
C       is in I3 format.
C       ==============================================================
C
        READ(5,*)ID
        IF(ID .EQ. 1) GO TO 400
        IF(ID .EQ. 2) GO TO 401
        GO TO 191
400     CONTINUE
        WRITE(5,402)
402     FORMAT(5X,' INPUT THE NAME OF THE FILE AS XXXXXX.DAT  ')
C
C       ------------------------------------------------------------
C       ENTER THE NAME OF THE FILE WITHOUT '.DAT'
C       ------------------------------------------------------------
C
        READ(5,403)NM1
403     FORMAT(6A1)
        OPEN(UNIT=1,NAME='NM1.DAT',TYPE='OLD',FORM='FORMATTED')
        READ(1,404)N
404     FORMAT(I3)
        CALL NEWPAG
        CALL CHRSIZ(2)
        CALL ANMODE
        DO 405 I=1,N
        READ(1,406)X(I),Y(I)
406     FORMAT(2F10.4)
        WRITE(5,407)I,X(I),Y(I)
407     FORMAT(2X,'X(',I2,')= ',F10.5,3X,'Y(',I2,')= ',F10.5)
405     CONTINUE
        GO TO 408
401     CONTINUE
        WRITE(5,410)
410     FORMAT(//,' NO. OF DATA POINTS ? (4-50) ',$)
        READ(5,*)N
        DO 411 I=1,N
417     WRITE(5,412)I
412     FORMAT(5X,'FOR DATA #',2X,I2,2X,'INPUT X(I), Y(I)')
        READ(5,*)X(I),Y(I)
416     WRITE(5,413)
413     FORMAT(3X,'DO YOU WISH TO MODIFY THE DATA',/,3X,
     &  'INPUT [1] FOR YES ; [2] FOR NO',$)
        READ(5,*)ID
        IF(ID .EQ. 1) GO TO 414
        IF(ID .EQ. 2) GO TO 415
        GO TO 416
414     GO TO 417
415     CONTINUE
411     CONTINUE
        WRITE(5,501)
501     FORMAT(5X,'NAME OF THE DATA FILE TO STORE THE DATA')
        WRITE(5,502)
502     FORMAT(5X,'INPUT AS XXXXXX[.DAT]')
```

```
      READ(5,503)NM1
503   FORMAT(6A1)
      OPEN(UNIT=1,FILE='NM1.DAT',STATUS='NEW',FORM='FORMATTED')
      WRITE(1,504)N
504   FORMAT(I3)
      DO 505 I=1,N
      WRITE(1,506)X(I),Y(I)
506   FORMAT(2F10.5)
505   CONTINUE
408   CONTINUE
      CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
      WRITE(5,420)
420   FORMAT(//,' ENTER RANGE OF DEGREES TO BE CHECKED [2,6] : ',$)
      READ(5,*)MS,MF
      WRITE(5,172)
172   FORMAT(//,4X,'VALUE OF X',11X,'VALUE OF Y')
      WRITE(5,174)
174   FORMAT(4X,10('-'),11X,10('-'),/)
      DO 180 I=1,N
      WRITE(5,181)X(I),Y(I)
181   FORMAT(5X,F8.3,13X,F8.3)
180   CONTINUE
C
C     ---------------------------------------------------------
C     CHECKS IF ORDER RANGE IS CORRECT, IF NOT REDUCES MF
C     ---------------------------------------------------------
C
      IF(MF.LE.N-1)GOTO 5
      MF=N-1
      WRITE(5,200)MF
200   FORMAT(' DEGREE REDUCED TO : ',I2)
5     MFP1=MF+1
      MFP2=MF+2
C
C     ------------------------------------------------------------------
C     Constructs the input matrix [A], from the data
C     ------------------------------------------------------------------
C
      DO 10 I=1,N
      XN(I)=1.
10    CONTINUE
      DO 30 I=1,MFP1
      A(I,1)=0.
      A(I,MFP2)=0.
      DO 20 J=1,N
      A(I,1)=A(I,1)+XN(J)
      A(I,MFP2)=A(I,MFP2)+Y(J)*XN(J)
      XN(J)=XN(J)*X(J)
20    CONTINUE
30    CONTINUE
C
C     ----------------------------------------------------------
C     Computes the last row of [A]
C     ----------------------------------------------------------
C
      DO 50 I=2,MFP1
      A(MFP1,I)=0.
      DO 40 J=1,N
```

```
      A(MFP1,I)=A(MFP1,I)+XN(J)
      XN(J)=XN(J)*X(J)
40    CONTINUE
50    CONTINUE
C
C     ------------------------------------------------------------
C     Fill in the rest of the matrix [A]
C     ------------------------------------------------------------
C
      DO 70 J=2,MFP1
      DO 60 I=1,MF
60    A(I,J)=A(I+1,J-1)
70    CONTINUE
C
C     ------------------------------------------------------------
C     Call a subroutine to solve the system.
C
C     Do this for every degree from MS to MF.
C
C     Get the LU decomposition of [A].
C     ------------------------------------------------------------
C
      CALL LUDCMP(A,MFP1)
      MSP1=MS+1
C
C     ------------------------------------------------------------
C     Reset the R.H.S. into {C} for each degree.
C     ------------------------------------------------------------
C
80    DO 95 I=MSP1,MFP1
      DO 90 J=1,I
      C(J)=A(J,MFP2)
90    CONTINUE
      CALL SOLNQ(A,C,I)
C
C     ------------------------------------------------------------
C     Compute the value of BETA
C     ------------------------------------------------------------
C
      IM1=I-1
      BETA=0.
      DO 94 IPT=1,N
      SUM=0.
      DO 93 ICOEF=2,I
      JCOEF=I-ICOEF+2
      SUM=(SUM+C(JCOEF))*X(IPT)
93    CONTINUE
      SUM=SUM+C(1)
      BETA=BETA+(Y(IPT)-SUM)**2
94    CONTINUE
      BETA=BETA/(N-I)
      IF(BETA.GE.SMALL)GOTO 95
      SMALL=BETA
      ISMALL=I
      DO 100 K=1,7
           IF(K.GT.I)C(K)=0./1.E12
100   CO(K)=C(K)
95    CONTINUE
C
C     ------------------------------------------------------------
```

```
C       Print the program results
C       ---------------------------------------------------------
C
433     CALL NEWPAG
        CALL CHRSIZ(2)
        CALL ANMODE
110     WRITE(5,120)
120     FORMAT(///,' THE FINAL VALUE OF THE COEFF. ARE :',/)
        WRITE(5,130)(I-1,CO(I),I=1,ISMALL)
130     FORMAT(/,' C(',I1,')= ',F12.5)
        WRITE(5,431)
431     FORMAT(3X,'HIT RETURN TO CONTINUE')
        READ(5,432,ERR=433)
432     FORMAT(A1)
        CLOSE(UNIT=1)
        RETURN
        END
C
C
C=================================================================
C
C                        SUBROUTINE LUDCMP
C
C=================================================================
C
C
C       This subroutine forms the LU decomposition matrix of [A].
C
C       The upper triangular matrix [U] has ones on its diagonal.
C
C       These values are not included in the result.
C       ---------------------------------------------------------
C
        SUBROUTINE LUDCMP(A,N)
        DIMENSION A(50,11)
        DO 30 I=1,N
        DO 35 J=2,N
        SUM =0.
        IF(J.GT.I)GOTO 15
        JM1=J-1
        DO 10 K=1,JM1
10      SUM=SUM+A(I,K)*A(K,J)
        A(I,J)=A(I,J)-SUM
        GOTO 35
15      IM1=I-1
        IF(IM1.EQ.0)GOTO 25
        DO 20 K=1,IM1
20      SUM=SUM+A(I,K)*A(K,J)
C
C       ---------------------------------------------------------
C       Tests for small value in the diagonal
C       ---------------------------------------------------------
C
25      IF(ABS(A(I,I)).LT.1.0E-10)GOTO 99
        A(I,J)=(A(I,J)-SUM)/A(I,I)
35      CONTINUE
30      CONTINUE
        RETURN
99      WRITE(5,100)
100     FORMAT('1REDUCTION HALTED. SMALL VALUE IN THE DIAGONAL !')
```

```
      RETURN
      END
C
C
C=================================================================
C
C                        SUBROUTINE SOLNQ
C
C=================================================================
C
C     This subroutine finds the solution to a set of linear
C
C     equations that correspond to the R.H.S. of the vector {B}.
C
C     The [A] matrix is the LU decomposition of the original
C
C     equations as produced by LUDCMP. The solution vector is
C
C     returned in the [B] vector.
C     ------------------------------------------------------------
C
      SUBROUTINE SOLNQ(A,B,N)
      DIMENSION A(50,11),B(10)
C
C     ------------------------------------------------------------
C     Do the reduction step
C     ------------------------------------------------------------
C
      B(1)=B(1)/A(1,1)
      DO 20 I=2,N
      IM1=I-1
      SUM=0.
      DO 10 K=1,IM1
10    SUM=SUM+A(I,K)*B(K)
      B(I)=(B(I)-SUM)/A(I,I)
20    CONTINUE
C
C     ------------------------------------------------------------
C     Back substitute. The elements of [U] on the diagonal are ones.
C     ------------------------------------------------------------
C
      DO 40 J=2,N
      NMJP2=N-J+2
      NMJP1=N-J+1
      SUM=0.
      DO 30 K=NMJP2,N
30    SUM=SUM+A(NMJP1,K)*B(K)
      B(NMJP1)=B(NMJP1)-SUM
40    CONTINUE
      RETURN
      END
```

```
C*********************************************************
C
C
C       PROGRAM DATCOM
C
C
C       BY DOUGLAS McALLISTER
C
C
C*********************************************************
C
C       this program is to read data from the digitech
C       datalogger 3000 and record it in indexed files.
C
        DIMENSION CHAN(75),VALUE(75)
        BYTE BUFFER(40),DATA(75,40),TEMP(80)
        CHARACTER*10 NAME1
C
C-- Open source unit
C
        OPEN(UNIT=1,NAME='  TXB0:',TYPE='OLD')
C
C       open initializating data file
C
        OPEN(UNIT=3,NAME='INITAL.DAT',STATUS='OLD')
        READ(3,10)NAME1,TIME
        INTVAL=TIME
 10     FORMAT(A10,F8.0)
C
C
C       open output file
C
        OPEN(UNIT=2,NAME=NAME1,TYPE='NEW',ACCESS='KEYED',
     1  ORGANIZATION='INDEXED',FORM='FORMATTED',RECORDSIZE=15,
     2  KEY=(1:9),SHARED)
C
C
C
        T1=SECNDS(0.0)
        CALL PURGE
C
 100    DO 200 I=1,72
 105    READ(1,210) LENGTH,(TEMP(K),K=1,LENGTH)
        IF (LENGTH .LT. 4) GOTO 105
C
        J = 1
        DO 120 K = 1,LENGTH
        IF (TEMP(K) .GE. '0' .AND. TEMP(K) .LE. '9' ) GOTO 110
        IF ( TEMP(K) .EQ. '.' ) GOTO 110
        IF ( TEMP(K) .EQ. 'L' ) GOTO 105
        GOTO 120
 110    BUFFER(J) = TEMP(K)
        J = J + 1
 120    CONTINUE
C
        DO 140 K=1,6
        DATA(I,K)=BUFFER(K+9)
 140    CONTINUE
        DO 170 K=7,15
        DATA(I,K)=BUFFER(K-6)
```

```
 170     CONTINUE
C
         WRITE(2,230)(DATA(I,K),K=1,15)
C
C
 200     CONTINUE
         T2=SECNDS(T1)
         IF(T2.LT.INTVAL) GOTO 100
 210     FORMAT(Q,40A1)
 230     FORMAT(15A1)
C

C
         CLOSE(UNIT=1)
         CLOSE(UNIT=2)
         CLOSE(UNIT=3)
         END
         SUBROUTINE PURGE
C
C  PURGE, Clears out the typeahead buffer
C
         INTEGER*4 SYS$QIO,SYS$ASSIGN,SYS$CANCEL
         BYTE BUFFER(200)
C
         PARAMETER READ_PURGE='831'X
C
         ICODE=SYS$ASSIGN('TT',I_CHAN,,)
C
         ICODE=SYS$QIO(,%VAL(I_CHAN),%VAL(READ_PURGE),,,,BUFFER,
         1 %VAL(200),,,,)
C
         ICODE=SYS$CANCEL(%VAL(I_CHAN))
         RETURN
         END
```

```
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C        PROGRAM FURNACE TEMPERATURES
C
C
C        BY DOUGLAS McALLISTER
C  MODIFIED BY ARNAB KUMAR MALLIK
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C        this program is to provide graphical and tabular output
C        from data files created by the program ronda.
C
C
C
        COMMON /CALIB/WTT(33,7),GAN(8,5)
C
            COMMON /TITLES/ TITLE,CTITLE,XTITLE,YTITLE
            COMMON /TP/ CHAN(12)
             COMMON X(300,12),Y(300,12),BGT(300),NPTS(12),L(12),NCURVS,
     1  XMIN(12),XMAX(12),YMAX(12),YMIN(12),XMINI,XMAXI,TIME(12),
     2  YMINI,YMAXI,XDIV,YDIV,LS,M,LTI,LTIX,LTIY,MAY,JP
C
            COMMON /VIEW/BEGTEM(2)
            CHARACTER*9 LOCASC
        CHARACTER*3 DI
        DIMENSION NAME1(15)
        CHARACTER*30 TITLE,CTITLE,XTITLE,YTITLE
        REAL WATEMP
        LOGICAL EX
        INTEGER IANS,LOCINT
C
C       ---------------------------------------------------------------
C
C              WELCOME MESSAGE AND SYMBOL EXPLANATION
C
C       ---------------------------------------------------------------
C
         CALL INITT(960)
         CALL TERM(2,4096)
         CALL CHRSIZ(2)
         CALL ANMODE
         CALL NEWPAG
         CALL CHRSIZ(2)
         CALL ANMODE
         WRITE(5,700)
700      FORMAT(///,' Welcome to MASTER  !',//,
     &       ' This is the postprocessing program for the furnace',/,
     &       ' data collected by the datalogger',//,
     &       ' NOTE: In the symbol [DDDHHMM]',//,10X,
     &       'DDD = Day number',//,10X,'HH  =Hour ',//,10X,
     &       'MM  = Minute',///,10X,'Example : 1300430')
C
4         CONTINUE
         WRITE(5,5)
   5       FORMAT('  ENTER DATA FILE NAME XXXX.DAT : ',$)
             READ(5,7,ERR=8)I,(NAME1(J),J=1,I)
             GOTO 10
   7     FORMAT(Q,10A1)
   8     WRITE(5,9)
   9     FORMAT(/' NO DATA FILE OF THAT NAME '/)
```

```
10      NAME1(I+1)='.'
        NAME1(I+2)='D'
        NAME1(I+3)='A'
        NAME1(I+4)='T'
C
C      ----------------------------------------------------------------
C
C          CHECK IF THERMISTOR DATA FILE IS PRESENT IN DIRECTORY
C
C      ----------------------------------------------------------------
C
        INQUIRE(FILE='THERMIS.DAT',EXIST=EX,DIRECT=DI)
        IF(.NOT.EX)THEN
        CALL NEWPAG
        CALL CHRSIZ(2)
        CALL ANMODE
        WRITE(5,600)
600     FORMAT(//,'** THERE IS NO FILE ''THERMIS.DAT'' **',//)
        GOTO 1399
        ENDIF
        IF(DI.NE.'YES')THEN
        WRITE(5,620)
620     FORMAT(//,'** File THERMIS.DAT is not direct access **',//)
        GOTO 1399
         ENDIF
C
C      ----------------------------------------------------------------
C
C       OPEN THE THERMISTOR COEFFICIENT DATA FILE AND READ THE DATA
C
C       INTO THE WTT(33,7) ARRAY FOR USE WITH SUBROUTINE CNVRT1
C
C      ----------------------------------------------------------------
C

        OPEN(10,FILE='THERMIS.DAT',ACCESS='DIRECT',STATUS='OLD',
     &       FORM='FORMATTED',RECL=75)
C
C       Read the data into the array
C
        DO 630 I=1,33
630     READ(10,640,REC=I) (WTT(I,J),J=1,7)
640     FORMAT(7F10.3)
C
C      ----------------------------------------------------------------
C
C          CHECK IF THE GASFLO DATA FILE IS PRESENT IN DIRECTORY
C
C      ----------------------------------------------------------------
C
        INQUIRE(FILE='GASFLO.DAT',EXIST=EX,DIRECT=DI)
        IF(.NOT.EX)THEN
        CALL NEWPAG
        CALL CHRSIZ(2)
        CALL ANMODE
        WRITE(5,600)
201     FORMAT(//,'** THERE IS NO FILE ''GASFLO.DAT'' **',//)
        GOTO 1399
        ENDIF
```

```
      IF(DI.NE.'YES')THEN
      WRITE(5,202)
202   FORMAT(//,'** File GASFLO.DAT is not direct access **',//)
      GOTO 1399
      ENDIF
C
C     ------------------------------------------------------------
C
C      OPEN THE THE GASFLO COEFFICIENT DATA FILE AND READ THE DATA
C
C      INTO THE GAN(8,5) ARRAY FOR USE WITH SUBROUTINE CNVRT2
C
C     ------------------------------------------------------------
C
      OPEN(11,FILE='GASFLO.DAT',ACCESS='DIRECT',STATUS='OLD',
     &     FORM='FORMATTED',RECL=55)
C
C      Read the data into the array
C
      DO 204 I=1,8
204   READ(11,205,REC=I) (GAN(I,J),J=1,5)
205   FORMAT(5F10.3)
C
C     ------------------------------------------------------------
C
C                    ENTRY OF WATER REFERENCE TIME
C
C     ------------------------------------------------------------
C      open input file
C
          OPEN(UNIT=1,NAME=NAME1,STATUS='OLD',ACCESS='KEYED',
     1  ORGANIZATION='INDEXED',FORM='FORMATTED',RECORDSIZE=15,
     2  KEY=(1:9),SHARED)
C
19       CALL NEWPAG
         CALL CHRSIZ(2)
         CALL ANMODE
        WRITE(5,20)
20            FORMAT('   WATER REFERENCE TIME ? [DDDHHMM]  ',$)
              READ(5,22)IANS
C             water temperature values at this time are used to
C             compute water temp rise
  22        FORMAT(I7)
              LOC=(IANS*100)
              DO 31 I=100,131
              LOCINT=LOC+I
          ENCODE(9,32,LOCASC)LOCINT
              READ(1,33,KEY=LOCASC,ERR=19)BGT(I)
        IF((I .GE. 100) .AND.(I .LE.131))CALL CNVRT1(I,BGT(I),WTT)
  31    CONTINUE
  32      FORMAT(I9)
  33      FORMAT(T10,F6.2)
              BGT(3)=0
          BGT(1)=(BGT(130)+BGT(131))/2.
              BEGTEM(1)=BGT(1)
              DO 35 I=100,129
              BGT(3)=BGT(3)+BGT(I)
  35        CONTINUE
              BEGTEM(2)=BGT(3)
```

```
100       CALL NEWPAG
        CALL CHRSIZ(2)
        CALL ANMODE
        WRITE(5,110)
110     FORMAT('  CHOSE OPTION ',/,
     1  ' TEMPERATURE/POSITION PROFILE [P] ',/,
     2  ' TEMPERATURE/TIME PROFILE [T] ',/,
     3  ' CREATE OUTPUT FILE [O] ',/,
     4  ' EXIT PROGRAM [E] ',/,
     5  ' APPROACH TO STEADY STATE [S] ',/,
     6  ' VIEW CHANNEL DATA [C] ',/,' SELECT OPTION -> ',$)
C
            READ(5,160)ANS
            IF(ANS.EQ.'P') GOTO 140
            IF(ANS.EQ.'S') GOTO 135
            IF(ANS.EQ.'T') GOTO 500
            IF (ANS.EQ.'C') GOTO 125
            IF(ANS.EQ.'O') GOTO 120
            IF(ANS.NE.'E') GOTO 100
            GOTO 1398
120       CALL FURNOUT
            GOTO 100
125     CALL VIEWC
            GOTO 100
135     CALL STEADY
            GOTO 100
C
140     CALL ANMODE
        CALL CHRSIZ(2)
        CALL ANMODE
          WRITE(5,150)
150     FORMAT(///,' DO YOU WISH TO SEE ',
     1  /,' THE FURNANCE TEMPERATURE PROFILE [F] ? ',
     2  /,'  THE WATER TEMPERATURE PROFILE [W] ? ',
     3  /,'  THE BRICK TEMPERATURE PROFILE [B] ? ',
     4  /,'  THE HEAT FLUX PROFILE [H] ? ',
     5  /,'  MAIN MENU [M] ? ',/,' SELECT OPTION -> ',$)
            READ(5,160)ANS
160     FORMAT(A1)
            IF (ANS.EQ.'M') GOTO 100
            IF (ANS.EQ.'H') GOTO 280
            IF (ANS.EQ.'B') GOTO 260
            IF (ANS.NE.'W'.AND.ANS.NE.'B'.AND.ANS.NE.'F')GOTO 140
            IF(ANS.EQ.'W') GO TO 200
            IF(ANS.NE.'F') GO TO 140
C
C           FURNACE TEMPERATURE PLOTTING PARAMETERS
C
            CALL POSPROF(0,24)
            YTITLE='TEMP DEG C'
            XTITLE='DISTANCE ALONG FURNACE'
            TITLE='FURNANCE TEMP PROFILE'
            CTITLE='TIME(S)'
            XMINI=0.0
            XMAXI=300.0
            XDIV=20.0
            YMAXI=1500.
            YMINI=0.
            CALL MAXMIN(Y,25,NCURVS,YDIV,YMAXI,YMINI)
          DO 180 J=1,NCURVS
```

```
            NPTS(J)=25
C
            DO 170 I=1,25
            X(I,J)=I*10
170       CONTINUE
            X(23,J)=240
            X(24,J)=260
            X(25,J)=280
 180      CONTINUE
            GO TO 1390
C
C           WATER TEMPERATURE PLOTTING PARAMETERS
C
200       K=1
            CALL POSPROF(100,29)
            TITLE='TEMPERATURE PROFILE'
            YTITLE='TEMP DEG C'
            XTITLE='THERMISTER'
            CTITLE='TIME(S)'
            XMINI=100.0
            XMAXI=130.0
            XDIV=3.0
            YMAXI=40.
            YMINI=10.
            CALL MAXMIN(Y,30,NCURVS,YDIV,YMAXI,YMINI)
          DO 250 J=1,NCURVS
            NPTS(J)=30
            M=1
            DO 250 I=1,30
            X(I,J)=I+99
250       CONTINUE
            GOTO 1390
C
C           BRICK TEMPERATURE PLOTTING PARAMETERS
C
260       MAY=0
            CALL POSPROF(10,19)
            TITLE='BRICK TEMP PROFILE'
            YTITLE='TEMP DEG C'
            XTITLE='BRICK DEPTH'
            CTITLE='TIMES(S)'
            XMINI=0.
            XMAXI=18.
            XDIV=2.
            DO 270 J=1,NCURVS
            NPTS(J)=6
            X(1,J)=0.
            X(2,J)=6.35
            X(3,J)=11.43
            X(4,J)=14.6
            X(5,J)=16.51
          X(6,J)=17.78
            Y(6,J)=Y(1,J)
            Y(2,J)=Y(17,J)
            Y(3,J)=Y(20,J)
            Y(4,J)=Y(16,J)
            Y(5,J)=Y(19,J)
            Y(1,J)=Y(18,J)
 270      CONTINUE
            YMAXI=1500.
```

```
              YNINI=0.
              CALL MAXMIN(Y,6,NCURVS,YDIV,YMAXI,YMINI)
              GOTO 1390
C
C             HEAT FLUX PLOTTING PARAMETERS
C
280         MAY=1
              WATEMP=(BGT(131)+BGT(132))/2.
              CALL POSPROF(100,31)
              TITLE='HEAT FLUX'
              XTITLE='THERMISTER'
              YTITLE='MJ/HR'
              CTITLE='TIME(S)'
              XMINI=100.
              XMAXI=130.
              XDIV=3.
              DO 310 J=1,NCURVS
              NPTS(J)=30
              DO 310 I=1,30
              X(I,J)=I+99
              Y(I,J)=(Y(I,J)-BGT(I+99)+((Y(31,J)+Y(32,J))/2.)
     1    -BGT(1))*1.012
 310          CONTINUE
              CALL MAXMIN(Y,30,NCURVS,YDIV,YMAXI,YMINI)
              GOTO 1390
C
C         TEMPERATURE TIME PROFILE
C
500         CALL TIMPROF
              GOTO 1390

C
C        THE PROGRAM THEN PLOTS ALL THE CURVES WITH AXES TITLES AND
C        A GRAPH TITLE AND A LEGEND IF ONE HAS BEEN REQUESTED
C
C
1390     CALL PLOTXY
              CALL ANMODE
              CALL NEWPAG
              CALL ANMODE
              GOTO 100
1398     CALL NEWPAG
              CALL ANMODE
1399        CONTINUE
              CLOSE(UNIT=17)
         CLOSE(UNIT=10)
         CLOSE(UNIT=11)
         STOP
         END
C*****************************************************************
C
C
              SUBROUTINE MAXMIN(Y,I,J,DIV,MAX,MIN)
C
C
C*****************************************************************
C
C             this routine is to find a suitable scale to match
C             the highest and lowest values given.
C
```

```
      REAL Y(300,12),MAX,MIN,B(3)
      CALL NEWPAG
      WRITE(5,50)
50    FORMAT(' DO YOU WANT AUTOSCALE? [Y/N]   ',$)
      READ(5,60)ANS
60    FORMAT(A1)
      IF(ANS.NE.'N') GOTO 100
      WRITE(5,70)MAX
70    FORMAT(' MAXIMUM SCALE VALUE ? [',F12.6,']  ',$)
      READ(5,*)MAX
      WRITE(5,80)MIN
80    FORMAT(' MINIMUM SCALE VALUE ? [',F12.6,']  ',$)
      READ(5,*)MIN
      GOTO 115
100   MIN=15000
      MAX=0.
      DO 110 K=1,I
      DO 110 L=1,J
      IF(Y(K,L).GT.MAX) MAX=Y(K,L)
      IF(Y(K,L).LT.MIN) MIN=Y(K,L)
110   CONTINUE
      MAX=(MAX-MIN)*1.08+MIN
115   RANGE=(MAX-MIN)
      A=.001
      B(1)=5
      B(2)=2
      B(3)=1
120   DO 130 K=1,3
      DIVISION=B(K)/A
      IF((RANGE/DIVISION).GT.5) GOTO 140
130   CONTINUE
      A=A*10.
      GOTO 120
140   MIN=(INT(MIN/DIVISION))*DIVISION
      NODIV=INT((MAX-MIN)/DIVISION)+1.
      MAX=(NODIV*DIVISION)+MIN
      RETURN
      END
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C       SUBROUTINE ENTHL
C
C      THIS SUBROUTINE CALCULATES THE NET HEAT INPUT TO THE
C      FURNACE,HEAT LOST BY THE EXHAUST GASES, USING THE OSTWALD
C      CHART TO COMPUTE THE EXCESS AIR BASED ON THE GAS ANALYSIS.
C      THE MATRIX GAS CONSISTS OF GAS(1)= %CO2,GAS(2)= %O2, GAS(3)
C      = %CO, GAS(4)= MASS FLOW RATE OF MAIN AIR [LBM/HR],
C      GAS(5)= MASS FLOW RATE OF ATOMIZED AIR.THE MATRIX FMA(4)
C      CONSISTS OF FMA(1)= 1 FOR FUEL OIL, 2 FOR SLURRY, FMA(2)=
C      TOTAL AIR MASS FLOW RATE [LBM/HR], FMA(3)= OIL/SLURRY FLOW
C      RATE IN [LBM/HR], FMA(4)= METHANE FLOW RATE IN [LBM/HR].
C
      SUBROUTINE ENTHL(GAS,HG,HF,FMA,T,EXC1,EXC2,SPPM,NPPM)
      DIMENSION FUEL(5,8),MF(5,1)
      COMMON PATM,CO2,H2O,O2PROD,N2PROD,CO,OH,H2
      REAL KP1,KP2,KP3,PR,A1,A2,A3,EXC,CP,NETHT,THETA,TR
      REAL N2,N2ACT,N2PROD,MF,MFF,N,KGFUEL,LBFUEL,DPOC,THETA1,THETA2
      REAL NPROD,SPROD,SPPM,NPPM
      REAL GAS(5),FMA(4),MFUEL,BCO2,EXC1,EXC2
      INTEGER ID
```

```
      CHARACTER*1 IDUM
      HF=0.
      CALL INITT(30)
      CALL TERM(2,4096)
      FMA(1)=0.
      FMA(2)=0.
      C=0
      H=0
      N=0
      TEMP=0.
      O=0
      S=0
      ASH=0
      H2O=0
      MFUEL=0
      LBFUEL=0
      MFF=0
101   CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
      WRITE(5,102)
102   FORMAT(/,5X,' FOR THIS RUN WE HAVE :')
      WRITE(5,103)
103   FORMAT(/,5X,'1. FUEL OIL',/,5X,'2. SLURRY / MIXTURE',
     & /,5X,' ENTER OPTION -> [1] OR [2] ',$)
      READ (5,*)ID
      A1=GAS(4)
      A2=GAS(5)
      WRITE(5,*)A1,A2
309   WRITE(5,307)
307   FORMAT(10X,'PRESS RETURN TO CONTINUE')
      READ(5,308,ERR=309)IDIM
308   FORMAT(A1)
      A1=A1+A2
      FMA(2)=A1
      IF(ID .EQ. 1) GO TO 104
      IF(ID .EQ. 2) GO TO 105
      GO TO 101
104   CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
      FMA(1)=1
      MF(1,1)=FMA(3)/60.
      WRITE(5,789)
789   FORMAT(10X,'DO YOU HAVE THE SAME FUEL COMPOSITION')
      WRITE(5,788)
788   FORMAT(10X,' INPUT [Y]/[N] -> ',$)
      READ(5,786)IDUM
786   FORMAT(A1)
      IF(IDUM .EQ. 'Y')GO TO 787
      WRITE(5,107)
      READ(5,*) FUEL(1,1)
      WRITE(5,108)
      READ(5,*)FUEL(1,2)
      WRITE(5,109)
      READ(5,*) FUEL(1,3)
      WRITE(5,110)
      READ(5,*) FUEL(1,4)
      WRITE(5,111)
      READ(5,*) FUEL(1,5)
```

```
      WRITE(5,112)
      READ(5,*)FUEL(1,6)
      WRITE(5,113)
      READ(5,*)FUEL(1,7)
      WRITE(5,114)
114   FORMAT(10X,'ENTER THE LHV OF FUEL (BTU/LBM)= '$)
      READ(5,*)FUEL(1,8)
244   CONTINUE
      WRITE(5,241)
241   FORMAT(10X,'DO YOU WANT ANY CHANGES; INPUT [Y OR N]',$)
      READ(5,862)IDUM
      IF(IDUM .EQ. 'Y')GO TO 104
      IF(IDUM .EQ. 'N')GO TO 243
      GO TO 244
243   CONTINUE
787   CONTINUE
      C=C+(FUEL(1,1)*MF(1,1))/100.0
      H=H+(FUEL(1,2)*MF(1,1))/100.0
      N=N+(FUEL(1,3)*MF(1,1))/100.0
      O=O+(FUEL(1,4)*MF(1,1))/100.0
      S=S+(FUEL(1,5)*MF(1,1))/100.0
      ASH=ASH+(FUEL(1,6)*MF(1,1))/100.0
      H2O=H2O+(FUEL(1,7)*MF(1,1))/100.0
      MFF=MFF+MF(1,1)
      MFUEL=MFF
      LBFUEL=MFF
      HF=HF+(FMA(3)*FUEL(1,8))
      GO TO 115
105   J=2
251   CONTINUE
      CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
      FMA(1)=2
      MF(1,1)=(FMA(3))/60.
      FUEL(1,8)=18531.59
      FUEL(1,1)=86.38
      FUEL(1,2)=13.53
      FUEL(1,3)=.0016
      FUEL(1,4)=0.0
      FUEL(1,5)=.083
      FUEL(1,6)=0.
      FUEL(1,7)=0.
      MFF=FMA(3)
      C=C+(MF(1,1)*FUEL(1,1))/100.
      H=H+(MF(1,1)*FUEL(1,2))/100.
      S=S+(MF(1,1)*FUEL(1,5))/100.
      N=N+(MF(1,1)*FUEL(1,3))/100.
      HF=HF+(FMA(3)*FUEL(1,8))/100.
      LBFUEL=MF(1,1)
      MFUEL=MF(1,1)
248   CONTINUE
      NN=2
      WRITE (5,15)
15    FORMAT(10X,' FOR THE SLURRY / MIXTURE')
      WRITE(5,789)
      WRITE(5,788)
      READ(5,786)IDUM
      MF(2,1)=FMA(4)
      IF( IDUM .EQ. 'Y' )GO TO 247
```

```
      WRITE(5,113)
      READ(5,*)FUEL(NN,7)
247   CONTINUE
      H2O=H2O+(MF(NN,1)*FUEL(NN,7))/100.
      MFF=MFF+(MF(NN,1)*60.)
      MF(NN,1)=MF(NN,1)-H2O
      IF( IDUM .EQ. 'Y')GO TO 2470
      WRITE(5,300)
300   FORMAT(10X,'ENTER % SORBENT IN SOLID FUEL = ',$)
      READ(5,*)SORB
2470  CONTINUE
      TEMP=(MF(NN,1)*SORB)/100.
      MF(NN,1)=MF(NN,1)-TEMP
      MFUEL=MFUEL+MF(NN,1)
      IF (IDUM .EQ. 'Y') GO TO 2471
      WRITE(5,107)
107   FORMAT(10X,'ENTER % CARBON IN ANALYSIS = ',$)
      READ (5,*)FUEL(NN,1)
      WRITE(5,108)
108   FORMAT(10X,'ENTER % HYDROGEN IN ANALYSIS = ',$)
      READ (5,*)FUEL(NN,2)
      WRITE(5,109)
109   FORMAT(10X,'ENTER  % OF NITROGEN IN ANALYSIS = ',$)
      READ (5,*) FUEL(NN,3)
      WRITE (5,110)
110   FORMAT(10X,'ENTER  % OF OXYGEN IN ANALYSIS = ',$)
      READ (5,*) FUEL(NN,4)
      WRITE (5,111)
111   FORMAT(10X,'ENTER % OF SULFUR IN ANALYSIS = ',$)
      READ (5,*) FUEL(NN,5)
      WRITE (5,112)
112   FORMAT(10X,'ENTER % OF ASH IN ANALYSIS = ',$)
      READ (5,*)FUEL(NN,6)
113   FORMAT(10X,'ENTER % OF H2O IN THE FUEL= ',$)
      WRITE(5,114)
      READ(5,*)FUEL(NN,8)
246   CONTINUE
      WRITE(5,241)
      READ(5,862)IDUM
      IF(IDUM .EQ. 'Y')GO TO 248
      IF(IDUM .EQ. 'N')GO TO 2471
      GO TO 246
2471  CONTINUE
      C=C+(FUEL(NN,1)*MF(NN,1))/100.0
      H=H+(FUEL(NN,2)*MF(NN,1))/100.0
      N=N+(FUEL(NN,3)*MF(NN,1))/100.0
      O=O+(FUEL(NN,4)*MF(NN,1))/100.0
      S=S+(FUEL(NN,5)*MF(NN,1))/100.0
      ASH=ASH+(FUEL(NN,6)*MF(NN,1))/100.0
C
C     THE HF IS BASED ON THE DRY COAL WITH ASH ONLY
C
      TEMP=(MF(NN,1)*FUEL(NN,8))*60.
      HF=HF+TEMP
      LBFUEL=MFUEL-ASH
      FMA(4)=(FMA(4)*60.)
      FMA(3)=FMA(3)+FMA(4)
      TEMP=MFUEL*60.
115   CONTINUE
C     THE LATENT HEAT OF VAPORIZATION IS 1054 BTU/LBM.
```

