```
* * * * * * * * * *  K Y P I P E 2  * * * * * * * * * *
*   University of Kentucky Hydraulic Analysis Program   *
* Distribution of Pressure and Flows in Piping Networks *
*         1000 PIPE VERSION - 1.10   (08/25/92)         *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

DATE: 1/ 2/2001
TIME: 16:36:41

INPUT DATA FILENAME ---------- gk_ic1.DAT
TABULATED OUTPUT FILENAME -------- gk_ic1.OUT
POSTPROCESSOR RESULTS FILENAME --- gk_ic1.RES

****
SUMMARY OF ORIGINAL DATA
****

U N I T S S P E C I F I E D

FLOWRATE ..... = liters/second
HEAD (HGL) ..... = meters
PRESSURE ..... = kpa

P I P E L I N E D A T A

STATUS CODE: XX -CLOSED PIPE FG -FIXED GRADE NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE

PIPE NUMBER	NODE NOS. #1	#2	LENGTH (m)	DIAMETER (cm)	ROUGHNESS COEFF.	MINOR LOSS COEFF.	FGN-HGL (m)
1-FG	0	1	5.0	50.0	110.00	2.00	9.28
2-PU	1	2	15.0	50.0	110.00	.00	
3	2	3	5.0	50.0	110.00	4.00	
4	3	4	3.0	50.0	110.00	.00	
5	4	5	31.0	60.0	110.00	.00	
7	5	6	325.0	80.0	110.00	.00	
9	6	7	2175.0	80.0	110.00	.00	
10	7	8	965.0	50.0	110.00	.00	
11	8	9	800.0	50.0	110.00	.00	
13	9	10	3.0	50.0	110.00	.00	
14	10	11	50.0	50.0	110.00	.00	
15	11	12	3.0	50.0	110.00	16.00	
16-FG	12	0	3.0	50.0	110.00	.00	26.25
17	7	13	900.0	60.0	110.00	.00	
19	13	14	791.0	60.0	110.00	.00	
20	14	15	4460.0	60.0	110.00	.00	
21	15	16	3.0	60.0	110.00	.00	
22	16	17	50.0	60.0	110.00	.00	
23	17	18	3.0	60.0	110.00	.00	
24-FG	18	0	3.0	60.0	110.00	.00	25.20

P U M P D A T A

THERE IS A PUMP IN LINE 2 DESCRIBED BY THE FOLLOWING DATA:

HEAD (m)	FLOWRATE (l/s)
61.00	.00
45.71	700.00
41.00	800.00

J U N C T I O N N O D E D A T A

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (l/s)	JUNCTION ELEVATION (m)	CONNECTING PIPES		
1		.00	8.55	1	2	
2		.00	8.55	2	3	
3		.00	8.55	3	4	
4		.00	8.55	4	5	
5		.00	8.55	5	7	
6		.00	21.48	7	9	
7		.00	12.83	9	10	17
8		.00	1.97	10	11	
9		.00	21.73	11	13	
10		.00	21.73	13	14	
11		.00	21.73	14	15	
12		.00	21.73	15	16	
13		.00	17.60	17	19	
14		.00	.57	19	20	
15		.00	18.63	20	21	
16		.00	18.63	21	22	
17		.00	18.63	22	23	
18		.00	18.63	23	24	

O U T P U T O P T I O N D A T A

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT

S Y S T E M C O N F I G U R A T I O N

NUMBER OF PIPES .....(p) = 20
NUMBER OF JUNCTION NODES .....(j) = 18
NUMBER OF PRIMARY LOOPS .....(l) = 0
NUMBER OF FIXED GRADE NODES .....(f) = 3
NUMBER OF SUPPLY ZONES .....(z) = 1

****
S I M U L A T I O N R E S U L T S
****

THE RESULTS ARE OBTAINED AFTER 4 TRIALS WITH AN ACCURACY = .00120

P I P E L I N E R E S U L T S

STATUS CODE: XX -CLOSED PIPE FG -FIXED GRADE NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (l/s)	HEAD LOSS (m)	PUMP HEAD (m)	MINOR LOSS (m)	LINE VELO. (m/s)	HL/ 1000 (m/m)
1-FG	0	1	700.28	.13	.00	1.30	3.57	26.78
2-PU	1	2	700.28	.40	45.70	.00	3.57	26.78
3	2	3	700.28	.13	.00	2.59	3.57	26.78
4	3	4	700.28	.08	.00	.00	3.57	26.78
5	4	5	700.28	.34	.00	.00	2.48	11.02
7	5	6	700.28	.88	.00	.00	1.39	2.71
9	6	7	700.28	5.90	.00	.00	1.39	2.71

10	7	8	359.69	7.52	.00	.00	1.83	7.80
11	8	9	359.69	6.24	.00	.00	1.83	7.80
13	9	10	359.69	.02	.00	.00	1.83	7.80
14	10	11	359.69	.39	.00	.00	1.83	7.80
15	11	12	359.69	.02	.00	2.74	1.83	7.80
16-FG	12	0	359.69	.02	.00	.00	1.83	7.80
17	7	13	340.58	2.61	.00	.00	1.20	2.90
19	13	14	340.58	2.29	.00	.00	1.20	2.90
20	14	15	340.58	12.93	.00	.00	1.20	2.90
21	15	16	340.58	.01	.00	.00	1.20	2.90
22	16	17	340.58	.15	.00	.00	1.20	2.90
23	17	18	340.58	.01	.00	.00	1.20	2.90
24-FG	18	0	340.58	.01	.00	.00	1.20	2.90

J U N C T I O N N O D E R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (l/s)	HYDRAULIC GRADE (m)	JUNCTION ELEVATION (m)	PRESSURE HEAD (m)	JUNCTION PRESSURE (kpa)
1		.00	7.85	8.55	-.70	-6.87
2		.00	53.15	8.55	44.60	437.33
3		.00	50.42	8.55	41.87	410.58
4		.00	50.34	8.55	41.79	409.79
5		.00	50.00	8.55	41.45	406.44
6		.00	49.11	21.48	27.63	270.99
7		.00	43.21	12.83	30.38	297.92
8		.00	35.68	1.97	33.71	330.63
9		.00	29.45	21.73	7.72	75.68
10		.00	29.42	21.73	7.69	75.45
11		.00	29.03	21.73	7.30	71.63
12		.00	26.27	21.73	4.54	44.56
13		.00	40.60	17.60	23.00	225.54
14		.00	38.31	.57	37.74	370.06
15		.00	25.37	18.63	6.74	66.11
16		.00	25.36	18.63	6.73	66.02
17		.00	25.22	18.63	6.59	64.60
18		.00	25.21	18.63	6.58	64.52

S U M M A R Y O F I N F L O W S A N D O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (l/s)
1	700.28
16	-359.69
24	-340.58

NET SYSTEM INFLOW = 700.28
NET SYSTEM OUTFLOW = -700.28
NET SYSTEM DEMAND = .00

**** KYPIPE SIMULATION COMPLETED ****.

DATE: 1/ 2/2001
TIME: 16:36:41

***** SIC PROGRAM: STEADY STATE - SURGE INITIAL CONDITIONS *****
Version 1.32, Nov. 1991

DATE = 01-03-2001

INPUT DATA FILE NAME FOR THIS SIMULATION = gk_ic1.SIC
OUTPUT DATA FILE NAME FOR THIS SIMULATION = gk_ic1.TIC

NUMBER OF PIPES = 20
NUMBER OF JUNCTION NODES = 18
FLOW UNITS = CUBIC METERS / SECONDS
PRESSURE UNITS = KPA
THE HAZEN WILLIAMS HEAD LOSS RELATION IS USED FOR THIS SIMULATION

**** SUMMARY OF INPUT DATA ***

PIPE NO.	NODE #1	NODE #2	LENGTH (MT.)	DIAM. (MM.)	PIPE RES.	SUM-M FACT.	PUMP TYPE	FGN GRADE
1	0	1	5.0	500.0	110.0	2.0	0.0	9.3
2	1	2	0.0	0.0	0.0	0.0	1.0	
3	2	3	5.0	500.0	110.0	4.0	0.0	
4	3	4	0.0	0.0	0.0	0.3	0.0	
5	4	5	31.0	600.0	110.0	0.0	0.0	
7	5	6	325.0	800.0	110.0	0.0	0.0	
9	6	7	2175.0	800.0	110.0	0.0	0.0	
10	7	8	965.0	800.0	110.0	0.0	0.0	
11	8	9	800.0	500.0	110.0	0.0	0.0	
13	9	10	3.0	500.0	110.0	0.0	0.0	
14	10	11	50.0	500.0	110.0	0.0	0.0	
15	11	12	3.0	500.0	110.0	16.0	0.0	
16	12	0	3.0	500.0	110.0	0.0	0.0	26.3
17	7	13	900.0	600.0	110.0	0.0	0.0	
19	13	14	791.0	600.0	110.0	0.0	0.0	
20	14	15	4460.0	600.0	110.0	0.0	0.0	
21	15	16	3.0	600.0	110.0	0.0	0.0	
22	16	17	50.0	500.0	110.0	0.0	0.0	
23	17	18	3.0	600.0	110.0	0.0	0.0	
24	18	0	3.0	600.0	110.0	0.0	0.0	25.2

FUNCTION OF ZERO LENGTH LINE SET UP:
LINE NO. 2 IS A COMPONENT BETWEEN TWO LINE SEGMENTS
LINE NO. 4 IS A COMPONENT BETWEEN TWO LINE SEGMENTS

*** DATA FOR PUMPS FOR THIS SYSTEM ***

PUMP TYPE # 1 IS DESCRIBED BY THE FOLLOWING DATA:

HEAD	DISCHARGE
61	0
45.71	.7
41	.8

THE FOLLOWING COEFFICIENTS ARE CALCULATED FOR THE PUMP CHARACTERISTIC:
A = 61
B = .257
C = -31.571

JUNCT. NO.	DEMAND	ELEVATION
1	0.0	8.6
2	0.0	8.6
3	0.0	8.6
4	0.0	8.6
5	0.0	8.6
6	0.0	21.5
7	0.0	12.8
8	0.0	2.0
9	0.0	21.7
10	0.0	21.7

11	0.0	21.7
12	0.0	21.7
13	0.0	17.6
14	0.0	0.6
15	0.0	18.6
16	0.0	18.6
17	0.0	18.6
18	0.0	18.6

**** THE RESULTS FOR THE STEADY STATE SIMULATION FOLLOW ****

NO. OF TRIALS = 8 - ACCURACY ATTAINED = 0

PIPE NO.	NODE #1	NODE #2	FLOW RATE	HEAD LOSS	MINOR LOSS	PUMP HEAD	LINE VELOCITY	HL 1000
1	0	1	0.74	0.15	1.45	0.00	3.77	29.65
2	1	2	0.74	0.00	0.00	43.91	0.00	0.00
3	2	3	0.74	0.15	2.90	0.00	3.77	29.65
4	3	4	0.74	0.00	0.14	0.00	0.00	0.00
5	4	5	0.74	0.38	0.00	0.00	2.62	12.20
7	5	6	0.74	0.98	0.00	0.00	1.47	3.01
9	6	7	0.74	6.54	0.00	0.00	1.47	3.01
10	7	8	0.43	1.06	0.00	0.00	0.85	1.10
11	8	9	0.43	8.67	0.00	0.00	2.19	10.83
13	9	10	0.43	0.03	0.00	0.00	2.19	10.83
14	10	11	0.43	0.54	0.00	0.00	2.19	10.83
15	11	12	0.43	0.03	3.91	0.00	2.19	10.83
16	12	0	0.43	0.03	0.00	0.00	2.19	10.83
17	7	13	0.31	2.20	0.00	0.00	1.10	2.44
19	13	14	0.31	1.93	0.00	0.00	1.10	2.44
20	14	15	0.31	10.88	0.00	0.00	1.10	2.44
21	15	16	0.31	0.01	0.00	0.00	1.10	2.44
22	16	17	0.31	0.30	0.00	0.00	1.58	5.93
23	17	18	0.31	0.01	0.00	0.00	1.10	2.44
24	18	0	0.31	0.01	0.00	0.00	1.10	2.44

JUNCTION NO.	ELEVATION (MT.)	DEMAND	PRESSURE (KPA)	PRESSURE HEAD	HYDRAULIC GRADE	DEMAND RESISTANCE
1	8.6	0.0	-8.5	-0.9	7.7	
2	8.6	0.0	422.1	43.0	51.6	
3	8.6	0.0	392.3	40.0	48.6	
4	8.6	0.0	390.9	39.9	48.4	
5	8.6	0.0	387.2	39.5	48.0	
6	21.5	0.0	250.9	25.6	47.1	
7	12.8	0.0	271.6	27.7	40.5	
8	2.0	0.0	367.7	37.5	39.5	
9	21.7	0.0	88.9	9.1	30.8	
10	21.7	0.0	88.6	9.0	30.8	
11	21.7	0.0	83.3	8.5	30.2	
12	21.7	0.0	44.6	4.6	26.3	
13	17.6	0.0	203.3	20.7	38.3	
14	0.6	0.0	351.4	35.8	36.4	
15	18.6	0.0	67.6	6.9	25.5	
16	18.6	0.0	67.5	6.9	25.5	
17	18.6	0.0	64.6	6.6	25.2	
18	18.6	0.0	64.5	6.6	25.2	

THE NET SYSTEM DEMAND = 0
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

PIPE NO.	FLOW
1	0.74
16	-0.43
24	-0.31

***** DATA FOR CARRYING OUT A SURGE ANALYSIS FOLLOWS:

THE TIME INCREMENT SELECTED FOR SURGE ANALYSIS = .0085 SEC.

*** TABLE OF ASSIGNED POSITIONS, LENGTHS AND INITIAL CONDITIONS FOR SURGE4 ***

SECTION NUMBER	ORIGINAL NODES		ASSIGNED NODES		ORIGINAL LENGTH	ASSIGNED LENGTH	WAVE SPEED	INITIAL CONDITIONS Q	H1	H2
1	0	1	19	1	5	10	1177	0.74	0.73	-0.87
2	1	2	1	2	0	0	1177	0.74	-0.87	43.04
3	2	3	2	3	5	10	1177	0.74	43.04	40.00
4	3	4	3	4	0	0	1177	0.74	40.00	39.86
5	4	5	4	5	31	30	1177	0.74	39.86	39.49
6	5	6	20	6	325	320	1177	0.74	39.49	25.58
7	6	7	21	7	2175	2171	1177	0.74	25.58	27.69
8	7	8	22	8	965	960	1177	0.43	27.69	37.49
9	8	9	23	9	800	800	1177	0.43	37.49	9.06
10	9	10	24	10	3	10	1177	0.43	9.06	9.03
11	10	11	25	11	50	50	1177	0.43	9.03	8.49
12	11	12	26	12	3	10	1177	0.43	8.49	4.55
13	12	0	27	28	3	10	1177	0.43	4.55	4.52
14	7	13	29	13	900	900	1177	0.31	27.69	20.73
15	13	14	30	14	791	790	1177	0.31	20.73	35.83
16	14	15	31	15	4460	4462	1177	0.31	35.83	6.89
17	15	16	32	16	3	10	1177	0.31	6.89	6.88
18	16	17	33	17	50	50	1177	0.31	6.88	6.58
19	17	18	34	18	3	10	1177	0.31	6.58	6.58
20	18	0	35	36	3	10	1177	0.31	6.58	6.57

NOTES:

1. Head computations at FGN'S use elevation of other end of pipe section
2. Pipe section resistances are based on initial conditions (Q <> 0)
3. Resistances for zero flow sections based on velocity (4 ft/s or 1 m/s)
4. The use of the Hazen Williams head loss relation results in values

***** THE INITIAL CONDITION DATA FILE FOR SURGE4 IS NOW BEING GENERATED *****

1. SYSTEM DATA:

Number of line segments = -18
Number of components = 2
Number of junctions = 17
Number of SDO's = 0
Time increment = .0085

NOTE: USERS MUST PROVIDE THE ADDITIONAL SYSTEM DATA

2. *LINE SEGMENT DATA:*

FIRST POSITION	SECOND POSITION	NO. OF TIME INCREMENTS	C/GA	INITIAL FLOW	SEGMENT RESISTANCE
19	1	1	611.2385	0.7398	2.9156
2	3	1	611.2385	0.7398	5.5604
4	5	3	424.4712	0.7398	0.6910
20	6	32	238.7651	0.7398	1.7845
21	7	217	238.7651	0.7398	11.9426
22	8	96	238.7651	0.4296	5.7425
23	9	80	611.2385	0.4296	46.9600
24	10	1	611.2385	0.4296	0.1761
25	11	5	611.2385	0.4296	2.9350
26	12	1	611.2385	0.4296	21.3345
27	28	1	611.2385	0.4296	0.1761
29	13	90	424.4712	0.3102	22.8139
30	14	79	424.4712	0.3102	20.0509

31	15	446	424.4712	0.3102	113.0557
32	16	1	424.4712	0.3102	0.0760
33	17	5	611.2385	0.3102	3.0799
34	18	1	424.4712	0.3102	0.0760
35	36	1	424.4712	0.3102	0.0760

The total number of wave travel increments = 1061

3. COMPONENT DATA:

1st	2nd	characteristics			Heads	
POS.	POS.	A	B	C	H1	H2
1.0	2	61.000	0.257	-31.571	-0.866	43.044
3.0	4	0.000	0.000	-0.250	40.001	39.864

5. JUNCTION DATA:

POS. NO. 1st PIPE	NO. OF LEGS	INITIAL HEAD	ADDITIONAL POS. NO's	
5	-2	39.49	20	
6	-2	25.58	21	
7	-3	27.69	22	29
8	-2	37.49	23	
9	-2	9.06	24	
10	-2	9.03	25	
11	-2	8.49	26	
12	-2	4.55	27	
13	-2	20.73	30	
14	-2	35.83	31	
15	-2	6.89	32	
16	-2	6.88	33	
17	-2	6.58	34	
18	-2	6.58	35	
19	0	0.73		
28	0	4.52		
36	0	6.57		

NOTE: HEAD values noted above at reservoirs connections may be incorrect
- elevations of reservoir connections are undefined in the SIC data.

6. SDO DATA - NO SDO'S WERE SET UP IN THE SIC DATA FILE

8. CHECK VALVE DATA
ALL Check Valve data must be provided by the User - with SURGEDAT

NOTE: Users must provide the following data using SURGEDAT

9a. VARIABLE INPUT DATA
9b. time - ratio data
10. TABULATED OUTPUT DATA
11. PLOTTED OUTPUT DATA
12. SCREEN PLOT DATA

>>>> THE INITIAL CONDITION FILE FOR SURGEDAT (gk_ic1.ICF) IS NOW GENERATED *****

