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AUTOMATIC CURVE PLOTTING OF PILOT PLANT PROCESS DATA

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ABSTRACT

Instructions and sample data sheets are presented for automatic curve plotting of pilot plant process data using the CASPER routine on the IBM 7090.

Facsimile Price $ 1.60
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Office of Technical Services
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1.0 INTRODUCTION

With the issue of CASPER[1] (Calcomp Automatic Scaling, Plotting, Editing Routine), a general Fortran subroutine is now available to produce curve plots on the Calcomp 570 plotter. A special feature of the routine is the option of plotting data from punched cards. This option is of particular value to data processing groups since report quality plots can be prepared automatically from a wide variety of process data.

CASPER is presently being run on the IBM 7090, but is scheduled to be recompiled for use on the new CDC 1604-A computer at ORNL.

2.0 SEQUENCE OF PLOTTING OPERATIONS

The data to be plotted are tabulated (Sec. 3.0) and appropriate titles and x-y labels entered on the data sheets. Service cards (see Fig. 7) are completed and sent with the data sheets, control cards, and CASPER program deck to K-25 (data sheets can be keypunched at ORNL also). The program is run on the IBM 7090 and the output magnetic tape returned to ORNL for plotting on the Calcomp 570. Finished plots are returned by plant mail. The entire sequence requires 3 to 4 days with normal handling.

3.0 INSTRUCTIONS FOR AUTOMATIC CURVE PLOTTING

3.1 Data Sheets

Data sheets have been prepared for use with the CASPER curve plotting routine. Figures 1 and 2 are sample plots prepared on the Calcomp 570 from punched cards. Figures 3 and 4 are the completed data sheets used to prepare Figure 1. Figures 5 and 6 are the completed data sheets for Figure 2.

The data sheets are applicable to general pilot plant use by operating personnel. Normally data sheet 1 and columns 28-30 of sheet 2 would be completed by the supervisor or data group. Columns 1-20, 78-80, and the descriptive data on sheet 2 may be completed by operating personnel.

Table 1 summarizes the limitations on each entry to the data sheets. Note that the graph grid is selected by the programmer in column 30, card 5 of data sheet 2. However, three types of paper (Table 2) are available for use in plotting. The paper type is selected on the Calcomp Work Request Card (Fig. 7b).

FIG 1 PER CENT COMP R-2 DISSO.