```
C
      CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
      WRITE(5,131)HF
131   FORMAT(/,10X,' THE TOTAL ENTHALPY IN [BTU/HR]= ',E10.4)
      WRITE (5,116)MFF
116   FORMAT(/,10X,'TOTAL INPUT FLOW RATE [LBM/HR]= ',F10.2)
      WRITE(5,117)TEMP
117   FORMAT(10X,'TOTAL COMPUTED FUEL FLOWRATE [LBM/HR]=',F10.2)
      WTC=(C/LBFUEL)
      WTH=(H/LBFUEL)
      WTN=(N/LBFUEL)
      WTO=(O/LBFUEL)
      WTS=(S/LBFUEL)
C
C     MOLES OF EACH PER 100 LBM OF FUEL.
C
      C=100.0*WTC/12.0
      H=100.0*WTH/1.0
      X1=H/C
      N=100.0*WTN/14.0
      O=100.0*WTO/16.0
      X2=O/C
      X3=N/C
      S=100.0*WTS/32.0
      X4=S/C
      H2O=100.0*WTH2O/18.0
      CO2=C
      O2=CO2+H/4-O/2-N/2-S
      XS=1+(X1/4.0)-(X2/2.0)+X4+(X3/2.0)
      N2=O2*3.76
      STOI =(4.76*28.967*O2)/(C*12+H+O*16+N*14+S*32)
      ACTOI=A1/(MFF*60.)
      EXCES=(ACTOI/STOI)-1.
      EXCES=EXCES*100
      WRITE(5,123)EXCES
      EXC2=EXCES
123   FORMAT(5X,' THE INLET EXCESS AIR IN %age = ',F10.2)
C
863   WRITE(5,860)
860   FORMAT(/,5X,' PRESS RETURN TO CONTINUE ',$)
      READ(5,862,ERR=863)IDUM
862   FORMAT(A1)
C
C     DETERMINE THE STOICHIOMETRIC REACTION
C
      CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
C     ENTER THE PRESSURE IN ATMOSPHERES
      PATM=1.0
      BCO=GAS(1)
      BO2=GAS(2)
      BCO2=GAS(3)
      WRITE(5,*)XS,X1
864   WRITE(5,860)
      READ(5,862,ERR=864) IDUM
      CALL GASAN(BCO,BCO2,BO2,EXC,X1,XS)
      E=EXC
```

```
      EXC1=EXC
      WRITE(5,124)E
124   FORMAT(/,5X,' FROM OSTWALD CHART EXCESS AIR %age= ',F10.2)
1134  WRITE(5,860)
      READ(5,862,ERR=1134) IDUM
      E=1+(E/100.)
      PHI=1/E
C
C
C     COMPUTE O2,AND N2 ACTUAL
C
C
      H2O=H2O+H/2
      O2ACT=O2/PHI
      N2ACT=3.76*O2ACT
      O2PROD=O2ACT-O2
      N2PROD=N2ACT
      SPROD=S
      NPROD=N
      DPOC=O2PROD+N2PROD+SPROD+NPROD+CO2
      SPPM=(S*1000000)/DPOC
      NPPM=(N*1000000)/DPOC
C
C      DISSOCIATION
C
C   INITIALIZING THE VARIABLES
C
      KP1=2.028E-04
      KP2=3.78
      KP3=5.37E-05
      OH=0
      CO=0
      H2=0
      X1S=0
      X2S=0
      X3S=0
C
C    ALL KP VALUES ARE AT 1800 K AND IN UNITS OF ATMOSPHERES
C
C
C   DISSOC OF WATER TO  H2 AND .5 O2
C
C     SET FLAG
C
      ID=0
C
C              SOLVE FOR X
C
2500  IF (ID.EQ.0)THEN
      X=.5*H2O
 2510 CALL RNUMA(X,RNUM3)
              IF(RNUM3.GT.KP3)THEN
              X=X-.5
                      IF(X.LT.0)THEN
                      X=.5
                      GO TO 2550
                      END IF
              GO TO 2510
              ELSE
              X=X+.5
```

```
                END IF
        ELSE
        X=XIS
        ENDIF
2550    IF (X .LT.0)THEN
        X=.05
        GO TO 2600
        END IF
        IF(X.EQ.H2O)THEN
        X=X-.05
        END IF
        CALL RNUMA (X,RNUM3)
                IF (RNUM3.LT.0)THEN
                X=.1
                GO TO 2550
                END IF
        IF(RNUM3.GT.KP3)THEN
        X=X-.05
        GO TO 2550
        ELSE
        X=X+.05
        END IF
2600    IF(X.EQ.H2O)THEN
        X=X-.05
        END IF
        CALL RNUMA (X,RNUM3)
        IF(RNUM3.GT.KP3)THEN
        X=X-.01
        GO TO 2600
        ELSE
        X=X+.01
        END IF
2700    IF(X.EQ.H2O)THEN
        X=X-.0005
        END IF
        CALL RNUMA (X,RNUM3)
        IF(RNUM3.GT.KP3)THEN
        X=X-.0005
        GO TO 2700
        END IF
C
C     CHANGE VALUES BY X
C
        H2O=H2O-X
        O2PROD=O2PROD+X/2
        H2=H2+X
C
C      SET STORE X FOR NEXT ITERATION TO START WITH
C      SET FLAG IF X IS CONVERGING
C
        IF (ABS(X).LE..001)THEN
        IFLAG1=1
        ELSE
        IFLAG1=0
        END IF
        XIS=X
C
C     DISSOCIATION OF CO2 TO CO AND .5 O2
C
          IF (C.EQ.0)THEN
```

```
                IFLAG2=1
                IFLAG3=1
                IFLAG4=1
                GO TO 7000
                END IF
C
C     SOLVE FOR X
C
        IF (ID.EQ.0)THEN
        X=.9*CO2
 3090   CALL RNUMB(X,RNUM3)
                IF(RNUM3.GT.KP3)THEN
                X=X-.5
                        IF (X.LT.0)THEN
                        X=.5
                        GO TO 3100
                        END IF
                GO TO 3090
                ELSE
                X=X+.5
                END IF
        ELSE
        X=X2S
        END IF
 3100   IF(X.LT.0)THEN
        X=.05
        GO TO 3200
        END IF
        CALL RNUMB(X,RNUM3)
                IF(RNUM3.LT.0)THEN
                X=.1
                GO TO 3100
                END IF
        IF(RNUM3.GT.KP1)THEN
        X=X-.05
        GO TO 3100
        ELSE
        X=X+.05
        END IF
 3200   CALL RNUMB(X,RNUM3)
                IF (RNUM3.GT.KP1)THEN
                X=X-.01
                GO TO 3200
                ELSE
                X=X+.01
                END IF
 3300   CALL RNUMB(X,RNUM3)
        IF (RNUM3.GT.KP1)THEN
        X=X-.0005
        GO TO 3300
        END IF
C
C     CHANGE VALUES BY X
C
        CO2=CO2-X
        CO=CO+X
        O2PROD=O2PROD+X/2
C
C     STORE X FOR NEXT ITERATION
C     SET FLAG FOR CONVERGENCE
```

```
C
        IF (ABS(X).LE..001)THEN
        IFLAG2=1
        ELSE
        IFLAG2=0
        END IF
        X2S=X
C
C     DISSOCIATION OF CO2 AND H2 TO CO AND H2O
C
C      SOLVE FOR X
C
        IF (ID.EQ.0)THEN
        X=.000001
        ELSE
        X=X3S/2
        END IF
 3400   CALL RNUMC(X,RNUM3)
        IF (RNUM3.GT.KP2)THEN
        X=X+.0001
        GO TO 3400
        ELSE
        X=X-.0001
        END IF
 3500   CALL RNUMC(X,RNUM3)
        IF (RNUM3.GT.KP2)THEN
        X=X+.00005
        GO TO 3500
        ELSE
        X=X-.00005
        END IF
 3600   CALL RNUMC(X,RNUM3)
        IF (RNUM3.GT.KP2)THEN
        X=X+.00001
        GO TO 3600
        END IF
C
C   CHANGE VALUES BY X
C
        CO2=CO2-X
        H2=H2-X
        CO=CO+X
        H2O=H2O+X
C
C   STORE X FOR NEXT ITERATION
C
        IF (ABS(X).LE..001)THEN
        IFLAG3=1
        ELSE
        IFLAG3=0
        END IF
        X3S=X
C
C   CHECK TO SEE IF FOUR DISSOCIATION HAVE GONE TO COMPLETION
C
 7000   IF(IFLAG1.EQ.0)THEN
        ID=1
        GO TO 2500
        END IF
C
```

```
      IF(IFLAG2.EQ.0)THEN
      ID=1
      GO TO 2500
      END IF
C
      IF(IFLAG3.EQ.0)THEN
      ID=1
      GO TO 2500
      END IF
C
C     THE UNITS OF ENTHALPY ARE KJ/KG AND ARE CALCULATED PER 100 LBM
C     OF FUEL INPUT.IT TAKES CARE OF THE MOISTURE IN THE SLURRY BY
C     TAKING ONLY THE DRY COAL CONTENT IN THE SLURRY.
C
      HG=CO2*(79495.7-000000.)+CO*(49555.4-000000.)+O2PROD*51723.3
     %+N2PROD*49015.8+OH*(46922.4+00000.)+H2*46180.4
     % +H2O*(62650.8-000000.)
C
C     ENTHALPY IN BTU/LBM AT THE SPECIFIED TEMPERATURE AND PRESSURE
C     FOR 115% THEO. AIR USING HOTTEL'S RATIO FOR CALCULATING HT
C
      WRITE(5,*)T
      WRITE(5,3452)
3452  FORMAT(5X,' DO YOU WANT TO CHANGE SUCTION TEMP; ENTER [Y/N]',$)
      READ(5,7677)IDUM
7677  FORMAT(A1)
      IF (IDUM .EQ. 'N' )GO TO 3453
      READ (5,3454)
3454  FORMAT (3X,'ENTER THE TEMP IN K = ',$)
      READ(5,*)T
3453  CONTINUE
      RATIO=(.587*(T-500)/1000+SQRT(.0396*((T-500)/1000)**2+.0466)-.1)
C
C     USING HOTTEL'S CORRECTION FACTOR TO CALCULATE HG AT OTHER
C     LEVEL OF EXCESS AIR OTHER THAN 15%
C
      CORR=(0.4*(1800-T)*(T-298)/(1800-298)**2)*(1-1.15/E)
C
      RATIO=RATIO+CORR
      HG=(HG/100)*MFUEL*60*0.4299
      HT=HG*RATIO
      HG=HT
      WRITE(5,1498)HG
1498  FORMAT(4X,' THE UNCORRECTED HG IN BTU/HR = ',4X,E12.6)
C
C     THIS IS FOR THE MOISTURE IN THE SLURRY
C
      TR=T*1.8
      THETA=TR/180.
      HFG=18987.81
C     THE UNIT OF HFG IS BTU/LBMOLE OF WATER
C     HFG IS THE LATENT HEAT OF VAPORIZATION OF WATER AT 80 F OR 540 R
C     THE CP IS INTEGRATED OVER THE ENTIRE RANGE
C     SEE VAN WYLEN FOR DETAILS
      THETA1=540./180.
      THETA2=TR/180.
      CP=(34.19*(THETA2-THETA1))
      CP=CP-((43.868/1.25)*(THETA2**1.25-THETA1**1.25))
      CP=CP+((19.778/1.5)*(THETA2**1.5-THETA1**1.5))
      CP=CP-(.442035*(THETA2**2-THETA1**2))
```

```
      CP=CP*180.
      NETHT=HFG+CP
      HG=HG+(H2O*60.*NETHT/100.)
C
C
C
C     NOTE THIS CORRECTION IS SOMEWHAT EXCESSIVE ABOVE T=1800 WHERE
C     THE SIGN OF THE CORRECTION CHANGES.
C
      WRITE(5,350)HG
350   FORMAT(/,5X,' THE TOTAL ENTHALPY OF EXHAUST [BTU/HR]= ',E12.6)
211   WRITE(5,860)
      READ(5,862,ERR=211)IDUM
       RETURN
     END
C
    SUBROUTINE RNUMA   (X,RNUM3)
      COMMON PATM,CO2,H2O,O2PROD,N2PROD,CO,OH,H2
      REAL N2PROD
      RNUM1=((H2+X)*(O2PROD+X/2)**.5)/(H2O-X)
      RNUM2=(PATM/(CO2+H2O+O2PROD+N2PROD+CO+OH+H2+X/2))**.5
      RNUM3=RNUM1*RNUM2
      RETURN
    END
C
    SUBROUTINE RNUMB  (X,RNUM3)
      COMMON PATM,CO2,H2O,O2PROD,N2PROD,CO,OH,H2
      REAL N2PROD
      RNUM1=((CO+X)*(O2PROD+X/2)**.5)/(CO2-X)
      RNUM2=(PATM/(CO2+H2O+O2PROD+N2PROD+CO+H2+OH+X/2))**.5
      RNUM3=RNUM1*RNUM2
      RETURN
    END
C
    SUBROUTINE RNUMC  (X,RNUM3)
      COMMON PATM ,CO2,H2O,O2PROD,N2PROD,CO,OH,H2
      REAL N2PROD
      RNUM1=((CO+X)*(H2O+X))/((CO2-X)*(H2O-X))
      RNUM2=1
      RNUM3=RNUM1*RNUM2
      RETURN
      END
C     ***********************************************************************
C     SUBROUTINE GASAN(BCO,CO2,BO2,EXC,X1,XS)
C     ***********************************************************************
C     THIS PROGRAM DRAWS THE OSTWALD CHARTS
C
C     CALCULATIONS BY G.NATARAJAN
C     MODIFICATIONS BY A.K.MALLIK
C
C     GRAPHICS BY J.EASTMAN
C
C     THIS PROGRAM WILL DRAW ON THE TERMINAL
C     THE OSTWALD CHARTS. EACH GOVERENED BY
C     THE VALUES FOR THE PERCENT OF O2,CO2,AND
C     CO, IN THE PRODUCTS OF A REACTION OR BURN.
C     IT HAS AN OPTION FOR MULTIPLE FUELS AND AN
C     OPTION FOR MULTIPLE DATA SETS.
C
C     ACESS RUN OSTWA.FOR
```

```
C       EXTERNAL REFERENCES
C       HEAD  - PUTS HEADINGS ON THE COLUMNS
C       HERE THE VARIABLES USED SHALL BE DEFINED
C       N IS THE  NUMBER OF FULES TO BE USED
C       R IS THE RATIO OF H2/CO PRODUCED FOR A GIVEN FUEL
C       XS IS THE STOICHIOMETRIC MOLAR NUMBER OF OXYGEN FOR COMPLETE COMBUSTIC
C       UPCO IS THE UPPER LIMIT ON THE CONSTANT CO
C       ECCO IS THE INCREMENT BETWEEN TWO CONSTANT CO LINES
C       EARL IS THE EXCESS AIR PERCENT RICH LIMIT
C       EALL IS THE EXCESS AIR PERCENT LEAN LIMIT
C       ECAL IS THE INCREMENT BETWEEN THE TWO EXCESS AIR PERCENT LINES
C       JDAT IS THE NUMBER OF DATA SETS USED
C       NUMB ARE THE DATA USED IN THE GRAPHICS
C       BCO IS THE PERCENT OF CO IN THE PRODUCTS
C       BO2 IS THE PERCENT OF O2 IN THE PRODUCTS
C       CO2 IS THE PERCENT OF CO2 IN THE PRODUCTS
C       XCO2, XCD IS THE PERCENTAGE OF CO2
C       YBO2, YCD IS THE PERCENTAGE OF O2
C       TCO IS THE PERCENTAGE OF CO
C       EXCES IS THE EXCESS AIR CALCULATED IN THE PRODUCTS
C       LA , Q ARE COUNTERS USED IN GRAPHICS
C       L, I, J, K, M, JJ, KK, ING, INH : ARE INTEGERS
C       A1,A2 ARE THE ORIGIN (X,Y)
C       B1 MAXIMUM X CO-ORDINATE
C       C1 MAXIMUM Y CO-ORDINATE
C       BJ, AI, A3, CI, AK, Z : ARE VARIABLES
C
      SUBROUTINE GASAN(BCO,CO2,BO2,EXC,X1,XS)
      DIMENSION  X (2), Y (2)
      DIMENSION NUMB (54)
      DATA NUMB/48, 46, 49, 46, 50, 46, 51, 46, 52, 46, 53, 46,
     &54, 46, 55, 46, 56, 46, 57, 46, 49, 48, 49, 49, 49, 50, 49,
     &51, 49, 52, 49, 53, 49, 54, 49, 55, 49, 56, 49, 57, 50, 48, 50,
     &49, 50, 50, 50, 51, 50, 52, 50, 53, 50, 54/
      INTEGER AB,JJ,KK,ING,INH
      INTEGER AC, DC
      INTEGER AA, BB
      REAL S,P,Q,R1,BCO,CO2,BO2,R,XS,EXC,X1
      DATA X/0.,19./
C
C       THIS PART SETS THE GRAPHICS WINDOW.
C

      LA = 0
      Q = 0
      CALL INITT (30)
      CALL TERM (2, 4096)
      CALL KEYFUN (1)
      CALL CZAXIS (0)
      CALL TWINDO (800, 4000, 600, 2800)
      CALL HOME
C
C     THE FIRST PAGE
C
      CALL CHRSIZ (1)
      CALL ANMODE
      WRITE (5, 820)
      CALL CHRSIZ (2)
      CALL ANMODE
      WRITE (5, 830)
```

```
      WRITE (5, 850)
      WRITE (5, 840)
      CALL CHRSIZ (3)
      CALL ANMODE
      WRITE (5, 860)
 10   READ (5, 870, ERR = 10) IDUM
 20   CONTINUE
C
C     INPUT FOR THE RATIO OF H2/CO=R IS TAKEN AS 0.25 FOR COAL
C     ,0.5 FOR LIQUID FUEL AND 1.0 FOR GASEOUS FUEL
C     THESE VALUES ARE USED TO CALCULATE THE EXCESS
C     AIR TOWARDS THE END OF THE PROGRAM.FOR INTERMEDIATE
C     VALUE THE VALUE OF R IS CALCULATED.
C
      R=X1/4.
110   CONTINUE
      CALL NEWPAG
      CALL ANMODE
      CALL CHRSIZ (3)
      WRITE(5,787)
787   FORMAT(10X,'ARE THE CONDITIONS SAME ')
      WRITE(5,788)
788   FORMAT(10X,'INPUT [Y]/[N] ->',$)
      READ(5,786)IDUM
786   FORMAT(A1)
      IF(IDUM .EQ. 'Y')GO TO 140
      WRITE (5, 900)
      READ (5, *) UPCO
      WRITE (5, 910)
      READ (5, *) ECCO
      WRITE (5, 920)
      READ (5, *) EARL
      WRITE (5, 930)
      READ (5, *) EALL
      WRITE (5, 940)
      READ (5, *) ECAL
      WRITE (5, 950)
      READ (5, *) GH
      IF (GH .EQ. 1.) GO TO 20
 140  CALL NEWPAG
C
C     THE BASIC MENU
C
      CALL CHRSIZ (2)
      CALL ANMODE
      WRITE (5, 1030)
      WRITE (5, 1040)
      WRITE (5, 1050)
      WRITE (5, 1070)
      WRITE (5, 1080)
      WRITE (5, 1090)
      WRITE (5, 1100)
      GO TO 180
 150  LA = 1
      Q = 1
      GO TO 190
160   CONTINUE
      CALL HOME
      CALL CHRSIZ (3)
      CALL ANMODE
```

```
      CALL NEWPAG
      GO TO 190
170   CONTINUE
C
C     THE MENU
C
      CALL HOME
      CALL CHRSIZ(3)
      CALL ANMODE
      WRITE (5, 1030)
      WRITE (5, 1040)
      WRITE (5, 1050)
      WRITE (5, 1070)
      WRITE (5, 1080)
      WRITE (5, 1090)
      WRITE (5, 1100)
 180  CONTINUE
      READ (5, *) CH
      IF (CH .EQ. 1.) GO TO 160
      IF (CH .EQ. 2.) GO TO 380
      IF (CH .EQ. 3.) GO TO 580
      IF (CH .EQ. 4.) GO TO 430
      IF (CH .EQ. 5.) GO TO 150
      GO TO 170
 190  CONTINUE
      A1 = 0.
      A2 = 0.
      B1 = 19.
      C1 = 26.
 200  CALL NEWPAG
C
C       THIS SECTION DRAWS THE GRAPH WITH ANY X,Y FRAME.
C
      CALL DWINDO (A1, B1, A2, C1)
 210  CONTINUE
C
C       THIS DRAWS THE OUTER BORDER.
C
      CALL MOVEA (A1, A2)
      CALL DRAWA (B1, A2)
      CALL DRAWA (B1, C1)
      CALL DRAWA (A1, C1)
      CALL DRAWA (A1, A2)
C
C       THIS DRAWS SOLID VERTICAL LINES EVERY 5 UNITS.
C
      DO 220 I = 1, 19, 5
         CALL MOVEA ( (I - 1.), 0.)
         CALL DRAWA ( (I - 1.), 26.)
 220  CONTINUE
C
C       THIS DRAWS SOLID HORIZONTAL LINES EVERY 5 UNITS.
C
      DO 230 I = 1, 26, 5
         CALL MOVEA (0., (I - 1.) )
         CALL DRAWA (19., (I - 1.) )
 230  CONTINUE
C
C       THIS SECTION DRAWS THE VERTICAL TIC MARKS.
C
```

```
      DO 240 I = 1, 19
         CALL MOVEA ( (A1 + I), A2)
         CALL DRAWA ( (A1 + I), (A2 + .25) )
         CALL MOVEA ( (A1 + I), (C1 - .25) )
         CALL DRAWA ( (A1 + I), C1)
 240  CONTINUE
C
C       THIS SECTION DRAWS THE HORIZONTAL TIC MARKS.
C
      DO 250 I = 1, 26
         CALL MOVEA (A1, (A2 + I) )
         CALL DRAWA ( (A1 + .25), (A2 + I) )
         CALL MOVEA ( (B1 - .25), (A2 + I) )
         CALL DRAWA (B1, (A2 + I) )
 250  CONTINUE
C
C       THIS SECTION PUTS THE NUMBERS BY THE HORIZONTAL
C       TIC MARKS.
C
      JJ = 2.*A1 + 1.
      KK = 2.*B1
      XN = 0.
      DO 260 I = JJ, KK, 2
         JJ = JJ - 1
         CALL MOVEA (A1 + XN, A2)
         CALL ANMODE
         CALL LINEF
         CALL MOVER (0., 0.)
         CALL ANCHO (NUMB (I) )
         CALL ANCHO (NUMB (I + 1) )
         XN = XN + 1.
         CALL TSEND
 260     CONTINUE
C
C       THIS SECTION PUTS NUMBERS BY THE VERTICAL TIC MARKS.
C
         JJ = 2.*A2 + 1.
         KK = 2.*C1
         XN = 0.
         IF(JJ .GE. 2) GO TO 273
         JJ=1
 273      CONTINUE
         DO 270 I = JJ, KK, 2
          JJ = JJ - 1
          CALL MOVEA (A1, A2 + XN)
          CALL ANMODE
          CALL BAKSP
          CALL BAKSP
          CALL MOVER (0., 0.)
          CALL ANCHO (NUMB (I) )
          CALL ANCHO (NUMB (I + 1) )
          XN = XN + 1.
          CALL TSEND
 270     CONTINUE
C
C       THIS SECTION PRINTS THE TITLE AND LABELS THE AXIS.
C
      CALL HOME
      CALL CHRSIZ (1)
      CALL ANMODE
```

```
      WRITE (5, 1110)
      CALL MOVABS (100, 2700)
      CALL ANMODE
      WRITE (5, 1120)
      CALL CHRSIZ (3)
      CALL ANMODE
      WRITE (5, 1130)
      WRITE (5, 1140)
      WRITE (5, 1150)
      CALL CHRSIZ (1)
      CALL ANMODE
      CALL MOVABS (2000, 400)
      CALL ANMODE
      WRITE (5, 1160)
C
C       THIS SECTION PUTS THE LINES ON THE GRAPH.
C
      AT=R
      Z=XS
C
C     THIS PART OF THE PROGRAM DRAWS THE CONSTANT CO
C     LINES.
C
      CO = 0.
      J = 1
 280  IF (CO .GT. UPCO) GO TO 320
      K=1
      S=(1+AT)/2.
 300  IF(K .GT. 2) GO TO 310
      Y(K)=21.-(.79*Z+.21)*X(K)-(.79*Z-S*.37)*CO
      K=K+1
      GO TO 300
 310  CONTINUE
      M = 1
      CALL MOVEA (X (M), Y (M) )
      CALL DRAWA (X (M + 1), Y (M + 1) )
      CO = CO + ECCO
      GO TO 280
 320  CONTINUE
C
C     THIS PART OF THE PROGRAM DRAWS THE CONSTANT
C     EXCESS AIR LINES.
C
      E = EARL
 330  IF (E .GT. EALL) GO TO 360
      L=1
 340  IF( L .GT. 2) GO TO 350
       EF = E/100.
       S=(1+AT)/2.
       P=S*.63
       R1=.37+(.21/S)
       Y(L)=((S+Z*EF)*21.-S*(.21+(.79+R1*EF)*Z)*X(L))
       Y(L)=Y(L)/(P+(.79+EF)*Z)
       L=L+1
       GO TO 340
 350   CONTINUE
       M = 1
      CALL MOVEA (X (M), Y (M) )
      CALL DRAWA (X (M + 1), Y (M + 1) )
      E = E + ECAL
```

```
      GO TO 330
 360  CONTINUE
      CALL TSEND
 370  CONTINUE
C
      I=1
      CALL CHRSIZ (3)
      CALL MOVABS (2000, 200)
      CALL ANMODE
      WRITE (5, 1170) I, XS
      CALL HOME
      IF (LA .EQ. 1) GO TO 540
      GO TO 170
 380  CONTINUE
C
C       THIS SECTION ALLOWS THE USER TO ENLARGE
C       ANY PORTION OF THE CHART BY USING THE
C       CROSS HAIRS .
C
      CALL MOVABS (100, 1950)
      CALL CHRSIZ (3)
      CALL ANMODE
      WRITE (5, 670)
      WRITE (5, 680)
      WRITE (5, 690)
      WRITE (5, 700)
      WRITE (5, 710)
      CALL VCURSR (P, AI, A3)
      AJ = AI
      AK = A3
      CALL POINTA (AI, A3)
      CALL VCURSR (P, BI, A3)
      BJ = BI
      AK = A3
      CALL POINTA (BI, A3)
      CALL MOVEA (AJ, AK)
      CALL DRAWA (BJ, AK)
      A1 = AI
      B1 = BI
      CALL VCURSR (P, AI, CI)
      CJ = CI
      CALL POINTA (AI, CI)
      CALL MOVEA (AJ, AK)
      CALL DRAWA (AJ, CJ)
      CALL DRAWA (BJ, CJ)
      CALL DRAWA (BJ, AK)
      CALL TSEND
 390  READ (5, 1180, ERR = 390) IDUM
      AC = AJ
      AA = AK
      DC = CJ
      BB = BJ
      A1 = AC
      B1 = BB
      C1 = AA
      A2 = DC
      LA = 0
      IF (Q .EQ. 1) LA = 1
      GO TO 200
 430  CONTINUE
```

```
C
C       THIS SECTION GIVES THE COORDINATES OF A POINT ON THE GRAPH.
C
      CALL CHRSIZ (3)
      CALL MOVABS (0, 200)
      WRITE (5, 1230)
      WRITE (5, 1240)
 440  CONTINUE
      CALL VCURSR (IC, XCD, YCD)
      CALL POINTA (XCD, YCD)
      IF (IC .EQ. 80) GO TO 450
      IF (IC .EQ. 83) GO TO 460
 450  CONTINUE
      CALL ANMODE
      WRITE (5, 1250) XCD, YCD
      GO TO 440
 460  CALL NEWPAG
C
C     IN THIS SECTION THE CO% AND/OR EXCESS AIR VALUE IS
C     COMPUTED USING THE CENTROID OR THE CO-ORDINATE CHOSEN
C     BY THE USER.
C
      CALL MOVABS (1000, 1500)
      CALL CHRSIZ (2)
      CALL ANMODE
      AT = R
      Z = XS
 470  CALL NEWPAG
      CALL CHRSIZ (2)
      CALL ANMODE
      WRITE (5, 720)
      WRITE (5, 730)
      WRITE (5, 740)
      WRITE (5, 750)
      WRITE (5, 760)
      WRITE (5, 770)
      READ (5, *) L
      IF (L .EQ. 1) GO TO 490
      IF (L .EQ. 2) GO TO 480
      GO TO 470
 480  XCO2 = XCD
      YBO2 = YCD
 490  CONTINUE
      CALL NEWPAG
      AT = R
      Z = XS
      XCO2 = XCO2/100.
      YBO2 = YBO2/100.
      IF (BO2 .GT. 0.) GO TO 500
C
C     IF CO IS PRESENT IN THE RAW DATA THEN THE O2 VALUE
C     IS SET TO ZERO AND THE CO%, EXCESS AIR IS CALCULATED.
C
      YBO2 = 0.0000/1.E19
      T1 = 21. - (79.*Z + 21.) *XCO2
      T2 = 79.*Z + 18.5* (1 + AT)
      TCO = T1/T2
      T3 = (TCO + XCO2) *Z
      T4 = - 0.5* (1 + AT) *TCO
      EXCES = T4/T3
```

```
      XCO2 = XCO2*100.
      TCO = TCO*100
      GO TO 510
 500  CONTINUE
C
C     IF OXYGEN IS PRESENT IN THE RAW DATA THEN THE CO VALUE
C     IS SET TO ZERO AND THE EXCESS AIR IS CALCULATED.
C
      TCO = 0.0/1.0E17
      T3 = XCO2*Z
      T4 = YBO2
      EXCES = T4/T3
      XCO2 = XCO2*100.
      YBO2 = YBO2*100.
 510  CONTINUE
      EXCES = EXCES*100.
      CALL MOVABS (1000, 1500)
      CALL CHRSIZ (1)
      CALL ANMODE
      WRITE (5, 780) TCO, XCO2, YBO2
      WRITE (5, 790) EXCES
      EXC=EXCES
      WRITE (5, 800)
      WRITE (5,803)
803   FORMAT(' PLEASE EXIT THE OSTWALD PROGRAM TO CONTINUE')
      WRITE (5, 860)
 520  READ (5, 810, ERR = 520) IDUM
 530  CONTINUE
      GO TO 140
 540  CONTINUE
      LA = 0
      CALL HOME
      CALL MOVABS (0, 200)
      CALL CHRSIZ (3)
      CALL ANMODE
      AT=R
      S=(1+AT)/2.
C
C       THIS FINDS THE POINT RELATING CO AND CO2
C
        DO 550 K = 1, 2
           Y (K) = 21. - (.79*XS  + .21) *X (K) - (.79*XS  -
     &     S*.37) *BCO
 550    CONTINUE
C
C       SLOP IS THE SLOPE OF THE LINE
C       YCO IS THE Y COORDINATE
C       XCO IS THE X COORDINATE
C
        SLOP = (Y (2) - Y (1) ) / (X (2) - X (1) )
        YCO = SLOP*CO2  + Y (1)
        CALL MOVEA (CO2 , YCO)
        CALL POINTA (CO2, YCO)
        CALL MOVER (.125, .25)
        CALL DRAWR ( - .25, 0.)
        CALL DRAWR (0., - .5)
        CALL DRAWR (.25, .0)
        CALL DRAWR (0., .5)
C
C       THIS RELATES CO AND O2.
```

```
C
          XCO = (BO2  - Y (1) ) /SLOP
          CALL MOVEA (XCO - 0.125, BO2  )
          CALL DRAWR (.25, 0.)
          CALL MOVEA (XCO, BO2 + 0.5)
          CALL DRAWR (0., - 1.)
C
C        THIS RELATES CO2 AND O2.
C
          CALL MOVEA (CO2 , BO2 )
          CALL MOVER (0.125, .25)
          CALL DRAWR ( - .25, - .5)
          CALL MOVER (0., .5)
          CALL DRAWR (.25, - .5)
          CALL MOVEA (CO2 , BO2 )
          CALL MOVER (.125, 0.0)
          CALL DRAWR ( - .25, 0)
          CALL MOVEA (CO2 , BO2 )
          CALL MOVER (0., .25)
          CALL DRAWR (0, - 0.5)
          CALL TSEND
          XCO2 = (2.*CO2  + XCO) /3.
          YBO2 = (2.*BO2 + YCO) /3.
  560   CONTINUE
        CALL MOVABS (0, 50)
        GO TO 170
  580   CONTINUE
        CALL BELL
        RETURN
C
C
C
  660   FORMAT(////,4X,'WHICH FUEL * ',$)
  670   FORMAT(2X,'TO ENLARGE')
  680   FORMAT(2X,'LOCATE A POINT')
  690   FORMAT(2X,'HIT [P],MOVE HOR.')
  700   FORMAT(2X,'HIT [P],MOVE VER.')
  710   FORMAT(2X,'HIT [P],HIT RETURN')
  720   FORMAT(/,5X,'DO YOU WANT TO FIND THE EXCESS AIR BY: ')
  730   FORMAT(5X,'1. USING THE CENTROID OF THE THREE POINTS')
  740   FORMAT(5X,'    IF SO INPUT [1]')
  750   FORMAT(5X,'2. USING THE CO-ORD. CHOSEN BY THE USER')
  760   FORMAT(5X,'    IF SO INPUT [2]')
  770   FORMAT(/,5X,'WHICH WAY INPUT [1] OR [2]',$)
  780   FORMAT(/,5X,'CO%age= ',2X,F5.2,3X,'CO2%age= ',2X,F5.2,
       &3X,'O2%age= ',2X,F5.2)
  790   FORMAT (/, 5X, ' EXCESS AIR IN % = ', 3X, F5.2)
  800   FORMAT(///,20X,' THE PROGRAM STARTS ALL OVER AGAIN')
  810   FORMAT(A1)
  820   FORMAT(////,30X,'OSTWALD CHART')
  830   FORMAT(///,24X,'CALCULATIONS BY Goutham Natarajan')
  840   FORMAT(//,24X,'MODIFICATIONS BY Arnab K. Mallik')
  850   FORMAT(//,28X,'GRAPHICS BY Jeff Eastman')
  860   FORMAT(///,3X,'PRESS RETURN TO CONTINUE')
  870   FORMAT(A1)
  900   FORMAT (//, 10X, 'INPUT THE UPPER LIMIT ON THE CONSTANT
       & CO PERCENT LINE = ',$)
  910   FORMAT(10X,'INPUT THE INCREMENT BETWEEN TWO CONSTANT',1X,
       & 'CO PERCENT LINES=',$)
  920   FORMAT (10X, 'INPUT EXCESS AIR PERCENT RICH LIMIT=', $)
```

```
930   FORMAT(10X,'INPUT EXCESS AIR PERCENT LEAN LIMIT=',$)
940   FORMAT(10X,'INPUT THE INCREMENT BETWEEN EXCESS AIR
    &  PERCENT LINES=',$)
950   FORMAT (/////, 10X'ANY CHANGES YES(1)  NO(2):', $)
1030  FORMAT(3X,'***MENU****')
1040  FORMAT(//,3X,'DRAW       :1')
1050  FORMAT(3X,'ENLARGE    :2')
1070  FORMAT(3X,'END        :3')
1080  FORMAT(3X,'FIND CORD.:4')
1090  FORMAT(3X,'LOC. DATA :5')
1100  FORMAT(///,3X,'WHICH ONE:',$)
1110  FORMAT(49X,'OSTWALD CHART')
1120  FORMAT(3X,'Percent O2')
1130  FORMAT(/////,3X,'CO-CO2=BOX')
1140  FORMAT(3X,'CO-O2=CROSS')
1150  FORMAT(3X,'CO2-O2=STAR')
1160  FORMAT(10X,'CO2 Percent')
1170  FORMAT(//,3X,'FUEL #:',I2,4X,'XS=',F7.5)
1180  FORMAT(A1)
1230  FORMAT(///////,60X,'LINE UP X-HAIRS WITH POINT')
1240  FORMAT(60X,'PRESS (P) POINT: (S) STOP')
1250  FORMAT('+','X=',F6.3,3X,'Y=',F6.3,$)
C
      END

C
            SUBROUTINE PLOTXY
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C       THIS SUBROUTINE PLOTS THE CURVE OF Y VS X
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
            COMMON X(300,12),Y(300,12),BGT(300),NPTS(12),L(12),NCURVS,
     1  XMIN(12),XMAX(12),YMAX(12),YMIN(12),XMINI,XMAXI,TIME(12),
     2  YMINI,YMAXI,XDIV,YDIV,LS,M,LTI,LTIX,LTIY,MAY,JP
            COMMON /TITLES/ TITLE,CTITLE,XTITLE,YTITLE
          CHARACTER*30 TITLE,CTITLE,XTITLE,YTITLE
            BYTE ISTR(15)
            INTEGER TIME,YPOS
        CHARACTER*1 IDUM
C
C
       DO 111 I=1,NCURVS
       DO 112 J=1,NPTS(1)
       WRITE(5,*)X(I,J),Y(I,J)
112    CONTINUE
111    CONTINUE
       WRITE(5,113)
113    FORMAT(10X,' PLEASE HIT RETURN TO CONTINUE')
       READ(5,*)IDUM
            CALL TWINDO(410,3000,410,2700)
            CALL DWINDO(XMINI,XMAXI,YMINI,YMAXI)
            CALL CHRSIZ(4)
            CALL NEWPAG
C
C       PLOT X AXIS
C
            CALL MOVEA(XMINI,YMINI)
            IXINC=((XMAXI-XMINI)/XDIV)
```