```
      ************** - SURGE PROGRAM - VERSION 4.4 - *************
   COPYRIGHTED BY DON J. WOOD, JAMES E. FUNK - LEXINGTON, KENTUCKY, 1991

DATE =     -    TIME = 08:07:52

INPUT DATA FILE NAME = gk_ic1.DAT
OUTPUT DATA FILE NAME = gk_ic1.OUT

TOTAL SIMULATION TIME = 100                TIME INCREMENT = .01

SI UNITS ARE SPECIFIED:   FLOW = CMS  -  HEAD = M.

**** SUMMARY OF PIPE SYSTEM DATA ****

    NUMBERS OF SPECIFIC ELEMENTS

LINE SEGMENTS = 18      COMPONENTS = 2
JUNCTIONS = 17          BYPASS LINES = 0
SIDE ORIFICES = 0      RELIEF VALVES = 0
CHECK VALVES = 1       VARIABLE INPUTS= 1

                LINE SEGMENT DATA

POSITION     TRAVEL       C/GA      INITIAL     SEGMENT
OF ENDS    INCREMENTS              FLOWRATE    RESISTANCE
 19    1        1         611.24       0.74        2.92
  2    3        1         611.24       0.74        5.56
  4    5        3         424.47       0.74        0.69
 20    6       32         238.77       0.74        1.78
 21    7      217         238.77       0.74       11.94
 22    8       96         238.77       0.43        5.74
 23    9       80         611.24       0.43       46.96
 24   10        1         611.24       0.43        0.18
 25   11        5         611.24       0.43        2.93
 26   12        1         611.24       0.43       21.33
 27   28        1         611.24       0.43        0.18
 29   13       90         424.47       0.31       22.81
 30   14       79         424.47       0.31       20.05
 31   15      446         424.47       0.31      113.06
 32   16        1         424.47       0.31        0.08
 33   17        5         611.24       0.31        3.08
 34   18        1         424.47       0.31        0.08
 35   36        1         424.47       0.31        0.08