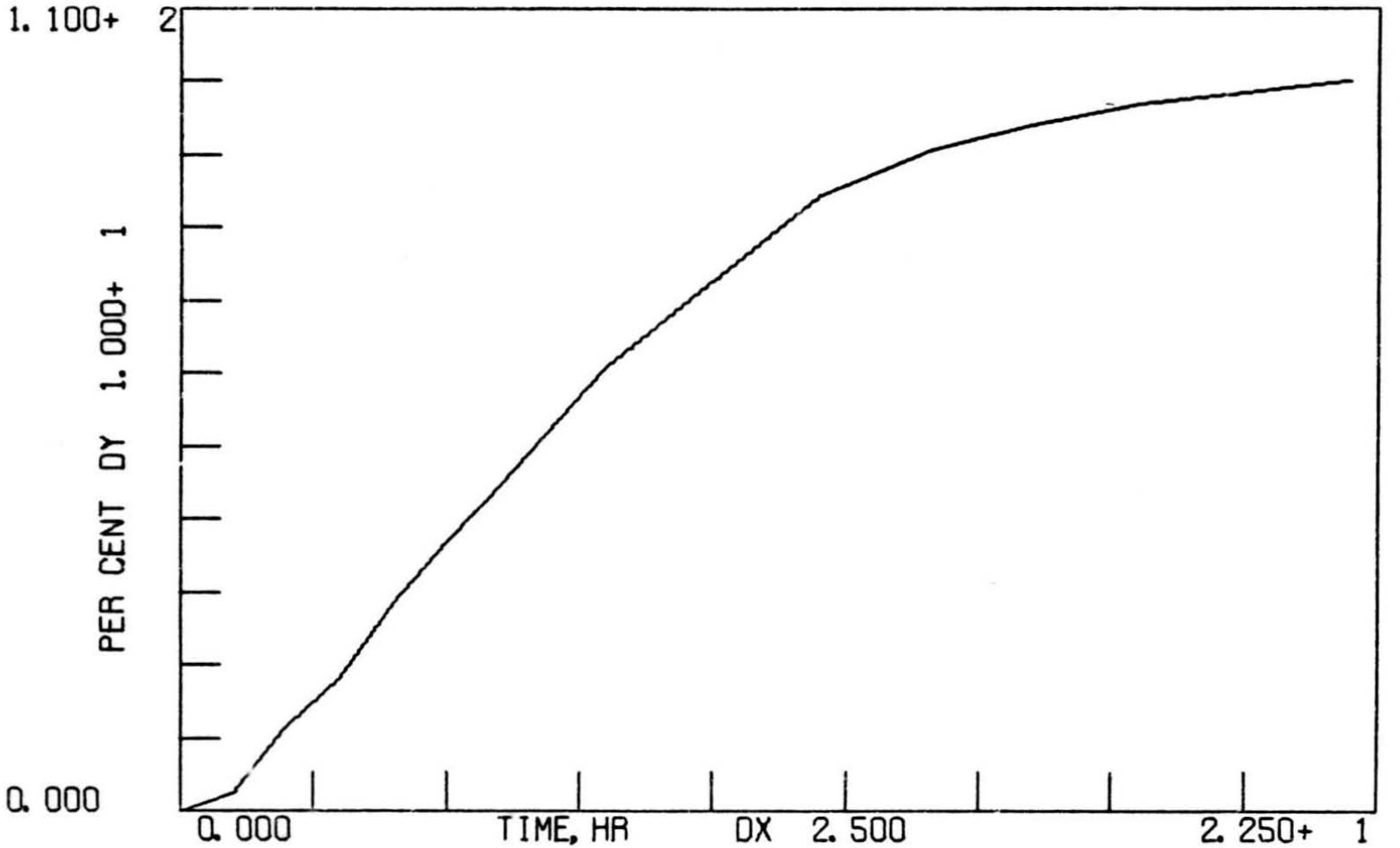
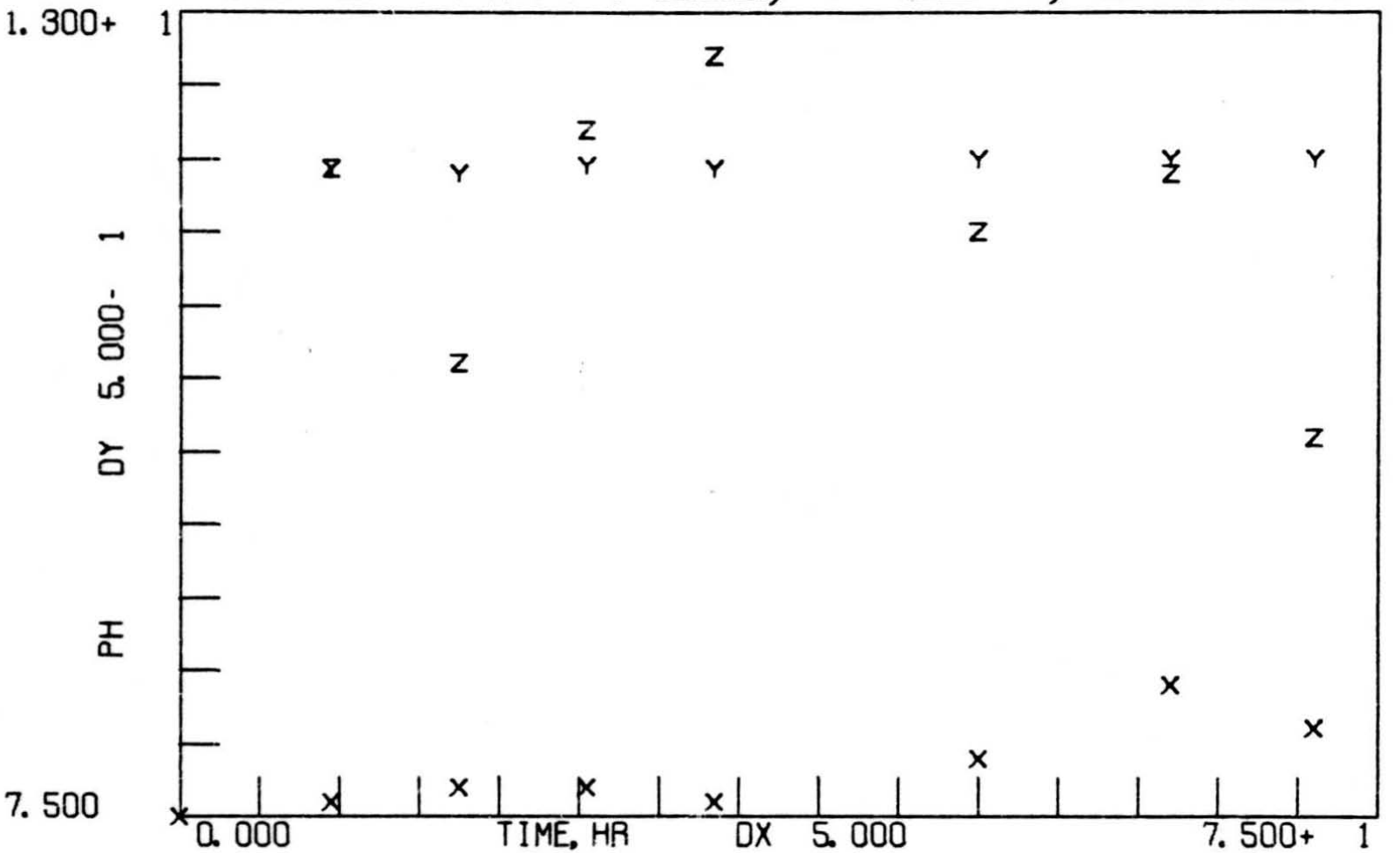