```
            DO 1000 J=0,IXINC
            CALL MOVREL(0,50)
            CALL DRWREL(0,-50)
            CALL MOVREL(-94,-98)
            CALL ANMODE
            XLAB=XMINI+(J*XDIV)
            WRITE(5,900) XLAB
900       FORMAT($,1H+,F6.1)
            CALL MOVEA(XLAB,YMINI)
            CALL DRAWR(XDIV,0.)
1000      CONTINUE
C
C       PLOT Y AXIS
C
            CALL MOVEA(XMINI,YMINI)
            IYINC2=((YMAXI-YMINI)/YDIV)
3000      DO 4000 J=0,IYINC2
            CALL MOVREL(50,0)
            CALL DRWREL(-50,0)
            CALL MOVREL(-250,-24)
            CALL ANMODE
            YLAB=YMINI+(J*YDIV)
            WRITE(5,3900)  YLAB
3900      FORMAT($,1H+,F6.1)
            CALL MOVEA(XMINI,YLAB)
            CALL DRAWR(0.,YDIV)
4000      CONTINUE
C
C       BOX IN THE GRAPH
C
            DO 4001 J=1,IXINC+1
            CALL DRAWR(XDIV,0.)
            CALL MOVREL(0,-50)
            CALL DRWREL(0,50)
4001      CONTINUE
C
            DO 4002 J=1,(IYINC2+IYINC1)
            CALL DRAWR(0.,-YDIV)
            CALL MOVREL(-50,0)
            CALL DRWREL(50,0)
4002      CONTINUE
C
            IF(IYINC1.EQ.0) GO TO 4010
            CALL MOVEA(XMINI,0.)
          DO 4003 J=1,IXINC+1
            CALL DRAWR(XDIV,0.)
            CALL MOVREL(0,-50)
            CALL DRWREL(0,100)
            CALL MOVREL(0,-50)
4003      CONTINUE
C
C       LABEL X AXIS TITLE
C
4010      CALL MOVABS(1400,250)
            CALL ANMODE
4150    WRITE(5,4160)XTITLE
4160    FORMAT($,1H+,30A)
C
C       LABEL Y AXIS TITLE
C
```

```
4170    CALL MOVABS(0,1800)
        CALL ANMODE
             WRITE(5,4200)YTITLE
4200      FORMAT(1H+,30A)
C
C       PRINT TITLE OF GRAPH
C
             CALL CHRSIZ(3)
          CALL MOVABS(1500,2900)
             CALL ANMODE
             WRITE(5,4500)TITLE
4500      FORMAT($,1H+,30A)
C
             CALL CHRSIZ(3)
             CALL MOVABS(3300,2100)
             CALL ANMODE
             WRITE(5,4650)CTITLE
4650    FORMAT(1H+,30A)
             YPOS=2000
             DO 4670 I=1,NCURVS
             YPOS=YPOS-100
             CALL MOVABS(3300,YPOS)
             CALL ANMODE
             WRITE(5,4680) TIME(I)
4670       CONTINUE
4680    FORMAT($,1H+,I7)
             CALL MOVABS(3350,1600)
C
C
C       DASH STYLE CODES
C
             L(1)=0
             L(2)=34
             L(3)=56
             L(4)=78
             L(5)=3676
             L(6)=3474
             L(7)=0
             L(8)=34
             L(9)=56
             L(10)=78
             L(11)=3676
             L(12)=3474
C
C       PLOT CURVES
C
             CALL CHRSIZ(4)
             DO 6000 K=1,NCURVS
             CALL MOVEA(X(1,K),Y(1,K))
             DO 5000 J=2,NPTS(K)
             CALL DASHA(X(J,K),Y(J,K),L(K))
5000       CONTINUE
6000       CONTINUE
             CALL MOVABS(1500,100)
C
             CALL ANMODE
             WRITE (5,7600)
7600       FORMAT (1H+,' HIT 'RETURN' TO CONTINUE.',$)
             READ (5,7610) ANS
7610       FORMAT(A1)
```

```
            RETURN
            END
C*********************************************************
C
C
            SUBROUTINE POSPROF(LSTART,LSTOP)
C
C           this program read date from the data file created
C           by the data logger program , formats it into a
C           useable form and then stores it in another file.
C
C
C*********************************************************
             COMMON X(300,12),Y(300,12),BGT(300),NPTS(12),L(12),NCURVS,
     1  XMIN(12),XMAX(12),YMAX(12),YMIN(12),XMINI,XMAXI,TIME(12),
     2  YMINI,YMAXI,XDIV,YDIV,LS,M,LTI,LTIX,LTIY,MAY,JP
        COMMON/CALIB/WTT(33,7),GAN(8,5)
C
             INTEGER CURVNO(12),CTIME,TIME
             CHARACTER*9 LOCASC
C
C
5       WRITE(5,10)
10      FORMAT(' HOW MANY TIMES DO YOU WISH TO SEE ? ',$)
             READ(5,20)NCURVS
20      FORMAT(I2)
25      DO 200 J=1,NCURVS
27      WRITE(5,40)J
             READ(5,50)CURVNO(J)
40      FORMAT(' TIME',I2,' [DDDHHMM] ',$)
50      FORMAT(I7)
C
C            convert input format to search format
C
             LOC=(CURVNO(J)*100)
C
C            read time
C
             ENCODE(9,130,LOCASC)LOC
             READ(1,150,KEY=LOCASC,ERR=210)TIME(J)
C
C            Read  values
C
             DO 100 I=0,LSTOP
             LOCINT=LOC+LSTART+I
        ICH=LSTART+I
             ENCODE(9,130,LOCASC)LOCINT
             READ(1,140,KEY=LOCASC,ERR=210)Y(I+1,J)
        IF((ICH.GE.100).AND. (ICH.LE.131))CALL CNVRT1(ICH,Y(I+1,J),WTT)
        IF((ICH.GE. 31).AND. (ICH.LE.38))CALL CNVRT2(ICH,Y(I+1,J),GAN)
 100      CONTINUE
 130      FORMAT(I9)
 140    FORMAT(T10,F6.2)
 150    FORMAT(I6)
             TIME(J)=TIME(J)*10
 200    CONTINUE
             GOTO 250
 210    WRITE(5,220)
 220    FORMAT(/,' A TIME OR DATE IS NOT IN THE FILE ',/,
     1  ' PLEASE TRY AGAIN ',/)
```

```
            GOTO 27
 250    RETURN
            END
C*************************************************
C
C
            SUBROUTINE TIMPROF
C
C
C*************************************************
C
C
            COMMON X(300,12),Y(300,12),BGT(300),NPTS(12),L(12),NCURVS,
     1  XMIN(12),XMAX(12),YMAX(12),YMIN(12),XMINI,XMAXI,TIME(12),
     2  YMINI,YMAXI,XDIV,YDIV,LS,M,LTI,LTIX,LTIY,MAY,JP
         COMMON/CALIB/WTT(33,7),GAN(8,5)
            COMMON /TITLES/ TITLE,CTITLE,XTITLE,YTITLE
            COMMON /TP/ CHAN(12)
            INTEGER TIME,CHAN
            CHARACTER*9 LOCASC
            CHARACTER*30 TITLE,XTITLE,CTITLE,YTITLE
            DIMENSION B(3)
            CALL NEWPAG
5           WRITE(5,10)
10          FORMAT(' ',////,' CHANNEL PLOT ? [C] ',
     1  /,' HEAT OUTPUT ? [H] ',
     2  /,' EFFICENCY   ? [E] ',
     3  /,' MAIN MENU  ? [M] ',$)
            READ(5,20)ANS
20          FORMAT(A1)
            IF(ANS.EQ.'M') GOTO 650
400       WRITE(5,420)
420     FORMAT(' ',/,'  BEGINING TIME  ?:DDDHHMM ',$)
            READ(5,430)LOK
430     FORMAT(I7)
            IA=INT(LOK/100)
            MI=LOK-(100*IA)
            DI=INT(IA/100)
            HI=IA-(100*DI)
            LOK=LOK*100
C
            WRITE(5,440)
 440    FORMAT(' ',/,'  ENDING TIME ?: DDDHHMM ',$)
            READ(5,430)LOCEND
            LOCEND=LOCEND*100
            IF(ANS.EQ.'C') GOTO 500
            CHAN(1)=140
            I=1
            K=1
 190      IF(LOK.GT.LOCEND) GOTO 595
            WRITE(5,*)LOK
          SUM=0
            HEAT=0
C           read input water temp
            DO 200 LL=130,131
            LOCINT=LOK+LL
            ENCODE(9,580,LOCASC)LOCINT
            READ(1,585,KEY=LOCASC,ERR=270)BGT(LL)
        CALL CNVRT1(LL,BGT(LL),WTT)
 200    CONTINUE
```

```
C
C             read output water temp
C
              BGT(2)=(BGT(130)+BGT(131))/2.
              DO 210 LL=100,129
              LOCINT=LOC+LL
              ENCODE(9,580,LOCASC)LOCINT
              READ(1,585,KEY=LOCASC,ERR=270)VAL
         CALL CNVRT1(LL,VAL,WTT)
              HEAT=VAL-BGT(LL)+BGT(1)-BGT(2)
              SUM=SUM+HEAT
 210        CONTINUE
              IF(ANS.EQ.'H') GOTO 250
 250     Y(I,1)=SUM*1.006
 260     X(I,1)=K/6.
              I=I+1
 270     LOC=LOC+1000
 300        NPTS(1)=I-1
              K=K+1
              M=M+10
              IF(M.LT.60) GOTO 190
              M=0
              H=H+1
              LOC=LOC+4000
              IF(H.LT.24) GOTO 190
              H=0
              LOC=LOC+760000
              GOTO 190
 500        WRITE(5,510)
 510        FORMAT(' ','   ENTER 999 AFTER LAST CHANNEL, LIMIT',
     1    ' OF 12 CHANNELS.  ',/,' VERTICAL SCALE IS BASED',
     2    ' UPON FIRST CHANNEL SELECTED. ')
              J=0
              I=1
 514        J=J+1
         IF(J.GT.12) GOTO 590
         WRITE(5,520)
 520        FORMAT(' ','CHANNEL NUMBER ? [XXX] ',$)
              READ(5,530)CHAN(J)
              IF(CHAN(J).EQ.999) GOTO 590
              TIME(J)=CHAN(J)
              LOC=LOK+CHAN(J)
              LOCEND=LOCEND+CHAN(J)
              M=MI
              D=DI
              H=HI
 530     FORMAT(I3)
              I=1
              K=0
 560     IF(LOC.GT.LOCEND) GOTO 515
         ENCODE(9,580,LOCASC)LOC
              READ(1,585,KEY=LOCASC,ERR=570)Y(I,J)
         IF((CHAN(J).GE.100).AND.(CHAN(J).LE.130))THEN
         CALL CNVRT1(CHAN(J),Y(I,J),WTT)
         ENDIF
              X(I,J)=(K/6.)
              I=I+1
 570     LOC=LOC+1000
              K=K+1
              M=M+10
```

```
            IF(M.LT.60)GOTO 560
            M=0
            H=H+1
            LOC=LOC+4000
            IF(H.LT.24) GOTO 560
            H=0
            LOC=LOC+760000
            GOTO 560
515     NPTS(J)=I-1
            GOTO 514
580     FORMAT(I9)
585     FORMAT(T10,F6.2)
590     NCURVS=J-1
            XMINI=0.
595       D=NPTS(1)/6.
            A=1.
            B(1)=5
            B(2)=2
            B(3)=1
596       DO 597 I=1,3
            XDIV=B(I)/A
            IF((D/XDIV).GT.5) GOTO 599
597     CONTINUE
            A=A*10
            GOTO 596
599       XM=INT(D/XDIV)+1.
            XMAXI=XM*XDIV
            IF(CHAN(1).LE.30) GOTO 700
            IF(CHAN(1).LE.36) GOTO 650
            IF(CHAN(1).LE.131) GOTO 600
            IF(CHAN(1).EQ.140) GOTO 750
600       YMAXI=60.
            YMINI=10.
            YDIV=5.
            TITLE='WATER TEMP HIST'
            XTITLE='TIME HOURS'
            YTITLE='DEG C'
            CTITLE='CHANNELS'
            RETURN
650       RETURN
700       YMAXI=1500.
            YMINI=0.
            YDIV=150.
            TITLE='FURNACE TIME HISTORY'
            YTITLE='DEG C'
            XTITLE='TIME,HRS'
            CTITLE='CHANNELS'
            RETURN
750       TITLE='HEAT OUT'
            YTITLE='MJ/HR'
            XTITLE='TIME HRS'
            CTITLE='START TIME'
            XMINI=0.
            YMAXI=40.
            YMINI=0.
            YDIV=5.
            NCURVS=1
            RETURN
            END
C*****************************************************
```

```
C
C
      SUBROUTINE FURNOUT
C
C*****************************************************
C
C     This program creates an output file for the entire
C     run for a given data file.
C
C
          COMMON X(300,12),Y(300,12),BGT(300),NPTS(12),L(12),NCURVS,
     1  XMIN(12),XMAX(12),YMAX(12),YMIN(12),XMINI,XMAXI,TIME(12),
     2  YMINI,YMAXI,XDIV,YDIV,LS,M,LTI,LTIX,LTIY,MAY,JP
          COMMON /TITLES/ TITLE,CTITLE,XTITLE,YTITLE
C
      COMMON/CALIB/WTT(33,7),GAN(8,5)
C
           COMMON /VIEW/ BEGTEM(2)
           DIMENSION VALUE(150),NAME1(15)
       INTEGER LOK
           DIMENSION FLORAT(70),HS(70)
           INTEGER CTIME,TIM,CHAN(150),RUN,H,COUNT
           CHARACTER*9 LOCASC
       CHARACTER*30 TITLE,XTITLE,CTITLE,YTITLE
       REAL HG,HF,T,EMP(2),GAS(5),FMA(4),LL,SPPM,NPPM
       REAL HW,EXC1,EXC2,TYME,RAD1,RAD2,PERT
       CHARACTER*1 IDUM,IDM
      DIMENSION NAME3(15),NAME4(15)
44    CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
      WRITE(5,101)
      WRITE(5,5)
5       FORMAT('  ENTER DATA FILE NAME XXXX.DAT : ',$)
          READ(5,7,ERR=8)I,(NAME3(J),J=1,I)
C     WRITE(5,*)NAME3
          GOTO 10
   7  FORMAT(Q,10A1)
   8  WRITE(5,9)
   9  FORMAT(/' NO DATA FILE OF THAT NAME '/)
          GO TO 44
10    NAME3(I+1)='.'
      NAME3(I+2)='D'
      NAME3(I+3)='A'
      NAME3(I+4)='T'
C
101   FORMAT(/,5X,'THE DATA CALCULATED IS STORED IN A FILE')
          OPEN(UNIT=2,NAME=NAME3,STATUS='NEW',FORM='FORMATTED')
C
C
       CALL NEWPAG
       WRITE(5,225)
225    FORMAT(//,10X,'WELCOME TO OUTPUT')
227    WRITE(5,512)
       READ(5,513,ERR=227)IDUM
       K=1
       COUNT=0
       CALL NEWPAG
       WRITE(5,600)
600    FORMAT(10X,'THE GAUGE PRESSURE FOR ATOM. AIR [PSIG]= ',$)
```

```
      READ(5,*)PR
      PR1=PR
      RAD1=((PR+14.7)/14.7)**0.5
      WRITE(5,601)
601   FORMAT(10X,'THE GAUGE PRESSURE FOR MAIN. AIR [PSIG]= ',$)
      READ(5,*)PR
      PR2=PR
      RAD2=((PR+14.7)/14.7)**0.5
228   CALL NEWPAG
 20   WRITE(5,21)
 21   FORMAT(' ','WHAT TIME DO YOU WISH TO SEE ?:DDDHHMM ',$)
           READ(5,22)LOK
 22   FORMAT(I7)
       IA=INT(LOK/100)
       M=LOK-(100*IA)
       D=INT(IA/100)
       H=IA-(100*D)
       TYME=(60.*H)+M
       LOK=LOK*100
       TIM=LOK/100
      COUNT=COUNT+1
C
C          convert input format to search format
C
      LOC=LOK-1
C
C          read thermister values
C
     DO 25 I=101,132
59        LOCINT=LOC+I
     J=I-1
          ENCODE(9,50,LOCASC)LOCINT
          READ(1,120,KEY=LOCASC,ERR=60)CHAN(J),VALUE(J)
     CALL CNVRT1(CHAN(J),VALUE(J),WTT)
          GOTO 25
60   VALUE(J)=0
25        CONTINUE
C
C
C          read thermocouple values
C
          LOC=LOK-1
          DO 30 I=1,30
     LOCINT=LOC+I
     J=I
          ENCODE(9,50,LOCASC)LOCINT
          READ(1,120,KEY=LOCASC,ERR=61)CHAN(J),VALUE(J)
          GOTO 30
 61     VALUE(J)=0.
 30  CONTINUE
C
C          read flow rates and gas percentage
C
          LOC=LOK-1
     DO 40 I=32,39
          LOCINT=LOC+I
     J=I-1
          ENCODE(9,50,LOCASC)LOCINT
          READ(1,120,KEY=LOCASC,ERR=62)CHAN(J),VALUE(J)
     CALL CNVRT2(CHAN(J),VALUE(J),GAN)
```

```
              GOTO 40
62            VALUE(I)=0.
  40      CONTINUE
  50      FORMAT(I9)
          FMA(3)=VALUE(34)
          IF(FMA(3) .LT. 3.8)THEN
          FMA(3) = 0.0
          ENDIF
          WRITE(5,*)CHAN(38),VALUE(38)
          WRITE(5,3398)
3398      FORMAT(5X,' DO YOU WANT TO CHANGE THE SO2 PPM ; ENTER [Y/N]',$)
          READ(5,3356)IDUM
3356      FORMAT(A1)
          IF(IDUM .EQ. 'N') GO TO 3399
          WRITE(5,3499)
3499      FORMAT(5X,'PLEASE ENTER THE DESIRED PPM ',$)
          READ(5,*)VALUE(38)
3399      CONTINUE
C
          LOC=LOK-1
          LOCINT=LOC+31
          ENCODE(9,50,LOCASC)LOCINT
          READ(1,120,KEY=LOCASC,ERR=6200)CHAN(30),VALUE(30)
          GO TO 6201
6200      VALUE(30)=0.
6201      CONTINUE
          IF(VALUE(30) .LT. 0.07)THEN
          VALUE(30)=0.
          ENDIF
          IF(VALUE(30) .GT. 0.07)THEN
          AS=VALUE(30)
          VALUE(30)=.01592+6.17*AS-15.71*AS**2+20.33*AS**3
          ENDIF
          IF( VALUE(30) .GT. 0.3)THEN
          AS=VALUE(30)
          VALUE(30)=.3883+1.608*AS
          ENDIF
          FMA(4)=VALUE(30)
          LOC=LOK-1
          LOCINT=LOC+60
          ENCODE(9,50,LOCASC)LOCINT
          READ(1,120,KEY=LOCASC,ERR=202)CHAN(40),VALUE(40)
          GO TO 203
202       VALUE(40)=0.
203       CONTINUE
C
120       FORMAT(T7,I3,T10,F6.2)
          WRITE(5,*)VALUE(40)
          IF(VALUE(40) .LT. 0.)THEN
          VALUE(40)=(-1.*VALUE(40))
          ENDIF
          AS=VALUE(40)
          IF(VALUE(40) .GE. 6.80) THEN
          VALUE(40)=335.1+161.2*AS-2.291*AS**2-1.052*AS**3+.1272*AS**4
     1      -.004463*AS**5
          GO TO 301
          ENDIF
          IF(VALUE(40) .GE. 4.0) THEN
          VALUE(40)=455.3+74.42*AS +20.82*AS**2-3.581*AS**3+.1889*AS**4
          GO TO 301
```

```
      ENDIF
      IF(VALUE(40) .GE. 1.2 )THEN
      VALUE(40)=216.3+269*AS-35.91*AS**2+2.941*AS**3
      GO TO 301
      ENDIF
      VALUE(40)=66.94+541.2*AS-194.6*AS**2+44.89*AS**3-
     1 5.499*AS**4+.3256*AS**5-.007483*AS**6
301   CONTINUE
      IF(VALUE(40) .LT. 270.)THEN
      T=700.
      GO TO 1001
      ENDIF
      T=VALUE(40)
1001   CONTINUE
       WRITE(5,*)T
       WRITE(5,*)FMA(3),FMA(4)
       WRITE(5,1201)
       READ(5,513)IDUM
       WRITE(5,7577)
7577   FORMAT(3X,'DO YOU WANT TO CHANGE SLURRY FLOWRATE [Y/N]',$)
       READ(5,7578)IDUM
7578   FORMAT(A1)
       IF(IDUM .EQ. 'Y')THEN
       WRITE(5,7579)
7579   FORMAT(5X,'PLEASE ENTER THE NEW FLOWRATE.LBM/MIN = ',$)
       READ(5,*)FMA(4)
       WRITE(5,*)FMA(3),FMA(4)
       ENDIF
       T=T+273.15
C          change time to useable form
C
           SUM=0
           SUMAL=0
           AVGTEM=(VALUE(130)+VALUE(131))/2.
           DO 72 I=100,129
           SUM=VALUE(I)+SUM
  72     CONTINUE
           SUMAL=SUM-BEGTEM(2)-AVGTEM+BEGTEM(1)
C
C
C          This part of the program will compute the useful heat
C           output, Hs, from the specific heat of water, Cp, times
C          the summation of the mass flow rates of water, Mf, times
C           the summation of the change of temperature of the water.
C
C                CP = 0.998 Btu/lb*'F
C                FLORAT = Mass flow rate, lb/hr.
C               AVGTEM = Average inlet water temperature, 'C
C               HSTOT = Total heat, Btu/hr.
C
C               FLOWS RECALIBRATED 7/18/88 . MALLIK ARNAB & JAMES OBLOZA
C
           HSTOT=0
C
            FLORAT(32)=476.22
            FLORAT(33)=729.35
            FLORAT(34)=698.39
            FLORAT(35)=777.89
            FLORAT(36)=697.46
            FLORAT(37)=707.80
```

```
      FLORAT(38)=732.10
      FLORAT(39)=719.03
            FLORAT(40)=734.04
            FLORAT(41)=732.15
            FLORAT(42)=745.26
            FLORAT(43)=494.97
      FLORAT(44)=467.77
            FLORAT(45)=566.21
            FLORAT(46)=463.08
            FLORAT(47)=569.02
            FLORAT(48)=471.52
            FLORAT(49)=469.64
            FLORAT(50)=436.83
            FLORAT(51)=478.08
            FLORAT(52)=479.96
            FLORAT(53)=458.39
            FLORAT(54)=444.33
            FLORAT(55)=444.33
            FLORAT(56)=443.39
            FLORAT(57)=487.46
       FLORAT(58)=463.08
            FLORAT(59)=484.67
            FLORAT(60)=458.39
            FLORAT(61)=476.21
C
            CP=0.998
            DO 87 I=32,61
            HS(I)=CP*FLORAT(I)*(VALUE(I+68)-AVGTEM)*9/5
            HSTOT=HSTOT+HS(I)
87          CONTINUE
C
       VALUE(61)=HSTOT
       VALUE(62)=SUMAL
       VALUE(36)=(VALUE(36))*RAD1
       VALUE(35)=(VALUE(35))*RAD2
       GAS(4)=VALUE(35)
       GAS(5)=VALUE(36)
       GAS(1)=VALUE(32)
       GAS(2)=VALUE(33)
       GAS(3)=VALUE(31)
       WRITE(5,1200)
1200   FORMAT(2X,'VALUE OF CO,O2,CO2,MAIN,ATOM ')
       WRITE(5,*)(GAS(I),I=1,5)
       WRITE(5,1201)
1201   FORMAT(2X,'PRESS RETURN TO CONTINUE')
       READ(5,513)IDUM
       CALL ENTHL(GAS,HG,HF,FMA,T,EXC1,EXC2,SPPM,NPPM)
       VALUE(60)=HF
       VALUE(63)=HG
       HW=HF-HSTOT-HG
       VALUE(64)=HW
       VALUE(34)=FMA(2)
       IF(FMA(1) .LT. 1.5)THEN
          VALUE(42)=FMA(3)
          VALUE(44)=0.
        ELSE
           VALUE(42)=(FMA(3)-FMA(4))
           VALUE(44)=FMA(4)
       ENDIF
       VALUE(41)=EXC1
```

```
      VALUE(45)=EXC2
C
C           header for output
C
      CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
        WRITE(5,787)NAME3,TIM
      WRITE(2,80)NAME3,TIM
 80   FORMAT('1',//,T20,'FILENAME:',T31,15A1,/,T20,
     1 'DATE/TIME',T31,I7,//,T10,'THERMOCOUPLES',
     2 T24,' DEG. C',/)
787   FORMAT(//,T20,'FILENAME:',T31,15A1,/,T20,
     1 'DATE/TIME',T31,I7,//,T10,'THERMOCOUPLES',
     2 T24,' DEG. C',/)
      DO 100 I=1,10
      WRITE(5,106)CHAN(I),VALUE(I),CHAN(I+10),VALUE(I+10),
     1 CHAN(I+20),VALUE(I+20)
      WRITE(2,106)CHAN(I),VALUE(I),CHAN(I+10),VALUE(I+10),
     1 CHAN(I+20),VALUE(I+20)
106   FORMAT(T10,I3,T16,F10.2,T30,I3,T36,F10.2,T50,I3,T56,F10.2)
100   CONTINUE
      WRITE(5,512)
      READ(5,513)IDUM
      CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
      WRITE(5,131)
      WRITE(2,131)
131   FORMAT(//,T10,'THERMISTERS',T24,'DEG. C',/)
      DO 132 I=1,10
      J=I+99
      WRITE(5,124)CHAN(J),VALUE(J),CHAN(J+10),VALUE(J+10),
     1 CHAN(J+20),VALUE(J+20)
      WRITE(2,124)CHAN(J),VALUE(J),CHAN(J+10),VALUE(J+10),
     1 CHAN(J+20),VALUE(J+20)
124   FORMAT(T10,I3,T16,F8.2,T30,I3,T36,F8.2,T50,I3,T56,F8.2)
132   CONTINUE
      WRITE(5,125)CHAN(131),VALUE(131)
      WRITE(2,125)CHAN(131),VALUE(131)
125   FORMAT(T10,I3,T16,F8.2,/)
511   WRITE(5,512)
512   FORMAT(/,5X,'PRESS RETURN TO CONTINUE',$)
      READ(5,513,ERR=511)IDUM
      CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
      WRITE(2,126)
      WRITE(5,126)
126   FORMAT(/,T10,'FLOW RATES: ',T26,' (LBM/HR)',/,T11
     1 ,'MAIN AIR',T24,'ATOM. AIR',T37,'TOTAL AIR',T54,
     2 'FUEL ',T67,'SLURRY/MIXTURE')
      WRITE(5,127)VALUE(35),VALUE(36),VALUE(34),VALUE(42)
     1 ,VALUE(44)
      WRITE(2,127)VALUE(35),VALUE(36),VALUE(34),VALUE(42)
     1 ,VALUE(44)
127   FORMAT(T10,F8.2,T24,F8.2,T37,F8.2,T50,F8.2,T65,F8.2,/)
      WRITE(5,128)VALUE(60),VALUE(61)
      WRITE(2,128)VALUE(60),VALUE(61)
128   FORMAT(T10,'HEAT INPUT(BTU/HR)',T30,E12.6,T46,'WATER LOSS'
```

```
     1   ,'(BTU/HR)',T67,E12.6)
         THEREFF = (VALUE(61))/(VALUE(60))
         THEREFF = THEREFF*100.
         RATHGHF = (VALUE(63))/(VALUE(60))
         WRITE(5,2356)THEREFF,RATHGHF
         WRITE(2,2356)THEREFF,RATHGHF
2356     FORMAT(/,T10,'THERMAL EFF. % =',5X,F5.2,3X,' HG/HF =',5X,F5.3)
          WRITE(5,129)VALUE(40)
          WRITE(2,129)VALUE(40)
129      FORMAT(/,T10,
     1   'TEMPERATURE(CER.)',T32,F7.2,2X,T44,'DEG. C',/)
          WRITE(5,150)VALUE(31),VALUE(32),VALUE(33)
         WRITE(2,150)VALUE(31),VALUE(32),VALUE(33)
150      FORMAT(T10,'CO2 %',T17,F7.2,T29,'CO %',T35,F7.2,T45,'O2 %',
     1    T52,F7.2)
         WRITE(5,1389)SPPM,NPPM
         WRITE(2,1389)SPPM,NPPM
1389     FORMAT(/,T10,'MAX SO2 PPM=',5X,F7.1,' MAX NO-NOX PPM=',4X,F7.1)
         WRITE(5,151)VALUE(37),VALUE(38)
         WRITE(2,151)VALUE(37),VALUE(38)
151      FORMAT(/,T10,'NO-NOx (PPM)',T25,F7.1,T42,'SO2 (PPM)',
     1   T57,F7.1)
          WRITE(5,152)VALUE(63),VALUE(64)
          WRITE(2,152)VALUE(63),VALUE(64)
152       FORMAT(/,T10,'EXH. GAS LOSS(BTU/HR)',T33,E12.6,T49,
     1   'WALL LOSS(BTU/HR)',T67,E12.6)
         WRITE(5,779)PR2,PR1
         WRITE(2,779)PR2,PR1
779      FORMAT(/,T10,'MAIN AIR (PSI) =',T28,F7.1,T38,'ATOMIZED AIR ',
     1   '(PSI) =',T57,F7.1)
         WRITE(5,154)VALUE(41)
         WRITE(2,154)VALUE(41)
154      FORMAT(T10,'EXCESS AIR % (OUTLET) =',T40,F7.2)
         WRITE(5,512)
514      CONTINUE
         READ(5,513,ERR=514)IDUM
513      FORMAT(A1)
         CALL NEWPAG
         WRITE(5,522)
522      FORMAT(//,' DO YOU WANT TO CALCULATE FOR ANOTHER TIME')
         WRITE(5,523)
523      FORMAT(/,' IF NOT THEN IT PLOTS THE GRAPH')
         WRITE(5,524)
524      FORMAT(5X,'PLEASE INPUT [Y]/[N] ',$)
         READ(5,254)IDUM
254      FORMAT(A1)
455      CONTINUE
         X(K,1)=TYME
         Y(K,1)=HF
         Y(K,2)=HSTOT
         Y(K,3)=HG
         Y(K,4)=HW
         WRITE(5,*)K,X(K,1),Y(K,1),Y(K,4)
         WRITE(5,1201)
         READ(5,513)IDM
         K=K+1
         IF(IDUM .EQ. 'Y')GO TO 228
456      TITLE='HEAT FLUX VRS. TIME'
         YTITLE='HEAT LOSS'
         XTITLE='TIME [HRS]'
```

```
          CTITLE='*10^3 BTU/HR'
457       DO 235 I=1,COUNT
          DO 236 J=1,4
          Y(I,J)=(Y(I,J))/1000.
          NPTS(J)=COUNT
236       CONTINUE
235       CONTINUE
          NCURVS=4
          LL=X(1,1)
          WRITE(5,*)X(1,1)
          X(1,1)=0.
          DO 237 I=2,COUNT
          X(I,1)=X(I,1)-LL
          X(I,1)=X(I,1)/60.
          WRITE(5,*)I,X(I,1)
          WRITE(5,512)
          READ(5,670)IDUM
237       CONTINUE
          DO 238 I=1,COUNT
          X(I,2)=X(I,1)
          X(I,3)=X(I,1)
          X(I,4)=X(I,1)
238       CONTINUE
          XMINI=0.
          XMAXI=10.
          XDIV=0.5
          YMINI=0.
          YMAXI=3000.
          DO 669 I=1,COUNT
          WRITE(5,668)X(I,1),(Y(I,J),J=1,4)
669       CONTINUE
          WRITE(5,512)
          READ(5,670)IDUM
670       FORMAT(A1)
          CALL MAXMIN(Y,COUNT,4,YDIV,YMAXI,YMINI)
          CALL PLOTXY
          CALL ANMODE
104       CONTINUE
          CALL NEWPAG
          CALL CHRSIZ(2)
          CALL ANMODE
          WRITE(5,1500)
1500      FORMAT( '  AFTER PLOTTING THE COMPUTED VALUES ARE')
          WRITE(5,1501)
1501      FORMAT( '  STORED IN A DATA FILE ')
          WRITE(5,15)
15        FORMAT('  ENTER DATA FILE NAME XXXX.DAT : ',$)
               READ(5,17,ERR=18)I,(NAME4(J),J=1,I)
C         WRITE(5,*)NAME4
               GOTO 29
17        FORMAT(Q,10A1)
18        WRITE(5,19)
19        FORMAT(/' NO DATA FILE OF THAT NAME '/)
               GOTO 104
29        NAME4(I+1)='.'
          NAME4(I+2)='D'
          NAME4(I+3)='A'
          NAME4(I+4)='T'
C
          OPEN(UNIT=13,NAME=NAME4,FORM='FORMATTED',STATUS='NEW')
```

```
      WRITE(13,535)COUNT
      WRITE(5,535)COUNT
535   FORMAT('1',I4)
      WRITE(13,667)
      CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
      WRITE(5,667)
667   FORMAT(5X,'TIME',4X,'HIN',8X,'HS'10X,'HG',10X,'HW')
      DO 666 I=1,COUNT
      WRITE(13,668)X(I,1),(Y(I,J),J=1,4)
      WRITE(5,668)X(I,1),(Y(I,J),J=1,4)
668   FORMAT(4X,F5.2,4(2X,E10.3))
666   CONTINUE
      WRITE(5,512)
      READ(5,513)IDUM
      CLOSE(UNIT=2)
      CLOSE(UNIT=13)
          RETURN
      END
C*****************************************************
C*****************************************************
C
C
          SUBROUTINE STEADY
C
C         this program read date from the data file created
C         by the data logger program , formats it into a
C         useable form. It is used during the run to find out
C     out if steady conditions are reached.
C
C*****************************************************
C
          COMMON X(300,12),Y(300,12),BGT(300),NPTS(12),L(12),NCURVS,
     1  XMIN(12),XMAX(12),YMAX(12),YMIN(12),XMINI,XMAXI,TIME(12),
     2  YMINI,YMAXI,XDIV,YDIV,LS,M,LTI,LTIX,LTIY,MAY,JP
          COMMON /TITLES/ TITLE,CTITLE,XTITLE,YTITLE
C
      COMMON/CALIB/WTT(33,7),GAN(8,5)
C
          COMMON /VIEW/ BEGTEM(2)
          DIMENSION VALUE(150),NAME1(15)
      INTEGER LOK
          DIMENSION FLORAT(70),HS(70)
          INTEGER CTIME,TIM,CHAN(150),COUNT,RUN
          CHARACTER*9 LOCASC
      CHARACTER*30 TITLE,XTITLE,CTITLE,YTITLE
      REAL HG,HF,T,EMP(2),GAS(5),FMA(4)
      REAL HW,EXC1,EXC2
      CHARACTER*1 IDUM
      DIMENSION NAME3(15),NAME4(15)
44    CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
      WRITE(5,101)
      WRITE(5,5)
5       FORMAT('  ENTER DATA FILE NAME XXXX.DAT : ',$)
          READ(5,7,ERR=8)I,(NAME3(J),J=1,I)
C     WRITE(5,*)NAME3
          GOTO 10
```

```
  7     FORMAT(Q,10A1)
  8     WRITE(5,9)
  9     FORMAT(/' NO DATA FILE OF THAT NAME '/)
             GO TO 44
10      NAME3(I+1)='.'
        NAME3(I+2)='D'
        NAME3(I+3)='A'
        NAME3(I+4)='T'
C
101     FORMAT(/,5X,'THE DATA CALCULATED IS STORED IN A FILE')
             OPEN(UNIT=2,NAME=NAME3,STATUS='NEW',FORM='FORMATTED')
C
C
         CALL NEWPAG
         WRITE(5,225)
225      FORMAT(//,10X,'WELCOME TO OUTPUT')
227      WRITE(5,512)
         READ(5,513,ERR=227)IDUM
         K=1
         COUNT=0
228      CALL NEWPAG
  20     WRITE(5,21)
  21     FORMAT(' ','WHAT TIME DO YOU WISH TO SEE ?:DDDHHMM ',$)
              READ(5,22)LOK
  22     FORMAT(I7)
          IA=INT(LOK/100)
          M=LOK-(100*IA)
          D=INT(IA/100)
          LOK=LOK*100
          TIM=LOK/100
         COUNT=COUNT+1
C
C             convert input format to search format
C
         LOC=LOK-1
C
C            read thermister values
C
        DO 25 I=101,132
59           LOCINT=LOC+I
        J=I-1
             ENCODE(9,50,LOCASC)LOCINT
             READ(1,120,KEY=LOCASC,ERR=60)CHAN(J),VALUE(J)
        CALL CNVRT1(CHAN(J),VALUE(J),WTT)
             GOTO 25
60      VALUE(J)=0
25           CONTINUE
C
C
C            read thermocouple values
C
             LOC=LOK-1
             DO 30 I=1,30
        LOCINT=LOC+I
        J=I
             ENCODE(9,50,LOCASC)LOCINT
             READ(1,120,KEY=LOCASC,ERR=61)CHAN(J),VALUE(J)
             GOTO 30
  61      VALUE(J)=0.
  30    CONTINUE
```