                COMPONENT DATA

POSITION NUMBERS = 1  2
      A =  61   B =  .257  C = -31.571
INITIAL FLOWRATE = .74     INITIAL HEADS =-.9 - 43

POSITION NUMBERS = 3  4
      A =  0   B =  0  C = -.25
INITIAL FLOWRATE = .74     INITIAL HEADS = 40 - 39.8

                JUNCTION DATA

 JUNCTION      NUMBER      INITIAL      CONNECTING
 LOCATION      OF LEGS      HEAD         POSITIONS
     5           2          39.5       20
     6           2          25.6       21
     7           3          27.7       22     29
     8           2          37.5       23
     9           2           9.1       24
    10           2           9.0       25
    11           2           8.5       26
    12           2           4.6       27
    13           2          20.7       30
    14           2          35.8       31
    15           2           6.9       32
```

16	2	6.9	33
17	2	6.6	34
18	2	6.6	35
19	0	0.7	
28	0	4.5	
36	0	6.6	

CHECK VALVE DATA

THERE IS A CHECK VALVE AT POSITION 3
TIME DELAY FOR VALVE = .1 - CV RESISTANCE = .25
NOTE: THIS CHECK VALVE WILL NOT REOPEN ONCE CLOSURE OCCURS
THE INITIAL HEAD LOSS DUE TO THE CHECK VALVE RESISTANCE = .14

NOTE: CHECK VALVE RESISTANCES MUST BE INCLUDED WITH THE COMPONENT DATA

VARIABLE INPUT DATA

INPUT # 1 - PUMP START UP OR SHUT DOWN IS SPECIFIED AT POSITION NO. 1
REFERENCE VALUES FOR PUMP COEFFICIENTS (N/NR (R) =1):
A = 61 B = .257 C = -31.571

TIME - RATIO INPUT DATA

TIME	RATIO
1	1
2	0

THE FOLLOWING INITIAL VALUE IS CALCULATED FOR THIS VARIABLE INPUT:
... These should agree with initial values previously input (in parenthesis)
THE INITIAL VALUES FOR PUMP COEFF. - A = 61 (61) B = .257 (.257)

**** SUMMARY OF INITIAL CONDITIONS FOR LINE SEGMENTS ****

END POSITION DESIGNATIONS: J - JUNCTION, C - COMPONENT, S - SDO
* - THIS DENOTES AN UNDESIGNATED END POSITION (UNACCEPTABLE) - CORRECT DATA

END POSITIONS #1	END POSITIONS #2	FLOW 1 to 2	HEAD #1	HEAD #2	HEAD LOSS	ELEVATION DIFFERENCE
19 J	1 C	0.74	0.7	-0.9	1.6	0.0
2 C	3 C	0.74	43.0	40.0	3.0	-0.0
4 C	5 J	0.74	39.9	39.5	0.4	0.0
20 J	6 J	0.74	39.5	25.6	1.0	12.9
21 J	7 J	0.74	25.6	27.7	6.5	-8.7
22 J	8 J	0.43	27.7	37.5	1.1	-10.9
23 J	9 J	0.43	37.5	9.1	8.7	19.8
24 J	10 J	0.43	9.1	9.0	0.0	-0.0
25 J	11 J	0.43	9.0	8.5	0.5	0.0
26 J	12 J	0.43	8.5	4.6	3.9	-0.0
27 J	28 J	0.43	4.6	4.5	0.0	0.0
29 J	13 J	0.31	27.7	20.7	2.2	4.8
30 J	14 J	0.31	20.7	35.8	1.9	-17.0
31 J	15 J	0.31	35.8	6.9	10.9	18.1
32 J	16 J	0.31	6.9	6.9	0.0	0.0
33 J	17 J	0.31	6.9	6.6	0.3	-0.0
34 J	18 J	0.31	6.6	6.6	0.0	0.0
35 J	36 J	0.31	6.6	6.6	0.0	0.0

****** FLOWRATE AND PRESSURE RESULTS ******

TIME	H- 4	Q- 4
0.200	39.9	0.740
0.400	39.9	0.740
0.600	39.9	0.740
0.800	39.9	0.740
1.000	39.9	0.740
1.200	24.8	0.689
1.400	10.4	0.627
1.600	-0.5	0.579
1.800	-7.5	0.548
2.000	-10.1	0.534
2.200	-10.1	0.531
2.400	0.5	0.506
2.600	-5.4	0.453
2.800	-6.8	0.437
3.000	-4.0	0.431
3.200	-7.8	0.408
3.400	-3.6	0.377
3.600	-3.7	0.365
3.800	-10.1	0.351
4.000	-4.8	0.343
4.200	-1.4	0.322
4.400	-1.8	0.305
4.600	0.1	0.279
4.800	0.9	0.301
5.000	-2.5	0.278
5.200	-9.1	0.269
5.400	2.6	0.239
5.600	15.6	0.285
5.800	-3.2	0.240
6.000	1.7	0.217
6.200	12.6	0.207
6.400	-10.1	0.295
6.600	-10.1	0.215
6.800	10.1	0.187
7.000	-4.3	0.199
7.200	-10.1	0.155
7.400	20.1	0.192
7.600	-10.1	0.124
7.800	-10.1	0.080
8.000	-10.1	0.231
8.200	-10.1	0.181
8.400	10.7	0.113
8.600	-10.1	0.180
8.800	-10.1	0.150
9.000	-10.1	0.239
9.200	18.7	0.022
9.400	-10.1	0.023
9.600	-10.1	0.217
9.800	44.6	0.122
10.000	46.5	0.125
10.200	16.7	0.064
10.400	-10.1	0.042
10.600	10.9	0.104
10.800	-10.1	0.241
11.000	6.1	0.032
11.200	32.7	0.138
11.400	-10.1	0.101
CV CLOSURE OCCURS AT POSITION # 3		
11.600	-9.6	-0.122
11.800	-10.1	0.032
12.000	-10.1	-0.074
12.200	-10.1	-0.013
12.400	-7.9	0.000
12.600	-10.1	0.074
12.800	-5.6	0.000
13.000	-10.1	0.216
13.200	106.0	0.000

13.400	-10.1	-0.023
13.600	-10.1	-0.102
13.800	-10.1	0.082
14.000	-10.1	0.016
14.200	-10.1	-0.092
14.400	-8.6	0.000
14.600	-10.1	0.041
14.800	-10.1	-0.075
15.000	6.6	0.000
15.200	-10.1	-0.144
15.400	-10.1	-0.235
15.600	-10.1	-0.234
15.800	-10.1	-0.004
16.000	-10.1	0.031
16.200	-10.1	0.130
16.400	-10.1	-0.020
16.600	21.9	0.000
16.800	7.9	0.000
17.000	-3.9	-0.034
17.200	-10.1	0.040
17.400	-10.1	0.115
17.600	-10.1	0.008
17.800	-10.1	0.016
18.000	-10.1	-0.170
18.200	52.7	0.000
18.400	-10.1	-0.012
18.600	21.1	0.000
18.800	-4.7	0.000
19.000	-10.1	-0.070
19.200	-10.1	0.052
19.400	-10.1	-0.029
19.600	40.0	0.000
19.800	-10.1	-0.104
20.000	-10.1	0.045
20.200	35.3	0.000
20.400	-10.1	0.115
20.600	38.4	0.000
20.800	37.7	0.000
21.000	-10.1	0.171
21.200	47.4	0.000
21.400	-10.1	-0.082
21.600	-10.1	-0.139
21.800	21.0	0.000
22.000	-10.1	-0.064
22.200	18.7	0.000
22.400	66.1	0.000
22.600	-10.1	-0.147
22.800	7.4	-0.096
23.000	-10.1	-0.097
23.200	-10.1	-0.154
23.400	-10.1	0.088
23.600	-10.1	-0.101
23.800	63.5	0.000
24.000	-10.1	0.046
24.200	-10.1	0.041
24.400	51.7	0.000
24.600	-10.1	-0.176
24.800	-10.1	-0.034
25.000	-10.1	-0.109
25.200	-10.1	-0.034
25.400	-10.1	-0.069
25.600	-4.4	0.000
25.800	-10.1	-0.023
26.000	-10.1	0.118
26.201	-10.1	-0.057
26.401	-10.1	-0.084
26.601	-10.1	0.017
26.801	-10.1	-0.161
27.001	-10.1	-0.188

27.201	33.7	0.000
27.401	90.5	0.000
27.601	-10.1	-0.061
27.801	-10.1	0.011
28.001	-10.1	0.000
28.201	-10.1	0.050
28.401	-10.1	-0.091
28.601	70.5	0.000
28.801	-10.1	-0.089
29.001	33.8	0.000
29.201	-10.1	0.018
29.401	-10.1	0.016
29.601	-10.1	0.046
29.801	-10.1	-0.115
30.001	-10.1	0.025
30.201	-10.1	0.111
30.401	-10.1	0.078
30.601	21.2	0.000
30.801	-10.1	-0.141
31.001	-10.1	0.050
31.201	-10.1	-0.139
31.401	-10.1	0.007
31.601	-10.1	-0.132
31.801	-10.1	-0.058
32.001	-10.1	0.107
32.201	71.5	0.000
32.401	-10.1	0.097
32.601	-10.1	-0.076
32.801	-10.1	-0.074
33.000	-10.1	-0.144
33.200	55.3	0.000
33.400	-10.1	-0.009
33.600	-1.3	-0.049
33.800	-10.1	-0.025
34.000	-10.1	-0.093
34.200	-10.1	-0.097
34.400	-10.1	0.010
34.600	8.4	0.000
34.800	71.1	0.000
35.000	11.5	0.000
35.200	-10.1	0.073
35.400	-10.1	0.011
35.600	-10.1	-0.019
35.800	-10.1	-0.168
36.000	-10.1	-0.098
36.200	-10.1	-0.021
36.400	-10.1	0.042
36.600	-10.1	0.080
36.800	-10.1	0.043
37.000	-10.1	0.001
37.200	-10.1	-0.025
37.400	-10.1	0.054
37.600	-10.1	0.037
37.800	-10.1	-0.070
38.000	-10.1	0.012
38.200	22.7	0.000
38.400	-10.1	0.201
38.600	-10.1	-0.075
38.799	27.2	0.000
38.999	-10.1	0.001
39.199	17.8	0.000
39.399	-5.2	-0.027
39.599	-10.1	0.020
39.799	-10.1	0.049
39.999	-10.1	0.012
40.199	-10.1	0.029
40.399	-10.1	0.070
40.599	57.4	0.000
40.799	-10.1	0.064

40.999	44.2	0.000
41.199	-10.1	-0.095
41.399	60.2	0.000
41.599	-10.1	-0.033
41.799	-10.1	0.003
41.999	-10.1	0.055
42.199	-10.1	0.226
42.399	19.2	0.000
42.599	-10.1	0.027
42.799	70.4	0.000
42.999	60.9	0.000
43.199	-10.1	-0.193
43.399	-10.1	-0.237
43.599	-10.1	0.128
43.799	-10.1	-0.193
43.999	26.7	0.000
44.199	-10.1	-0.010
44.399	25.4	0.000
44.599	8.2	0.000
44.798	-10.1	0.157
44.998	-10.1	0.012
45.198	-10.1	0.028
45.398	-3.9	0.000
45.598	50.9	0.000
45.798	5.6	0.000
45.998	-10.1	0.099
46.198	-10.1	0.190
46.398	-10.1	0.160
46.598	37.2	0.000
46.798	-10.1	0.095
46.998	1.0	0.000
47.198	-10.1	-0.009
47.398	-10.1	0.007
47.598	-10.1	0.021
47.798	-10.1	0.030
47.998	6.6	-0.092
48.198	-8.0	0.000
48.398	24.5	0.000
48.598	-10.1	-0.248
48.798	-10.1	0.133
48.998	-10.1	-0.074
49.198	30.6	0.000
49.398	-10.1	-0.038
49.598	40.6	0.000
49.798	-10.1	0.119
49.998	-10.1	0.172
50.198	-7.7	0.000
50.398	-10.1	-0.107
50.598	-10.1	0.062
50.797	-10.1	0.022
50.997	-10.1	0.005
51.197	-10.1	0.070
51.397	-10.1	-0.082
51.597	61.2	0.000
51.797	-10.1	-0.049
51.997	86.1	0.000
52.197	-10.1	0.143
52.397	-10.1	0.027
52.597	-10.1	0.069
52.797	-10.1	-0.168
52.997	-10.1	0.027
53.197	100.7	0.000
53.397	-10.1	-0.024
53.597	-10.1	-0.078
53.797	-10.1	0.035
53.997	-10.1	0.070
54.197	-10.1	0.026