FIG 2 PH(X=FEED, Y=CLAR, Z=COL.)



PILOT PLANT CURVE PLOT DATA SHEET I

NAME E.C. MØNCRIEF COMPUTER REQUEST No. 3033 DATE 15 FEB 63

CONTROL CARDS

These cards are NOT numbered

	NAME, BUILDING NUMBER, ROOM, PLANT, etc.
*ID	E.C.MØNCRIEF,BLDG 3019,RM 104,X-10
*CHARGE (	3033)
*TIME (min) (	5)
*EXECUTE	
*ASSIGN (8, A6)	
*TAPE (8, PØØL, SAVE), (27, PØØL), (10, INPUT), (9, ØUTPUT),	
*TYPE (BINARY)	
*DATA	

DATA CARDS

Cards 1 through 4

PLOT TITLE (1–48)	CARD No. (80)
FIG 1 PER CENT CØMP R-2 DISSØ	1

Y LABEL (1–36)	
PER CENT	2

X LABEL (1–36)	
TIME,HR	3

PLOTTING PARAMETERS				
X MAX (1–10)	X MIN (11–20)	Y MAX (21–30)	Y MIN (31–40)	
0.E	0.E	0.E	0.E	4

PLOTTING PARAMETERS (cont'd)			
X LENGTH (41–50)	Y LENGTH (51–60)	POINT SIZE (61–70)	
7.5E 00	5.0E 00	0.E	4

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(3 2-63)

Fig. 3.

PILOT PLANT CURVE PLOT DATA SHEET 2

Cards No. 5 through end

X VALUE (1–10)	Y VALUE (11–20)	N (28–30)	CARD No. (78–80)
0.00E00	0.0E00	2	5
1.0E00	2.50E00	0	6
2.0E00	1.17E01	0	7
3.0E00	1.825E01	0	8
4.0E00	2.838E01	0	9
5.0E00	3.685E01	0	10
6.0E00	4.460E01	0	11
8.0E00	6.090E01	0	12
1.0E01	7.275E01	0	13
1.2E01	8.444E01	0	14
1.4E01	9.050E01	0	15
1.6E01	9.420E01	0	16
1.8E01	9.700E01	0	17
2.05E01	9.897E01	0	18
2.20E01	1.002E02	-1	19

No keypunch below this line

DATE	4-5-62	DESCRIPTION OF DATA
TIME	0930	PER CENT COMPLETION OF R-2 DISSOLUTION
RUN No.	R-2	
OPERATOR	ECM	
MISC.		

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(3 2-63)

Fig. 4.

PILOT PLANT CURVE PLOT DATA SHEET I

NAME E.C. MØNCRIEF COMPUTER REQUEST No. 3033 DATE 15 FEB 63

CONTROL CARDS

These cards are NOT numbered

NAME, BUILDING NUMBER, ROOM, PLANT, etc.