```
C
C             read flow rates and gas percentage
C
              LOC=LOK-1
              DO 40 I=32,39
              LOCINT=LOC+I
         J=I-1
              ENCODE(9,50,LOCASC)LOCINT
              READ(1,120,KEY=LOCASC,ERR=62)CHAN(J),VALUE(J)
         CALL CNVRT2(CHAN(J),VALUE(J),GAN)
              GOTO 40
62            VALUE(I)=0.
  40     CONTINUE
  50     FORMAT(I9)
C
         LOC=LOK-1
         LOCINT=LOC+60
         ENCODE(9,50,LOCASC)LOCINT
         READ(1,120,KEY=LOCASC,ERR=202)CHAN(40),VALUE(40)
         GO TO 203
202      VALUE(40)=0.
203      CONTINUE
C
120      FORMAT(T7,I3,T10,F6.2)
         WRITE(5,*)VALUE(40)
         IF(VALUE(40) .LT. 0.)THEN
         VALUE(40)=(-1.*VALUE(40))
         ENDIF
         AS=VALUE(40)
         IF(VALUE(40) .GE. 6.80) THEN
         VALUE(40)=335.1+161.2*AS-2.291*AS**2-1.052*AS**3+.1272*AS**4
      1  -.004463*AS**5
         GO TO 301
         ENDIF
         IF(VALUE(40) .GE. 4.0) THEN
         VALUE(40)=455.3+74.42*AS +20.82*AS**2-3.581*AS**3+.1889*AS**4
         GO TO 301
         ENDIF
         IF(VALUE(40) .GE. 1.2 )THEN
         VALUE(40)=216.3+269*AS-35.91*AS**2+2.941*AS**3
         GO TO 301
         ENDIF
         VALUE(40)=66.94+541.2*AS-194.6*AS**2+44.89*AS**3-
      1  5.499*AS**4+.3256*AS**5-.007483*AS**6
301      CONTINUE
         IF(VALUE(40) .LT. 270.)THEN
         T=700.
         GO TO 1001
         ENDIF
         T=VALUE(40)
1001      CONTINUE
          WRITE(5,*)VALUE(40)
          WRITE(5,*)T
          WRITE(5,1201)
          READ(5,513)IDUM
          T=T+273.15
C             change time to useable form
C
              SUM=0
              SUMAL=0
```

```
            AVGTEM=(VALUE(130)+VALUE(131))/2.
            DO 72 I=100,129
            SUM=VALUE(I)+SUM
 72       CONTINUE
            SUMAL=SUM-BEGTEM(2)-AVGTEM+BEGTEM(1)
C
C
C           This part of the program will compute the useful heat
C            output, Hs, from the specific heat of water, Cp, times
C           the summation of the mass flow rates of water, Mf, times
C            the summation of the change of temperature of the water.
C
C                 CP = 0.998 Btu/lb*'F
C                 FLORAT = Mass flow rate, lb/hr.
C               AVGTEM = Average inlet water temperature, 'C
C               HSTOT = Total heat, Btu/hr.
C
C               FLOWS RECALIBRATED 2/26/88 . MALLIK ARNAB
C
            HSTOT=0
C
             FLORAT(32)=496.74
             FLORAT(33)=487.56
             FLORAT(34)=523.63
             FLORAT(35)=493.20
             FLORAT(36)=506.01
             FLORAT(37)=491.33
        FLORAT(38)=488.43
        FLORAT(39)=482.83
             FLORAT(40)=455.23
             FLORAT(41)=479.44
             FLORAT(42)=481.67
             FLORAT(43)=517.50
        FLORAT(44)=483.95
             FLORAT(45)=484.75
             FLORAT(46)=469.66
             FLORAT(47)=471.63
             FLORAT(48)=509.85
             FLORAT(49)=481.35
             FLORAT(50)=451.25
             FLORAT(51)=497.02
             FLORAT(52)=515.39
             FLORAT(53)=472.09
             FLORAT(54)=452.84
             FLORAT(55)=456.20
             FLORAT(56)=484.31
             FLORAT(57)=518.54
             FLORAT(58)=472.63
             FLORAT(59)=519.33
             FLORAT(60)=483.55
             FLORAT(61)=508.48
C
             CP=0.998
             DO 87 I=32,61
             HS(I)=CP*FLORAT(I)*(VALUE(I+68)-AVGTEM)*9/5
             HSTOT=HSTOT+HS(I)
87           CONTINUE
C
          VALUE(61)=HSTOT
          VALUE(62)=SUMAL
```

```
      WRITE(5,600)
600   FORMAT(10X,'THE GAUGE PRESSURE FOR ATOM. AIR [PSIG]= ',$)
      READ(5,*)PR
      PR1=PR
      RAD=((PR+14.7)/14.7)**0.5
      VALUE(36)=(VALUE(36))*RAD
      WRITE(5,601)
601   FORMAT(10X,'THE GAUGE PRESSURE FOR MAIN AIR [PSIG]= ',$)
      READ(5,*)PR
      PR2=PR
      RAD=((PR+14.7)/14.7)**0.5
      VALUE(35)=(VALUE(35))*RAD
      GAS(4)=VALUE(35)
      GAS(5)=VALUE(36)
      GAS(1)=VALUE(32)
      GAS(2)=VALUE(33)
      GAS(3)=VALUE(31)
      WRITE(5,1200)
1200  FORMAT(2X,'VALUE OF CO,O2,CO2,MAIN,ATOM ')
      WRITE(5,*)(GAS(I),I=1,5)
      WRITE(5,1201)
1201  FORMAT(2X,'PRESS RETURN TO CONTINUE')
      READ(5,513)IDUM
      CALL ENTHL(GAS,HG,HF,FMA,T,EXC1,EXC2,PERT,SPPM,NPPM)
      VALUE(60)=HF
      VALUE(63)=HG
      HW=HF-HSTOT-HG
      VALUE(64)=HW
      VALUE(34)=FMA(2)
      IF(FMA(1) .LT. 1.5)THEN
         VALUE(42)=FMA(3)
         VALUE(44)=0.
       ELSE
          VALUE(42)=(FMA(3)-FMA(4))
          VALUE(44)=FMA(4)
      ENDIF
      VALUE(41)=EXC1
      VALUE(45)=EXC2
C
C          header for output
C
      CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
        WRITE(5,787)NAME3,TIM
      WRITE(2,80)NAME3,TIM
 80   FORMAT('1',//,T20,'FILENAME:',T31,15A1,/,T20,
     1 'DATE/TIME',T31,I7,//,T10,'THERMOCOUPLES',
     2 T24,' DEG. C',/)
787   FORMAT(//,T20,'FILENAME:',T31,15A1,/,T20,
     1 'DATE/TIME',T31,I7,//,T10,'THERMOCOUPLES',
     2 T24,' DEG. C',/)
      DO 100 I=1,10
      WRITE(5,106)CHAN(I),VALUE(I),CHAN(I+10),VALUE(I+10),
     1 CHAN(I+20),VALUE(I+20)
      WRITE(2,106)CHAN(I),VALUE(I),CHAN(I+10),,VALUE(I+10),
     1 CHAN(I+20),VALUE(I+20)
106   FORMAT(T10,I3,T16,F10.2,T30,I3,T36,F10.2,T50,I3,T56,F10.2)
100   CONTINUE
      WRITE(5,513)
```

```
      READ(5,513)IDUM
      CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
      WRITE(5,131)
      WRITE(2,131)
131   FORMAT(//,T10,'THERMISTERS',T24,'DEG. C',/)
      DO 132 I=1,10
      J=I+99
      WRITE(5,124)CHAN(J),VALUE(J),CHAN(J+10),VALUE(J+10),
     1CHAN(J+20),VALUE(J+20)
      WRITE(2,124)CHAN(J),VALUE(J),CHAN(J+10),VALUE(J+10),
     1CHAN(J+20),VALUE(J+20)
124   FORMAT(T10,I3,T16,F8.2,T30,I3,T36,F8.2,T50,I3,T56,F8.2)
132   CONTINUE
      WRITE(5,125)CHAN(131),VALUE(131)
      WRITE(2,125)CHAN(131),VALUE(131)
125   FORMAT(T10,I3,T16,F8.2,/)
511   WRITE(5,512)
512   FORMAT(/,5X,'PRESS RETURN TO CONTINUE',$)
      READ(5,513,ERR=511)IDUM
      CALL NEWPAG
      CALL CHRSIZ(2)
      CALL ANMODE
      WRITE(2,126)
      WRITE(5,126)
126   FORMAT(/,T10,'FLOW RATES: ',T26,' (LBM/HR)',/,T11
     1,'MAIN AIR',T24,'ATOM. AIR',T37,'TOTAL AIR',T54,
     2'FUEL ',T67,'METHANE')
      WRITE(5,127)VALUE(35),VALUE(36),VALUE(34),VALUE(42)
     1,VALUE(44)
      WRITE(2,127)VALUE(35),VALUE(36),VALUE(34),VALUE(42)
     1,VALUE(44)
127   FORMAT(T10,F8.2,T24,F8.2,T37,F8.2,T50,F8.2,T65,F8.2,/)
      WRITE(5,128)VALUE(60),VALUE(61)
      WRITE(2,128)VALUE(60),VALUE(61)
128   FORMAT(T10,'HEAT INPUT(BTU/HR)',T30,E10.3,T47,'WATER LOSS'
     1,'(BTU/HR)',T65,E10.3)
       WRITE(5,129)VALUE(40)
       WRITE(2,129)VALUE(40)
129   FORMAT(/,T10,
     1'TEMPERATURE(CER.)',T32,F7.2,2X,T44,'DEG. C',/)
       WRITE(5,150)VALUE(31),VALUE(32),VALUE(33)
      WRITE(2,150)VALUE(31),VALUE(32),VALUE(33)
150   FORMAT(T10,'CO2 %',T17,F7.2,T29,'CO %',T35,F7.2,T45,'O2 %',
     1 T52,F7.2)
      WRITE(5,151)VALUE(37),VALUE(38)
      WRITE(2,151)VALUE(37),VALUE(38)
151   FORMAT(/,T10,'NO-NOx (PPM)',T25,F7.1,T42,'SO2 (PPM)',
     1T57,F7.1)
       WRITE(5,152)VALUE(63),VALUE(64)
       WRITE(2,152)VALUE(63),VALUE(64)
152    FORMAT(/,T10,'EXH. GAS LOSS(BTU/HR)',T31,E10.3,T44,
     1'WALL LOSS(BTU/HR)',T62,E10.3)
      WRITE(5,153)VALUE(45)
      WRITE(2,153)VALUE(45)
153   FORMAT(T10,'EXCESS AIR % (INLET) =',T40,F7.2)
      WRITE(5,779)PR2,PR1
      WRITE(2,779)PR2,PR1
779   FORMAT(T10,'MAIN AIR (PSI) =',T28,F7.1,T38,'ATOMIZED AIR ',
```

FILENAME: CC9.DAT
DATE/TIME 2251430

THERMOCOUPLES DEG. C

0	26.06	10	1012.70	20	1019.00
1	489.61	11	1073.60	21	996.27
2	86.07	12	1133.40	22	982.53
3	959.68	13	1106.70	23	997.54
4	8.99	14	1015.90	24	978.20
5	26.91	15	1065.30	25	621.67
6	1121.80	16	943.39	26	188.79
7	1169.20	17	1010.70	27	177.71
8	1144.80	18	1029.40	28	95.28
9	851.33	19	1081.20	29	0.00

THERMISTORS DEG. C

100	27.68	110	33.03	120	34.37
101	27.42	111	35.27	121	34.01
102	29.92	112	35.36	122	35.52
103	30.22	113	36.80	123	35.55
104	34.05	114	43.98	124	39.43
105	32.83	115	37.22	125	37.38
106	31.97	116	35.20	126	36.02
107	32.05	117	37.58	127	33.52
108	30.58	118	38.81	128	35.13
109	31.80	119	36.02	129	37.42
131	23.55				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1119.14	217.77	1336.91	0.00	219.00

HEAT INPUT(BTU/HR) 0.138792E+07 WATER LOSS(BTU/HR) 0.307002E+06

THERMAL EFF. % = 22.12 HG/HF = 0.601

TEMPERATURE 1143.05 DEG. C

CO2 % 16.67 CO % 0.03 O2 % 1.98

MAX SO2 PPM= 4623.8 MAX NO-NOX PPM= 2314.6

SO2 (PPM) 2330.4 NO-NOX (PPM) 804.9

EXH. GAS LOSS(BTU/HR) 0.834418E+06 WALL LOSS(BTU/HR) 0.246500E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 9.01

```
     1    '(PSI) =',T57,F7.1)
          WRITE(5,154)VALUE(41)
          WRITE(2,154)VALUE(41)
154       FORMAT(T10,'EXCESS AIR % (OUTLET) =',T40,F7.2)
514       CONTINUE
          READ(5,513,ERR=514)IDUM
513       FORMAT(A1)
          CALL NEWPAG
          WRITE(5,522)
522       FORMAT(//,' DO YOU WANT TO CALCULATE FOR ANOTHER TIME')
          WRITE(5,523)
523       FORMAT(/,' IF NOT THEN IT PLOTS THE GRAPH')
          WRITE(5,524)
524       FORMAT(5X,'PLEASE INPUT [Y]/[N] ',$)
          READ(5,254)IDUM
254       FORMAT(A1)
455       CONTINUE
          X(K,1)=IANS
          Y(K,1)=HF
          Y(K,2)=HSTOT
          Y(K,3)=HG
          Y(K,4)=HW
          K=K+1
          IF(IDUM .EQ. 'Y')GO TO 228
456       TITLE='HEAT FLUX VRS. TIME'
          YTITLE='HEAT LOSS'
          XTITLE='TIME [HRS]'
          CTITLE='*10^3 BTU/HR'
457       DO 235 I=1,COUNT
          DO 236 J=1,4
          Y(I,J)=(Y(I,J))/1000.
236       CONTINUE
235       CONTINUE
          NCURVS=4
          LL=X(1,1)
          X(1,1)=0.
          DO 237 I=2,COUNT
          X(I,1)=X(I,1)-LL
          X(I,1)=X(I,1)/60.
237       CONTINUE
          DO 238 I=1,COUNT
          X(I,2)=X(I,1)
          X(I,3)=X(I,1)
          X(I,4)=X(I,1)
238       CONTINUE
104       CONTINUE
          CALL NEWPAG
          CALL CHRSIZ(2)
          CALL ANMODE
          WRITE(5,15)
15       FORMAT('  ENTER DATA FILE NAME XXXX.DAT : ',$)
              READ(5,17,ERR=18)I,(NAME4(J),J=1,I)
C        WRITE(5,*)NAME4
              GOTO 29
17       FORMAT(Q,10A1)
 18      WRITE(5,19)
19       FORMAT(/' NO DATA FILE OF THAT NAME '/)
              GOTO 104
29       NAME4(I+1)='.'
         NAME4(I+2)='D'
```

```
      NAME4(I+3)='A'
      NAME4(I+4)='T'
C
       OPEN(UNIT=13,NAME=NAME4,FORM='FORMATTED',STATUS='NEW')
       WRITE(13,535)COUNT
       WRITE(5,535)COUNT
535    FORMAT('1',I4)
       WRITE(13,667)
       WRITE(5,667)
667    FORMAT(5X,'TIME',4X,'HIN',8X,'HS'10X,'HG',10X,'HW')
       I=1
666    CONTINUE
       WRITE(13,668)X(I,1),(Y(I,J),J=1,4)
       WRITE(5,668)X(I,1),(Y(I,J),J=1,4)
668    FORMAT(4X,F5.2,4(2X,E10.3))
       I=I+1
       IF(I .LE. COUNT)GO TO 666
       WRITE(5,512)
       READ(5,513)IDUM
       CLOSE(UNIT=2)
       CLOSE(UNIT=13)
            RETURN
       END
C*************************************************
C
C
            SUBROUTINE VIEWC
C
C
C*************************************************
C
C           this program finds data from specific
C           channels at various times
      COMMON/CALIB/WTT(33,7),GAN(8,5)
C
            DIMENSION NAME1(15),VALUE(250)
            INTEGER CHAN
            CHARACTER*9 LOCASC
 80        WRITE(5,81)
 81       FORMAT(' ','CHANNEL NUMBER [XXX] ',$)
            READ(5,90)CHAN
 90    FORMAT(I3)
            WRITE(5,100)
 100   FORMAT(' ','BEGINING TIME  ?:DDDHHMM ',$)
            READ(5,110)LOC
 110   FORMAT(I7)
C
            WRITE(5,120)
 120   FORMAT(' ','ENDING TIME ?: DDDHHMM ',$)
            READ(5,110)LOCEND
            LOCEND=(LOCEND*100)+CHAN
            IA=INT(LOC/100)
            M=LOC-(100*IA)
            D=INT(IA/100)
            H=IA-(100*D)
            LOC=(LOC*100)+CHAN
            I=1
            CALL NEWPAG
            WRITE(5,130)CHAN
 130      FORMAT(' ',/,'CHANNEL  ',I3,//)
```

```
500     IF(LOC.GT.LOCEND) GOTO 1000
        ENCODE(9,600,LOCASC)LOC
             READ(1,610,KEY=LOCASC,ERR=510)VALUE(I)
        IF((CHAN .GE.100).AND.(CHAN.LE.131))THEN
        CALL CNVRT1(CHAN,VALUE(I),WFF)
        ENDIF
        IF((CHAN.GE.31).AND.(CHAN.LE.38))THEN
        CALL CNVRT2(CHAN,VALUE(I),GAN)
        ENDIF
             TIME=(LOC-CHAN)/100
             WRITE(5,*)TIME,VALUE(I)
510       LOC=LOC+1000
             M=M+10
             I=I+1
             IF(M.NE.60)GOTO 500
               M=0
             H=H+1
             LOC=LOC+4000
             IF(H.NE.24) GOTO 500
        H=0
             LOC=LOC+760000
             GOTO 500
600     FORMAT(I9)
610     FORMAT(T10,F6.2)
310     FORMAT(I7)
1000    RETURN
        END
C
C
C       ***************************************************************
C       *                                                             *
C       *                                                             *
                        SUBROUTINE CNVRT1(NCH,RES,WFF)
C       *                                                             *
C       *                                                             *
C       ***************************************************************
C
C       AUTHOR: Mallik Arnab K.                  DATE: Feb 26 ,1988
C
C
C       GENERAL DESCRIPTION OF SUBROUTINE
C       =================================
C
C       This routine converts the thermistor resistances [ Kohm ] to
C                                                        --------
C       degrees centigrade according to the calibration data.
C       ------------------
C
C
C       SPECIAL INSTRUCTIONS
C       ====================
C
C       1.  This routine is to be used with program INIT.FOR
C
C       2.  Last calibration date: JAN 26, 1988
C
C
C       PROCEDURE FOR RUNNING ROUTINE
C       =============================
C
```

```
C       CALL CONVRT(NCH,RES,WFF)
C
C       where:
C               NCH     : CHANNEL NUMBER [100-131], (USD).
C
C               RES     : RESISTANCE [Kohm], (USD).
C
C       NOTE: the channel temperatured is returned by the routine in
C
C             the RES field.
C       ------------------------------------------------------------------
C
C
C       COMPUTING THE CONVERSION
C
        DIMENSION WFF(33,7)
        REAL RES,T
        INTEGER ICH,NCH,K,I
        ICH=NCH-99
        T=RES/100.
        RES=WFF(1,1)
        DO 10 I=2,7
10      RES=RES+WFF(1,I)*T**(I-1)
        K=ICH+1
        T=RES
        RES=WFF(K,1)
        DO 15 I=2,7
15      RES=RES+WFF(K,I)*T**(I-1)
        RETURN
        END

C
C
C       ***************************************************************
C       *                                                             *
C       *                                                             *
                        SUBROUTINE CNVRT2(NCH,RED,GAN)
C       *                                                             *
C       *                                                             *
C       ***************************************************************
C
C       AUTHOR: MALLIK ARNAB K.                 DATE: FEB 26 ,1988
C
C
C       GENERAL DESCRIPTION OF SUBROUTINE
C       =================================
C
C       This routine converts the Flow meter and Gas analyzer
C
C       data to the actual reading according to the calibration data.
C
C
C
C       SPECIAL INSTRUCTIONS
C       ====================
C
C       1.  This routine is to be used with program JERYL2 !!
C
C       PROCEDURE FOR RUNNING ROUTINE
C       =============================
```