54.397	-10.1	0.113
54.597	-10.1	0.145

54.797	-10.1	0.047
54.997	-10.1	-0.045
55.197	9.3	0.000
55.397	15.8	0.000
55.597	46.0	0.000
55.797	-10.1	-0.046
55.997	-10.1	0.016
56.197	-10.1	0.071
56.397	-10.1	0.066
56.597	-10.1	-0.078
56.796	-10.1	-0.045
56.996	18.4	0.000
57.196	47.4	0.000
57.396	-10.1	-0.048
57.596	-10.1	0.179
57.796	-10.1	0.050
57.996	-10.1	-0.078
58.196	-10.1	-0.188
58.396	-10.1	0.111
58.596	83.0	0.000
58.796	-10.1	-0.098
58.996	-10.1	-0.057
59.196	-10.1	0.005
59.396	0.6	0.000
59.596	-10.1	0.001
59.796	-10.1	0.051
59.996	35.9	0.000
60.196	-10.1	0.115
60.396	-10.1	-0.093
60.596	35.7	0.000
60.796	-10.1	-0.114
60.996	22.6	0.000
61.196	-10.1	-0.065
61.396	50.1	0.000
61.596	-10.1	-0.037
61.796	-10.1	0.001
61.996	-10.1	0.027
62.196	-10.1	-0.214
62.396	-10.1	-0.082
62.596	-10.1	-0.129
62.795	-10.1	0.006
62.995	-10.1	-0.003
63.195	41.0	0.000
63.395	30.2	0.000
63.595	-10.1	0.071
63.795	-10.1	0.177
63.995	-10.1	-0.149
64.195	-10.1	0.069
64.395	37.7	0.000
64.595	38.5	0.000
64.795	14.4	0.000
64.995	-10.1	-0.017
65.196	45.3	0.000
65.396	-10.1	-0.009
65.596	-10.1	0.113
65.796	-10.1	0.032
65.996	-10.1	-0.034
66.196	9.6	0.000
66.396	-10.1	-0.046
66.596	0.3	0.000
66.796	-10.1	0.042
66.996	-10.1	-0.010
67.196	16.2	-0.145
67.396	-10.1	-0.009
67.596	-2.2	0.000
67.796	-10.1	0.013
67.996	-10.1	0.120
68.196	47.7	0.000
68.396	40.1	0.000

68.596	23.8	0.000
68.796	-10.1	-0.167
68.996	-10.1	0.064
69.196	-10.1	-0.040
69.396	-10.1	0.024
69.596	45.0	0.000
69.797	-10.0	0.000
69.997	-10.1	-0.124
70.197	-10.1	-0.169
70.397	-10.1	0.010
70.597	-10.1	-0.155
70.797	-10.1	0.010
70.997	-10.1	0.109
71.197	51.3	0.000
71.397	-10.1	0.064
71.597	-10.0	0.000
71.797	-4.8	0.000
71.997	-10.1	-0.033
72.197	0.6	0.000
72.397	-10.1	0.087
72.597	-10.1	0.032
72.797	0.2	0.000
72.997	-10.1	-0.142
73.197	-10.1	-0.007
73.397	40.8	0.000
73.597	-10.1	0.002
73.797	-10.1	-0.026
73.997	-10.1	-0.067
74.197	-10.1	0.042
74.397	-10.1	-0.166
74.598	-10.1	-0.109
74.798	-10.1	-0.040
74.998	86.8	0.000
75.198	-10.1	0.044
75.398	-10.1	-0.028
75.598	-10.1	-0.088
75.798	-10.1	0.060
75.998	-10.1	0.051
76.198	-10.1	-0.132
76.398	0.8	0.000
76.598	-10.1	0.019
76.798	98.3	0.000
76.998	19.8	0.000
77.198	-10.1	0.128
77.398	-10.1	-0.087
77.598	-10.1	-0.167
77.798	-10.1	-0.058
77.998	13.5	0.000
78.198	-10.1	0.039
78.398	-10.1	0.042
78.598	47.6	0.000
78.798	-10.1	-0.168
78.998	16.9	0.000
79.199	-10.1	0.002
79.399	-10.1	-0.110
79.599	-10.1	0.105
79.799	-10.1	0.053
79.999	-10.1	0.061
80.199	84.2	0.000
80.399	-10.1	-0.289
80.599	78.4	0.000
80.799	-10.1	0.134
80.999	-10.1	-0.140
81.199	-10.1	-0.227
81.399	-10.1	0.038
81.599	-10.1	0.011
81.799	-10.1	0.045
81.999	25.3	-0.195
82.199	-0.4	-0.053

82.399	-10.1	-0.000
82.599	-10.1	-0.018
82.799	83.1	0.000
82.999	-10.1	-0.106
83.199	39.2	0.000
83.399	-10.1	0.139
83.599	45.0	0.000
83.799	24.5	0.000
84.000	-10.1	0.056
84.200	62.8	0.000
84.400	-10.1	0.080
84.600	-10.1	-0.033
84.800	-10.1	-0.098
85.000	42.2	0.000
85.200	-10.1	0.113
85.400	125.2	0.000
85.600	-10.1	0.072
85.800	-10.1	-0.032
86.000	44.6	0.000
86.200	-10.1	-0.152
86.400	-10.1	0.050
86.600	-10.1	-0.222
86.800	-10.1	0.037
87.000	-10.1	0.054
87.200	16.1	0.000
87.400	-10.1	-0.118
87.600	-10.1	-0.169
87.800	-10.1	-0.156
88.000	-10.1	0.016
88.200	-10.1	0.011
88.400	15.8	0.000
88.601	-10.1	-0.220
88.801	109.1	0.000
89.001	-10.1	0.051
89.201	-10.1	-0.033
89.401	-10.1	-0.031
89.601	-10.1	0.072
89.801	-6.5	0.000
90.001	-10.1	0.124
90.201	18.5	0.000
90.401	64.2	0.000
90.601	-10.1	-0.017
90.801	-10.1	-0.029
91.001	-10.1	0.009
91.201	-10.1	0.223
91.401	66.4	0.000
91.601	-10.1	-0.000
91.801	97.2	0.000
92.001	98.9	0.000
92.201	99.8	0.000
92.401	99.5	0.000
92.601	112.9	0.000
92.801	106.6	0.000
93.001	111.8	0.000
93.201	105.5	0.000
93.402	110.7	0.000
93.602	108.6	0.000
93.802	107.5	0.000
94.002	106.5	0.000
94.202	115.3	0.000
94.402	119.2	0.000
94.602	112.2	0.000
94.802	115.5	0.000
95.002	114.5	0.000
95.202	99.0	0.000
95.402	102.4	0.000
95.602	100.3	0.000
95.802	103.3	0.000
96.002	111.0	0.000

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 96.202    84.7      0.000
 96.402    91.7      0.000
 96.602    97.4      0.000
 96.802    64.2      0.000
 97.002    63.9      0.000
 97.202    67.9      0.000
 97.402    68.5      0.000
 97.602    54.1      0.000
 97.802    64.9      0.000
 98.003    99.2      0.000
 98.203    81.7      0.000
 98.403    97.3      0.000
 98.603    93.2      0.000
 98.803   121.2      0.000
 99.003   119.3      0.000
 99.203   117.7      0.000
 99.403   124.6      0.000
 99.603   124.9      0.000
 99.803    93.6      0.000

SUMMARY OF MAXIMUM AND MINIMUM HEADS
 POSITION NO.    MAXIMUM     MINIMUM
        1          236.0      -10.1
        2          236.2      -10.1
        3          318.3      -10.1
        4          131.2      -10.1
        5          126.0      -10.1
        6          114.5      -10.1
        7          117.5      -10.1
        8          138.1       -3.7
        9           84.6      -10.1
       10           75.0      -10.1
       11           89.9      -10.1
       12           58.2      -10.1
       13          122.2      -10.1
       14          131.4      -10.0
       15           53.0      -10.1
       16           53.4      -10.1
       17           43.5      -10.1
       18           41.7      -10.1
       19            0.7        0.7
       28            4.5        4.5
       36            6.6        6.6

*** END OF THIS SIMULATION ***


A PLOT FILE (gk_ic1.PLT) HAS BEEN CREATED WITH THE FOLLOWING DATA:

ITEM NO.    SPECIFIC RESULT
 1        HEAD AT POS. #  4
 2        FLOW AT POS. #  4
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***** SIC PROGRAM:  STEADY STATE - SURGE INITIAL CONDITIONS *****
                    Version 1.32, Nov. 1991

DATE = 01-05-2001

INPUT DATA FILE NAME FOR THIS SIMULATION = gk_ic2.SIC
OUTPUT DATA FILE NAME FOR THIS SIMULATION = gk_ic2.TIC


NUMBER OF PIPES = 20
NUMBER OF JUNCTION NODES = 18
   FLOW UNITS = CUBIC METERS / SECONDS
   PRESSURE UNITS = KPA
  THE HAZEN WILLIAMS HEAD LOSS RELATION IS USED FOR THIS SIMULATION

CLOSED LINES -  17

**** SUMMARY OF INPUT DATA ***

PIPE  NODE NODE LENGTH   DIAM.  PIPE   SUM-M  PUMP   FGN
 NO.   #1   #2   (MT.)   (MM.)  RES.   FACT.  TYPE  GRADE
   1    0    1     5.0  500.0  110.0    2.0   0.0    9.3
   2    1    2     0.0    0.0    0.0    0.0   1.0
   3    2    3     5.0  500.0  110.0    4.0   0.0
   4    3    4     0.0    0.0    0.0    0.3   0.0
   5    4    5    31.0  600.0  110.0    0.0   0.0
   7    5    6   325.0  800.0  110.0    0.0   0.0
   9    6    7  2175.0  800.0  110.0    0.0   0.0
  10    7    8   965.0  800.0  110.0    0.0   0.0
  11    8    9   800.0  500.0  110.0    0.0   0.0
  13    9   10     3.0  500.0  110.0    0.0   0.0
  14   10   11    50.0  500.0  110.0    0.0   0.0
  15   11   12     3.0  500.0  110.0   16.0   0.0
  16   12    0     3.0  500.0  110.0    0.0   0.0   26.3
  17    7   13   900.0  600.0  110.0    0.0   0.0
  19   13   14   791.0  600.0  110.0    0.0   0.0
  20   14   15  4460.0  600.0  110.0    0.0   0.0
  21   15   16     3.0  600.0  110.0    0.0   0.0
  22   16   17    50.0  500.0  110.0    0.0   0.0
  23   17   18     3.0  600.0  110.0    0.0   0.0
  24   18    0     3.0  600.0  110.0    0.0   0.0   25.2

 FUNCTION OF ZERO LENGTH LINE SET UP:
    LINE NO.  2  IS A COMPONENT BETWEEN TWO LINE SEGMENTS
    LINE NO.  4  IS A COMPONENT BETWEEN TWO LINE SEGMENTS


*** DATA FOR PUMPS FOR THIS SYSTEM ***

PUMP TYPE # 1  IS DESCRIBED BY THE FOLLOWING DATA:
 HEAD      DISCHARGE
 61              0
 45.71           .7
 41              .8

THE FOLLOWING COEFFICIENTS ARE CALCULATED FOR THE PUMP CHARACTERISTIC:
        A =  61
        B =  .257
        C = -31.571
```