*ID	
*CHARGE ( )	
*TIME (min) ( )	
*EXECUTE	
*ASSIGN (8, A6)	
*TAPE (8, PØØL, SAVE), (27, PØØL), (10, INPUT), (9, ØUTPUT),	
*TYPE (BINARY)	
*DATA	

Ø MIT

DATA CARDS

Cards 1 through 4

PLOT TITLE (1–48)	CARD No. (80)
FIG 2 PH(X=FEED,Y=CLAR,Z=CØL.)	1

Y LABEL (1–36)	
PH	2

X LABEL (1–36)	
TIME, HR	3

PLOTTING PARAMETERS				
X MAX (1–10)	X MIN (11–20)	Y MAX (21–30)	Y MIN (31–40)	
0.E	0.E	0.E	0.E	4

PLOTTING PARAMETERS (cont'd)			
X LENGTH (41–50)	Y LENGTH (51–60)	POINT SIZE (61–70)	
7.5E00	5.0E00	0.E	4

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(3 2-63)

Fig. 5.

PILOT PLANT CURVE PLOT DATA SHEET 2

Cards No. 5 through end

X VALUE (1–10)	Y VALUE (11–20)	N (28–30)	CARD No. (78–80)
0.E00	7.5E00	2	5
9.5E00	7.6E00	0	6
1.75E01	7.7E00	0	7
2.55E01	7.7E00	0	8
3.35E01	7.6E00	0	9
5.00E01	7.9E00	0	10
6.20E01	8.4E00	0	11
7.10E01	8.1E00	4	12
9.5E00	1.193E01	0	13
1.75E01	1.190E01	0	14
2.55E01	1.195E01	0	15
3.35E01	1.193E01	0	16
5.00E01	1.20E01	0	17
6.20E01	1.20E01	0	18
7.10E01	1.20E01	15	19
9.5E00	1.193E01	0	20
1.75E01	1.06E01	0	21
2.55E01	1.22E01	0	22
3.35E01	1.27E01	0	23
5.00E01	1.15E01	0	24
6.20E01	1.19E01	0	25
7.10E01	1.01E01	-17	26

No keypunch below this line

DATE	12-26-61	DESCRIPTION OF DATA
TIME	1015	LLWPP PH VALUES
RUN No.	HR-5	
OPERATOR	ECM	
MISC.		

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(3 2-63)

Fig. 6.

Table 1. Input Limitations for CASPER Data Cards

Sheet	Card	Column	Remarks
1	1	1-48	Curve title limited to 48 characters for 9 x 12 plot, 30 characters for 5 x 7 1/2-in. plot; write o as Ø, i as I, zero as 0.
1	2	1-36	Same as for title except 36 characters for 9 x 12 plot and 8 characters for 5 x 7 1/2-in. plot.
1	3	1-36	Same as for title except 36 characters for 9 x 12 plot and 8 characters for 5 x 7 1/2-in. plot.
1	4	1-10	Enter maximum x-value or 0 (zero)(in which case x-max will be computed); decimal point is indicated; E means exponential; enter values as floating point numbers, i.e., 1.501E+02 for 150.1, and 6.97E-01 for 0.697.
1	4	11-20	Same limitations as x-max.
1	4	21-30	Same limitations as x-max.
1	4	31-40	Same limitations as x-max.
1	4	41-50	Enter 0 before decimal point for standard x-length (12-in.) or enter floating point value for desired reduced x-axis length.
1	4	51-60	Enter 0 before decimal point for standard Y-length (9-in.) or enter floating point value for reduced Y-axis length.
1	4	61-70	Enter 0 for standard size (0.05-in.) plotting symbol; enter 1 for reduced (0.03-in.) symbol size.
2	5	1-10	Enter first x-value (i.e., time) in floating point notation.
2	5	11-20	Enter first Y-value (i.e., temperature) in floating point notation.
2	5	30	The value of N determines the choice of graph grid: 0 for lined graph paper, 1 for blank graph paper with completed grid, 2 for blank graph paper with intervals indicated (see ORNL-3394 for examples).

Table 1. (continued)

Sheet	Card	Column	Remarks
2	6	1-10	Same as columns 1-10 card 5.
2	6	11-20	Same as columns 11-20 card 5.
2	6	28-30	Enter a 0 in column 30.
2	7--i	1-10, 11-20	Same as card 5 and 6.
2	7--i	28-30	Enter a 0 in column 30 for all data points of curve except the last. With last point of curve enter a 1, 4, 5, 15, 17, or 18 in column 30 (or 28-30 if necessary) for a line plot, or for a x, -, Y, Z, or + plotting symbol, respectively. If additional curves go on the same graph start subsequent cards with zeros and end last data card with desired plotting symbol number in columns 28-30. Enter a minus sign before the plotting symbol number if the curve being plotted is the last one for that graph. Fourteen other symbols are available for plotting but the ones listed above are standard typewriter symbols and as such could be put in the title or X-Y labels for legend purposes (see Fig. 2).
2	7···	80 or 79-80	Enter consecutive card No. (7 through maximum number required).