```
C
C       CALL CNVRT2(NCH,RED,GAN)
C
C       where:
C               NCH     : CHANNEL NUMBER [100-130], (USD).
C
C               RED     : READING , (USD).
C
C       ------------------------------------------------------------------
C
C       COMPUTING THE CONVERSION
C
        DIMENSION GAN(8,5)
        REAL T,RED
        INTEGER ICN,NCH,I
        ICH=NCH-30
        T=RED/GAN(ICH,5)
        RED=GAN(ICH,1)
        DO 10 I=2,4
10      RED=RED+GAN(ICH,I)*T**(I-1)
        RETURN
        END
```

APPENDIX C

TABULATED DATA SETS

TABULATION OF DATA RECORDS: EXPERIMENTAL MEASUREMENTS
AND CALCULATIONS FROM FIRING DATA

Data Layout

Filename:	Run number by drum specification
Data/Time:	format [DDDHHMM] (day number in year)
Thermocouples:	#'s 0 - 24 : underside of furnace roof #'s 25 - 29: roof profile
Thermistors:	#'s 100 - 129 : water exit temperatures #'s 130, 131 : water entry temperatures
Remaining data:	as specified

FILENAME: SH1.DAT
DATE/TIME 2361400

THERMOCOUPLES DEG. C

0	28.11	10	977.97	20	973.85
1	563.00	11	1022.60	21	950.69
2	121.69	12	1105.20	22	936.70
3	984.10	13	1044.20	23	945.35
4	3.30	14	976.95	24	921.94
5	26.51	15	1021.10	25	671.27
6	1139.10	16	897.57	26	263.63
7	1157.30	17	951.76	27	248.05
8	1147.90	18	983.82	28	153.21
9	830.57	19	1033.60	29	0.00

THERMISTORS DEG. C

100	28.59	110	30.29	120	31.79
101	28.61	111	32.74	121	30.85
102	30.16	112	30.05	122	32.73
103	29.70	113	33.39	123	33.80
104	32.36	114	36.99	124	35.83
105	31.45	115	33.15	125	33.56
106	30.01	116	31.94	126	34.49
107	29.76	117	33.80	127	30.80
108	28.20	118	34.51	128	32.43
109	29.58	119	33.49	129	34.36
131	23.44				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1188.11	168.86	1356.97	0.00	208.20

HEAT INPUT(BTU/HR) 0.137000E+07 WATER LOSS(BTU/HR) 0.238758E+06

THERMAL EFF. % = 17.43 HG/HF = 0.602

TEMPERATURE 1052.72 DEG. C

CO2 % 16.63 CO % 0.06 O2 % 2.35

MAX SO2 PPM= 1916.0 MAX NO-NOX PPM= 2611.9

SO2 (PPM) 1910.3 NO-NOX (PPM) 528.0

EXH. GAS LOSS(BTU/HR) 0.825126E+06 WALL LOSS(BTU/HR) 0.306116E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 11.07

FILENAME: SH1.DAT
DATE/TIME 2361410

THERMOCOUPLES DEG. C

0	28.44	10	1030.80	20	1013.40
1	572.78	11	1073.80	21	993.59
2	123.56	12	1124.70	22	981.89
3	1014.20	13	1095.70	23	988.00
4	4.22	14	1017.30	24	971.46
5	28.24	15	1058.90	25	699.86
6	1161.90	16	949.83	26	270.03
7	1147.80	17	1003.00	27	255.93
8	1159.00	18	1022.50	28	153.76
9	871.65	19	1072.20	29	0.00

THERMISTORS DEG. C

100	29.23	110	30.43	120	31.92
101	28.53	111	32.46	121	31.30
102	30.65	112	30.88	122	32.93
103	30.02	113	33.41	123	32.73
104	33.54	114	37.75	124	37.18
105	31.73	115	33.45	125	34.19
106	30.45	116	32.31	126	35.04
107	29.73	117	34.39	127	30.99
108	28.49	118	34.51	128	32.26
109	29.84	119	33.46	129	34.74
131	23.87				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1259.84	168.06	1427.90	0.00	208.80

HEAT INPUT(BTU/HR) 0.137395E+07 WATER LOSS(BTU/HR) 0.240673E+06

THERMAL EFF. % = 17.52 HG/HF = 0.669

TEMPERATURE 1090.93 DEG. C

CO2 % 15.43 CO % 0.06 O2 % 3.68

MAX SO2 PPM= 1780.3 MAX NO-NOX PPM= 2426.9

SO2 (PPM) 1772.3 NO-NOX (PPM) 546.8

EXH. GAS LOSS(BTU/HR) 0.918957E+06 WALL LOSS(BTU/HR) 0.214320E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 19.33

FILENAME: SH1.DAT
DATE/TIME 2361430

THERMOCOUPLES DEG. C

0	28.96	10	995.02	20	995.53
1	587.24	11	1036.40	21	970.59
2	127.36	12	1137.70	22	951.51
3	1004.80	13	1051.50	23	959.14
4	1.10	14	1002.70	24	934.97
5	26.01	15	1044.20	25	708.86
6	1152.00	16	909.76	26	267.49
7	1191.70	17	971.86	27	245.24
8	1185.40	18	1003.40	28	156.23
9	864.36	19	1045.00	29	0.00

THERMISTORS DEG. C

100	28.85	110	30.07	120	31.65
101	28.34	111	31.73	121	30.53
102	30.40	112	29.74	122	32.26
103	29.15	113	32.65	123	32.75
104	31.96	114	36.53	124	36.93
105	30.98	115	32.82	125	33.88
106	29.72	116	31.60	126	33.94
107	29.20	117	33.52	127	29.84
108	27.68	118	33.92	128	31.90
109	29.52	119	32.94	129	33.57
131	23.69				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1128.38	181.25	1309.63	0.00	208.20

HEAT INPUT(BTU/HR) 0.137000E+07 WATER LOSS(BTU/HR) 0.223820E+06

THERMAL EFF. % = 16.34 HG/HF = 0.588

TEMPERATURE 1071.96 DEG. C

CO2 % 18.43 CO % 0.06 O2 % 1.19

MAX SO2 PPM= 2031.6 MAX NO-NOX PPM= 2769.5

SO2 (PPM) 2133.9 NO-NOX (PPM) 589.3

EXH. GAS LOSS(BTU/HR) 0.805053E+06 WALL LOSS(BTU/HR) 0.341127E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 4.91

FILENAME: SH1.DAT
DATE/TIME 2361620

THERMOCOUPLES DEG. C

0	29.88	10	1017.20	20	1014.80
1	589.64	11	1059.80	21	991.46
2	134.98	12	1116.60	22	980.77
3	1006.00	13	1075.50	23	984.33
4	2.22	14	1012.20	24	971.86
5	29.98	15	1054.10	25	715.08
6	1160.20	16	939.80	26	289.35
7	1141.00	17	997.82	27	269.51
8	1163.90	18	1017.20	28	166.59
9	867.72	19	1064.30	29	0.00

THERMISTORS DEG. C

100	28.89	110	30.18	120	31.34
101	27.82	111	32.90	121	30.17
102	29.32	112	29.19	122	31.77
103	28.55	113	32.38	123	32.05
104	31.36	114	36.09	124	37.12
105	31.02	115	32.27	125	32.88
106	29.52	116	31.42	126	33.71
107	29.08	117	33.16	127	30.17
108	27.64	118	33.21	128	31.58
109	29.48	119	32.38	129	33.76
131	23.73				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1193.92	199.51	1393.43	0.00	190.80

HEAT INPUT(BTU/HR) 0.125550E+07 WATER LOSS(BTU/HR) 0.210578E+06

THERMAL EFF. % = 16.77 HG/HF = 0.606

TEMPERATURE 1079.80 DEG. C

CO2 % 15.62 CO % 0.07 O2 % 3.42

MAX SO2 PPM= 1811.7 MAX NO-NOX PPM= 2469.7

SO2 (PPM) 1671.3 NO-NOX (PPM) 639.7

EXH. GAS LOSS(BTU/HR) 0.761398E+06 WALL LOSS(BTU/HR) 0.283524E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 17.31

FILENAME: SH1.DAT
DATE/TIME 2361630

THERMOCOUPLES DEG. C

0	29.31	10	1057.40	20	1053.00
1	597.64	11	1101.10	21	1031.40
2	136.60	12	1157.90	22	1023.00
3	1054.30	13	1125.90	23	1027.70
4	1.42	14	1049.60	24	1013.70
5	26.96	15	1094.90	25	738.01
6	1209.60	16	901.94	26	291.10
7	1173.40	17	1039.20	27	271.34
8	1195.60	18	1064.20	28	166.69
9	901.00	19	1108.50	29	0.00

THERMISTORS DEG. C

100	29.45	110	30.83	120	32.03
101	27.85	111	32.05	121	31.02
102	28.83	112	29.25	122	32.64
103	28.78	113	33.02	123	32.36
104	31.51	114	36.37	124	37.52
105	31.48	115	33.12	125	33.50
106	29.95	116	32.16	126	34.74
107	29.61	117	33.50	127	30.72
108	28.36	118	34.04	128	31.72
109	29.94	119	32.59	129	34.62
131	24.07				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1097.51	209.23	1306.74	0.00	189.00

HEAT INPUT(BTU/HR) 0.124366E+07 WATER LOSS(BTU/HR) 0.216690E+06

THERMAL EFF. % = 17.42 HG/HF = 0.631

TEMPERATURE 1106.35 DEG. C

CO2 % 15.56 CO % 0.07 O2 % 3.32

MAX SO2 PPM= 1811.5 MAX NO-NOX PPM= 2469.5

SO2 (PPM) 1713.5 NO-NOX (PPM) 735.2

EXH. GAS LOSS(BTU/HR) 0.784195E+06 WALL LOSS(BTU/HR) 0.242775E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 17.32

FILENAME: SH1.DAT
DATE/TIME 2361640

THERMOCOUPLES DEG. C

0	29.16	10	1078.40	20	1067.00
1	609.46	11	1117.00	21	1047.00
2	139.44	12	1164.40	22	1038.60
3	1065.50	13	1145.20	23	1044.10
4	5.15	14	1062.80	24	1030.80
5	30.82	15	1106.30	25	760.94
6	1210.90	16	1001.40	26	294.06
7	1199.90	17	1056.30	27	274.22
8	1210.40	18	1078.60	28	169.19
9	926.47	19	1118.30	29	0.00

THERMISTORS DEG. C

100	29.85	110	31.09	120	32.12
101	27.80	111	33.45	121	31.11
102	28.62	112	31.19	122	32.47
103	28.12	113	33.75	123	33.27
104	31.25	114	37.28	124	36.74
105	31.27	115	33.37	125	33.70
106	30.37	116	32.41	126	34.57
107	30.21	117	33.96	127	30.93
108	28.73	118	34.92	128	32.21
109	30.36	119	33.01	129	33.73
131	24.34				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1006.17	210.51	1216.68	0.00	189.60

HEAT INPUT(BTU/HR) 0.124761E+07 WATER LOSS(BTU/HR) 0.216296E+06

THERMAL EFF. % = 17.34 HG/HF = 0.617

TEMPERATURE 1119.42 DEG. C

CO2 % 16.90 CO % 0.08 O2 % 2.59

MAX SO2 PPM= 1905.5 MAX NO-NOX PPM= 2597.5

SO2 (PPM) 1695.3 NO-NOX (PPM) 769.5

EXH. GAS LOSS(BTU/HR) 0.769584E+06 WALL LOSS(BTU/HR) 0.261730E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 11.67

FILENAME: SH3.DAT
DATE/TIME 2171840

THERMOCOUPLES DEG. C

0	28.29	10	879.04	20	899.18
2	1070.10	12	1055.00	22	867.42
3	911.80	13	1030.60	23	873.86
4	1076.80	14	903.91	24	807.90
5	1106.30	15	955.71	25	566.60
6	1096.70	16	812.50	26	127.29
7	1095.10	17	934.03	27	237.75
8	1102.80	18	914.58	28	57.91
9	939.09	19	967.06	30	263.31

1

THERMISTORS DEG. C

100	30.85	110	30.58	120	33.26
101	35.93	111	32.49	121	31.95
102	36.76	112	31.96	122	33.23
103	34.29	113	33.46	123	33.05
104	38.05	114	36.46	124	37.41
105	36.27	115	33.72	125	34.55
106	31.46	116	31.99	126	34.58
107	30.68	117	34.16	127	30.85
108	28.13	118	34.83	128	32.33
109	30.30	119	34.00	129	33.32
131	24.24				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
809.13	227.38	1036.51	0.00	210.00

HEAT INPUT(BTU/HR) 0.136425E+07 WATER LOSS(BTU/HR) 0.260046E+06

THERMAL EFF. % = 19.06 HG/HF = 0.670

TEMPERATURE 1103.06 DEG. C

CO2 % 14.13 CO % 0.12 O2 % 4.54

MAX SO2 PPM= 1661.9 MAX NO-NOX PPM= 2265.5

SO2 (PPM) 1687.6 NO-NOX (PPM) 4.4

EXH. GAS LOSS(BTU/HR) 0.914452E+06 WALL LOSS(BTU/HR) 0.189752E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 27.65

FILENAME: SH3.DAT
DATE/TIME 2171850

THERMOCOUPLES DEG. C

0	28.54	10	947.87	20	970.01
1	600.36	11	1030.40	21	960.85
2	1096.70	12	1103.80	22	937.18
3	936.09	13	1084.20	23	942.02
4	1139.10	14	966.95	24	890.78
5	1157.30	15	1021.80	25	604.55
6	1130.60	16	884.81	26	128.21
7	1134.30	17	1000.50	27	242.78
8	1143.40	18	982.48	28	60.92
9	996.90	19	1031.70	30	263.31

THERMISTORS DEG. C

100	32.54	110	30.25	120	32.50
101	37.75	111	32.22	121	31.10
102	37.93	112	31.07	122	32.65
103	35.30	113	32.56	123	32.89
104	38.44	114	35.91	124	37.34
105	37.02	115	32.48	125	34.87
106	32.98	116	30.89	126	34.32
107	30.74	117	32.89	127	30.92
108	27.49	118	33.90	128	32.43
109	29.78	119	33.31	129	34.15
131	24.89				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1297.30	226.90	1524.20	0.00	210.00

HEAT INPUT(BTU/HR) 0.136425E+07 WATER LOSS(BTU/HR) 0.250444E+06

THERMAL EFF. % = 18.36 HG/HF = 0.626

TEMPERATURE 1062.94 DEG. C

CO2 % 14.56 CO % 0.12 O2 % 3.97

MAX SO2 PPM= 1716.9 MAX NO-NOX PPM= 2340.4

SO2 (PPM) 1706.7 NO-NOX (PPM) 4.2

EXH. GAS LOSS(BTU/HR) 0.853643E+06 WALL LOSS(BTU/HR) 0.260163E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 23.65

FILENAME: SH3.DAT
DATE/TIME 2171900

THERMOCOUPLES DEG. C

0	28.54	10	994.99	20	1018.70
1	586.52	11	1072.60	21	1008.00
2	1109.10	12	1129.40	22	988.38
3	959.04	13	1116.90	23	992.45
4	1152.30	14	1008.80	24	952.25
5	1167.10	15	1063.20	25	642.43
6	1141.60	16	935.71	26	128.74
7	1150.40	17	1045.50	27	247.80
8	1157.60	18	1029.60	28	60.38
9	1035.30	19	1074.70	30	267.22

THERMISTORS DEG. C

100	32.17	110	30.61	120	32.40
101	37.86	111	31.86	121	31.53
102	39.14	112	31.07	122	32.77
103	35.15	113	33.07	123	32.79
104	38.79	114	35.92	124	36.76
105	37.17	115	32.61	125	34.10
106	31.99	116	31.26	126	34.38
107	30.63	117	33.12	127	30.62
108	27.67	118	33.88	128	32.19
109	29.91	119	32.93	129	34.73
131	24.94				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1301.70	228.01	1529.71	0.00	210.00

HEAT INPUT(BTU/HR) 0.136425E+07 WATER LOSS(BTU/HR) 0.248692E+06

THERMAL EFF. % = 18.23 HG/HF = 0.663

TEMPERATURE 1096.45 DEG. C

CO2 % 14.09 CO % 0.13 O2 % 4.37

MAX SO2 PPM= 1670.6 MAX NO-NOX PPM= 2277.3

SO2 (PPM) 1716.4 NO-NOX (PPM) 4.2

EXH. GAS LOSS(BTU/HR) 0.904352E+06 WALL LOSS(BTU/HR) 0.211206E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 27.00

FILENAME: SH3.DAT
DATE/TIME 2171910

THERMOCOUPLES DEG. C

0	28.39	10	1034.40	20	1067.20
1	591.97	11	1114.00	21	1053.70
2	1057.50	12	1172.90	22	1036.00
3	982.55	13	1156.40	23	1036.50
4	1203.60	14	1054.40	24	1000.90
5	1224.20	15	1109.20	25	676.63
6	1171.00	16	976.47	26	130.27
7	1202.00	17	1091.60	27	247.02
8	1211.30	18	1074.70	28	59.39
9	1072.60	19	1116.10	30	263.31

THERMISTORS DEG. C

100	31.86	110	30.57	120	32.82
101	36.44	111	32.29	121	31.36
102	36.90	112	31.94	122	33.10
103	34.73	113	33.61	123	33.45
104	37.67	114	36.63	124	37.15
105	36.22	115	33.20	125	34.32
106	31.82	116	31.46	126	34.66
107	30.47	117	33.74	127	30.69
108	27.83	118	34.19	128	32.79
109	29.91	119	33.36	129	34.49
131	24.94				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1161.39	228.94	1390.33	0.00	210.00

HEAT INPUT(BTU/HR) 0.136425E+07 WATER LOSS(BTU/HR) 0.246728E+06

THERMAL EFF. % = 18.09 HG/HF = 0.625

TEMPERATURE 1133.44 DEG. C

CO2 % 15.70 CO % 0.13 O2 % 2.54

MAX SO2 PPM= 1858.0 MAX NO-NOX PPM= 2532.9

SO2 (PPM) 2055.0 NO-NOX (PPM) 4.0

EXH. GAS LOSS(BTU/HR) 0.853093E+06 WALL LOSS(BTU/HR) 0.264429E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 14.45

FILENAME: SH4.DAT
DATE/TIME 2101330

THERMOCOUPLES DEG. C

0	27.61	10	1017.50	20	1016.20
1	661.32	11	1089.10	21	1007.70
2	1216.70	12	1151.70	22	979.12
3	1109.90	13	1132.70	23	980.64
4	1255.20	14	1017.50	24	930.77
5	1240.20	15	1063.30	25	677.04
6	1272.70	16	948.53	26	116.29
7	1189.90	17	1042.50	27	227.98
8	1211.00	18	1023.30	28	50.40
9	1067.90	19	1077.20	30	64.25

THERMISTORS DEG. C

100	29.17	110	31.51	120	32.21
101	27.35	111	35.10	121	31.36
102	29.65	112	35.11	122	32.39
103	30.21	113	34.26	123	31.90
104	36.80	114	39.97	124	36.92
105	36.42	115	34.17	125	33.68
106	32.64	116	32.02	126	33.92
107	32.53	117	34.07	127	30.76
108	29.45	118	35.26	128	31.21
109	30.87	119	33.68	129	32.96
131	23.41				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
951.51	210.91	1162.42	0.00	167.40

HEAT INPUT(BTU/HR) 0.101739E+07 WATER LOSS(BTU/HR) 0.270319E+06

THERMAL EFF. % = 26.57 HG/HF = 0.581

TEMPERATURE 955.00 DEG. C

CO2 % 16.45 CO % 0.01 O2 % 2.52

MAX SO2 PPM= 1889.5 MAX NO-NOX PPM= 2575.7

SO2 (PPM) 268.8 NO-NOX (PPM) 50.7

EXH. GAS LOSS(BTU/HR) 0.591365E+06 WALL LOSS(BTU/HR) 0.155706E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 12.59

FILENAME: SH4.DAT
DATE/TIME 2101340

THERMOCOUPLES DEG. C

0	28.04	10	1041.70	20	1043.50
1	651.79	11	1109.70	21	1034.70
2	1167.10	12	1159.90	22	1014.40
3	1100.00	13	1146.30	23	1017.50
4	1210.90	14	1042.70	24	974.99
5	1202.20	15	1088.50	25	705.50
6	1236.80	16	978.00	26	118.71
7	1189.30	17	1071.10	27	238.40
8	1197.50	18	1058.30	28	50.84
9	1084.80	19	1103.40	30	58.54

THERMISTORS DEG. C

100	29.23	110	31.64	120	32.30
101	26.83	111	35.41	121	31.03
102	29.78	112	35.47	122	32.44
103	31.87	113	34.39	123	32.27
104	40.04	114	39.94	124	36.85
105	38.60	115	34.63	125	33.54
106	33.99	116	32.12	126	34.40
107	32.43	117	34.79	127	30.64
108	29.49	118	34.63	128	30.68
109	31.27	119	33.74	129	33.09
131	23.40				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
771.18	221.01	992.19	0.00	167.40

HEAT INPUT(BTU/HR) 0.101739E+07 WATER LOSS(BTU/HR) 0.282725E+06

THERMAL EFF. % = 27.79 HG/HF = 0.557

TEMPERATURE 994.25 DEG. C

CO2 % 17.80 CO % 0.19 O2 % 0.79

MAX SO2 PPM= 2061.5 MAX NO-NOX PPM= 2810.2

SO2 (PPM) 344.0 NO-NOX (PPM) 35.4

EXH. GAS LOSS(BTU/HR) 0.566804E+06 WALL LOSS(BTU/HR) 0.167861E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 3.43

FILENAME: SH4.DAT
DATE/TIME 2101350

THERMOCOUPLES DEG. C

0	28.14	10	1030.70	20	1027.90
1	670.82	11	1094.80	21	1020.40
2	1182.60	12	1157.50	22	995.86
3	1097.00	13	1138.00	23	997.64
4	1352.90	14	1031.50	24	960.49
5	1241.50	15	1072.90	25	722.72
6	1303.40	16	965.27	26	121.98
7	1194.20	17	1054.90	27	238.90
8	1208.70	18	1039.80	28	52.46
9	1070.10	19	1085.40	30	68.79

THERMISTORS DEG. C

100	29.26	110	31.80	120	31.89
101	26.59	111	34.56	121	30.67
102	29.35	112	35.95	122	32.23
103	30.84	113	34.14	123	31.60
104	37.91	114	39.05	124	36.15
105	37.42	115	34.47	125	33.77
106	33.94	116	32.00	126	32.96
107	32.98	117	34.40	127	29.81
108	29.73	118	34.32	128	30.55
109	31.35	119	33.48	129	32.82
131	23.48				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
809.68	226.06	1035.73	0.00	168.00

HEAT INPUT(BTU/HR) 0.102104E+07 WATER LOSS(BTU/HR) 0.268849E+06

THERMAL EFF. % = 26.33 HG/HF = 0.554

TEMPERATURE 965.20 DEG. C

CO2 % 17.21 CO % 0.02 O2 % 1.26

MAX SO2 PPM= 2003.6 MAX NO-NOX PPM= 2731.2

SO2 (PPM) 268.8 NO-NOX (PPM) 48.5

EXH. GAS LOSS(BTU/HR) 0.565697E+06 WALL LOSS(BTU/HR) 0.186494E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 6.34

FILENAME: SH4.DAT
DATE/TIME 2101400

THERMOCOUPLES DEG. C

0	28.14	10	1075.20	20	1067.80
1	659.15	11	1142.00	21	1058.80
2	1225.40	12	1189.90	22	1036.20
3	1135.40	13	1176.50	23	1037.00
4	1352.30	14	1071.30	24	1002.20
5	1266.30	15	1114.00	25	742.04
6	1297.10	16	1009.60	26	124.63
7	1227.30	17	1095.30	27	247.92
8	1240.40	18	1080.20	28	53.43
9	1116.80	19	1125.20	30	70.35

THERMISTORS DEG. C

100	28.90	110	32.64	120	32.76
101	26.09	111	36.48	121	32.11
102	29.05	112	36.31	122	32.27
103	30.55	113	35.27	123	32.28
104	37.74	114	41.02	124	35.52
105	38.10	115	35.27	125	33.62
106	34.60	116	32.76	126	34.46
107	33.46	117	34.91	127	30.34
108	30.55	118	34.96	128	31.24
109	32.12	119	34.13	129	33.59
131	23.45				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
813.24	225.69	1038.93	0.00	168.00

HEAT INPUT(BTU/HR) 0.102104E+07 WATER LOSS(BTU/HR) 0.284744E+06

THERMAL EFF. % = 27.89 HG/HF = 0.588

TEMPERATURE 999.76 DEG. C

CO2 % 16.83 CO % 0.01 O2 % 1.55

MAX SO2 PPM= 1968.2 MAX NO-NOX PPM= 2683.0

SO2 (PPM) 271.5 NO-NOX (PPM) 44.4

EXH. GAS LOSS(BTU/HR) 0.600390E+06 WALL LOSS(BTU/HR) 0.135906E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 8.20

FILENAME: SH4.DAT
DATE/TIME 2101610

THERMOCOUPLES DEG. C

0	29.78	10	1066.60	20	1053.30
1	645.35	11	1115.00	21	1044.20
2	1131.30	12	1142.70	22	1025.20
3	1095.60	13	1135.50	23	1027.30
4	1276.10	14	1049.20	24	1006.70
5	1205.80	15	1089.00	25	760.47
6	1236.90	16	1007.50	26	133.66
7	1184.20	17	1073.40	27	256.68
8	1191.90	18	1057.50	28	60.92
9	1092.40	19	1097.90	30	67.25

THERMISTORS DEG. C

100	28.94	110	31.44	120	31.45
101	26.33	111	33.50	121	30.25
102	29.00	112	33.20	122	31.40
103	29.79	113	33.61	123	30.74
104	34.26	114	37.58	124	35.45
105	33.55	115	33.11	125	32.05
106	31.14	116	30.88	126	32.87
107	30.78	117	33.11	127	29.41
108	28.97	118	34.15	128	30.56
109	30.89	119	32.60	129	31.97
131	23.62				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1011.58	228.01	1239.59	0.00	167.40

HEAT INPUT(BTU/HR) 0.101739E+07 WATER LOSS(BTU/HR) 0.224370E+06

THERMAL EFF. % = 22.05 HG/HF = 0.661

TEMPERATURE 985.37 DEG. C

CO2 % 14.68 CO % 0.02 O2 % 3.90

MAX SO2 PPM= 1725.4 MAX NO-NOX PPM= 2352.0

SO2 (PPM) 204.7 NO-NOX (PPM) 40.3

EXH. GAS LOSS(BTU/HR) 0.672623E+06 WALL LOSS(BTU/HR) 0.120397E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 23.05

FILENAME: SH5.DAT
DATE/TIME 2391500

THERMOCOUPLES DEG. C

0	25.16	10	1053.10	20	1086.10
1	547.72	11	1103.00	21	1061.20
2	121.84	12	1160.10	22	1058.80
3	979.27	13	1144.10	23	1058.50
4	76.59	14	1066.90	24	1056.70
5	23.14	15	1113.20	25	742.64
6	1161.20	16	1003.20	26	291.30
7	1171.30	17	1061.40	27	268.17
8	1197.60	18	1085.90	28	164.00
9	887.12	19	1124.60	29	0.00

THERMISTORS DEG. C

100	26.13	110	27.08	120	28.16
101	25.74	111	28.54	121	26.97
102	25.94	112	28.68	122	28.25
103	26.02	113	28.61	123	28.07
104	27.51	114	30.47	124	31.02
105	27.63	115	28.14	125	28.41
106	27.11	116	27.38	126	29.01
107	26.22	117	28.74	127	27.03
108	24.96	118	28.67	128	27.93
109	26.79	119	28.28	129	28.11
131	23.05				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
859.51	212.01	1071.52	0.00	165.00

HEAT INPUT(BTU/HR) 0.915876E+06 WATER LOSS(BTU/HR) 0.121391E+06

THERMAL EFF. % = 13.25 HG/HF = 0.659

TEMPERATURE 1089.14 DEG. C

CO2 % 15.73 CO % 0.03 O2 % 3.05

MAX SO2 PPM= 1825.4 MAX NO-NOX PPM= 2488.3

SO2 (PPM) 1190.1 NO-NOX (PPM) 1039.9

EXH. GAS LOSS(BTU/HR) 0.603585E+06 WALL LOSS(BTU/HR) 0.190900E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 16.45

FILENAME: SH5.DAT
DATE/TIME 2391510

THERMOCOUPLES DEG. C

0	25.26	10	1081.20	20	1114.60
1	566.10	11	1133.20	21	1088.30
2	129.91	12	1186.40	22	1083.60
3	1005.80	13	1175.70	23	1083.60
4	76.96	14	1097.20	24	1081.80
5	24.04	15	1141.80	25	763.73
6	1185.30	16	1030.70	26	293.03
7	1212.20	17	1091.30	27	269.98
8	1231.10	18	1111.40	28	170.68
9	912.79	19	1150.80	29	0.00

THERMISTORS DEG. C

100	26.40	110	27.47	120	28.52
101	25.82	111	28.45	121	27.30
102	26.07	112	28.86	122	28.68
103	26.32	113	29.06	123	28.58
104	27.83	114	31.05	124	32.19
105	27.93	115	28.67	125	28.19
106	27.42	116	27.76	126	29.49
107	26.67	117	29.15	127	27.23
108	25.14	118	29.37	128	28.28
109	27.24	119	28.79	129	28.77
131	23.30				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
857.32	216.98	1074.30	0.00	167.40

HEAT INPUT(BTU/HR) 0.929198E+06 WATER LOSS(BTU/HR) 0.125271E+06

THERMAL EFF. % = 13.48 HG/HF = 0.662

TEMPERATURE 1110.48 DEG. C

CO2 % 16.15 CO % 0.02 O2 % 3.00

MAX SO2 PPM= 1863.4 MAX NO-NOX PPM= 2540.1

SO2 (PPM) 1210.7 NO-NOX (PPM) 999.1

EXH. GAS LOSS(BTU/HR) 0.615123E+06 WALL LOSS(BTU/HR) 0.188804E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 14.13

FILENAME: SH5.DAT
DATE/TIME 2391520

THERMOCOUPLES DEG. C

0	25.19	10	1095.40	20	1117.30
1	582.61	11	1138.60	21	1094.60
2	123.15	12	1168.40	22	1092.70
3	1024.60	13	1182.60	23	1092.50
4	76.89	14	1098.90	24	1093.50
5	26.84	15	1138.90	25	785.62
6	1190.80	16	1042.30	26	298.47
7	1166.70	17	1101.00	27	276.27
8	1195.00	18	1115.40	28	170.18
9	934.56	19	1150.40	29	0.00

THERMISTORS DEG. C

100	26.42	110	27.30	120	28.57
101	25.83	111	28.74	121	27.47
102	26.14	112	29.71	122	28.54
103	26.28	113	29.36	123	28.80
104	28.18	114	30.76	124	31.09
105	28.12	115	28.70	125	28.44
106	27.42	116	27.82	126	29.35
107	26.55	117	29.02	127	27.25
108	25.22	118	29.33	128	28.36
109	27.22	119	28.73	129	28.53
131	23.25				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
892.31	216.71	1109.01	0.00	166.20

HEAT INPUT(BTU/HR) 0.922538E+06 WATER LOSS(BTU/HR) 0.126748E+06

THERMAL EFF. % = 13.74 HG/HF = 0.684

TEMPERATURE 1119.97 DEG. C

CO2 % 15.15 CO % 0.02 O2 % 3.80

MAX SO2 PPM= 1767.8 MAX NO-NOX PPM= 2409.8

SO2 (PPM) 1389.2 NO-NOX (PPM) 1047.5

EXH. GAS LOSS(BTU/HR) 0.631259E+06 WALL LOSS(BTU/HR) 0.164531E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 20.16

FILENAME: SH5.DAT
DATE/TIME 2391530

THERMOCOUPLES DEG. C

0	25.16	10	1111.20	20	1140.50
1	598.20	11	1159.70	21	1115.70
2	126.01	12	1213.40	22	1109.30
3	1045.00	13	1197.20	23	1110.70
4	81.00	14	1125.30	24	1108.30
5	29.68	15	1166.80	25	803.21
6	1212.60	16	1059.00	26	304.00
7	1241.60	17	1119.70	27	281.83
8	1264.70	18	1135.50	28	170.63
9	951.46	19	1174.70	29	0.00

THERMISTORS DEG. C

100	26.66	110	27.60	120	28.76
101	25.91	111	28.82	121	27.53
102	26.21	112	29.91	122	28.96
103	26.48	113	29.49	123	28.73
104	28.26	114	31.44	124	31.90
105	28.26	115	28.91	125	28.61
106	27.59	116	28.02	126	29.40
107	26.78	117	29.45	127	27.63
108	25.41	118	29.16	128	28.42
109	27.46	119	28.92	129	28.77
131	23.34				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
934.61	219.00	1153.61	0.00	180.60

HEAT INPUT(BTU/HR) 0.100247E+07 WATER LOSS(BTU/HR) 0.130147E+06

THERMAL EFF. % = 12.98 HG/HF = 0.659

TEMPERATURE 1138.75 DEG. C

CO2 % 15.51 CO % 0.02 O2 % 3.24

MAX SO2 PPM= 1821.8 MAX NO-NOX PPM= 2483.5

SO2 (PPM) 1274.3 NO-NOX (PPM) 1096.7

EXH. GAS LOSS(BTU/HR) 0.661021E+06 WALL LOSS(BTU/HR) 0.211302E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 16.67

FILENAME: SH5.DAT
DATE/TIME 2391540

THERMOCOUPLES DEG. C

0	25.16	10	1131.00	20	1151.30
1	612.76	11	1177.00	21	1127.80
2	125.69	12	1221.10	22	1121.40
3	1071.00	13	1219.50	23	1122.40
4	78.78	14	1137.90	24	1120.60
5	35.43	15	1177.50	25	822.81
6	1236.50	16	1076.50	26	311.73
7	1245.30	17	1133.90	27	290.20
8	1268.70	18	1147.30	28	175.89
9	972.32	19	1185.70	29	0.00

THERMISTORS DEG. C

100	26.66	110	27.90	120	28.91
101	25.89	111	29.25	121	27.66
102	26.47	112	29.33	122	28.91
103	26.56	113	29.75	123	28.69
104	28.59	114	31.48	124	32.86
105	28.44	115	29.14	125	28.60
106	27.75	116	28.31	126	29.57
107	26.88	117	29.36	127	27.47
108	25.46	118	29.66	128	28.56
109	27.46	119	29.00	129	28.79
131	23.30				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
834.87	218.98	1053.84	0.00	181.20

HEAT INPUT(BTU/HR) 0.100580E+07 WATER LOSS(BTU/HR) 0.134619E+06

THERMAL EFF. % = 13.38 HG/HF = 0.685

TEMPERATURE 1149.08 DEG. C

CO2 % 16.01 CO % 0.03 O2 % 2.97

MAX SO2 PPM= 1842.5 MAX NO-NOX PPM= 2511.7

SO2 (PPM) 1400.6 NO-NOX (PPM) 1039.9

EXH. GAS LOSS(BTU/HR) 0.689055E+06 WALL LOSS(BTU/HR) 0.182126E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 15.39

FILENAME: SH5.DAT
DATE/TIME 2391550

THERMOCOUPLES DEG. C

0	25.36	10	1147.00	20	1163.30
1	627.45	11	1190.70	21	1140.40
2	122.40	12	1229.10	22	1135.60
3	1081.50	13	1234.30	23	1136.40
4	82.22	14	1150.80	24	1135.00
5	38.16	15	1189.40	25	840.98
6	1244.80	16	1090.50	26	318.08
7	1240.90	17	1147.80	27	296.93
8	1266.50	18	1161.70	28	179.30
9	990.49	19	1197.00	29	0.00

THERMISTORS DEG. C

100	26.61	110	27.87	120	28.88
101	25.80	111	29.18	121	27.52
102	26.26	112	29.93	122	29.05
103	26.53	113	29.80	123	29.03
104	28.32	114	31.48	124	33.10
105	28.42	115	29.07	125	28.83
106	27.74	116	28.07	126	29.57
107	26.94	117	29.68	127	27.59
108	25.50	118	29.72	128	28.63
109	27.53	119	29.16	129	28.85
131	23.29				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
856.80	218.22	1075.01	0.00	180.60

HEAT INPUT(BTU/HR) 0.100247E+07 WATER LOSS(BTU/HR) 0.135766E+06

THERMAL EFF. % = 13.54 HG/HF = 0.688

TEMPERATURE 1160.35 DEG. C

CO2 % 15.78 CO % 0.05 O2 % 3.13

MAX SO2 PPM= 1835.5 MAX NO-NOX PPM= 2502.2

SO2 (PPM) 1403.4 NO-NOX (PPM) 1028.7

EXH. GAS LOSS(BTU/HR) 0.690131E+06 WALL LOSS(BTU/HR) 0.176573E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 15.82

FILENAME: SH5.DAT
DATE/TIME 2391600

THERMOCOUPLES DEG. C

0	25.56	10	1154.40	20	1162.30
1	636.29	11	1192.80	21	1141.20
2	128.99	12	1224.80	22	1137.00
3	1085.90	13	1236.10	23	1137.80
4	83.21	14	1152.50	24	1137.20
5	44.61	15	1187.80	25	858.07
6	1244.00	16	1096.20	26	324.97
7	1256.70	17	1152.00	27	304.17
8	1262.30	18	1161.80	28	181.37
9	1004.00	19	1195.80	29	0.00

THERMISTORS DEG. C

100	26.47	110	27.61	120	28.97
101	25.71	111	29.21	121	27.69
102	26.11	112	29.68	122	28.92
103	26.40	113	29.80	123	28.74
104	28.23	114	31.33	124	32.04
105	28.40	115	29.14	125	29.37
106	27.59	116	28.08	126	29.32
107	26.85	117	29.53	127	27.43
108	25.52	118	30.21	128	28.51
109	27.38	119	29.02	129	29.00
131	23.18				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
900.01	219.63	1119.64	0.00	181.20

HEAT INPUT(BTU/HR) 0.100580E+07 WATER LOSS(BTU/HR) 0.137841E+06

THERMAL EFF. % = 13.70 HG/HF = 0.695

TEMPERATURE 1167.48 DEG. C

CO2 % 15.76 CO % 0.04 O2 % 3.24

MAX SO2 PPM= 1823.8 MAX NO-NOX PPM= 2486.1

SO2 (PPM) 1232.2 NO-NOX (PPM) 982.0

EXH. GAS LOSS(BTU/HR) 0.698713E+06 WALL LOSS(BTU/HR) 0.169246E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 16.55

FILENAME: SH5.DAT
DATE/TIME 2391610

THERMOCOUPLES DEG. C

0	25.74	10	1157.90	20	1167.30
1	643.42	11	1196.10	21	1146.10
2	133.18	12	1231.20	22	1142.10
3	1095.20	13	1237.60	23	1142.70
4	84.83	14	1157.60	24	1142.10
5	52.10	15	1192.50	25	870.36
6	1251.80	16	1100.50	26	330.86
7	1259.70	17	1156.30	27	309.97
8	1266.20	18	1167.10	28	185.83
9	1010.90	19	1200.50	29	0.00

THERMISTORS DEG. C

100	26.68	110	27.82	120	29.10
101	25.85	111	29.14	121	27.58
102	26.41	112	30.12	122	29.32
103	26.48	113	30.05	123	28.76
104	28.42	114	31.40	124	32.58
105	28.61	115	29.35	125	28.75
106	27.81	116	28.58	126	29.97
107	26.93	117	29.65	127	27.62
108	25.53	118	29.93	128	28.81
109	27.57	119	29.16	129	28.66
131	23.33				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1006.74	218.91	1225.65	0.00	180.60

HEAT INPUT(BTU/HR) 0.100247E+07 WATER LOSS(BTU/HR) 0.137243E+06

THERMAL EFF. % = 13.69 HG/HF = 0.690

TEMPERATURE 1174.58 DEG. C

CO2 % 16.53 CO % 0.03 O2 % 2.74

MAX SO2 PPM= 1880.2 MAX NO-NOX PPM= 2563.1

SO2 (PPM) 1309.1 NO-NOX (PPM) 910.1

EXH. GAS LOSS(BTU/HR) 0.691243E+06 WALL LOSS(BTU/HR) 0.173984E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 13.13

FILENAME: SH6.DAT
DATE/TIME 2451120

THERMOCOUPLES DEG. C

0	22.51	10	813.76	20	826.72
1	426.31	11	892.92	21	807.44
2	80.88	12	892.42	22	784.31
3	860.78	13	906.32	23	799.75
4	50.23	14	839.24	24	772.34
5	18.79	15	889.98	25	496.20
6	1079.50	16	752.47	26	198.24
7	1105.60	17	780.78	27	156.33
8	1108.00	18	823.68	28	92.68
9	657.98	19	903.89	29	0.00

THERMISTORS DEG. C

100	27.87	110	30.94	120	30.14
101	30.47	111	33.30	121	30.75