JUNCT. NO.	DEMAND	ELEVATION
1	0.0	8.6
2	0.0	8.6
3	0.0	8.6
4	0.0	8.6
5	0.0	8.6
6	0.0	21.5
7	0.0	12.8
8	0.0	2.0
9	0.0	21.7
10	0.0	21.7
11	0.0	21.7
12	0.0	21.7
13	0.0	17.6
14	0.0	0.6
15	0.0	18.6
16	0.0	18.6
17	0.0	18.6
18	0.0	18.6

THERE IS A SEPARATE PRESSURE ZONE SUPPLIED THROUGH PIPE # 24

**** THE RESULTS FOR THE STEADY STATE SIMULATION FOLLOW ****

NO. OF TRIALS = 8 - ACCURACY ATTAINED = 0

PIPE NO.	NODE #1	NODE #2	FLOW RATE	HEAD LOSS	MINOR LOSS	PUMP HEAD	LINE VELOCITY	HL 1000
1	0	1	0.58	0.10	0.90	0.00	2.97	19.05
2	1	2	0.58	0.00	0.00	50.43	0.00	0.00
3	2	3	0.58	0.10	1.80	0.00	2.97	19.05
4	3	4	0.58	0.00	0.08	0.00	0.00	0.00
5	4	5	0.58	0.24	0.00	0.00	2.06	7.84
7	5	6	0.58	0.63	0.00	0.00	1.16	1.93
9	6	7	0.58	4.20	0.00	0.00	1.16	1.93
10	7	8	0.58	1.86	0.00	0.00	1.16	1.93
11	8	9	0.58	15.24	0.00	0.00	2.97	19.05
13	9	10	0.58	0.06	0.00	0.00	2.97	19.05
14	10	11	0.58	0.95	0.00	0.00	2.97	19.05
15	11	12	0.58	0.06	7.19	0.00	2.97	19.05
16	12	0	0.58	0.06	0.00	0.00	2.97	19.05
LINE NO. 17 IS SHUT OFF								
19	13	14	0.00	0.00	0.00	0.00	0.00	0.00
20	14	15	0.00	0.00	0.00	0.00	0.00	0.00
21	15	16	0.00	0.00	0.00	0.00	0.00	0.00
22	16	17	0.00	0.00	0.00	0.00	0.00	0.00
23	17	18	0.00	0.00	0.00	0.00	0.00	0.00
24	18	0	0.00	0.00	0.00	0.00	0.00	0.00