Table 2. Graph Paper Types Available for Calcomp 570 Plotting from Data Cards

Paper Type[a]	Description[b]
00	blank paper
02	ruled paper, 1/2-in. grid, 10 lines/grid
03	ruled paper, 3/8-in. grid, 10 lines/grid

[a]Enter paper type on Calcomp Work Request Card, Fig. 7b.

[b]Samples available at Curve Plotter.

3.2 Control Cards

Eight control cards (Fig. 3) must accompany the program deck and data (sheets or cards) to K-25 for plotting. Only the ID, CHARGE, and TIME cards require information. The CHARGE refers to an IBM charge number which can be obtained from Central Data Processing. The TIME is the estimated machine time required for the program.

The control cards may be reused for more than one job by writing "OMIT" across the control card part of data sheet 1 (see Fig. 5) and enclosing the cards when requesting computer service. The CASPER deck is inserted between the *TYPE (BINARY) and *DATA cards. Data cards for the points to be plotted are placed after the *DATA card in the assembled deck.

3.3 CASPER Deck

Persons desiring to initiate plots may obtain copies of the CASPER deck by contacting E. C. Moncrief, Building 3019.

3.4 Work Request Cards

Work request cards for keypunch, plotting, and computer services are shown in Fig. 7. The Request for Services card should accompany the data sheets for keypunching. The Calcomp Work Request card is sent to K-25 with the program deck. The 7090 Sequence card is also sent with the program deck. All entries in Fig. 7a must be as shown except name, date, and estimated run time. Entering "EXPRESS" (see Fig. 7a) on the card will expedite running the program at the IBM 7090 (the code will be run on a special monitor for short programs).

Work request cards are available at the Math Panel Office.

3.5 Curve Plotting Schedule

A schedule will be established in the Pilot Plant Section for submitting material for plotting. Persons desiring curve plotting service should complete the data sheets and return to E. C. Moncrief, Bldg. 3019. Data sheets are available on request.

REFERENCE

1. M. P. Lietzke and R. E. Smith, "CASPER: A Generalized Program for Plotting and Scaling Data," ORNL-3394, January 16, 1963.

7090 SEQUENCE CARD

☐ COMPATIBILITY	☒ ABSOLUTE TAPE ASSIGNMENT		DATE 15 FEB 63
NAME E. C. MØNCRIEF		REQUEST NO. 3033	SEQUENCE NO.
☐ COMPILE	☐ ASSEMBLE	☒ EXECUTE	RUN NO.
SIZE PAPER	NO. PARTS	RIGHT PERFORATION OR COLUMN	ESTIMATED RUN TIME 5 MIN

CHANNEL A

LOG NO.	REEL NO.	ASSIGN NO.	SAVED TAPE NO.	✓ SAVE	✓ LIST	✓ PNCH	✓ PLOT	DEN	COMMENTS
8	PØØL	.6		✓			✓	✓	CALCØMP PLØTS
27	SCRATCH	4							

EXPRESS

CHANNEL B

LOG NO.	REEL NO.	ASSIGN NO.	SAVED TAPE NO.	✓ SAVE	✓ LIST	✓ PNCH	✓ PLOT	DEN	COMMENTS

OPERATOR | STOP LOCATION | ☐ PULLED ON TIME

UCN-2687 (1 1-61)

(a)

CALCOMP WORK REQUEST

IN			OUT
	NAME E. C. MØNCRIEF	REQUEST NO. 3033	
	BUILDING NUMBER 3019 , X-10		
	REEL NUMBER	NUMBER PLOTS 2	
	INK COLOR	PAPER TYPE 00	
	REEL of		
	WORK DONE BY		

UCN-3652 (3 6-62)

(b)

REQUEST FOR SERVICES

IN			OUT
	NAME E. C. MØNCRIEF	REQUEST NUMBER 3033	
	BUILDING NUMBER 3019 , X-10	ROOM NUMBER 104	
	WORK TO BE DONE	DONE BY	COMMENTS
	☒ KEYPUNCH		
	☒ REPRODUCE		
	☐ SORT		
	☐ LIST		
	☐ OTHER		
	DEADLINE (IF URGENT) YESTERDAY		

UCN-1010 (3 10-62)

(c)

Fig. 7. Work Request Cards.