102	32.02	112	35.84	122	31.28
103	29.75	113	33.94	123	32.68
104	34.68	114	37.50	124	35.94
105	31.91	115	33.96	125	32.06
106	31.18	116	31.44	126	33.03
107	31.14	117	33.71	127	29.27
108	29.51	118	33.88	128	30.88
109	29.92	119	32.52	129	31.76
131	22.03				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1146.03	219.41	1365.45	0.00	184.20

HEAT INPUT(BTU/HR) 0.109021E+07 WATER LOSS(BTU/HR) 0.286699E+06

THERMAL EFF. % = 26.30 HG/HF = 0.614

TEMPERATURE 968.79 DEG. C

CO2 % 15.53 CO % 0.02 O2 % 3.55

MAX SO2 PPM= 1795.9 MAX NO-NOX PPM= 2448.1

SO2 (PPM) 985.4 NO-NOX (PPM) 6.9

EXH. GAS LOSS(BTU/HR) 0.669107E+06 WALL LOSS(BTU/HR) 0.134404E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 18.32

FILENAME: SH6.DAT
DATE/TIME 2451130

THERMOCOUPLES DEG. C

0	22.94	10	887.57	20	911.55
1	444.44	11	970.80	21	883.94
2	82.02	12	965.45	22	870.26
3	890.73	13	984.28	23	885.68
4	54.52	14	915.43	24	866.03
5	20.94	15	967.74	25	549.93
6	1118.90	16	822.66	26	211.81
7	1133.80	17	859.26	27	171.23
8	1127.70	18	908.74	28	98.57
9	726.84	19	979.57	29	0.00

THERMISTORS DEG. C

100	27.41	110	30.75	120	31.32
101	29.45	111	33.74	121	31.56
102	33.76	112	36.16	122	31.82
103	30.82	113	34.66	123	33.28
104	34.33	114	38.14	124	36.21
105	32.96	115	34.11	125	32.77
106	31.42	116	31.43	126	33.27
107	30.38	117	34.17	127	29.74
108	29.26	118	34.53	128	31.71
109	29.84	119	32.79	129	32.92
131	22.12				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1211.97	221.20	1433.17	0.00	184.20

HEAT INPUT(BTU/HR) 0.109021E+07 WATER LOSS(BTU/HR) 0.295485E+06

THERMAL EFF. % = 27.10 HG/HF = 0.598

TEMPERATURE 1008.16 DEG. C

CO2 % 17.28 CO % 0.02 O2 % 1.90

MAX SO2 PPM= 1952.3 MAX NO-NOX PPM= 2661.3

SO2 (PPM) 1040.8 NO-NOX (PPM) 6.9

EXH. GAS LOSS(BTU/HR) 0.652183E+06 WALL LOSS(BTU/HR) 0.142542E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 9.06

FILENAME: SH6.DAT
DATE/TIME 2451250

THERMOCOUPLES DEG. C

0	23.94	10	899.18	20	875.11
1	545.86	11	931.28	21	855.16
2	104.25	12	924.41	22	832.63
3	891.95	13	941.97	23	841.25
4	66.85	14	887.74	24	822.54
5	21.39	15	921.10	25	636.55
6	1080.40	16	818.82	26	260.83
7	50.13	17	851.43	27	219.31
8	1078.90	18	870.08	28	124.29
9	788.66	19	925.55	29	0.00

THERMISTORS DEG. C

100	26.14	110	28.03	120	28.94
101	26.22	111	30.38	121	28.42
102	28.61	112	30.95	122	28.96
103	28.25	113	30.10	123	30.06
104	29.84	114	32.82	124	32.81
105	28.00	115	30.85	125	29.71
106	27.64	116	29.01	126	30.37
107	26.93	117	30.65	127	27.23
108	25.49	118	31.26	128	28.88
109	27.08	119	30.29	129	31.04
131	22.21				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
965.06	220.44	1185.50	0.00	181.20

HEAT INPUT(BTU/HR) 0.107246E+07 WATER LOSS(BTU/HR) 0.190630E+06

THERMAL EFF. % = 17.78 HG/HF = 0.684

TEMPERATURE 1005.27 DEG. C

CO2 % 14.36 CO % 0.03 O2 % 4.79

MAX SO2 PPM= 1666.8 MAX NO-NOX PPM= 2272.2

SO2 (PPM) 731.2 NO-NOX (PPM) 4.2

EXH. GAS LOSS(BTU/HR) 0.733060E+06 WALL LOSS(BTU/HR) 0.148770E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 27.28

FILENAME: SH6.DAT
DATE/TIME 2451300

THERMOCOUPLES DEG. C

0	24.56	10	979.01	20	999.47
1	557.92	11	1043.50	21	972.25
2	108.66	12	1059.40	22	957.49
3	939.96	13	1043.70	23	963.34
4	67.92	14	1000.60	24	943.49
5	23.44	15	1051.00	25	666.41
6	1172.80	16	913.51	26	273.22
7	52.05	17	952.30	27	236.55
8	1194.50	18	1001.40	28	126.30
9	832.54	19	1062.70	29	0.00

THERMISTORS DEG. C

100	26.47	110	29.10	120	29.98
101	25.51	111	31.78	121	30.21
102	26.43	112	32.79	122	30.45
103	26.59	113	31.61	123	32.35
104	29.62	114	34.42	124	36.67
105	29.35	115	32.05	125	31.00
106	28.47	116	30.20	126	32.27
107	28.32	117	32.41	127	28.61
108	26.62	118	32.91	128	29.85
109	27.93	119	31.57	129	32.57
131	22.31				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
872.27	221.47	1093.74	0.00	181.80

HEAT INPUT(BTU/HR) 0.107601E+07 WATER LOSS(BTU/HR) 0.218287E+06

THERMAL EFF. % = 20.29 HG/HF = 0.629

TEMPERATURE 1085.37 DEG. C

CO2 % 18.50 CO % 0.02 O2 % 1.14

MAX SO2 PPM= 2008.2 MAX NO-NOX PPM= 2737.6

SO2 (PPM) 1256.5 NO-NOX (PPM) 21.0

EXH. GAS LOSS(BTU/HR) 0.676822E+06 WALL LOSS(BTU/HR) 0.180901E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 6.10

FILENAME: SH6.DAT
DATE/TIME 2451310

THERMOCOUPLES DEG. C

0	24.86	10	1035.40	20	1033.60
1	576.43	11	1090.20	21	1008.60
2	110.06	12	1090.20	22	998.35
3	976.93	13	1103.30	23	1004.20
4	69.66	14	1033.80	24	989.19
5	23.71	15	1081.20	25	701.67
6	1204.50	16	962.42	26	283.47
7	53.48	17	1001.90	27	245.24
8	1215.80	18	1036.90	28	130.90
9	883.71	19	1093.10	29	0.00

THERMISTORS DEG. C

100	26.54	110	29.60	120	30.20
101	26.40	111	31.92	121	30.10
102	27.94	112	33.42	122	30.41
103	27.34	113	31.86	123	31.59
104	31.50	114	35.04	124	35.94
105	30.10	115	32.17	125	31.59
106	29.06	116	30.57	126	32.78
107	28.55	117	32.41	127	29.20
108	27.35	118	32.46	128	30.43
109	28.44	119	31.90	129	32.49
131	22.39				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
933.49	222.93	1156.42	0.00	182.40

HEAT INPUT(BTU/HR) 0.107956E+07 WATER LOSS(BTU/HR) 0.229341E+06

THERMAL EFF. % = 21.24 HG/HF = 0.663

TEMPERATURE 1075.08 DEG. C

CO2 % 16.03 CO % 0.02 O2 % 3.10

MAX SO2 PPM= 1844.7 MAX NO-NOX PPM= 2514.6

SO2 (PPM) 1004.8 NO-NOX (PPM) 4.2

EXH. GAS LOSS(BTU/HR) 0.715669E+06 WALL LOSS(BTU/HR) 0.134550E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 15.26

FILENAME: SH7.DAT
DATE/TIME 2461230

THERMOCOUPLES DEG. C

0	24.34	10	1131.10	20	1120.40
1	631.45	11	1177.70	21	1094.30
2	127.02	12	1187.50	22	1080.50
3	1077.30	13	1209.50	23	1088.30
4	77.68	14	1125.80	24	1076.60
5	37.58	15	1162.30	25	816.00
6	1254.90	16	1072.70	26	308.56
7	51.52	17	1129.30	27	255.88
8	1278.60	18	1122.00	28	132.11
9	1078.60	19	1170.50	29	0.00

THERMISTORS DEG. C

100	28.35	110	28.98	120	29.03
101	27.08	111	31.08	121	29.19
102	27.86	112	32.26	122	29.56
103	26.99	113	31.23	123	30.07
104	30.49	114	33.74	124	34.43
105	30.70	115	30.52	125	29.60
106	29.19	116	29.29	126	31.33
107	28.69	117	31.30	127	28.03
108	27.19	118	31.84	128	29.41
109	28.18	119	30.46	129	31.33
131	22.85				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1263.93	226.42	1490.35	0.00	181.80

HEAT INPUT(BTU/HR) 0.109547E+07 WATER LOSS(BTU/HR) 0.199576E+06

THERMAL EFF. % = 18.22 HG/HF = 0.622

TEMPERATURE 1082.03 DEG. C

CO2 % 15.97 CO % 0.00 O2 % 2.55

MAX SO2 PPM= 1881.3 MAX NO-NOX PPM= 2564.5

SO2 (PPM) 1334.6 NO-NOX (PPM) 115.8

EXH. GAS LOSS(BTU/HR) 0.681349E+06 WALL LOSS(BTU/HR) 0.214545E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 13.07

FILENAME: SH7.DAT
DATE/TIME 2461240

THERMOCOUPLES DEG. C

0	24.76	10	1153.50	20	1143.20
1	626.00	11	1200.70	21	1117.00
2	131.19	12	1208.10	22	1104.80
3	1089.20	13	1234.40	23	1111.60
4	82.89	14	1147.40	24	1101.50
5	42.36	15	1183.40	25	843.17
6	1272.70	16	1098.30	26	326.47
7	54.79	17	1154.10	27	270.29
8	1292.20	18	1145.30	28	139.19
9	1103.30	19	1191.60	29	0.00

THERMISTORS DEG. C

100	28.13	110	29.32	120	29.65
101	26.80	111	30.90	121	29.42
102	27.49	112	32.76	122	29.84
103	26.87	113	31.54	123	31.29
104	30.81	114	34.54	124	33.29
105	30.94	115	30.84	125	30.55
106	29.63	116	29.47	126	31.65
107	29.47	117	31.72	127	28.02
108	27.64	118	31.59	128	29.58
109	28.65	119	30.90	129	31.53
131	22.93				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1297.60	227.19	1524.79	0.00	182.40

HEAT INPUT(BTU/HR) 0.109909E+07 WATER LOSS(BTU/HR) 0.204843E+06

THERMAL EFF. % = 18.64 HG/HF = 0.633

TEMPERATURE 1101.81 DEG. C

CO2 % 15.66 CO % 0.00 O2 % 2.80

MAX SO2 PPM= 1838.0 MAX NO-NOX PPM= 2505.5

SO2 (PPM) 1314.7 NO-NOX (PPM) 115.4

EXH. GAS LOSS(BTU/HR) 0.695214E+06 WALL LOSS(BTU/HR) 0.199033E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 15.67

FILENAME: SH7.DAT
DATE/TIME 2461250

THERMOCOUPLES DEG. C

0	24.84	10	1169.00	20	1156.30
1	618.00	11	1212.60	21	1131.00
2	133.11	12	1217.20	22	1120.60
3	1086.70	13	1247.50	23	1126.20
4	86.21	14	1160.30	24	1118.20
5	52.92	15	1194.50	25	867.64
6	1278.70	16	1114.70	26	344.00
7	59.17	17	1169.00	27	284.08
8	1295.90	18	1159.20	28	148.33
9	1121.50	19	1202.20	29	0.00

THERMISTORS DEG. C

100	27.54	110	29.56	120	29.62
101	26.38	111	31.64	121	29.23
102	27.22	112	32.76	122	30.06
103	26.88	113	31.84	123	31.41
104	30.93	114	34.53	124	33.52
105	31.14	115	31.03	125	30.52
106	29.38	116	29.81	126	32.19
107	29.43	117	31.86	127	28.74
108	27.80	118	32.49	128	29.56
109	28.81	119	31.14	129	32.00
131	22.86				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1335.43	225.45	1560.88	0.00	183.00

HEAT INPUT(BTU/HR) 0.110270E+07 WATER LOSS(BTU/HR) 0.208776E+06

THERMAL EFF. % = 18.93 HG/HF = 0.652

TEMPERATURE 1114.83 DEG. C

CO2 % 15.26 CO % 0.00 O2 % 3.11

MAX SO2 PPM= 1800.1 MAX NO-NOX PPM= 2453.8

SO2 (PPM) 1403.4 NO-NOX (PPM) 113.4

EXH. GAS LOSS(BTU/HR) 0.719157E+06 WALL LOSS(BTU/HR) 0.174767E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 18.05

FILENAME: SH7.DAT
DATE/TIME 2461310

THERMOCOUPLES DEG. C

0	25.19	10	1190.80	20	1174.70
1	600.22	11	1229.50	21	1150.40
2	142.13	12	1233.00	22	1144.20
3	1086.60	13	1263.20	23	1144.80
4	95.35	14	1179.30	24	1140.00
5	67.90	15	1211.10	25	906.15
6	1288.80	16	1137.00	26	374.39
7	64.12	17	1188.30	27	308.51
8	1307.10	18	1179.30	28	164.43
9	1144.10	19	1217.90	29	0.00

THERMISTORS DEG. C

100	27.42	110	30.07	120	29.95
101	26.40	111	32.01	121	29.91
102	27.34	112	33.00	122	30.44
103	27.16	113	32.35	123	31.24
104	30.82	114	34.88	124	35.77
105	31.25	115	31.38	125	31.31
106	29.62	116	30.29	126	31.78
107	29.90	117	32.30	127	28.66
108	28.56	118	33.06	128	30.11
109	29.27	119	31.39	129	31.90
131	23.10				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1210.52	225.50	1436.01	0.00	183.00

HEAT INPUT(BTU/HR) 0.110270E+07 WATER LOSS(BTU/HR) 0.212732E+06

THERMAL EFF. % = 19.29 HG/HF = 0.658

TEMPERATURE 1137.30 DEG. C

CO2 % 15.56 CO % 0.01 O2 % 2.89

MAX SO2 PPM= 1827.6 MAX NO-NOX PPM= 2491.4

SO2 (PPM) 1386.4 NO-NOX (PPM) 115.0

EXH. GAS LOSS(BTU/HR) 0.725245E+06 WALL LOSS(BTU/HR) 0.164723E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 16.31

FILENAME: SH7.DAT
DATE/TIME 2461300

THERMOCOUPLES DEG. C

0	25.09	10	1180.00	20	1166.40
1	601.12	11	1221.10	21	1142.00
2	135.33	12	1226.10	22	1134.30
3	1083.90	13	1254.00	23	1136.70
4	87.43	14	1171.00	24	1130.00
5	60.12	15	1203.90	25	888.34
6	1284.70	16	1126.20	26	360.03
7	61.43	17	1179.50	27	297.03
8	1303.40	18	1169.90	28	157.70
9	1134.40	19	1210.70	29	0.00

THERMISTORS DEG. C

100	27.39	110	29.52	120	29.62
101	26.25	111	31.81	121	29.46
102	27.32	112	33.14	122	30.08
103	26.88	113	32.19	123	30.97
104	31.05	114	34.64	124	34.69
105	30.99	115	31.12	125	30.54
106	29.51	116	29.78	126	32.22
107	29.67	117	32.04	127	28.36
108	28.21	118	32.33	128	29.69
109	28.87	119	31.28	129	31.60
131	22.89				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1305.22	226.24	1531.45	0.00	183.00

HEAT INPUT(BTU/HR) 0.110270E+07 WATER LOSS(BTU/HR) 0.209727E+06

THERMAL EFF. % = 19.02 HG/HF = 0.653

TEMPERATURE 1137.72 DEG. C

CO2 % 15.45 CO % 0.00 O2 % 2.99

MAX SO2 PPM= 1851.4 MAX NO-NOX PPM= 2523.8

SO2 (PPM) 1046.3 NO-NOX (PPM) 159.9

EXH. GAS LOSS(BTU/HR) 0.720231E+06 WALL LOSS(BTU/HR) .172742E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 14.85

FILENAME: CC3.DAT
DATE/TIME 2071650

THERMOCOUPLES DEG. C

0	27.94	10	949.88	20	885.78
1	662.53	11	985.25	21	881.30
2	1074.70	12	1016.80	22	853.79
3	1044.50	13	1005.10	23	855.21
4	1159.00	14	912.39	24	830.52
5	1239.90	15	933.34	25	733.42
6	1093.40	16	881.85	26	146.31
7	1070.80	17	912.69	27	266.85
8	1097.10	18	890.30	28	69.47
9	986.85	19	938.74	29	0.00

THERMISTORS DEG. C

100	35.57	110	33.96	120	34.80
101	38.98	111	36.85	121	32.56
102	41.18	112	39.17	122	33.65
103	37.88	113	35.59	123	33.13
104	39.67	114	40.27	124	37.26
105	39.48	115	36.40	125	34.54
106	35.88	116	34.42	126	34.02
107	34.41	117	35.84	127	31.18
108	31.67	118	36.51	128	32.71
109	33.11	119	36.07	129	34.81
131	24.34				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
873.96	201.70	1075.66	19.69	93.00

HEAT INPUT(BTU/HR) 0.115918E+07 WATER LOSS(BTU/HR) 0.331975E+06

THERMAL EFF. % = 28.64 HG/HF = 0.565

TEMPERATURE 956.52 DEG. C

CO2 % 13.55 CO % 0.05 O2 % 3.96

MAX SO2 PPM= 2962.9 MAX NO-NOX PPM= 1803.1

SO2 (PPM) 180.8 NO-NOX (PPM) 71.2

EXH. GAS LOSS(BTU/HR) 0.655400E+06 WALL LOSS(BTU/HR) .171805E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 23.35

FILENAME: CC3.DAT
DATE/TIME 2071710

THERMOCOUPLES DEG. C

0	28.63	10	959.70	20	936.24
1	675.66	11	1040.10	21	931.92
2	1102.90	12	1085.90	22	901.55
3	1111.70	13	1070.30	23	902.05
4	1236.50	14	964.03	24	864.29
5	1270.00	15	990.49	25	739.82
6	1184.60	16	911.55	26	147.23
7	1149.10	17	968.86	27	277.22
8	1173.90	18	947.49	28	70.71
9	1034.50	19	1001.70	29	0.00

THERMISTORS DEG. C

100	36.54	110	34.41	120	35.08
101	39.63	111	37.68	121	33.52
102	41.44	112	39.70	122	34.33
103	38.81	113	36.44	123	34.44
104	41.89	114	41.35	124	37.44
105	40.58	115	36.58	125	35.12
106	36.74	116	35.37	126	34.64
107	35.23	117	37.64	127	31.87
108	32.00	118	37.54	128	33.32
109	33.54	119	36.61	129	34.77
131	24.39				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
827.24	211.43	1038.68	20.10	93.60

HEAT INPUT(BTU/HR) 0.117191E+07 WATER LOSS(BTU/HR) 0.352949E+06

THERMAL EFF. % = 30.12 HG/HF = 0.555

TEMPERATURE 991.20 DEG. C

CO2 % 14.61 CO % 0.03 O2 % 2.98

MAX SO2 PPM= 3141.7 MAX NO-NOX PPM= 1995.6

SO2 (PPM) 98.0 NO-NOX (PPM) 18.5

EXH. GAS LOSS(BTU/HR) 0.650690E+06 WALL LOSS(BTU/HR) .168271E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 16.03

FILENAME: CC3.DAT
DATE/TIME 2071730

THERMOCOUPLES DEG. C

0	28.81	10	1000.50	20	994.10
1	710.05	11	1097.10	21	987.74
2	1160.30	12	1147.70	22	958.99
3	1163.30	13	1130.40	23	961.53
4	1285.30	14	1018.90	24	918.56
5	1294.70	15	1051.90	25	758.46
6	1247.90	16	960.06	26	150.17
7	1208.80	17	1027.20	27	296.91
8	1234.90	18	1007.90	28	73.54
9	1088.00	19	1063.10	29	0.00

THERMISTORS DEG. C

100	37.59	110	35.40	120	36.32
101	41.82	111	40.10	121	34.66
102	44.73	112	41.85	122	35.37
103	41.27	113	38.01	123	35.53
104	42.37	114	44.10	124	37.89
105	43.49	115	37.73	125	36.60
106	38.24	116	36.14	126	35.92
107	37.55	117	37.76	127	32.94
108	33.49	118	38.71	128	33.50
109	34.56	119	37.64	129	35.97
131	24.55				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1012.15	208.56	1220.71	19.85	120.00

HEAT INPUT(BTU/HR) 0.139275E+07 WATER LOSS(BTU/HR) 0.394063E+06

THERMAL EFF. % = 28.29 HG/HF = 0.559

TEMPERATURE 1047.01 DEG. C

CO2 % 15.16 CO % 0.03 O2 % 2.37

MAX SO2 PPM= 3490.6 MAX NO-NOX PPM= 2240.3

SO2 (PPM) 56.6 NO-NOX (PPM) 8.4

EXH. GAS LOSS(BTU/HR) 0.778430E+06 WALL LOSS(BTU/HR) .220257E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 12.54

FILENAME: CC4.DAT
DATE/TIME 2251330

THERMOCOUPLES DEG. C

0	28.36	10	825.70	20	834.91
1	571.21	11	876.25	21	829.40
2	82.00	12	972.73	22	794.79
3	927.18	13	928.96	23	803.79
4	6.70	14	843.32	24	796.66
5	24.61	15	877.17	25	566.79
6	1001.50	16	760.99	26	90.94
7	1022.00	17	846.23	27	185.55
8	1021.50	18	829.98	28	42.38
9	689.14	19	883.76	30	100.79

THERMISTORS DEG. C

100	30.58	110	32.99	120	32.28
101	32.24	111	33.75	121	31.99
102	32.50	112	34.05	122	31.92
103	32.92	113	34.76	123	31.57
104	37.92	114	38.39	124	36.21
105	36.72	115	34.14	125	31.41
106	33.39	116	32.33	126	30.36
107	32.89	117	34.29	127	29.58
108	30.70	118	34.31	128	29.71
109	32.21	119	33.68	129	28.81
131	23.96				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
791.09	227.80	1018.90	0.00	184.80

HEAT INPUT(BTU/HR) 0.101693E+07 WATER LOSS(BTU/HR) 0.261588E+06

THERMAL EFF. % = 25.72 HG/HF = 0.524

TEMPERATURE 916.07 DEG. C

CO2 % 15.33 CO % 0.04 O2 % 3.54

MAX SO2 PPM= 4252.7 MAX NO-NOX PPM= 2128.8

SO2 (PPM) 2157.4 NO-NOX (PPM) 1.5

EXH. GAS LOSS(BTU/HR) 0.533153E+06 WALL LOSS(BTU/HR) 0.222189E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 18.23

FILENAME: CC4.DAT
DATE/TIME 2251340

THERMOCOUPLES DEG. C

0	28.56	10	905.53	20	916.52
1	546.92	11	975.43	21	908.31
2	83.50	12	1053.90	22	875.48
3	1001.20	13	1022.60	23	884.43
4	4.77	14	923.52	24	873.49
5	23.84	15	965.50	25	578.36
6	1103.40	16	846.20	26	95.18
7	1104.70	17	931.81	27	193.20
8	1103.90	18	920.06	28	42.53
9	701.79	19	975.07	30	100.79

THERMISTORS DEG. C

100	30.89	110	32.57	120	32.97
101	32.34	111	33.62	121	32.47
102	34.58	112	34.90	122	32.71
103	34.19	113	35.27	123	31.49
104	40.20	114	39.04	124	36.67
105	38.41	115	34.64	125	32.52
106	34.75	116	32.89	126	32.04
107	33.46	117	34.95	127	29.93
108	30.70	118	35.20	128	29.90
109	32.42	119	33.85	129	29.81
131	24.12				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
988.27	227.98	1216.26	0.00	186.00

HEAT INPUT(BTU/HR) 0.102354E+07 WATER LOSS(BTU/HR) 0.280720E+06

THERMAL EFF. % = 27.43 HG/HF = 0.539

TEMPERATURE 967.72 DEG. C

CO2 % 15.79 CO % 0.03 O2 % 2.88

MAX SO2 PPM= 4398.5 MAX NO-NOX PPM= 2201.8

SO2 (PPM) 2157.4 NO-NOX (PPM) 1.4

EXH. GAS LOSS(BTU/HR) 0.551683E+06 WALL LOSS(BTU/HR) 0.191137E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 14.42

FILENAME: CC4.DAT
DATE/TIME 2251350

THERMOCOUPLES DEG. C

0	28.86	10	956.75	20	958.53
1	551.39	11	1021.20	21	948.61
2	88.61	12	1086.30	22	917.62
3	1032.50	13	1062.10	23	926.72
4	3.65	14	963.11	24	917.12
5	22.49	15	1005.90	25	606.22
6	1136.10	16	892.24	26	99.90
7	1133.90	17	973.54	27	201.65
8	1132.60	18	962.86	28	44.20
9	730.51	19	1014.70	30	102.82

THERMISTORS DEG. C

100	30.79	110	32.17	120	33.08
101	32.87	111	33.97	121	32.18
102	35.39	112	34.32	122	32.97
103	34.80	113	34.90	123	31.41
104	40.73	114	38.06	124	37.29
105	38.65	115	34.50	125	32.67
106	34.56	116	32.84	126	31.93
107	33.53	117	34.62	127	30.33
108	30.56	118	35.41	128	30.07
109	31.98	119	33.93	129	29.90
131	24.24				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
799.28	228.23	1027.51	0.00	186.00

HEAT INPUT(BTU/HR) 0.102354E+07 WATER LOSS(BTU/HR) 0.280480E+06

THERMAL EFF. % = 27.40 HG/HF = 0.554

TEMPERATURE 997.36 DEG. C

CO2 % 15.87 CO % 0.03 O2 % 2.76

MAX SO2 PPM= 4424.5 MAX NO-NOX PPM= 2214.8

SO2 (PPM) 2316.7 NO-NOX (PPM) 1.4

EXH. GAS LOSS(BTU/HR) 0.566889E+06 WALL LOSS(BTU/HR) 0.176171E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 13.77

FILENAME: CC4.DAT
DATE/TIME 2251400

THERMOCOUPLES DEG. C

0	29.03	10	990.74	20	988.76
1	563.40	11	1051.30	21	978.07
2	91.86	12	1109.20	22	948.56
3	1053.40	13	1088.30	23	956.95
4	3.37	14	991.25	24	948.81
5	21.64	15	1034.10	25	635.64
6	1156.00	16	923.82	26	103.30
7	1153.60	17	1003.00	27	209.27
8	1152.00	18	993.03	28	44.15
9	760.35	19	1043.00	30	102.82

THERMISTORS DEG. C

100	30.68	110	31.95	120	33.07
101	32.99	111	33.16	121	31.73
102	35.33	112	33.93	122	32.91
103	35.19	113	34.72	123	32.87
104	41.27	114	38.08	124	36.30
105	38.78	115	34.26	125	32.42
106	34.75	116	32.31	126	31.84
107	32.46	117	34.71	127	30.31
108	29.83	118	34.69	128	30.23
109	31.57	119	33.86	129	29.81
131	24.23				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
905.74	227.91	1133.65	0.00	186.00

HEAT INPUT(BTU/HR) 0.102354E+07 WATER LOSS(BTU/HR) 0.275529E+06

THERMAL EFF. % = 26.92 HG/HF = 0.566

TEMPERATURE 1018.14 DEG. C

CO2 % 15.88 CO % 0.03 O2 % 2.75

MAX SO2 PPM= 4427.7 MAX NO-NOX PPM= 2216.4

SO2 (PPM) 2303.9 NO-NOX (PPM) 1.4

EXH. GAS LOSS(BTU/HR) 0.579201E+06 WALL LOSS(BTU/HR) 0.168810E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 13.69

FILENAME: CC4.DAT
DATE/TIME 2251410

THERMOCOUPLES DEG. C

0	29.26	10	1016.60	20	1011.10
1	569.89	11	1073.30	21	999.80
2	98.26	12	1125.40	22	971.81
3	1069.00	13	1107.20	23	979.19
4	1.17	14	1012.90	24	972.83
5	21.24	15	1054.60	25	663.44
6	1170.20	16	948.40	26	107.59
7	1168.00	17	1025.70	27	216.62
8	1166.30	18	1015.50	28	45.82
9	787.93	19	1063.40	30	100.79

THERMISTORS DEG. C

100	30.52	110	31.36	120	33.11
101	33.00	111	33.80	121	32.20
102	35.76	112	33.65	122	32.45
103	35.04	113	34.55	123	31.86
104	41.21	114	38.45	124	37.41
105	38.45	115	33.94	125	33.10
106	34.48	116	32.71	126	32.10
107	32.31	117	34.96	127	30.23
108	29.14	118	34.92	128	30.34
109	31.05	119	33.94	129	30.08
131	24.22				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
904.06	228.27	1132.33	0.00	185.40

HEAT INPUT(BTU/HR) 0.102024E+07 WATER LOSS(BTU/HR) 0.274121E+06

THERMAL EFF. % = 26.87 HG/HF = 0.583

TEMPERATURE 997.36 DEG. C

CO2 % 14.95 CO % 0.04 O2 % 3.78

MAX SO2 PPM= 4176.8 MAX NO-NOX PPM= 2090.8

SO2 (PPM) 2087.2 NO-NOX (PPM) 1.2

EXH. GAS LOSS(BTU/HR) 0.594616E+06 WALL LOSS(BTU/HR) 0.151503E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 20.32

FILENAME: CC4.DAT
DATE/TIME 2251500

THERMOCOUPLES DEG. C

0	29.96	10	1097.50	20	1082.60
1	617.53	11	1141.00	21	1070.10
2	108.00	12	1180.70	22	1046.70
3	1123.80	13	1167.20	23	1048.80
4	2.57	14	1084.10	24	1048.30
5	18.81	15	1119.90	25	773.27
6	1219.40	16	1026.90	26	125.06
7	1227.10	17	1096.40	27	258.56
8	1222.20	18	1086.20	28	49.70
9	889.53	19	1126.60	30	100.79

THERMISTORS DEG. C

100	30.22	110	30.74	120	32.62
101	33.21	111	31.86	121	31.64
102	36.07	112	31.81	122	32.07
103	34.80	113	34.04	123	31.58
104	40.58	114	36.55	124	36.30
105	38.14	115	33.72	125	32.52
106	32.94	116	32.32	126	32.54
107	31.01	117	33.87	127	30.27
108	27.67	118	34.50	128	31.02
109	29.90	119	33.83	129	30.91
131	24.24				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1033.54	230.91	1264.45	0.00	185.40

HEAT INPUT(BTU/HR) 0.102024E+07 WATER LOSS(BTU/HR) 0.253206E+06

THERMAL EFF. % = 24.82 HG/HF = 0.578

TEMPERATURE 1040.13 DEG. C

CO2 % 15.90 CO % 0.04 O2 % 2.70

MAX SO2 PPM= 4437.7 MAX NO-NOX PPM= 2221.5

SO2 (PPM) 2315.7 NO-NOX (PPM) 1.0

EXH. GAS LOSS(BTU/HR) 0.589824E+06 WALL LOSS(BTU/HR) 0.177210E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 13.44

FILENAME: CC4.DAT
DATE/TIME 2251510

THERMOCOUPLES DEG. C

0	30.26	10	1108.40	20	1093.70
1	626.63	11	1150.50	21	1081.00
2	109.89	12	1189.70	22	1058.30
3	1132.20	13	1177.10	23	1059.60
4	3.29	14	1094.80	24	1059.40
5	17.77	15	1130.00	25	790.63
6	1227.00	16	1037.50	26	127.70
7	1232.20	17	1107.30	27	266.27
8	1227.80	18	1096.70	28	49.46
9	905.35	19	1135.10	30	100.79

THERMISTORS DEG. C

100	30.23	110	30.63	120	32.88
101	33.52	111	31.90	121	31.44
102	35.57	112	32.31	122	32.65
103	34.76	113	34.17	123	31.54
104	41.13	114	36.75	124	36.96
105	37.99	115	33.40	125	32.67
106	33.17	116	32.03	126	32.17
107	30.48	117	33.71	127	30.50
108	27.55	118	34.02	128	30.77
109	29.96	119	33.71	129	30.88
131	24.30				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1031.82	231.24	1263.06	0.00	186.00

HEAT INPUT(BTU/HR) 0.102354E+07 WATER LOSS(BTU/HR) 0.251782E+06

THERMAL EFF. % = 24.60 HG/HF = 0.578

TEMPERATURE 1047.01 DEG. C

CO2 % 16.06 CO % 0.04 O2 % 2.57

MAX SO2 PPM= 4473.5 MAX NO-NOX PPM= 2239.4

SO2 (PPM) 2412.7 NO-NOX (PPM) 1.0

EXH. GAS LOSS(BTU/HR) 0.591619E+06 WALL LOSS(BTU/HR) 0.180139E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 12.56

FILENAME: CC5.DAT
DATE/TIME 2221340

THERMOCOUPLES DEG. C

0	26.54	10	938.43	20	870.46
1	655.41	11	971.51	21	868.96
2	1059.90	12	1008.20	22	839.91
3	961.74	13	1001.30	23	844.41
4	1090.00	14	894.23	24	826.38
5	1097.50	15	929.01	25	611.16
6	1084.40	16	840.23	26	104.83
7	1062.80	17	900.30	27	188.82
8	1067.20	18	881.60	28	60.29
9	970.39	19	932.88	30	94.86

THERMISTORS DEG. C

100	32.75	110	33.63	120	34.92
101	34.34	111	35.24	121	32.56
102	35.62	112	36.50	122	32.85
103	34.23	113	36.01	123	32.98
104	38.04	114	40.56	124	36.47
105	36.60	115	37.19	125	34.39
106	33.62	116	34.31	126	33.70
107	34.90	117	35.83	127	30.72
108	30.87	118	36.47	128	32.03
109	33.19	119	35.31	129	32.54
131	24.62				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
894.84	225.08	1119.93	0.00	182.40

HEAT INPUT(BTU/HR) 0.102573E+07 WATER LOSS(BTU/HR) 0.285297E+06

THERMAL EFF. % = 27.81 HG/HF = 0.577

TEMPERATURE 988.74 DEG. C

CO2 % 14.67 CO % 0.04 O2 % 3.56

MAX SO2 PPM= 4177.1 MAX NO-NOX PPM= 2091.0

SO2 (PPM) 2203.2 NO-NOX (PPM) 23.8

EXH. GAS LOSS(BTU/HR) 0.591960E+06 WALL LOSS(BTU/HR) 0.148473E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 20.31

FILENAME: CC5.DAT
DATE/TIME 2221350

THERMOCOUPLES DEG. C

0	26.59	10	950.21	20	896.35
1	674.51	11	989.65	21	893.61
2	1051.90	12	1034.10	22	866.55
3	949.80	13	1024.20	23	871.97
4	1102.00	14	919.43	24	854.73
5	1102.00	15	953.01	25	631.66
6	1106.80	16	858.71	26	110.93
7	1080.00	17	925.81	27	199.51
8	1081.80	18	911.47	28	58.88
9	984.41	19	960.11	30	94.86

THERMISTORS DEG. C

100	31.41	110	32.47	120	33.76
101	33.23	111	34.63	121	32.71
102	33.67	112	34.81	122	32.70
103	33.32	113	35.26	123	33.17
104	37.74	114	38.93	124	37.21
105	35.83	115	35.67	125	34.28
106	32.98	116	32.95	126	33.63
107	33.18	117	34.77	127	31.30
108	29.62	118	35.68	128	32.26
109	32.54	119	34.91	129	32.85
131	24.63				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
896.80	222.53	1119.32	0.00	182.40

HEAT INPUT(BTU/HR) 0.102573E+07 WATER LOSS(BTU/HR) 0.265079E+06

THERMAL EFF. % = 25.84 HG/HF = 0.569

TEMPERATURE 982.57 DEG. C

CO2 % 14.61 CO % 0.03 O2 % 3.29

MAX SO2 PPM= 4210.2 MAX NO-NOX PPM= 2107.6

SO2 (PPM) 2434.2 NO-NOX (PPM) 19.9

EXH. GAS LOSS(BTU/HR) 0.583962E+06 WALL LOSS(BTU/HR) 0.176689E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 19.39

FILENAME: CC5.DAT
DATE/TIME 2221400

THERMOCOUPLES DEG. C

0	26.91	10	966.50	20	923.24
1	668.06	11	1009.80	21	920.24
2	1045.60	12	1051.20	22	894.61
3	947.00	13	1043.70	23	898.59
4	1095.10	14	942.07	24	882.42
5	1106.60	15	976.93	25	648.90
6	1113.00	16	883.12	26	115.27
7	1087.00	17	950.97	27	208.65
8	1093.50	18	938.00	28	60.89
9	999.42	19	984.82	30	96.81

THERMISTORS DEG. C

100	30.78	110	31.58	120	33.27
101	32.63	111	33.46	121	31.76
102	33.35	112	34.40	122	32.13
103	32.81	113	34.49	123	32.55
104	37.03	114	37.26	124	36.44
105	34.69	115	34.63	125	33.75
106	32.06	116	32.17	126	33.23
107	32.25	117	34.13	127	30.77
108	28.56	118	35.03	128	31.74
109	31.34	119	33.88	129	33.01
131	24.37				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
922.26	224.10	1146.36	0.00	183.60

HEAT INPUT(BTU/HR) 0.103247E+07 WATER LOSS(BTU/HR) 0.248469E+06

THERMAL EFF. % = 24.07 HG/HF = 0.585

TEMPERATURE 983.81 DEG. C

CO2 % 14.00 CO % 0.04 O2 % 3.70

MAX SO2 PPM= 4082.1 MAX NO-NOX PPM= 2043.4

SO2 (PPM) 2290.2 NO-NOX (PPM) 46.2

EXH. GAS LOSS(BTU/HR) 0.604503E+06 WALL LOSS(BTU/HR) 0.179498E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 23.04

FILENAME: CC3.DAT
DATE/TIME 2071640

THERMOCOUPLES DEG. C

0	28.21	10	943.34	20	912.47
1	655.24	11	1023.60	21	909.23
2	1091.90	12	1069.50	22	878.64
3	1099.10	13	1053.10	23	878.14
4	1219.60	14	943.34	24	840.16
5	1230.60	15	970.31	25	723.56
6	1174.90	16	893.81	26	143.92
7	1135.10	17	945.89	27	271.29
8	1159.90	18	925.02	28	69.37
9	1020.40	19	980.74	29	0.00

THERMISTORS DEG. C

100	36.62	110	34.46	120	35.52
101	40.37	111	37.74	121	33.76
102	42.55	112	41.53	122	34.36
103	39.15	113	36.35	123	33.52
104	41.50	114	42.40	124	37.28
105	40.54	115	36.60	125	34.66
106	36.79	116	34.69	126	35.07
107	36.15	117	36.92	127	31.76
108	32.55	118	37.55	128	32.89
109	33.67	119	37.09	129	35.12
131	24.24				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
841.57	206.60	1048.17	16.93	93.00

HEAT INPUT(BTU/HR) 0.110804E+07 WATER LOSS(BTU/HR) 0.363597E+06

THERMAL EFF. % = 32.81 HG/HF = 0.545

TEMPERATURE 971.44 DEG. C

CO2 % 14.52 CO % 0.02 O2 % 2.84

MAX SO2 PPM= 3299.4 MAX NO-NOX PPM= 2201.3

SO2 (PPM) 48.2 NO-NOX (PPM) 48.2

EXH. GAS LOSS(BTU/HR) 0.604100E+06 WALL LOSS(BTU/HR) .140343E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 15.96

FILENAME: CC3.DAT
DATE/TIME 2071620

THERMOCOUPLES DEG. C

0	27.71	10	924.66	20	890.98
1	638.34	11	993.62	21	887.74
2	1053.50	12	1041.20	22	857.79
3	1059.00	13	1023.30	23	857.07
4	1184.30	14	917.09	24	821.57
5	1215.30	15	944.51	25	712.27
6	1130.40	16	872.82	26	144.97
7	1102.70	17	919.58	27	271.15
8	1128.00	18	899.68	28	69.16
9	990.36	19	955.45	29	0.00

THERMISTORS DEG. C

100	35.61	110	34.50	120	35.24
101	40.27	111	38.55	121	33.40
102	42.66	112	40.68	122	34.24
103	38.99	113	36.05	123	33.52
104	42.07	114	41.09	124	36.90
105	41.13	115	37.00	125	34.50
106	36.68	116	35.38	126	34.84
107	36.09	117	36.50	127	31.59
108	32.75	118	37.02	128	32.67
109	34.02	119	36.18	129	35.06
131	24.06				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
921.70	208.65	1130.35	19.00	93.00