JUNCTION NO.	ELEVATION (MT.)	DEMAND	PRESSURE (KPA)	PRESSURE HEAD	HYDRAULIC GRADE	DEMAND RESISTANCE
1	8.6	0.0	-2.6	-0.3	8.3	
2	8.6	0.0	492.0	50.2	58.7	
3	8.6	0.0	473.4	48.3	56.8	
4	8.6	0.0	472.6	48.2	56.7	
5	8.6	0.0	470.2	47.9	56.5	
6	21.5	0.0	337.2	34.4	55.9	
7	12.8	0.0	380.9	38.8	51.7	
8	2.0	0.0	469.1	47.8	49.8	
9	21.7	0.0	125.8	12.8	34.6	
10	21.7	0.0	125.3	12.8	34.5	
11	21.7	0.0	115.9	11.8	33.5	

12	21.7	0.0	44.9	4.6	26.3
13	17.6	0.0	74.5	7.6	25.2
14	0.6	0.0	241.5	24.6	25.2
15	18.6	0.0	64.4	6.6	25.2
16	18.6	0.0	64.4	6.6	25.2
17	18.6	0.0	64.4	6.6	25.2
18	18.6	0.0	64.4	6.6	25.2

THE NET SYSTEM DEMAND = 0
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

PIPE NO.	FLOW
1	0.58
16	-0.58
24	0.00

***** DATA FOR CARRYING OUT A SURGE ANALYSIS FOLLOWS:

THE TIME INCREMENT SELECTED FOR SURGE ANALYSIS = .0085 SEC.

*** TABLE OF ASSIGNED POSITIONS, LENGTHS AND INITIAL CONDITIONS FOR SURGE4 ***

SECTION NUMBER	ORIGINAL NODES		ASSIGNED NODES		ORIGINAL LENGTH	ASSIGNED LENGTH	WAVE SPEED	INITIAL CONDITIONS Q	H1	H2
1	0	1	19	1	5	10	1177	0.58	0.73	-0.26
2	1	2	1	2	0	0	1177	0.58	-0.26	50.17
3	2	3	2	3	5	10	1177	0.58	50.17	48.27
4	3	4	3	4	0	0	1177	0.58	48.27	48.19
5	4	5	4	5	31	30	1177	0.58	48.19	47.95
6	5	6	20	6	325	320	1177	0.58	47.95	34.39
7	6	7	21	7	2175	2171	1177	0.58	34.39	38.84
8	7	8	22	8	965	960	1177	0.58	38.84	47.83
9	8	9	23	9	800	800	1177	0.58	47.83	12.83
10	9	10	24	10	3	10	1177	0.58	12.83	12.77
11	10	11	25	11	50	50	1177	0.58	12.77	11.82
12	11	12	26	12	3	10	1177	0.58	11.82	4.58
13	12	0	27	28	3	10	1177	0.58	4.58	4.52
14	7	13	29	13	900	900	1177	0.00	38.84	7.60
15	13	14	30	14	791	790	1177	0.00	7.60	24.63
16	14	15	31	15	4460	4462	1177	0.00	24.63	6.57
17	15	16	32	16	3	10	1177	0.00	6.57	6.57
18	16	17	33	17	50	50	1177	0.00	6.57	6.57
19	17	18	34	18	3	10	1177	0.00	6.57	6.57
20	18	0	35	36	3	10	1177	0.00	6.57	6.57

NOTES:

1. Head computations at FGN'S use elevation of other end of pipe section
2. Pipe section resistances are based on initial conditions (Q <> 0)
3. Resistances for zero flow sections based on velocity (4 ft/s or 1 m/s)
4. The use of the Hazen Williams head loss relation results in values

***** THE INITIAL CONDITION DATA FILE FOR SURGE4 IS NOW BEING GENERATED *****

1. SYSTEM DATA:

Number of line segments = -18
Number of components = 2
Number of junctions = 17
Number of SDO's = 0
Time increment = .0085

NOTE: USERS MUST PROVIDE THE ADDITIONAL SYSTEM DATA

2. LINE SEGMENT DATA:

FIRST POSITION	SECOND POSITION	NO. OF TIME INCREMENTS	C/GA	INITIAL FLOW	SEGMENT RESISTANCE
19	1	1	611.2385	0.5827	2.9254
2	3	1	611.2385	0.5827	5.5702
4	5	3	424.4712	0.5827	0.7158
20	6	32	238.7651	0.5827	1.8487
21	7	217	238.7651	0.5827	12.3720
22	8	96	238.7651	0.5827	5.4892
23	9	80	611.2385	0.5827	44.8884
24	10	1	611.2385	0.5827	0.1683
25	11	5	611.2385	0.5827	2.8055
26	12	1	611.2385	0.5827	21.3267
27	28	1	611.2385	0.5827	0.1683
29	13	90	424.4712	0.0000	26.9065
30	14	79	424.4712	0.0000	23.6479
31	15	446	424.4712	0.0000	133.3369
32	16	1	424.4712	0.0000	0.0897
33	17	5	611.2385	0.0000	4.0464
34	18	1	424.4712	0.0000	0.0897
35	36	1	424.4712	0.0000	0.0897

The total number of wave travel increments = 1061

3. COMPONENT DATA:

1st POS.	2nd POS.	characteristics A	B	C	Heads H1	H2
1.0	2	61.000	0.257	-31.571	-0.263	50.165
3.0	4	0.000	0.000	-0.250	48.274	48.189

5. JUNCTION DATA:

POS. NO. 1st PIPE	NO. OF LEGS	INITIAL HEAD	ADDITIONAL POS. NO's
5	-2	47.95	20
6	-2	34.39	21
7	-3	38.84	22 29
8	-2	47.83	23
9	-2	12.83	24
10	-2	12.77	25
11	-2	11.82	26
12	-2	4.58	27
13	-2	7.60	30
14	-2	24.63	31
15	-2	6.57	32
16	-2	6.57	33
17	-2	6.57	34

```
    18       -2          6.57          35
    19        0          0.73
    28        0          4.52
    36        0          6.57

NOTE: HEAD values noted above at reservoirs connections may be incorrect
   - elevations of reservoir connections are undefined in the SIC data.

6. SDO DATA  -  NO SDO'S WERE SET UP IN THE SIC DATA FILE


8. CHECK VALVE DATA
    ALL Check Valve data must be provided by the User - with SURGEDAT

NOTE: Users must provide the following data using SURGEDAT

   9a. VARIABLE INPUT DATA
      9b. time - ratio data
   10. TABULATED OUTPUT DATA
   11. PLOTTED OUTPUT DATA
   12. SCREEN PLOT DATA

>>>> THE INITIAL CONDITION FILE FOR SURGEDAT (gk_ic2.ICF) IS NOW GENERATED *****
```

********** - SURGE PROGRAM - VERSION 4.4 - **********
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DATE = - TIME = 14:38:05

INPUT DATA FILE NAME = gk_ic2.DAT
OUTPUT DATA FILE NAME = gk_ic2.OUT

TOTAL SIMULATION TIME = 100 TIME INCREMENT = .01

SI UNITS ARE SPECIFIED: FLOW = CMS - HEAD = M.

**** SUMMARY OF PIPE SYSTEM DATA ****

NUMBERS OF SPECIFIC ELEMENTS

LINE SEGMENTS = 18 COMPONENTS = 2
JUNCTIONS = 17 BYPASS LINES = 0
SIDE ORIFICES = 0 RELIEF VALVES = 0
CHECK VALVES = 1 VARIABLE INPUTS= 1

LINE SEGMENT DATA

POSITION OF ENDS		TRAVEL INCREMENTS	C/GA	INITIAL FLOWRATE	SEGMENT RESISTANCE
19	1	1	611.24	0.58	2.93
2	3	1	611.24	0.58	5.57
4	5	3	424.47	0.58	0.72
20	6	32	238.77	0.58	1.85
21	7	217	238.77	0.58	12.37
22	8	96	238.77	0.58	5.49
23	9	80	611.24	0.58	44.89
24	10	1	611.24	0.58	0.17
25	11	5	611.24	0.58	2.81
26	12	1	611.24	0.58	21.33
27	28	1	611.24	0.58	0.17
29	13	90	424.47	0.00	26.91
30	14	79	424.47	0.00	23.65
31	15	446	424.47	0.00	133.34
32	16	1	424.47	0.00	0.09
33	17	5	611.24	0.00	4.05
34	18	1	424.47	0.00	0.09
35	36	1	424.47	0.00	0.09

COMPONENT DATA

POSITION NUMBERS = 1 2
A = 61 B = .257 C = -31.571
INITIAL FLOWRATE = .58 INITIAL HEADS =-.3 - 50.1

POSITION NUMBERS = 3 4
A = 0 B = 0 C = -.25
INITIAL FLOWRATE = .58 INITIAL HEADS = 48.2 - 48.1

JUNCTION DATA

JUNCTION LOCATION	NUMBER OF LEGS	INITIAL HEAD	CONNECTING POSITIONS
5	2	47.9	20
6	2	34.4	21
7	3	38.8	22 29
8	2	47.8	23
9	2	12.8	24
10	2	12.8	25
11	2	11.8	26
12	2	4.6	27
13	2	7.6	30
14	2	24.6	31
15	2	6.6	32
16	2	6.6	33
17	2	6.6	34
18	2	6.6	35
19	0	0.7	
28	0	4.5	
36	0	6.6	

CHECK VALVE DATA

THERE IS A CHECK VALVE AT POSITION 3
TIME DELAY FOR VALVE = .1 - CV RESISTANCE = .25
NOTE: THIS CHECK VALVE WILL NOT REOPEN ONCE CLOSURE OCCURS
THE INITIAL HEAD LOSS DUE TO THE CHECK VALVE RESISTANCE = .08

NOTE: CHECK VALVE RESISTANCES MUST BE INCLUDED WITH THE COMPONENT DATA

VARIABLE INPUT DATA

INPUT # 1 - PUMP START UP OR SHUT DOWN IS SPECIFIED AT POSITION NO. 1
REFERENCE VALUES FOR PUMP COEFFICIENTS (N/NR (R) =1):
A = 61 B = .257 C = -31.571

TIME - RATIO INPUT DATA

TIME	RATIO
1	1
2	0

THE FOLLOWING INITIAL VALUE IS CALCULATED FOR THIS VARIABLE INPUT:
... These should agree with initial values previously input (in parenthesis)
THE INITIAL VALUES FOR PUMP COEFF. - A = 61 (61) B = .257 (.257)

**** SUMMARY OF INITIAL CONDITIONS FOR LINE SEGMENTS ****

END POSITION DESIGNATIONS: J - JUNCTION, C - COMPONENT, S - SDO
* - THIS DENOTES AN UNDESIGNATED END POSITION (UNACCEPTABLE) - CORRECT DATA

END POSITIONS #1	END POSITIONS #2	FLOW 1 to 2	HEAD #1	HEAD #2	HEAD LOSS	ELEVATION DIFFERENCE
19 J	1 C	0.58	0.7	-0.3	1.0	0.0
2 C	3 C	0.58	50.2	48.3	1.9	-0.0
4 C	5 J	0.58	48.2	47.9	0.2	0.0
20 J	6 J	0.58	47.9	34.4	0.6	12.9
21 J	7 J	0.58	34.4	38.8	4.2	-8.7
22 J	8 J	0.58	38.8	47.8	1.9	-10.9
23 J	9 J	0.58	47.8	12.8	15.2	19.8
24 J	10 J	0.58	12.8	12.8	0.1	-0.0
25 J	11 J	0.58	12.8	11.8	1.0	-0.0

26 J	12 J	0.58	11.8	4.6	7.2	0.0
27 J	28 J	0.58	4.6	4.5	0.1	0.0
29 J	13 J	0.00	38.8	7.6	0.0	31.2
30 J	14 J	0.00	7.6	24.6	0.0	-17.0
31 J	15 J	0.00	24.6	6.6	0.0	18.1
32 J	16 J	0.00	6.6	6.6	0.0	0.0
33 J	17 J	0.00	6.6	6.6	0.0	0.0
34 J	18 J	0.00	6.6	6.6	0.0	0.0
35 J	36 J	0.00	6.6	6.6	0.0	0.0

****** FLOWRATE AND PRESSURE RESULTS ******

TIME	H- 4	Q- 4
0.200	48.2	0.583
0.400	48.2	0.583
0.600	48.2	0.583
0.800	48.2	0.583
1.000	48.2	0.583
1.200	32.7	0.531
1.400	17.6	0.466
1.600	6.1	0.416
1.800	-1.2	0.382
2.000	-4.3	0.366
2.200	-4.6	0.364
2.400	-4.1	0.363
2.600	-1.7	0.330
2.800	-2.6	0.310
3.000	-3.0	0.306
3.200	-2.1	0.309
3.400	-0.8	0.284
3.600	-1.5	0.266
3.800	-2.2	0.259
4.000	-1.6	0.265
4.200	-0.3	0.246
4.400	-0.9	0.229
4.600	-1.9	0.222
4.800	-1.1	0.228
5.000	0.1	0.213
5.200	-0.0	0.198
5.400	-0.9	0.190
5.600	-0.6	0.196
5.800	0.4	0.184
6.000	1.0	0.170
6.200	-0.7	0.162
6.400	-0.5	0.167
6.600	0.4	0.158
6.800	0.8	0.146
7.000	-0.0	0.137
7.200	-0.1	0.143
7.400	0.1	0.137
7.600	1.3	0.124
7.800	0.0	0.115
8.000	0.2	0.119
8.200	0.4	0.116
8.400	1.3	0.104
8.600	0.6	0.094
8.800	0.8	0.097
9.000	0.5	0.096
9.200	1.4	0.086
9.400	0.3	0.075
9.600	0.3	0.076
9.800	0.6	0.078
10.000	1.4	0.069
10.200	0.5	0.058
10.400	0.8	0.057
10.600	0.5	0.060
10.800	1.8	0.052
11.000	1.0	0.041

11.200	0.5	0.039
11.400	0.6	0.042
11.600	1.8	0.034
11.800	0.9	0.025
12.000	0.8	0.021
12.200	0.1	0.025
12.400	1.5	0.018
12.600	1.3	0.009
12.800	0.7	0.004
13.000	0.4	0.009
13.200	1.4	0.003

CV CLOSURE OCCURS AT POSITION # 3

13.400	4.0	0.000
13.600	4.5	0.000
13.800	2.3	0.000
14.000	4.8	0.000
14.200	1.4	0.000
14.400	3.6	0.000
14.600	1.8	0.000
14.800	5.3	0.000
15.000	4.4	0.000
15.200	2.8	0.000
15.400	3.0	0.000
15.600	0.7	0.000
15.800	3.8	0.000
16.000	1.1	0.000
16.200	5.0	0.000
16.400	3.5	0.000
16.600	3.4	0.000
16.800	1.5	0.000
17.000	0.5	0.000
17.200	3.4	0.000
17.400	1.4	0.000
17.600	3.8	0.000
17.800	2.7	0.000
18.000	3.9	0.000
18.200	1.1	0.000
18.400	1.3	0.000
18.600	2.7	0.000
18.800	2.7	0.000
19.000	3.2	0.000
19.200	2.5	0.000
19.400	4.0	0.000
19.600	1.7	0.000
19.800	2.9	0.000
20.000	2.4	0.000
20.200	4.4	0.000
20.400	3.4	0.000
20.600	3.0	0.000
20.800	3.4	0.000
21.000	2.4	0.000
21.200	4.2	0.000
21.400	2.4	0.000
21.600	5.4	0.000
21.800	3.5	0.000
22.000	3.7	0.000
22.200	2.1	0.000
22.400	2.5	0.000
22.600	4.1	0.000
22.800	2.5	0.000
23.000	5.2	0.000
23.200	2.9	0.000
23.400	4.2	0.000
23.600	0.8	0.000
23.800	2.5	0.000
24.000	2.7	0.000
24.200	2.7	0.000
24.400	4.3	0.000

24.600	1.7	0.000
24.800	4.0	0.000
25.000	0.3	0.000
25.200	2.8	0.000
25.400	1.3	0.000
25.600	3.2	0.000
25.800	3.4	0.000
26.000	1.2	0.000
26.201	3.5	0.000
26.401	1.0	0.000
26.601	3.6	0.000
26.801	1.0	0.000
27.001	3.8	0.000
27.201	2.9	0.000
27.401	2.1	0.000
27.601	2.8	0.000
27.801	2.4	0.000
28.001	4.1	0.000
28.201	2.1	0.000
28.401	4.3	0.000
28.601	2.8	0.000
28.801	3.7	0.000
29.001	2.1	0.000
29.201	3.4	0.000
29.401	3.4	0.000
29.601	3.5	0.000
29.801	4.0	0.000
30.001	2.6	0.000
30.201	4.6	0.000
30.401	1.6	0.000
30.601	3.5	0.000
30.801	1.7	0.000
31.001	4.5	0.000
31.201	3.1	0.000
31.401	2.6	0.000
31.601	4.0	0.000
31.801	84.4	0.000
32.001	87.7	0.000
32.201	89.3	0.000
32.401	86.2	0.000
32.601	81.9	0.000
32.801	77.6	0.000
33.000	76.7	0.000
33.200	76.4	0.000
33.400	77.7	0.000
33.600	79.1	0.000
33.800	78.9	0.000
34.000	80.6	0.000
34.200	83.8	0.000
34.400	91.0	0.000
34.600	98.9	0.000
34.800	106.1	0.000
35.000	112.6	0.000
35.200	114.2	0.000
35.400	113.8	0.000
35.600	110.6	0.000
35.800	107.6	0.000
36.000	83.8	0.000
36.200	86.2	0.000
36.400	88.3	0.000
36.600	91.3	0.000
36.800	76.0	0.000
37.000	68.5	0.000
37.200	65.3	0.000
37.400	63.9	0.000
37.600	61.2	0.000
37.800	24.0	0.000
38.000	44.4	0.000