HEAT INPUT(BTU/HR) 0.114640E+07 WATER LOSS(BTU/HR) 0.363323E+06

THERMAL EFF. % = 31.69 HG/HF = 0.533

TEMPERATURE 970.20 DEG. C

CO2 % 14.14 CO % 0.02 O2 % 3.31

MAX SO2 PPM= 3001.9 MAX NO-NOX PPM= 1950.1

SO2 (PPM) 147.7 NO-NOX (PPM) 42.2

EXH. GAS LOSS(BTU/HR) 0.611391E+06 WALL LOSS(BTU/HR) 0.171686E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 20.93

FILENAME: CC3.DAT
DATE/TIME 2071610

THERMOCOUPLES DEG. C

0	27.26	10	906.00	20	884.61
1	624.91	11	987.62	21	881.87
2	1046.60	12	1041.10	22	851.45
3	1063.00	13	1021.00	23	851.35
4	1188.60	14	911.22	24	810.24
5	1213.00	15	939.78	25	702.00
6	1141.70	16	860.85	26	142.60
7	1104.90	17	915.55	27	266.42
8	1128.70	18	895.38	28	66.90
9	983.85	19	952.30	29	0.00

THERMISTORS DEG. C

100	35.59	110	34.40	120	34.59
101	39.97	111	38.77	121	32.43
102	42.54	112	40.84	122	33.90
103	38.76	113	36.01	123	33.25
104	41.55	114	41.38	124	37.19
105	40.94	115	36.69	125	34.82
106	37.30	116	35.01	126	35.24
107	36.75	117	36.40	127	31.11
108	33.27	118	37.43	128	32.68
109	34.11	119	36.34	129	34.62
131	23.85				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
949.25	212.67	1161.92	19.65	93.00

HEAT INPUT(BTU/HR) 0.115844E+07 WATER LOSS(BTU/HR) 0.367400E+06

THERMAL EFF. % = 31.72 HG/HF = 0.563

TEMPERATURE 1012.31 DEG. C

CO2 % 14.19 CO % 0.02 O2 % 3.31

MAX SO2 PPM= 3087.4 MAX NO-NOX PPM= 2001.3

SO2 (PPM) 759.1 NO-NOX (PPM) 759.1

EXH. GAS LOSS(BTU/HR) 0.652609E+06 WALL LOSS(BTU/HR) .138431E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 18.59

FILENAME: SH7.DAT
DATE/TIME 2461320

THERMOCOUPLES DEG. C

0	25.54	10	1200.60	20	1177.30
1	605.84	11	1234.00	21	1154.00
2	152.64	12	1236.00	22	1147.90
3	1089.40	13	1268.70	23	1147.60
4	92.95	14	1183.60	24	1143.60
5	63.56	15	1213.50	25	919.98
6	1294.00	16	1143.80	26	387.34
7	66.42	17	1193.40	27	318.03
8	1309.80	18	1181.90	28	164.63
9	1151.20	19	1220.00	29	0.00

THERMISTORS DEG. C

100	28.73	110	30.03	120	30.21
101	27.25	111	32.55	121	29.91
102	27.89	112	33.72	122	30.15
103	27.74	113	32.51	123	30.68
104	31.65	114	34.33	124	35.48
105	31.47	115	31.43	125	30.56
106	29.66	116	29.96	126	31.59
107	29.97	117	32.44	127	28.67
108	28.80	118	32.49	128	30.15
109	29.42	119	31.57	129	31.90
131	23.87				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1129.83	223.46	1353.29	0.00	182.40

HEAT INPUT(BTU/HR) 0.109909E+07 WATER LOSS(BTU/HR) 0.205293E+06

THERMAL EFF. % = 18.68 HG/HF = 0.660

TEMPERATURE 1139.42 DEG. C

CO2 % 15.10 CO % 0.01 O2 % 3.36

MAX SO2 PPM= 1827.6 MAX NO-NOX PPM= 2491.4

SO2 (PPM) 1302.6 NO-NOX (PPM) 113.4

EXH. GAS LOSS(BTU/HR) 0.725273E+06 WALL LOSS(BTU/HR) 0.168524E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 16.31

FILENAME: SH8.DAT
DATE/TIME 2461350

THERMOCOUPLES DEG. C

0	25.66	10	1164.60	20	1102.00
1	695.45	11	1178.70	21	1085.10
2	153.36	12	1168.30	22	1084.60
3	1060.60	13	1208.50	23	1084.80
4	103.79	14	1127.00	24	1079.90
5	71.75	15	1148.10	25	916.47
6	1248.90	16	1090.80	26	404.87
7	67.85	17	1131.00	27	327.45
8	1245.20	18	1111.60	28	173.32
9	1116.80	19	1149.00	29	0.00

THERMISTORS DEG. C

100	28.30	110	29.73	120	29.78
101	27.18	111	31.78	121	29.44
102	28.43	112	32.61	122	29.80
103	27.68	113	31.85	123	30.21
104	30.78	114	33.51	124	34.90
105	30.95	115	30.81	125	29.84
106	29.31	116	29.49	126	31.07
107	29.23	117	31.60	127	28.20
108	27.84	118	32.27	128	29.56
109	28.96	119	30.86	129	31.29
131	23.60				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
401.83	224.22	626.05	0.00	181.80

HEAT INPUT(BTU/HR) 0.105171E+07 WATER LOSS(BTU/HR) 0.192854E+06

THERMAL EFF. % = 18.34 HG/HF = 0.622

TEMPERATURE 1039.80 DEG. C

CO2 % 15.48 CO % 0.00 O2 % 3.28

MAX SO2 PPM= 1816.1 MAX NO-NOX PPM= 2475.7

SO2 (PPM) 1128.6 NO-NOX (PPM) 114.0

EXH. GAS LOSS(BTU/HR) 0.653891E+06 WALL LOSS(BTU/HR) 0.204965E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 17.03

FILENAME: SH8.DAT
DATE/TIME 2461440

THERMOCOUPLES DEG. C

0	26.21	10	919.11	20	878.02
1	592.98	11	937.67	21	861.43
2	146.66	12	940.72	22	870.63
3	855.95	13	939.70	23	871.20
4	95.59	14	912.64	24	862.82
5	51.10	15	936.65	25	758.58
6	1046.90	16	851.58	26	394.66
7	68.11	17	876.87	27	319.53
8	1072.90	18	890.40	28	179.33
9	874.29	19	926.19	29	0.00

THERMISTORS DEG. C

100	27.55	110	27.81	120	28.24
101	26.41	111	29.08	121	27.25
102	27.06	112	29.87	122	28.19
103	26.83	113	29.18	123	28.37
104	29.11	114	30.09	124	31.72
105	29.36	115	28.62	125	27.50
106	27.44	116	28.13	126	29.14
107	27.39	117	29.46	127	26.66
108	26.13	118	29.43	128	27.91
109	27.53	119	28.92	129	28.50
131	23.17				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
938.83	232.48	1171.32	0.00	169.80

HEAT INPUT(BTU/HR) 0.982288E+06 WATER LOSS(BTU/HR) 0.142664E+06

THERMAL EFF. % = 14.52 HG/HF = 0.564

TEMPERATURE 901.86 DEG. C

CO2 % 14.97 CO % 0.02 O2 % 4.15

MAX SO2 PPM= 1741.0 MAX NO-NOX PPM= 2373.3

SO2 (PPM) 1004.8 NO-NOX (PPM) 83.7

EXH. GAS LOSS(BTU/HR) 0.553921E+06 WALL LOSS(BTU/HR) 0.285703E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 21.97

FILENAME: SH8.DAT
DATE/TIME 2461450

THERMOCOUPLES DEG. C

0	26.09	10	999.35	20	980.47
1	576.97	11	1039.30	21	954.51
2	158.47	12	1055.90	22	971.56
3	919.26	13	1054.40	23	970.80
4	95.59	14	1009.60	24	963.16
5	48.63	15	1046.60	25	769.69
6	1146.20	16	935.73	26	390.92
7	68.96	17	975.68	27	317.36
8	1180.80	18	996.04	28	174.72
9	939.50	19	1041.60	29	0.00

THERMISTORS DEG. C

100	28.85	110	28.57	120	29.17
101	27.04	111	30.22	121	27.86
102	27.49	112	30.77	122	28.94
103	27.23	113	29.99	123	29.10
104	29.64	114	31.62	124	33.50
105	29.94	115	29.34	125	28.48
106	28.24	116	28.94	126	29.72
107	28.15	117	30.37	127	27.07
108	26.80	118	30.03	128	28.68
109	28.13	119	29.86	129	29.01
131	23.67				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
964.49	232.55	1197.04	0.00	181.20

HEAT INPUT(BTU/HR) 0.104824E+07 WATER LOSS(BTU/HR) 0.157746E+06

THERMAL EFF. % = 15.05 HG/HF = 0.566

TEMPERATURE 988.74 DEG. C

CO2 % 15.99 CO % 0.02 O2 % 3.06

MAX SO2 PPM= 1835.7 MAX NO-NOX PPM= 2502.4

SO2 (PPM) 1070.3 NO-NOX (PPM) 80.0

EXH. GAS LOSS(BTU/HR) 0.593438E+06 WALL LOSS(BTU/HR) 0.297056E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 15.81

FILENAME: SH8.DAT
DATE/TIME 2461500

THERMOCOUPLES DEG. C

0	26.36	10	1059.20	20	1040.40
1	579.46	11	1099.70	21	1013.40
2	160.89	12	1109.90	22	1025.30
3	965.43	13	1129.30	23	1024.30
4	101.53	14	1059.50	24	1019.30
5	37.92	15	1097.90	25	791.95
6	1188.90	16	999.75	26	386.98
7	71.02	17	1045.90	27	314.62
8	1222.00	18	1052.20	28	173.27
9	996.60	19	1098.90	29	0.00

THERMISTORS DEG. C

100	29.44	110	29.11	120	29.35
101	27.38	111	30.78	121	28.42
102	27.93	112	31.62	122	29.51
103	27.55	113	30.64	123	29.65
104	29.94	114	32.90	124	34.27
105	30.52	115	30.03	125	29.66
106	28.71	116	29.40	126	30.06
107	28.65	117	30.93	127	27.62
108	27.33	118	30.92	128	28.96
109	28.44	119	30.65	129	30.08
131	24.01				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
955.45	233.70	1189.15	0.00	181.20

HEAT INPUT(BTU/HR) 0.104824E+07 WATER LOSS(BTU/HR) 0.167446E+06

THERMAL EFF. % = 15.97 HG/HF = 0.592

TEMPERATURE 1034.38 DEG. C

CO2 % 16.00 CO % 0.02 O2 % 2.93

MAX SO2 PPM= 1844.7 MAX NO-NOX PPM= 2514.6

SO2 (PPM) 1203.1 NO-NOX (PPM) 59.9

EXH. GAS LOSS(BTU/HR) 0.620254E+06 WALL LOSS(BTU/HR) 0.260540E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 15.26

FILENAME: SH8.DAT
DATE/TIME 2461620

THERMOCOUPLES DEG. C

0	27.24	10	1019.50	20	1033.50
1	590.07	11	1065.60	21	1002.40
2	162.16	12	1083.80	22	1008.80
3	947.21	13	1096.90	23	1005.90
4	90.79	14	1031.80	24	996.78
5	20.16	15	1078.10	25	754.66
6	1166.00	16	986.39	26	364.75
7	67.51	17	1013.30	27	298.08
8	1207.70	18	1041.40	28	177.31
9	959.37	19	1085.60	29	0.00

THERMISTORS DEG. C

100	28.15	110	28.48	120	29.12
101	26.49	111	30.15	121	28.34
102	27.29	112	30.30	122	28.87
103	26.99	113	30.23	123	29.31
104	28.99	114	31.79	124	32.58
105	29.66	115	29.57	125	28.95
106	27.88	116	28.93	126	30.88
107	27.86	117	30.10	127	27.61
108	26.73	118	30.44	128	28.68
109	28.15	119	30.15	129	29.33
131	23.46				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
981.75	236.62	1218.38	0.00	181.80

HEAT INPUT(BTU/HR) 0.105171E+07 WATER LOSS(BTU/HR) 0.156980E+06

THERMAL EFF. % = 14.93 HG/HF = 0.595

TEMPERATURE 1038.98 DEG. C

CO2 % 16.16 CO % 0.04 O2 % 3.04

MAX SO2 PPM= 1856.9 MAX NO-NOX PPM= 2531.3

SO2 (PPM) 926.0 NO-NOX (PPM) 92.3

EXH. GAS LOSS(BTU/HR) 0.625317E+06 WALL LOSS(BTU/HR) 0.269413E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 14.52

FILENAME: SH8.DAT
DATE/TIME 2461630

THERMOCOUPLES DEG. C

0	27.29	10	1062.30	20	1072.20
1	604.67	11	1105.80	21	1042.70
2	163.16	12	1117.00	22	1045.60
3	976.16	13	1144.00	23	1041.40
4	88.90	14	1067.80	24	1037.30
5	13.72	15	1111.20	25	781.07
6	1184.50	16	1030.80	26	366.26
7	68.02	17	1066.50	27	299.79
8	1224.00	18	1075.90	28	182.39
9	999.42	19	1118.60	29	0.00

THERMISTORS DEG. C

100	28.22	110	28.98	120	29.41
101	26.54	111	30.51	121	28.51
102	27.34	112	31.16	122	29.32
103	27.14	113	30.66	123	29.64
104	29.07	114	31.88	124	34.24
105	29.96	115	29.86	125	29.03
106	28.27	116	29.32	126	30.39
107	28.40	117	30.38	127	27.73
108	27.08	118	31.50	128	29.11
109	28.30	119	30.20	129	30.19
131	23.53				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
974.96	237.98	1212.94	0.00	181.80

HEAT INPUT(BTU/HR) 0.105171E+07 WATER LOSS(BTU/HR) 0.164544E+06

THERMAL EFF. % = 15.65 HG/HF = 0.610

TEMPERATURE 1059.54 DEG. C

CO2 % 16.52 CO % 0.05 O2 % 2.64

MAX SO2 PPM= 1895.2 MAX NO-NOX PPM= 2583.5

SO2 (PPM) 1101.7 NO-NOX (PPM) 96.1

EXH. GAS LOSS(BTU/HR) 0.641349E+06 WALL LOSS(BTU/HR) 0.245817E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 12.26

FILENAME: SH8.DAT
DATE/TIME 2461640

THERMOCOUPLES DEG. C

0	27.29	10	1092.60	20	1094.40
1	620.38	11	1135.10	21	1068.40
2	161.16	12	1140.90	22	1067.80
3	1003.30	13	1172.10	23	1063.70
4	89.92	14	1092.10	24	1061.60
5	11.97	15	1131.60	25	805.01
6	1215.90	16	1059.60	26	367.90
7	68.94	17	1099.10	27	301.84
8	1239.00	18	1096.90	28	182.32
9	1030.60	19	1139.30	29	0.00

THERMISTORS DEG. C

100	28.36	110	29.06	120	29.50
101	26.80	111	30.61	121	28.72
102	27.33	112	31.74	122	29.79
103	27.37	113	30.67	123	30.05
104	29.53	114	32.79	124	34.50
105	30.22	115	30.04	125	29.00
106	28.47	116	29.28	126	30.65
107	28.57	117	31.00	127	27.89
108	27.29	118	32.19	128	29.42
109	28.50	119	30.54	129	30.37
131	23.60				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
958.28	237.23	1195.51	0.00	181.80

HEAT INPUT(BTU/HR) 0.105171E+07 WATER LOSS(BTU/HR) 0.170838E+06

THERMAL EFF. % = 16.24 HG/HF = 0.620

TEMPERATURE 1077.56 DEG. C

CO2 % 16.04 CO % 0.05 O2 % 2.75

MAX SO2 PPM= 1867.7 MAX NO-NOX PPM= 2546.1

SO2 (PPM) 1083.2 NO-NOX (PPM) 97.7

EXH. GAS LOSS(BTU/HR) 0.652371E+06 WALL LOSS(BTU/HR) 0.228501E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 13.87

FILENAME: SH8.DAT
DATE/TIME 2461650

THERMOCOUPLES DEG. C

0	27.51	10	1115.20	20	1111.30
1	633.40	11	1154.90	21	1086.20
2	164.20	12	1159.40	22	1084.10
3	1026.60	13	1190.30	23	1080.40
4	89.78	14	1111.20	24	1078.10
5	15.54	15	1147.70	25	826.97
6	1235.20	16	1079.80	26	371.38
7	68.84	17	1119.70	27	304.98
8	1251.60	18	1113.80	28	182.81
9	1053.60	19	1154.90	29	0.00

THERMISTORS DEG. C

100	28.27	110	29.11	120	29.60
101	26.75	111	31.18	121	28.92
102	27.63	112	31.46	122	29.70
103	27.38	113	30.96	123	29.93
104	30.01	114	32.48	124	35.26
105	30.34	115	30.46	125	29.35
106	28.67	116	29.74	126	31.59
107	28.72	117	31.11	127	28.28
108	27.81	118	31.75	128	29.41
109	28.58	119	30.89	129	30.70
131	23.65				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
945.31	238.11	1183.41	0.00	182.40

HEAT INPUT(BTU/HR) 0.105518E+07 WATER LOSS(BTU/HR) 0.174338E+06

THERMAL EFF. % = 16.52 HG/HF = 0.636

TEMPERATURE 1092.03 DEG. C

CO2 % 16.29 CO % 0.06 O2 % 2.61

MAX SO2 PPM= 1887.6 MAX NO-NOX PPM= 2573.2

SO2 (PPM) 1189.2 NO-NOX (PPM) 103.7

EXH. GAS LOSS(BTU/HR) 0.671239E+06 WALL LOSS(BTU/HR) 0.209603E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 12.70

FILENAME: SH8.DAT
DATE/TIME 2461700

THERMOCOUPLES DEG. C

0	27.46	10	1134.20	20	1121.90
1	644.48	11	1169.90	21	1097.90
2	160.86	12	1169.60	22	1094.90
3	1042.60	13	1204.40	23	1092.00
4	91.23	14	1123.60	24	1091.20
5	23.14	15	1156.40	25	847.20
6	1244.40	16	1095.30	26	377.04
7	69.28	17	1135.10	27	309.58
8	1258.50	18	1123.30	28	184.86
9	1074.90	19	1163.60	29	0.00

THERMISTORS DEG. C

100	28.21	110	29.31	120	29.65
101	26.68	111	30.83	121	28.75
102	27.61	112	32.08	122	30.18
103	27.38	113	31.23	123	30.51
104	30.08	114	32.43	124	34.43
105	30.61	115	30.34	125	29.45
106	28.74	116	29.67	126	31.05
107	29.20	117	31.03	127	27.98
108	27.67	118	31.50	128	29.33
109	28.78	119	30.81	129	30.87
131	23.53				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
907.58	239.36	1146.95	0.00	182.40

HEAT INPUT(BTU/HR) 0.105518E+07 WATER LOSS(BTU/HR) 0.178144E+06

THERMAL EFF. % = 16.88 HG/HF = 0.645

TEMPERATURE 1103.06 DEG. C

CO2 % 15.60 CO % 0.07 O2 % 3.22

MAX SO2 PPM= 1809.5 MAX NO-NOX PPM= 2466.7

SO2 (PPM) 1170.6 NO-NOX (PPM) 106.0

EXH. GAS LOSS(BTU/HR) 0.680114E+06 WALL LOSS(BTU/HR) 0.196921E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 17.45

FILENAME: CC2.DAT
DATE/TIME 2231500

THERMOCOUPLES DEG. C

0	27.46	10	1013.70	20	995.22
1	602.06	11	1061.00	21	988.35
2	1094.90	12	1109.90	22	962.91
3	967.72	13	1099.70	23	967.23
4	1145.40	14	1008.50	24	947.90
5	1028.50	15	1039.70	25	715.32
6	1151.80	16	940.97	26	141.08
7	1142.20	17	1015.20	27	265.27
8	1140.00	18	1008.70	28	59.10
9	1041.30	19	1051.40	30	89.17

THERMISTORS DEG. C

100	29.09	110	29.36	120	31.09
101	29.96	111	30.76	121	29.53
102	29.41	112	29.60	122	30.13
103	30.44	113	31.55	123	30.30
104	34.16	114	34.11	124	34.22
105	31.23	115	31.74	125	31.10
106	29.52	116	29.93	126	31.19
107	28.45	117	31.35	127	28.94
108	26.44	118	32.15	128	30.55
109	29.06	119	31.52	129	31.16
131	24.07				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
933.49	216.22	1149.71	0.00	182.40

HEAT INPUT(BTU/HR) 0.986816E+06 WATER LOSS(BTU/HR) 0.182528E+06

THERMAL EFF. % = 18.50 HG/HF = 0.589

TEMPERATURE 1006.45 DEG. C

CO2 % 15.16 CO % 0.04 O2 % 3.84

MAX SO2 PPM= 4190.7 MAX NO-NOX PPM= 2097.8

SO2 (PPM) 2241.4 NO-NOX (PPM) 1.4

EXH. GAS LOSS(BTU/HR) 0.581046E+06 WALL LOSS(BTU/HR) 0.223242E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 19.93

FILENAME: CC2.DAT
DATE/TIME 2231510

THERMOCOUPLES DEG. C

0	27.54	10	1037.50	20	1046.10
1	619.29	11	1084.90	21	1035.70
2	1060.10	12	1127.60	22	1010.70
3	961.46	13	1122.00	23	1015.10
4	1110.80	14	1043.20	24	999.40
5	987.16	15	1079.20	25	737.30
6	1130.30	16	973.95	26	141.31
7	1132.90	17	1061.70	27	263.02
8	1127.60	18	1052.40	28	61.01
9	1059.40	19	1091.30	30	91.04

THERMISTORS DEG. C

100	29.36	110	29.70	120	31.51
101	28.17	111	30.82	121	29.92
102	29.61	112	29.82	122	30.76
103	30.96	113	32.03	123	30.52
104	35.18	114	34.55	124	35.27
105	31.27	115	32.05	125	31.76
106	29.22	116	30.21	126	32.35
107	28.84	117	32.17	127	29.57
108	26.61	118	32.40	128	31.08
109	29.04	119	31.89	129	31.80
131	24.14				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
880.08	149.28	1029.36	0.00	181.80

HEAT INPUT(BTU/HR) 0.983570E+06 WATER LOSS(BTU/HR) 0.189558E+06

THERMAL EFF. % = 19.27 HG/HF = 0.575

TEMPERATURE 1025.12 DEG. C

CO2 % 15.84 CO % 0.03 O2 % 2.87

MAX SO2 PPM= 4405.3 MAX NO-NOX PPM= 2205.2

SO2 (PPM) 2444.0 NO-NOX (PPM) 1.4

EXH. GAS LOSS(BTU/HR) 0.565607E+06 WALL LOSS(BTU/HR) 0.228405E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 14.25

FILENAME: CC2.DAT
DATE/TIME 2231520

THERMOCOUPLES DEG. C

0	27.36	10	1037.10	20	1026.70
1	625.95	11	1079.00	21	1019.40
2	1085.80	12	1123.70	22	994.71
3	977.36	13	1114.40	23	998.53
4	1155.70	14	1031.10	24	983.01
5	858.29	15	1063.90	25	751.86
6	1152.30	16	968.96	26	141.03
7	1143.30	17	1044.90	27	262.15
8	1145.90	18	1036.60	28	61.77
9	1057.70	19	1075.10	30	89.17

THERMISTORS DEG. C

100	29.30	110	29.57	120	31.33
101	28.50	111	30.91	121	29.57
102	29.71	112	29.98	122	29.97
103	30.93	113	31.91	123	30.30
104	35.29	114	33.95	124	35.02
105	31.60	115	31.86	125	31.28
106	29.42	116	29.98	126	31.66
107	29.03	117	31.70	127	29.56
108	26.57	118	32.42	128	30.74
109	29.05	119	31.78	129	31.48
131	24.28				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
868.41	89.25	957.66	0.00	181.80

HEAT INPUT(BTU/HR) 0.983570E+06 WATER LOSS(BTU/HR) 0.181400E+06

THERMAL EFF. % = 18.44 HG/HF = 0.563

TEMPERATURE 994.90 DEG. C

CO2 % 15.61 CO % 0.04 O2 % 3.05

MAX SO2 PPM= 4354.2 MAX NO-NOX PPM= 2179.7

SO2 (PPM) 2163.2 NO-NOX (PPM) 1.4

EXH. GAS LOSS(BTU/HR) 0.553391E+06 WALL LOSS(BTU/HR) 0.248779E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 15.55

FILENAME: CC2.DAT
DATE/TIME 2231530

THERMOCOUPLES DEG. C

0	27.54	10	1053.60	20	1060.40
1	635.07	11	1101.70	21	1051.10
2	1080.20	12	1153.70	22	1028.90
3	971.92	13	1140.90	23	1032.80
4	1197.90	14	1058.50	24	1019.00
5	1204.50	15	1095.00	25	765.78
6	1165.80	16	995.27	26	142.55
7	1165.50	17	1075.50	27	263.85
8	1170.80	18	1068.70	28	62.15
9	1075.30	19	1104.90	30	92.94

THERMISTORS DEG. C

100	29.46	110	29.71	120	31.45
101	27.32	111	30.87	121	29.82
102	28.86	112	29.96	122	30.52
103	29.35	113	32.05	123	30.48
104	34.87	114	34.17	124	35.50
105	31.34	115	31.86	125	31.54
106	29.28	116	30.20	126	32.22
107	28.50	117	31.89	127	29.32
108	26.64	118	32.15	128	31.02
109	29.06	119	31.76	129	31.78
131	24.39				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
835.50	207.16	1042.66	0.00	181.80

HEAT INPUT(BTU/HR) 0.983570E+06 WATER LOSS(BTU/HR) 0.175865E+06

THERMAL EFF. % = 17.88 HG/HF = 0.581

TEMPERATURE 1037.83 DEG. C

CO2 % 16.02 CO % 0.05 O2 % 2.90

MAX SO2 PPM= 4420.8 MAX NO-NOX PPM= 2213.0

SO2 (PPM) 2000.5 NO-NOX (PPM) 1.4

EXH. GAS LOSS(BTU/HR) 0.571412E+06 WALL LOSS(BTU/HR) 0.236293E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 13.86

FILENAME: CC2.DAT
DATE/TIME 2231540

THERMOCOUPLES DEG. C

0	27.86	10	1090.70	20	1098.40
1	637.47	11	1142.70	21	1086.80
2	1102.40	12	1187.30	22	1064.40
3	1022.80	13	1174.50	23	1068.10
4	1225.40	14	1095.20	24	1056.90
5	1240.40	15	1132.80	25	781.12
6	1211.20	16	1032.90	26	143.37
7	1226.30	17	1113.30	27	265.44
8	1226.30	18	1101.30	28	63.24
9	1117.60	19	1140.00	30	89.17

THERMISTORS DEG. C

100	29.42	110	30.06	120	31.89
101	27.61	111	31.52	121	29.88
102	29.24	112	30.05	122	30.92
103	30.41	113	32.59	123	30.90
104	36.32	114	34.53	124	36.41
105	32.33	115	32.30	125	32.36
106	29.93	116	30.76	126	33.23
107	28.81	117	32.28	127	29.86
108	26.89	118	32.67	128	31.39
109	29.44	119	31.99	129	31.69
131	24.61				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
845.71	231.47	1077.17	0.00	181.80

HEAT INPUT(BTU/HR) 0.983570E+06 WATER LOSS(BTU/HR) 0.183877E+06

THERMAL EFF. % = 18.69 HG/HF = 0.584

TEMPERATURE 1058.41 DEG. C

CO2 % 15.86 CO % 0.05 O2 % 2.24

MAX SO2 PPM= 4502.8 MAX NO-NOX PPM= 2254.0

SO2 (PPM) 2333.3 NO-NOX (PPM) 1.3

EXH. GAS LOSS(BTU/HR) 0.574441E+06 WALL LOSS(BTU/HR) 0.225252E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 11.85

FILENAME: CC2.DAT
DATE/TIME 2231600

THERMOCOUPLES DEG. C

0	28.01	10	1124.00	20	1113.10
1	659.84	11	1167.30	21	1103.50
2	1140.50	12	1199.40	22	1082.90
3	1090.10	13	1192.80	23	1085.30
4	1256.50	14	1114.90	24	1076.40
5	1262.70	15	1146.90	25	816.90
6	1238.70	16	1061.00	26	146.21
7	1231.20	17	1130.40	27	272.10
8	1232.80	18	1120.30	28	63.22
9	1146.90	19	1154.40	30	91.04

THERMISTORS DEG. C

100	29.29	110	29.91	120	31.51
101	27.59	111	31.29	121	30.01
102	29.43	112	29.81	122	30.84
103	30.70	113	32.38	123	30.77
104	36.77	114	34.28	124	35.61
105	33.08	115	32.36	125	31.95
106	30.15	116	30.58	126	32.86
107	28.80	117	31.94	127	30.12
108	26.79	118	32.55	128	31.41
109	29.26	119	32.00	129	31.64
131	24.28				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
840.46	230.11	1070.58	0.00	181.20

HEAT INPUT(BTU/HR) 0.980324E+06 WATER LOSS(BTU/HR) 0.191468E+06

THERMAL EFF. % = 19.53 HG/HF = 0.594

TEMPERATURE 1084.26 DEG. C

CO2 % 16.52 CO % 0.06 O2 % 2.38

MAX SO2 PPM= 4550.6 MAX NO-NOX PPM= 2278.0

SO2 (PPM) 2401.8 NO-NOX (PPM) 1.2

EXH. GAS LOSS(BTU/HR) 0.582606E+06 WALL LOSS(BTU/HR) 0.206250E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 10.71

FILENAME: CC2.DAT
DATE/TIME 2231630

THERMOCOUPLES DEG. C

0	28.51	10	1168.80	20	1165.20
1	689.42	11	1209.90	21	1155.10
2	1150.80	12	1236.30	22	1138.80
3	1133.20	13	1231.80	23	1139.10
4	1253.80	14	1161.40	24	1135.90
5	1284.80	15	1193.70	25	865.51
6	1268.70	16	1107.30	26	151.69
7	1267.90	17	1180.00	27	296.52
8	1263.40	18	1171.30	28	65.74
9	1195.40	19	1202.20	30	160.48

THERMISTORS DEG. C

100	29.54	110	30.17	120	32.09
101	28.49	111	31.35	121	30.30
102	29.74	112	31.12	122	31.37
103	30.74	113	33.52	123	31.19
104	36.23	114	34.70	124	36.34
105	32.83	115	32.93	125	32.67
106	30.21	116	30.43	126	33.71
107	29.50	117	32.66	127	29.87
108	27.24	118	32.76	128	31.87
109	29.45	119	32.44	129	31.42
131	24.37				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
988.84	231.89	1220.73	0.00	210.60

HEAT INPUT(BTU/HR) 0.113938E+07 WATER LOSS(BTU/HR) 0.198709E+06

THERMAL EFF. % = 17.44 HG/HF = 0.619

TEMPERATURE 1133.44 DEG. C

CO2 % 16.36 CO % 0.05 O2 % 2.52

MAX SO2 PPM= 4513.2 MAX NO-NOX PPM= 2259.3

SO2 (PPM) 2630.5 NO-NOX (PPM) 1.0

EXH. GAS LOSS(BTU/HR) 0.704827E+06 WALL LOSS(BTU/HR) 0.235844E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 11.60

FILENAME: CC2.DAT
DATE/TIME 2231620

THERMOCOUPLES DEG. C

0	28.16	10	1155.20	20	1165.60
1	682.23	11	1205.40	21	1153.60
2	1160.30	12	1245.50	22	1133.60
3	1136.50	13	1233.70	23	1133.60
4	1295.70	14	1160.80	24	1128.50
5	1309.00	15	1195.60	25	846.00
6	1277.40	16	1094.90	26	149.30
7	1279.10	17	1179.10	27	286.47
8	1276.80	18	1167.30	28	64.62
9	1186.00	19	1201.30	30	166.10

THERMISTORS DEG. C

100	29.52	110	30.16	120	32.21
101	28.06	111	31.89	121	30.41
102	29.89	112	30.41	122	31.03
103	31.08	113	33.18	123	31.28
104	37.25	114	35.62	124	34.98
105	33.49	115	32.58	125	32.52
106	30.04	116	30.75	126	33.41
107	29.48	117	32.82	127	29.96
108	27.23	118	32.91	128	31.79
109	29.58	119	32.47	129	32.27
131	24.37				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1005.03	232.23	1237.26	0.00	211.20

HEAT INPUT(BTU/HR) 0.114263E+07 WATER LOSS(BTU/HR) 0.201153E+06

THERMAL EFF. % = 17.60 HG/HF = 0.584

TEMPERATURE 1131.29 DEG. C

CO2 % 17.60 CO % 0.05 O2 % 1.38

MAX SO2 PPM= 4809.5 MAX NO-NOX PPM= 2407.6

SO2 (PPM) 2810.3 NO-NOX (PPM) 1.1

EXH. GAS LOSS(BTU/HR) 0.667824E+06 WALL LOSS(BTU/HR) 0.273653E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 4.92

FILENAME: CC5.DAT
DATE/TIME 2221410

THERMOCOUPLES DEG. C

0	26.79	10	986.60	20	944.61
1	664.72	11	1031.20	21	940.03
2	1058.10	12	1070.80	22	912.47
3	957.95	13	1063.50	23	915.95
4	1142.10	14	964.21	24	900.28
5	1147.90	15	997.54	25	666.08
6	1136.20	16	903.51	26	115.54
7	1114.30	17	972.35	27	215.58
8	1118.60	18	955.55	28	56.17
9	1018.50	19	1002.40	30	94.86

THERMISTORS DEG. C

100	29.86	110	31.01	120	32.80
101	34.04	111	33.41	121	31.65
102	33.20	112	32.38	122	31.75
103	31.93	113	33.73	123	32.38
104	36.13	114	36.63	124	36.17
105	33.62	115	34.04	125	33.11
106	31.40	116	31.66	126	33.24
107	31.14	117	33.14	127	30.77
108	27.83	118	33.87	128	31.59
109	30.74	119	33.18	129	32.50
131	24.12				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
905.18	224.60	1129.78	0.00	183.00

HEAT INPUT(BTU/HR) 0.102910E+07 WATER LOSS(BTU/HR) 0.241498E+06

THERMAL EFF. % = 23.47 HG/HF = 0.599

TEMPERATURE 999.82 DEG. C

CO2 % 13.76 CO % 0.04 O2 % 3.69

MAX SO2 PPM= 4056.4 MAX NO-NOX PPM= 2030.6

SO2 (PPM) 2199.3 NO-NOX (PPM) 64.0

EXH. GAS LOSS(BTU/HR) 0.616586E+06 WALL LOSS(BTU/HR) 0.171016E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 23.80

FILENAME: CC5.DAT
DATE/TIME 2221420

THERMOCOUPLES DEG. C

0	26.74	10	1001.80	20	973.37
1	643.56	11	1046.20	21	966.50
2	1060.90	12	1081.10	22	939.52
3	964.26	13	1073.60	23	943.60
4	1146.00	14	984.26	24	929.85
5	1147.10	15	1018.90	25	683.61
6	1130.50	16	923.44	26	119.05
7	1117.50	17	995.96	27	221.36
8	1120.70	18	977.90	28	57.67
9	1031.20	19	1022.80	30	94.86

THERMISTORS DEG. C

100	29.74	110	30.49	120	32.51
101	33.42	111	32.32	121	31.09
102	32.57	112	32.07	122	31.77
103	31.67	113	33.32	123	32.02
104	35.36	114	35.74	124	37.07
105	32.77	115	33.38	125	33.40
106	31.08	116	31.05	126	33.46
107	30.36	117	33.13	127	30.67
108	27.48	118	33.62	128	31.34
109	30.06	119	33.04	129	32.48
131	24.10				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
930.68	224.52	1155.20	0.00	183.60

HEAT INPUT(BTU/HR) 0.103247E+07 WATER LOSS(BTU/HR) 0.230235E+06

THERMAL EFF. % = 22.23 HG/HF = 0.611

TEMPERATURE 1007.62 DEG. C

CO2 % 14.29 CO % 0.04 O2 % 4.46

MAX SO2 PPM= 4005.1 MAX NO-NOX PPM= 2004.9

SO2 (PPM) 2213.9 NO-NOX (PPM) 70.5

EXH. GAS LOSS(BTU/HR) 0.630577E+06 WALL LOSS(BTU/HR) 0.171658E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 25.35

FILENAME: CC6.DAT
DATE/TIME 2251550

THERMOCOUPLES DEG. C

0	29.68	10	1117.90	20	1081.20
2	114.86	12	1172.30	22	1048.60
3	1133.40	13	1164.60	23	1049.40
4	9.39	14	1090.50	24	1047.10
5	13.77	15	1117.40	25	834.31
6	1220.00	16	1039.50	26	137.59
7	1214.50	17	1096.10	27	283.74
8	1213.40	18	1085.90	28	51.44
9	944.05	19	1120.30	30	96.81

1

THERMISTORS DEG. C

100	30.23	110	30.62	120	32.69
101	32.25	111	31.93	121	30.97
102	35.84	112	31.19	122	32.42
103	34.46	113	33.74	123	31.44
104	41.33	114	36.17	124	36.62
105	37.53	115	33.29	125	32.58
106	33.01	116	31.93	126	32.52
107	30.35	117	33.83	127	30.30
108	27.57	118	34.02	128	31.09
109	29.66	119	33.56	129	30.59
131	24.28				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1040.25	231.45	1271.70	0.00	183.60

HEAT INPUT(BTU/HR) 0.906290E+06 WATER LOSS(BTU/HR) 0.244314E+06

THERMAL EFF. % = 26.96 HG/HF = 0.593

TEMPERATURE 1036.68 DEG. C

CO2 % 15.70 CO % 0.03 O2 % 3.09

MAX SO2 PPM= 4358.1 MAX NO-NOX PPM= 2181.6

SO2 (PPM) 1569.6 NO-NOX (PPM) 4.6

EXH. GAS LOSS(BTU/HR) 0.537382E+06 WALL LOSS(BTU/HR) 0.124594E+06

MAIN AIR (PSI) = 3.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 15.45

FILENAME: CC6.DAT
DATE/TIME 2251600

THERMOCOUPLES DEG. C

0	29.56	10	1116.60	20	1080.20
1	668.23	11	1145.70	21	1070.80
2	115.03	12	1164.60	22	1052.30
3	1125.70	13	1159.60	23	1053.10
4	8.39	14	1089.00	24	1052.30
5	13.74	15	1114.70	25	842.65
6	1214.80	16	1042.10	26	139.66
7	1201.70	17	1096.60	27	293.27
8	1199.70	18	1086.60	28	51.01
9	949.45	19	1118.70	30	102.82

THERMISTORS DEG. C

100	30.30	110	30.35	120	32.37
101	31.23	111	31.55	121	31.16
102	34.91	112	31.36	122	32.47
103	34.29	113	33.47	123	31.42
104	40.70	114	36.22	124	36.50
105	37.04	115	33.24	125	32.47
106	33.03	116	31.85	126	32.49
107	30.19	117	33.58	127	30.09
108	27.53	118	33.91	128	30.75
109	29.64	119	33.31	129	30.98
131	24.35				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
897.75	231.68	1129.42	0.00	183.60

HEAT INPUT(BTU/HR) 0.906290E+06 WATER LOSS(BTU/HR) 0.236987E+06

THERMAL EFF. % = 26.15 HG/HF = 0.619

TEMPERATURE 1041.28 DEG. C

CO2 % 14.90 CO % 0.04 O2 % 3.78

MAX SO2 PPM= 4170.7 MAX NO-NOX PPM= 2087.8

SO2 (PPM) 1491.2 NO-NOX (PPM) 4.6

EXH. GAS LOSS(BTU/HR) 0.560709E+06 WALL LOSS(BTU/HR) 0.102213E+06

MAIN AIR (PSI) = 3.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 20.49

FILENAME: CC6.DAT
DATE/TIME 2251610

THERMOCOUPLES DEG. C

0	29.56	10	1112.90	20	1085.40
1	668.49	11	1143.90	21	1075.50
2	118.66	12	1169.40	22	1057.80
3	1122.20	13	1162.30	23	1059.10
4	8.39	14	1093.20	24	1058.10
5	14.12	15	1118.80	25	848.54
6	1209.30	16	1041.70	26	143.45
7	1201.70	17	1101.70	27	299.45
8	1200.00	18	1092.90	28	52.36
9	953.01	19	1122.80	30	96.81

THERMISTORS DEG. C

100	30.32	110	30.43	120	32.57
101	31.16	111	32.01	121	31.09
102	34.71	112	30.40	122	32.22
103	33.50	113	33.77	123	31.35
104	40.48	114	36.88	124	36.58
105	37.14	115	33.13	125	32.33
106	32.33	116	31.89	126	32.54
107	29.86	117	33.59	127	30.16
108	27.45	118	33.68	128	31.25
109	29.64	119	33.78	129	31.02
131	24.47				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
828.77	232.59	1061.37	0.00	183.00

HEAT INPUT(BTU/HR) 0.903329E+06 WATER LOSS(BTU/HR) 0.230160E+06

THERMAL EFF. % = 25.48 HG/HF = 0.595

TEMPERATURE 1041.28 DEG. C

CO2 % 15.68 CO % 0.05 O2 % 3.02

MAX SO2 PPM= 4366.7 MAX NO-NOX PPM= 2185.9

SO2 (PPM) 1660.3 NO-NOX (PPM) 4.6

EXH. GAS LOSS(BTU/HR) 0.537442E+06 WALL LOSS(BTU/HR) 0.135727E+06

MAIN AIR (PSI) = 3.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 15.23

FILENAME: CC6.DAT
DATE/TIME 2251620

THERMOCOUPLES DEG. C

0	29.93	10	1123.60	20	1102.30
1	668.20	11	1160.40	21	1090.30
2	120.58	12	1191.60	22	1072.40
3	1118.20	13	1176.20	23	1072.70
4	7.59	14	1110.50	24	1071.60
5	14.62	15	1138.00	25	855.58
6	1206.70	16	1054.70	26	146.64
7	1216.80	17	1117.70	27	306.27
8	1207.80	18	1107.90	28	54.37
9	958.15	19	1138.80	30	94.86

THERMISTORS DEG. C

100	30.26	110	30.25	120	32.56
101	31.31	111	31.17	121	31.03
102	34.56	112	30.67	122	32.30
103	33.68	113	33.47	123	31.33
104	40.17	114	36.39	124	37.49
105	35.81	115	32.84	125	32.28
106	31.85	116	31.81	126	32.22
107	29.37	117	33.06	127	29.87
108	27.27	118	33.40	128	30.88
109	29.53	119	33.42	129	31.57
131	24.43				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
810.79	229.15	1039.93	0.00	183.60

HEAT INPUT(BTU/HR) 0.906290E+06 WATER LOSS(BTU/HR) 0.224942E+06

THERMAL EFF. % = 24.82 HG/HF = 0.604

TEMPERATURE 1050.44 DEG. C

CO2 % 15.56 CO % 0.06 O2 % 3.18

MAX SO2 PPM= 4331.5 MAX NO-NOX PPM= 2168.3

SO2 (PPM) 1531.5 NO-NOX (PPM) 4.6

EXH. GAS LOSS(BTU/HR) 0.547870E+06 WALL LOSS(BTU/HR) 0.133478E+06

MAIN AIR (PSI) = 3.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 16.14

FILENAME: CC6.DAT
DATE/TIME 2251450

THERMOCOUPLES DEG. C

0	28.29	10	1012.60	20	982.70
1	604.36	11	1046.20	21	965.91
2	118.98	12	1086.80	22	952.68
3	1039.10	13	1072.70	23	958.28
4	26.64	14	988.25	24	949.37
5	41.02	15	1025.10	25	693.62
6	1127.90	16	926.42	26	130.49
7	1115.10	17	982.65	27	250.73
8	1116.20	18	988.76	28	54.11
9	836.90	19	1029.20	30	80.23

THERMISTORS DEG. C

100	28.81	110	29.94	120	31.90
101	26.98	111	31.33	121	31.28
102	28.47	112	25.33	122	32.02
103	28.54	113	32.87	123	32.16
104	30.44	114	35.29	124	35.73
105	29.73	115	32.17	125	31.76
106	29.08	116	30.81	126	31.72
107	29.33	117	33.19	127	29.39
108	27.34	118	33.32	128	29.48
109	29.67	119	31.86	129	29.27
131	24.78				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
772.12	219.54	991.66	0.00	174.60

HEAT INPUT(BTU/HR) 0.861864E+06 WATER LOSS(BTU/HR) 0.156819E+06

THERMAL EFF. % = 18.20 HG/HF = 0.670

TEMPERATURE 1098.66 DEG. C

CO2 % 14.04 CO % 0.00 O2 % 3.68

MAX SO2 PPM= 4087.9 MAX NO-NOX PPM= 2046.3

SO2 (PPM) 1410.2 NO-NOX (PPM) 5.7

EXH. GAS LOSS(BTU/HR) 0.577369E+06 WALL LOSS(BTU/HR) 0.127676E+06

MAIN AIR (PSI) = 3.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 22.87

FILENAME: CC6.DAT
DATE/TIME 2251500

THERMOCOUPLES DEG. C

0	28.39	10	990.90	20	951.51
1	606.08	11	1016.30	21	940.57
2	121.69	12	1026.70	22	932.42
3	991.69	13	1034.80	23	938.79
4	26.49	14	951.97	24	933.95
5	40.95	15	987.08	25	709.50
6	1072.80	16	917.42	26	130.35
7	1060.60	17	960.62	27	252.90
8	1055.40	18	963.42	28	51.81
9	843.27	19	1002.60	30	68.79

THERMISTORS DEG. C

100	28.89	110	29.65	120	31.27
101	26.93	111	30.75	121	30.43
102	28.31	112	24.23	122	31.82
103	28.45	113	32.30	123	31.89
104	29.75	114	34.40	124	35.44
105	29.36	115	31.66	125	31.12
106	28.76	116	30.44	126	31.26
107	28.40	117	32.33	127	29.21
108	26.75	118	32.62	128	29.42
109	29.08	119	31.19	129	29.10
131	24.88				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
679.45	203.47	882.92	0.00	183.00

HEAT INPUT(BTU/HR) 0.903329E+06 WATER LOSS(BTU/HR) 0.140602E+06

THERMAL EFF. % = 15.56 HG/HF = 0.709

TEMPERATURE 1040.13 DEG. C

CO2 % 10.86 CO % 0.00 O2 % 4.63

MAX SO2 PPM= 3566.3 MAX NO-NOX PPM= 1785.2

SO2 (PPM) 1092.4 NO-NOX (PPM) 5.5

EXH. GAS LOSS(BTU/HR) 0.640192E+06 WALL LOSS(BTU/HR) 0.122535E+06

MAIN AIR (PSI) = 3.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 40.44

FILENAME: CC7.DAT
DATE/TIME 2381410

THERMOCOUPLES DEG. C

0	25.19	10	939.65	20	898.21
1	469.06	11	974.51	21	880.80
2	93.73	12	972.48	22	866.87
3	876.90	13	1013.10	23	874.83
4	8.14	14	907.37	24	866.60
5	16.94	15	942.45	25	619.98
6	1008.70	16	866.28	26	197.39
7	969.75	17	905.40	27	188.00
8	986.29	18	900.50	28	121.31
9	791.29	19	950.39	29	0.00

THERMISTORS DEG. C

100	29.40	110	31.34	120	33.44
101	30.87	111	33.67	121	32.28
102	30.04	112	32.75	122	33.97
103	29.26	113	34.15	123	33.54
104	32.50	114	39.55	124	36.92
105	32.09	115	35.28	125	33.35
106	30.68	116	33.72	126	32.66
107	31.04	117	35.13	127	30.21
108	29.08	118	36.76	128	31.88
109	30.83	119	34.96	129	34.00
131	22.55				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
883.92	216.65	1100.57	0.00	185.40

HEAT INPUT(BTU/HR) 0.889077E+06 WATER LOSS(BTU/HR) 0.286750E+06

THERMAL EFF. % = 32.25 HG/HF = 0.565

TEMPERATURE 962.75 DEG. C

CO2 % 14.87 CO % 0.04 O2 % 3.86

MAX SO2 PPM= 4182.5 MAX NO-NOX PPM= 2093.7

SO2 (PPM) 1747.1 NO-NOX (PPM) 817.7

EXH. GAS LOSS(BTU/HR) 0.502014E+06 WALL LOSS(BTU/HR) 0.100313E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 20.16

FILENAME: CC7.DAT
DATE/TIME 2381420

THERMOCOUPLES DEG. C

0	25.29	10	902.59	20	888.66
1	473.70	11	929.17	21	869.26
2	98.33	12	927.90	22	867.52
3	832.71	13	961.23	23	871.75
4	8.07	14	879.51	24	876.23
5	18.26	15	913.59	25	631.07
6	953.65	16	838.67	26	205.76
7	948.63	17	886.87	27	196.12
8	952.81	18	881.47	28	125.91
9	781.68	19	918.79	29	0.00

THERMISTORS DEG. C

100	28.35	110	29.14	120	32.01
101	27.13	111	31.30	121	31.35
102	27.29	112	27.09	122	32.37
103	26.85	113	31.41	123	32.25
104	29.75	114	35.04	124	35.81
105	29.29	115	32.54	125	32.67
106	28.38	116	31.53	126	32.07
107	28.12	117	32.83	127	29.35
108	26.57	118	33.57	128	30.95
109	28.49	119	32.65	129	33.41
131	22.68				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
891.89	218.39	1110.27	0.00	185.40

HEAT INPUT(BTU/HR) 0.889077E+06 WATER LOSS(BTU/HR) 0.215693E+06

THERMAL EFF. % = 24.26 HG/HF = 0.585

TEMPERATURE 993.67 DEG. C

CO2 % 14.56 CO % 0.05 O2 % 4.19

MAX SO2 PPM= 4096.1 MAX NO-NOX PPM= 2050.4

SO2 (PPM) 1689.5 NO-NOX (PPM) 830.3

EXH. GAS LOSS(BTU/HR) 0.519875E+06 WALL LOSS(BTU/HR) 0.153509E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 22.63

FILENAME: CC7.DAT
DATE/TIME 2381430

THERMOCOUPLES DEG. C

0	25.26	10	901.80	20	906.02
1	479.64	11	941.33	21	886.13
2	100.37	12	976.70	22	871.95
3	850.51	13	966.52	23	877.42
4	5.67	14	902.79	24	872.20
5	20.89	15	937.26	25	635.24
6	980.08	16	840.31	26	215.43
7	986.57	17	899.06	27	205.01
8	1000.70	18	897.14	28	131.51
9	778.72	19	940.57	29	0.00

THERMISTORS DEG. C

100	27.97	110	28.48	120	30.65
101	26.41	111	30.25	121	30.46
102	26.94	112	26.65	122	31.16
103	27.00	113	31.42	123	31.96
104	29.88	114	34.81	124	35.47
105	29.14	115	32.14	125	31.40
106	28.30	116	30.17	126	31.15
107	27.54	117	32.43	127	28.31
108	26.31	118	33.07	128	30.04
109	28.15	119	31.52	129	32.12
131	22.77				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
863.44	208.31	1071.75	0.00	184.20

HEAT INPUT(BTU/HR) 0.885045E+06 WATER LOSS(BTU/HR) 0.197153E+06

THERMAL EFF. % = 22.28 HG/HF = 0.576

TEMPERATURE 975.16 DEG. C

CO2 % 14.52 CO % 0.03 O2 % 4.10

MAX SO2 PPM= 4116.7 MAX NO-NOX PPM= 2060.8

SO2 (PPM) 1731.7 NO-NOX (PPM) 740.2

EXH. GAS LOSS(BTU/HR) 0.510159E+06 WALL LOSS(BTU/HR) 0.177733E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 22.03

FILENAME: CC7.DAT
DATE/TIME 2381440

THERMOCOUPLES DEG. C

0	25.21	10	918.36	20	928.76
1	485.01	11	967.95	21	908.66
2	104.49	12	1016.80	22	895.98
3	862.74	13	988.56	23	899.96
4	5.72	14	928.25	24	894.73
5	22.76	15	964.38	25	642.06
6	1005.10	16	856.65	26	223.05
7	1027.80	17	920.62	27	211.12
8	1032.70	18	926.98	28	135.45
9	785.55	19	966.93	29	0.00

THERMISTORS DEG. C

100	27.71	110	28.02	120	29.97
101	26.37	111	29.96	121	29.70
102	26.89	112	25.73	122	30.81
103	26.83	113	30.80	123	30.69
104	30.08	114	33.74	124	34.22
105	28.68	115	31.18	125	30.47
106	28.23	116	29.29	126	30.71
107	26.71	117	31.55	127	27.96
108	25.87	118	32.18	128	29.39
109	27.81	119	30.82	129	31.44
131	22.80				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
793.49	216.55	1010.05	0.00	184.20

HEAT INPUT(BTU/HR) 0.885045E+06 WATER LOSS(BTU/HR) 0.180693E+06

THERMAL EFF. % = 20.42 HG/HF = 0.577

TEMPERATURE 994.90 DEG. C

CO2 % 15.11 CO % 0.05 O2 % 3.57

MAX SO2 PPM= 4243.1 MAX NO-NOX PPM= 2124.0

SO2 (PPM) 2088.1 NO-NOX (PPM) 803.0

EXH. GAS LOSS(BTU/HR) 0.510998E+06 WALL LOSS(BTU/HR) 0.193354E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 18.49

FILENAME: CC7.DAT
DATE/TIME 2381450

THERMOCOUPLES DEG. C

0	25.31	10	937.26	20	965.76
1	492.39	11	987.13	21	940.06
2	106.36	12	1032.00	22	927.59
3	871.80	13	1013.80	23	928.86
4	5.05	14	954.31	24	928.35
5	23.69	15	992.73	25	652.93
6	1009.70	16	878.91	26	229.73
7	1035.70	17	949.73	27	216.40
8	1033.40	18	952.58	28	139.34
9	797.44	19	995.32	29	0.00

THERMISTORS DEG. C

100	27.50	110	27.36	120	30.02
101	26.17	111	29.20	121	29.30
102	26.36	112	24.21	122	30.65
103	26.83	113	30.01	123	30.39
104	28.98	114	33.18	124	34.34
105	28.10	115	30.94	125	30.76
106	27.63	116	28.91	126	30.82
107	26.22	117	31.40	127	27.95
108	25.22	118	31.68	128	29.54
109	27.09	119	30.41	129	31.35
131	22.85				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
761.91	220.68	982.59	0.00	184.80

HEAT INPUT(BTU/HR) 0.887928E+06 WATER LOSS(BTU/HR) 0.166827E+06

THERMAL EFF. % = 18.79 HG/HF = 0.597

TEMPERATURE 1030.91 DEG. C

CO2 % 15.72 CO % 0.02 O2 % 2.92

MAX SO2 PPM= 4411.7 MAX NO-NOX PPM= 2208.4

SO2 (PPM) 2153.4 NO-NOX (PPM) 840.9

EXH. GAS LOSS(BTU/HR) 0.530449E+06 WALL LOSS(BTU/HR) 0.190652E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 14.09

FILENAME: CC7.DAT
DATE/TIME 2381500

THERMOCOUPLES DEG. C

0	25.14	10	958.48	20	981.89
1	498.50	11	1011.00	21	958.48
2	106.77	12	1057.10	22	946.52
3	889.06	13	1041.70	23	950.08
4	4.25	14	971.71	24	946.52
5	24.91	15	1011.00	25	666.13
6	1039.20	16	901.65	26	236.08
7	1057.50	17	968.91	27	221.53
8	1071.80	18	975.27	28	143.55
9	811.04	19	1018.00	29	0.00

THERMISTORS DEG. C

100	27.36	110	27.17	120	29.76
101	25.95	111	28.80	121	28.94
102	26.39	112	23.52	122	30.24
103	26.44	113	29.66	123	30.23
104	28.01	114	32.12	124	34.90
105	27.44	115	30.34	125	30.56
106	27.18	116	28.80	126	30.24
107	26.38	117	31.11	127	27.80
108	25.04	118	31.02	128	29.54
109	26.93	119	30.09	129	31.48
131	22.89				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
861.00	220.89	1081.89	0.00	184.20

HEAT INPUT(BTU/HR) 0.885045E+06 WATER LOSS(BTU/HR) 0.156529E+06

THERMAL EFF. % = 17.69 HG/HF = 0.603

TEMPERATURE 1037.83 DEG. C

CO2 % 15.80 CO % 0.03 O2 % 3.63

MAX SO2 PPM= 4289.2 MAX NO-NOX PPM= 2147.1

SO2 (PPM) 2254.1 NO-NOX (PPM) 835.4

EXH. GAS LOSS(BTU/HR) 0.534104E+06 WALL LOSS(BTU/HR) 0.194412E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 17.25

FILENAME: CC7.DAT
DATE/TIME 2381510

THERMOCOUPLES DEG. C

0	25.31	10	967.74	20	999.29
1	504.29	11	1019.40	21	976.14
2	111.47	12	1061.40	22	966.98
3	885.48	13	1050.20	23	968.00
4	7.15	14	987.84	24	969.27
5	26.91	15	1026.20	25	679.59
6	1023.40	16	913.44	26	241.68
7	1048.10	17	986.83	27	225.94
8	1050.40	18	990.39	28	147.16
9	820.77	19	1030.40	29	0.00

THERMISTORS DEG. C

100	27.33	110	26.95	120	29.69
101	25.79	111	28.65	121	28.68
102	26.02	112	23.33	122	29.92
103	26.30	113	29.48	123	29.73
104	27.38	114	32.19	124	33.72
105	26.93	115	29.73	125	30.29
106	26.67	116	28.86	126	30.02
107	25.90	117	30.30	127	27.89
108	24.60	118	30.64	128	29.59
109	26.52	119	30.25	129	31.23
131	22.95				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
831.59	218.10	1049.69	0.00	184.80

HEAT INPUT(BTU/HR) 0.887928E+06 WATER LOSS(BTU/HR) 0.146348E+06

THERMAL EFF. % = 16.48 HG/HF = 0.609

TEMPERATURE 1059.54 DEG. C

CO2 % 15.63 CO % 0.03 O2 % 3.05

MAX SO2 PPM= 4356.2 MAX NO-NOX PPM= 2180.7

SO2 (PPM) 2236.4 NO-NOX (PPM) 825.5

EXH. GAS LOSS(BTU/HR) 0.540378E+06 WALL LOSS(BTU/HR) 0.201202E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 15.50

FILENAME: CC8.DAT
DATE/TIME 2391050

THERMOCOUPLES DEG. C

0	25.31	10	1000.20	20	1029.00
1	608.20	11	1034.40	21	1010.80
2	133.73	12	1096.20	22	999.19
3	951.51	13	1051.10	23	1000.70
4	2.72	14	1024.30	24	988.00
5	31.72	15	1049.00	25	805.81
6	1074.00	16	960.77	26	297.23
7	1099.30	17	1013.10	27	268.46
8	1115.10	18	1028.50	28	171.55
9	907.82	19	1057.90	29	0.00

THERMISTORS DEG. C

100	27.36	110	28.22	120	29.04
101	26.62	111	30.10	121	27.94
102	27.62	112	29.63	122	29.07
103	26.99	113	29.70	123	29.05
104	30.58	114	32.03	124	31.74
105	30.34	115	29.36	125	28.92
106	29.28	116	28.70	126	29.68
107	27.37	117	29.70	127	27.73
108	26.56	118	29.34	128	28.76
109	28.22	119	29.21	129	28.79
131	23.71				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
740.94	217.10	958.04	0.00	180.60

HEAT INPUT(BTU/HR) 0.914193E+06 WATER LOSS(BTU/HR) 0.139533E+06

THERMAL EFF. % = 15.26 HG/HF = 0.626

TEMPERATURE 1082.03 DEG. C

CO2 % 15.45 CO % 0.03 O2 % 2.77

MAX SO2 PPM= 4402.9 MAX NO-NOX PPM= 2204.1

SO2 (PPM) 1884.3 NO-NOX (PPM) 803.8

EXH. GAS LOSS(BTU/HR) 0.572521E+06 WALL LOSS(BTU/HR) 0.202139E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 14.31

FILENAME: CC8.DAT
DATE/TIME 2391120

THERMOCOUPLES DEG. C

0	25.94	10	1060.00	20	1089.20
1	558.49	11	1110.10	21	1063.10
2	136.80	12	1169.50	22	1062.60
3	977.44	13	1150.70	23	1062.90
4	83.91	14	1079.30	24	1055.30
5	34.41	15	1121.60	25	762.71
6	1165.10	16	1013.40	26	312.23
7	1186.80	17	1070.90	27	286.93
8	1208.20	18	1093.30	28	177.96
9	892.99	19	1131.70	29	0.00

THERMISTORS DEG. C

100	27.20	110	27.87	120	28.89
101	26.78	111	29.22	121	27.63
102	26.78	112	29.58	122	29.12
103	26.62	113	29.60	123	28.95
104	28.98	114	32.33	124	33.39
105	29.18	115	29.10	125	28.77
106	28.54	116	28.26	126	29.52
107	27.06	117	29.31	127	27.37
108	26.06	118	29.23	128	28.45
109	27.85	119	29.19	129	28.65
131	23.32				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
911.39	222.42	1133.81	0.00	181.80

HEAT INPUT(BTU/HR) 0.920267E+06 WATER LOSS(BTU/HR) 0.141663E+06

THERMAL EFF. % = 15.39 HG/HF = 0.633

TEMPERATURE 1125.91 DEG. C

CO2 % 16.34 CO % 0.01 O2 % 2.79

MAX SO2 PPM= 4468.2 MAX NO-NOX PPM= 2236.7

SO2 (PPM) 1958.9 NO-NOX (PPM) 1065.2

EXH. GAS LOSS(BTU/HR) 0.582750E+06 WALL LOSS(BTU/HR) 0.195854E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 12.69

FILENAME: CC8.DAT
DATE/TIME 2391130

THERMOCOUPLES DEG. C

0	25.91	10	1088.70	20	1106.70
1	566.62	11	1131.50	21	1084.30
2	137.04	12	1177.00	22	1081.40
3	1000.10	13	1185.00	23	1081.40
4	83.82	14	1094.00	24	1076.50
5	31.55	15	1135.30	25	784.60
6	1188.00	16	1038.20	26	312.30
7	1192.40	17	1092.40	27	287.03
8	1216.20	18	1109.20	28	179.67
9	921.48	19	1145.20	29	0.00

THERMISTORS DEG. C

100	27.28	110	28.03	120	28.87
101	26.74	111	29.20	121	27.75
102	26.79	112	29.92	122	29.13
103	26.70	113	29.65	123	29.40
104	29.00	114	31.91	124	32.19
105	28.90	115	29.13	125	28.86
106	28.65	116	28.35	126	29.69
107	27.27	117	29.45	127	27.58
108	26.12	118	29.46	128	28.72
109	27.94	119	29.25	129	28.71
131	23.38				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
947.56	221.66	1169.22	0.00	181.20

HEAT INPUT(BTU/HR) 0.917230E+06 WATER LOSS(BTU/HR) 0.140999E+06

THERMAL EFF. % = 15.37 HG/HF = 0.654

TEMPERATURE 1147.30 DEG. C

CO2 % 15.75 CO % 0.02 O2 % 3.14

MAX SO2 PPM= 4385.5 MAX NO-NOX PPM= 2195.3

SO2 (PPM) 2000.5 NO-NOX (PPM) 1074.1

EXH. GAS LOSS(BTU/HR) 0.600145E+06 WALL LOSS(BTU/HR) 0.176086E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 14.75

FILENAME: CC8.DAT
DATE/TIME 2391140

THERMOCOUPLES DEG. C

0	25.99	10	1103.40	20	1119.00
1	579.46	11	1145.00	21	1097.70
2	136.75	12	1187.80	22	1093.20
3	1030.50	13	1212.20	23	1093.40
4	84.86	14	1109.20	24	1090.20
5	33.25	15	1146.10	25	803.04
6	1210.30	16	1051.10	26	312.92
7	1217.40	17	1108.40	27	287.74
8	1229.50	18	1119.60	28	180.00
9	942.20	19	1155.70	29	0.00

THERMISTORS DEG. C

100	27.40	110	28.03	120	29.18
101	26.87	111	29.73	121	27.88
102	26.83	112	29.82	122	29.12
103	26.68	113	29.79	123	29.23
104	28.73	114	32.15	124	32.96
105	29.06	115	29.20	125	29.41
106	28.64	116	28.36	126	29.43
107	27.26	117	29.92	127	27.75
108	26.26	118	29.64	128	28.93
109	28.05	119	29.25	129	29.10
131	23.41				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
893.56	207.89	1101.45	0.00	181.80

HEAT INPUT(BTU/HR) 0.920267E+06 WATER LOSS(BTU/HR) 0.143674E+06

THERMAL EFF. % = 15.61 HG/HF = 0.653

TEMPERATURE 1158.92 DEG. C

CO2 % 16.90 CO % 0.06 O2 % 3.18

MAX SO2 PPM= 4470.2 MAX NO-NOX PPM= 2237.7

SO2 (PPM) 2360.7 NO-NOX (PPM) 745.4

EXH. GAS LOSS(BTU/HR) 0.601027E+06 WALL LOSS(BTU/HR) 0.175566E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0

EXCESS AIR % (OUTLET) = 12.64

FILENAME: CC8.DAT
DATE/TIME 2391150

THERMOCOUPLES DEG. C

0	26.09	10	1116.80	20	1128.20
1	591.05	11	1156.30	21	1108.20
2	139.04	12	1194.20	22	1102.90
3	1040.70	13	1226.60	23	1103.40
4	84.30	14	1119.00	24	1100.50
5	33.88	15	1154.40	25	818.38
6	1208.70	16	1062.40	26	315.55
7	1222.10	17	1120.60	27	290.66
8	1240.10	18	1128.80	28	176.16
9	958.02	19	1163.00	29	0.00

THERMISTORS DEG. C

100	27.51	110	28.12	120	29.25
101	27.42	111	29.69	121	27.80
102	26.79	112	29.82	122	29.41
103	26.88	113	30.05	123	29.14
104	29.07	114	32.23	124	32.92
105	29.26	115	29.52	125	28.81
106	28.69	116	28.47	126	29.85
107	27.36	117	29.88	127	27.78
108	26.11	118	29.74	128	28.66
109	28.11	119	29.34	129	29.06
131	23.45				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
788.97	222.39	1011.35	0.00	180.60

HEAT INPUT(BTU/HR) 0.914193E+06 WATER LOSS(BTU/HR) 0.145673E+06

THERMAL EFF. % = 15.93 HG/HF = 0.664

TEMPERATURE 1166.26 DEG. C

CO2 % 16.18 CO % 0.06 O2 % 3.00

MAX SO2 PPM= 4421.6 MAX NO-NOX PPM= 2213.4

SO2 (PPM) 2180.8 NO-NOX (PPM) 970.4

EXH. GAS LOSS(BTU/HR) 0.607055E+06 WALL LOSS(BTU/HR) 0.161465E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 13.84

FILENAME: CC8.DAT
DATE/TIME 2391230

THERMOCOUPLES DEG. C

0	24.04	10	986.29	20	1032.40
1	538.05	11	1047.50	21	1007.40
2	107.25	12	1116.30	22	998.00
3	950.47	13	1078.50	23	999.52
4	66.71	14	1017.90	24	991.13
5	26.36	15	1062.60	25	670.18
6	1109.60	16	944.56	26	230.23
7	1136.30	17	1002.80	27	217.15
8	1145.40	18	1028.80	28	138.14
9	833.24	19	1074.10	29	0.00

THERMISTORS DEG. C

100	25.37	110	26.54	120	27.35
101	25.96	111	27.62	121	26.57
102	25.59	112	27.88	122	27.43
103	25.61	113	27.80	123	27.36
104	27.28	114	29.46	124	30.90
105	27.32	115	27.79	125	27.54
106	27.06	116	26.69	126	28.15
107	25.96	117	28.15	127	26.26
108	24.56	118	28.10	128	27.43
109	26.62	119	27.46	129	27.41
131	22.76				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
938.27	208.71	1146.98	0.00	186.60

HEAT INPUT(BTU/HR) 0.944565E+06 WATER LOSS(BTU/HR) 0.113901E+06

THERMAL EFF. % = 12.06 HG/HF = 0.604

TEMPERATURE 1076.44 DEG. C

CO2 % 16.36 CO % 0.00 O2 % 2.48

MAX SO2 PPM= 4537.1 MAX NO-NOX PPM= 2271.2

SO2 (PPM) 2095.9 NO-NOX (PPM) 21.0

EXH. GAS LOSS(BTU/HR) 0.570155E+06 WALL LOSS(BTU/HR) 0.260509E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 11.03

FILENAME: CC8.DAT
DATE/TIME 2391240

THERMOCOUPLES DEG. C

0	24.41	10	1028.40	20	1064.60
1	542.78	11	1088.50	21	1040.70
2	108.95	12	1144.40	22	1033.60
3	963.72	13	1129.20	23	1035.20
4	67.07	14	1049.70	24	1029.20
5	28.39	15	1095.30	25	695.21
6	1134.50	16	984.61	26	239.30
7	1161.70	17	1040.60	27	228.03
8	1181.20	18	1062.50	28	140.56
9	864.06	19	1105.70	29	0.00

THERMISTORS DEG. C

100	26.11	110	26.88	120	27.70
101	26.38	111	28.28	121	26.94
102	25.88	112	28.46	122	28.01
103	25.89	113	28.26	123	27.78
104	27.31	114	29.59	124	30.66
105	27.52	115	27.83	125	27.65
106	27.09	116	27.05	126	28.57
107	26.13	117	28.45	127	26.64
108	24.68	118	28.10	128	27.77
109	26.80	119	27.80	129	27.68
131	23.04				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
980.05	209.98	1190.03	0.00	187.20

HEAT INPUT(BTU/HR) 0.947602E+06 WATER LOSS(BTU/HR) 0.117102E+06

THERMAL EFF. % = 12.36 HG/HF = 0.612

TEMPERATURE 1109.63 DEG. C

CO2 % 16.33 CO % 0.00 O2 % 2.56

MAX SO2 PPM= 4539.2 MAX NO-NOX PPM= 2272.3

SO2 (PPM) 2061.8 NO-NOX (PPM) 78.8

EXH. GAS LOSS(BTU/HR) 0.580021E+06 WALL LOSS(BTU/HR) 0.250479E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 10.98

FILENAME: CC8.DAT
DATE/TIME 2391250

THERMOCOUPLES DEG. C

0	24.61	10	1050.10	20	1085.80
1	551.10	11	1107.20	21	1062.10
2	110.74	12	1160.00	22	1055.30
3	985.27	13	1148.60	23	1055.90
4	68.62	14	1070.40	24	1051.70
5	31.02	15	1114.70	25	719.32
6	1158.00	16	1005.40	26	248.02
7	1176.70	17	1064.50	27	235.83
8	1197.80	18	1083.20	28	145.29
9	887.59	19	1125.60	29	0.00

THERMISTORS DEG. C

100	26.18	110	26.88	120	27.80
101	26.39	111	27.98	121	27.11
102	25.89	112	28.60	122	27.95
103	25.82	113	28.52	123	27.70
104	27.58	114	30.15	124	31.75
105	27.57	115	28.12	125	27.67
106	27.16	116	27.16	126	28.80
107	26.06	117	28.53	127	26.68
108	24.76	118	28.50	128	27.78
109	26.85	119	27.89	129	27.82
131	22.96				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
920.30	210.37	1130.67	0.00	186.60

HEAT INPUT(BTU/HR) 0.944565E+06 WATER LOSS(BTU/HR) 0.122453E+06

THERMAL EFF. % = 12.96 HG/HF = 0.622

TEMPERATURE 1124.83 DEG. C

CO2 % 15.84 CO % 0.03 O2 % 2.93

MAX SO2 PPM= 4415.3 MAX NO-NOX PPM= 2210.2

SO2 (PPM) 1994.8 NO-NOX (PPM) 1081.4

EXH. GAS LOSS(BTU/HR) 0.587701E+06 WALL LOSS(BTU/HR) 0.234411E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 14.00

FILENAME: CC8.DAT
DATE/TIME 2391300

THERMOCOUPLES DEG. C

0	24.51	10	1068.80	20	1091.70
1	563.59	11	1123.40	21	1070.70
2	113.19	12	1166.40	22	1064.70
3	1008.20	13	1165.30	23	1064.10
4	68.50	14	1080.20	24	1061.80
5	31.96	15	1121.50	25	741.16
6	1174.50	16	1021.90	26	256.34
7	1184.30	17	1078.40	27	243.22
8	1202.20	18	1093.20	28	150.45
9	906.70	19	1132.50	29	0.00

THERMISTORS DEG. C

100	26.16	110	26.94	120	27.76
101	25.91	111	28.10	121	27.23
102	25.71	112	28.68	122	28.11
103	25.77	113	28.70	123	27.93
104	27.54	114	30.16	124	31.40
105	27.62	115	28.16	125	27.81
106	27.11	116	27.06	126	28.74
107	26.35	117	28.63	127	26.65
108	24.71	118	28.72	128	27.76
109	26.79	119	27.89	129	28.13
131	22.88				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
924.50	205.26	1129.77	0.00	186.60

HEAT INPUT(BTU/HR) 0.944565E+06 WATER LOSS(BTU/HR) 0.124448E+06

THERMAL EFF. % = 13.18 HG/HF = 0.624

TEMPERATURE 1132.37 DEG. C

CO2 % 15.97 CO % 0.02 O2 % 2.80

MAX SO2 PPM= 4449.9 MAX NO-NOX PPM= 2227.6

SO2 (PPM) 2162.2 NO-NOX (PPM) 1054.8

EXH. GAS LOSS(BTU/HR) 0.589754E+06 WALL LOSS(BTU/HR) 0.230363E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 13.14

FILENAME: CC8.DAT
DATE/TIME 2391310

THERMOCOUPLES DEG. C

0	24.91	10	1081.50	20	1103.80
1	578.78	11	1132.10	21	1081.70
2	115.03	12	1174.80	22	1075.70
3	1024.60	13	1175.40	23	1075.70
4	71.19	14	1092.90	24	1074.40
5	31.86	15	1132.10	25	762.01
6	1186.70	16	1032.00	26	265.73
7	1198.50	17	1090.00	27	252.02
8	1214.10	18	1103.30	28	153.64
9	922.58	19	1141.50	29	0.00

THERMISTORS DEG. C

100	26.16	110	26.91	120	27.96
101	25.81	111	28.10	121	26.92
102	25.82	112	28.60	122	28.27
103	25.85	113	28.75	123	27.94
104	27.54	114	30.31	124	31.20
105	27.54	115	28.36	125	28.03
106	27.02	116	27.32	126	29.01
107	26.24	117	28.70	127	26.73
108	24.93	118	28.49	128	27.90
109	26.85	119	27.98	129	28.41
131	22.89				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1000.20	206.46	1206.66	0.00	186.60

HEAT INPUT(BTU/HR) 0.944565E+06 WATER LOSS(BTU/HR) 0.125332E+06

THERMAL EFF. % = 12.60 HG/HF = 0.641

TEMPERATURE 1145.18 DEG. C

CO2 % 15.50 CO % 0.00 O2 % 3.12

MAX SO2 PPM= 4353.5 MAX NO-NOX PPM= 2179.3

SO2 (PPM) 2266.8 NO-NOX (PPM) 1213.1

EXH. GAS LOSS(BTU/HR) 0.605479E+06 WALL LOSS(BTU/HR) 0.213754E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 15.57

FILENAME: CC8.DAT
DATE/TIME 2391200

THERMOCOUPLES DEG. C

0	25.39	10	1066.80	20	1095.90
1	602.88	11	1115.70	21	1076.40
2	136.22	12	1161.60	22	1071.10
3	993.09	13	1141.60	23	1071.10
4	1.77	14	1086.60	24	1063.10
5	39.67	15	1121.30	25	805.32
6	1156.00	16	1031.60	26	307.75
7	1180.40	17	1082.10	27	284.03
8	1202.10	18	1098.10	28	177.51
9	925.15	19	1132.30	29	0.00

THERMISTORS DEG. C

100	27.34	110	28.34	120	29.08
101	26.48	111	29.88	121	28.04
102	27.32	112	30.21	122	29.25
103	26.88	113	30.25	123	29.04
104	30.07	114	31.71	124	31.89
105	29.95	115	29.40	125	29.53
106	29.31	116	28.60	126	29.80
107	27.27	117	29.78	127	27.76
108	26.53	118	29.88	128	28.95
109	28.25	119	29.32	129	28.71
131	23.45				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
761.94	214.07	976.01	0.00	179.40

HEAT INPUT(BTU/HR) 0.908118E+06 WATER LOSS(BTU/HR) 0.148139E+06

THERMAL EFF. % = 16.31 HG/HF = 0.647

TEMPERATURE 1135.58 DEG. C

CO2 % 16.34 CO % 0.02 O2 % 2.94

MAX SO2 PPM= 4480.9 MAX NO-NOX PPM= 2243.1

SO2 (PPM) 2400.0 NO-NOX (PPM) 784.5

EXH. GAS LOSS(BTU/HR) 0.587126E+06 WALL LOSS(BTU/HR) 0.172853E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 12.38

FILENAME: CC9.DAT
DATE/TIME 2251440

THERMOCOUPLES DEG. C

0	26.84	10	924.05	20	947.51
1	546.31	11	983.34	21	926.90
2	119.54	12	1071.50	22	915.30
3	952.73	13	1014.80	23	922.83
4	15.59	14	947.21	24	907.34
5	32.40	15	989.70	25	640.43
6	1081.00	16	856.60	26	123.63
7	1102.80	17	930.69	27	243.48
8	1117.70	18	955.76	28	46.28
9	803.43	19	994.77	29	0.00

THERMISTORS DEG. C

100	28.54	110	29.60	120	31.02
101	27.82	111	30.80	121	30.49
102	28.31	112	26.91	122	31.65
103	28.27	113	31.72	123	31.22
104	30.39	114	34.35	124	35.06
105	29.60	115	31.55	125	30.95
106	29.30	116	29.98	126	31.24
107	28.81	117	32.56	127	29.13
108	27.41	118	32.19	128	29.32
109	29.46	119	30.99	129	29.12
131	25.13				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
800.84	201.26	1002.10	0.00	178.20

HEAT INPUT(BTU/HR) 0.112935E+07 WATER LOSS(BTU/HR) 0.136260E+06

THERMAL EFF. % = 12.07 HG/HF = 0.665

TEMPERATURE 1058.41 DEG. C

CO2 % 13.77 CO % 0.04 O2 % 4.51

MAX SO2 PPM= 3971.7 MAX NO-NOX PPM= 1988.2

SO2 (PPM) 1966.6 NO-NOX (PPM) 2.0

EXH. GAS LOSS(BTU/HR) 0.751089E+06 WALL LOSS(BTU/HR) 0.242001E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 26.38

FILENAME: CC9.DAT
DATE/TIME 2251550

THERMOCOUPLES DEG. C

0	26.84	10	1040.40	20	1051.90
1	602.25	11	1098.30	21	1028.70
2	122.90	12	1152.70	22	1020.90
3	1048.00	13	1122.60	23	1026.40
4	10.34	14	1046.90	24	1015.20
5	26.34	15	1091.90	25	701.57
6	1163.70	16	970.67	26	129.23
7	1165.30	17	1040.90	27	254.49
8	1185.60	18	1060.20	28	48.10
9	888.69	19	1098.60	29	0.00

THERMISTORS DEG. C

100	28.49	110	30.50	120	31.99
101	27.76	111	32.03	121	31.32
102	28.70	112	29.02	122	32.65
103	28.51	113	32.80	123	32.37
104	31.27	114	35.71	124	36.25
105	30.49	115	32.59	125	31.78
106	30.18	116	30.91	126	32.03
107	29.72	117	33.84	127	29.66
108	28.47	118	33.59	128	29.72
109	30.23	119	31.49	129	29.67
131	25.02				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
884.22	198.68	1082.91	0.00	183.00

HEAT INPUT(BTU/HR) 0.115977E+07 WATER LOSS(BTU/HR) 0.164701E+06

THERMAL EFF. % = 14.20 HG/HF = 0.657

TEMPERATURE 1119.42 DEG. C

CO2 % 14.78 CO % 0.06 O2 % 3.51

MAX SO2 PPM= 4225.5 MAX NO-NOX PPM= 2115.2

SO2 (PPM) 2031.7 NO-NOX (PPM) 801.9

EXH. GAS LOSS(BTU/HR) 0.762189E+06 WALL LOSS(BTU/HR) 0.232880E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 18.97

FILENAME: CC9.DAT
DATE/TIME 2251420

THERMOCOUPLES DEG. C

0	26.26	10	991.43	20	996.78
1	475.46	11	1055.40	21	975.15
2	85.63	12	1109.40	22	960.64
3	971.46	13	1094.50	23	976.16
4	11.99	14	993.72	24	957.84
5	27.29	15	1043.90	25	583.93
6	1128.80	16	920.95	26	174.94
7	1134.40	17	987.62	27	160.99
8	1122.70	18	1007.50	28	87.26
9	825.41	19	1061.10	29	0.00

THERMISTORS DEG. C

100	27.93	110	33.26	120	34.99
101	28.15	111	35.16	121	34.85
102	31.01	112	35.89	122	35.83
103	30.87	113	36.98	123	36.93
104	34.51	114	44.19	124	39.34
105	33.27	115	37.50	125	37.65
106	32.11	116	36.09	126	36.57
107	32.23	117	37.87	127	33.67
108	30.77	118	38.30	128	35.56
109	31.93	119	36.51	129	38.25
131	23.60				

FLOW RATES: (LBM/HR)

MAIN AIR	ATOM. AIR	TOTAL AIR	FUEL	SLURRY/MIXTURE
1050.98	195.92	1246.90	0.00	219.00

HEAT INPUT(BTU/HR) 0.138792E+07 WATER LOSS(BTU/HR) 0.316462E+06

THERMAL EFF. % = 22.80 HG/HF = 0.565

TEMPERATURE 1092.03 DEG. C

CO2 % 16.78 CO % 0.04 O2 % 1.99

MAX SO2 PPM= 4649.7 MAX NO-NOX PPM= 2327.6

SO2 (PPM) 2387.2 NO-NOX (PPM) 804.7

EXH. GAS LOSS(BTU/HR) 0.784331E+06 WALL LOSS(BTU/HR) 0.287127E+06

MAIN AIR (PSI) = 2.0 ATOMIZED AIR (PSI) 80.0
EXCESS AIR % (OUTLET) = 8.42

END

DATE FILMED

8/20/93