38.200	44.8	0.000
38.400	50.1	0.000
38.600	44.5	0.000
38.799	58.6	0.000
38.999	65.0	0.000
39.199	66.6	0.000
39.399	67.2	0.000
39.599	51.8	0.000
39.799	6.1	0.000
39.999	3.3	0.000
40.199	1.8	0.000
40.399	-10.1	0.015
40.599	-0.9	0.000
40.799	2.4	0.000
40.999	-3.3	0.000
41.199	-8.2	0.000
41.399	3.5	0.000
41.599	1.2	0.000
41.799	-10.1	-0.016
41.999	-10.1	0.048
42.199	4.1	0.000
42.399	-9.1	0.000
42.599	-10.1	0.002
42.799	-5.1	0.000
42.999	-1.3	0.000
43.199	-6.2	0.000
43.399	20.1	0.000
43.599	8.1	0.000
43.799	-2.1	0.000
43.999	-2.3	0.000
44.199	-8.4	0.000
44.399	-4.9	0.000
44.599	-8.2	0.000
44.798	12.0	0.000
44.998	10.7	0.000
45.198	5.7	0.000
45.398	1.0	0.000
45.598	-7.5	0.000
45.798	-3.7	0.000
45.998	22.5	0.000
46.198	13.4	0.000
46.398	6.2	0.000
46.598	20.5	0.000
46.798	28.0	0.000
46.998	0.5	0.000
47.198	-7.0	0.000
47.398	15.9	0.000
47.598	-10.1	-0.002
47.798	2.7	0.000
47.998	12.3	0.000
48.198	22.8	0.000
48.398	-10.1	-0.053
48.598	-1.1	0.000
48.798	10.2	0.000
48.998	23.3	0.000
49.198	2.8	0.000
49.398	18.4	0.000
49.598	29.5	0.000
49.798	-7.4	-0.015
49.998	-10.1	0.050
50.198	10.5	0.000
50.398	-1.8	0.000
50.598	19.4	0.000
50.797	5.3	0.000
50.997	8.2	0.000
51.197	-10.1	0.044
51.397	-10.1	0.015
51.597	-7.8	0.000

51.797	22.4	0.000
51.997	-5.5	0.000
52.197	11.1	0.000
52.397	20.7	0.000
52.597	9.2	0.000
52.797	-10.1	0.006
52.997	-10.1	-0.001
53.197	16.9	0.000
53.397	-0.1	0.000
53.597	-0.8	0.000
53.797	-4.9	-0.029
53.997	-10.1	-0.044
54.197	-10.1	-0.024
54.397	-10.1	-0.002
54.597	12.1	0.000
54.797	-3.1	0.000
54.997	-2.8	0.000
55.197	13.6	0.000
55.397	-6.8	0.000
55.597	-0.7	0.000
55.797	-10.1	-0.015
55.997	30.8	0.000
56.197	13.2	0.000
56.397	18.0	0.000
56.597	15.0	0.000
56.796	-10.1	-0.015
56.996	-10.1	0.034
57.196	-10.1	0.014
57.396	28.9	0.000
57.596	26.4	0.000
57.796	1.4	0.000
57.996	15.1	0.000
58.196	-10.1	0.009
58.396	-10.1	-0.020
58.596	-10.1	0.013
58.796	90.8	0.000
58.996	62.7	0.000
59.196	66.8	0.000
59.396	61.3	0.000
59.596	64.3	0.000
59.796	58.0	0.000
59.996	62.4	0.000
60.196	62.7	0.000
60.396	63.8	0.000
60.596	70.5	0.000
60.796	71.2	0.000
60.996	75.5	0.000
61.196	69.0	0.000
61.396	61.9	0.000
61.596	72.4	0.000
61.796	96.8	0.000
61.996	90.4	0.000
62.196	83.8	0.000
62.396	87.7	0.000
62.596	95.2	0.000
62.795	96.4	0.000
62.995	96.4	0.000
63.195	94.6	0.000
63.395	94.8	0.000
63.595	78.1	0.000
63.795	84.8	0.000
63.995	52.3	0.000
64.195	44.7	0.000
64.395	50.0	0.000
64.595	40.6	0.000
64.795	44.1	0.000
64.995	41.6	0.000
65.196	42.7	0.000

65.396	37.7	0.000
65.596	60.2	0.000
65.796	46.5	0.000
65.996	47.0	0.000
66.196	48.7	0.000
66.396	54.3	0.000
66.596	70.6	0.000
66.796	25.8	0.000
66.996	13.4	0.000
67.196	26.7	0.000
67.396	27.8	0.000
67.596	-10.1	0.000
67.796	-10.1	-0.005
67.996	-10.1	0.017
68.196	-10.1	0.000
68.396	10.7	0.000
68.596	4.4	0.000
68.796	56.6	0.000
68.996	-10.1	0.034
69.196	-3.0	0.000
69.396	-9.6	-0.003
69.596	-10.1	0.010
69.797	24.5	0.000
69.997	11.9	0.000
70.197	8.4	0.000
70.397	-0.5	0.000
70.597	8.3	0.000
70.797	5.7	0.000
70.997	-10.1	0.055
71.197	-10.1	-0.045
71.397	-10.1	-0.042
71.597	0.6	0.000
71.797	-10.1	0.026
71.997	16.6	0.000
72.197	-5.4	-0.026
72.397	-10.1	-0.003
72.597	-6.0	-0.023
72.797	0.5	-0.059
72.997	-10.1	-0.005
73.197	-7.2	-0.016
73.397	30.3	0.000
73.597	8.6	0.000
73.797	0.2	0.000
73.997	-10.1	0.007
74.197	-10.1	-0.082
74.397	-10.1	0.051
74.598	-1.5	0.000
74.798	30.4	0.000
74.998	10.4	0.000
75.198	-10.1	0.039
75.398	8.1	0.000
75.598	-10.1	0.021
75.798	-10.1	0.041
75.998	30.7	0.000
76.198	19.0	0.000
76.398	-7.3	0.000
76.598	9.5	0.000
76.798	-2.7	-0.041
76.998	6.6	0.000
77.198	-10.1	0.018
77.398	1.5	-0.064
77.598	6.3	0.000
77.798	0.1	0.000
77.998	28.0	0.000
78.198	-10.1	0.009
78.398	-10.1	0.019
78.598	-10.1	-0.037
78.798	-10.1	0.047

78.998	-10.1	-0.011
79.199	-5.2	0.000
79.399	21.6	0.000
79.599	-10.1	0.027
79.799	-10.1	0.018
79.999	12.7	0.000
80.199	-10.1	-0.048
80.399	20.3	0.000
80.599	28.4	0.000
80.799	0.5	0.000
80.999	20.9	0.000
81.199	8.3	0.000
81.399	-10.1	-0.036
81.599	-10.1	-0.009
81.799	74.9	0.000
81.999	56.0	0.000
82.199	70.9	0.000
82.399	71.5	0.000
82.599	47.0	0.000
82.799	49.3	0.000
82.999	42.5	0.000
83.199	45.3	0.000
83.399	42.5	0.000
83.599	59.9	0.000
83.799	52.2	0.000
84.000	39.2	0.000
84.200	35.2	0.000
84.400	44.5	0.000
84.600	54.9	0.000
84.800	64.6	0.000
85.000	65.3	0.000
85.200	65.8	0.000
85.400	63.3	0.000
85.600	65.1	0.000
85.800	55.1	0.000
86.000	65.5	0.000
86.200	52.9	0.000
86.400	68.7	0.000
86.600	68.1	0.000
86.800	77.1	0.000
87.000	50.3	0.000
87.200	66.4	0.000
87.400	39.5	0.000
87.600	34.5	0.000
87.800	46.0	0.000
88.000	22.1	0.000
88.200	55.5	0.000
88.400	46.3	0.000
88.601	80.0	0.000
88.801	67.2	0.000
89.001	82.1	0.000
89.201	77.6	0.000
89.401	77.4	0.000
89.601	83.0	0.000
89.801	14.6	0.000
90.001	20.5	0.000
90.201	32.1	0.000
90.401	42.7	0.000
90.601	-10.1	-0.037
90.801	-10.1	0.085
91.001	-10.1	0.076
91.201	-10.1	-0.037
91.401	-10.1	0.085
91.601	-10.1	-0.063
91.801	34.1	0.000
92.001	26.2	0.000
92.201	23.1	0.000
92.401	63.5	0.000

92.601	-10.1	-0.070
92.801	-10.1	0.062
93.001	-10.1	0.036
93.201	-10.1	-0.070
93.402	-10.1	-0.117
93.602	-10.1	0.077
93.802	24.7	0.000
94.002	16.4	0.000
94.202	45.9	0.000
94.402	41.9	0.000
94.602	-10.1	0.062
94.802	-10.1	-0.050
95.002	-10.1	0.001
95.202	-10.1	0.062
95.402	-10.1	-0.071
95.602	41.4	0.000
95.802	37.4	0.000
96.002	17.2	0.000
96.202	44.9	0.000
96.402	-10.1	0.007
96.602	-10.1	0.002
96.802	-10.1	-0.004
97.002	-10.1	0.007
97.202	-10.1	-0.086
97.402	29.6	0.000
97.602	37.6	0.000
97.802	24.4	0.000
98.003	-10.1	0.010
98.203	9.5	0.000
98.403	-10.1	0.027
98.603	-10.1	-0.027
98.803	-10.1	-0.072
99.003	-10.1	-0.032
99.203	29.1	0.000
99.403	32.9	0.000
99.603	39.1	0.000
99.803	-1.3	0.000

SUMMARY OF MAXIMUM AND MINIMUM HEADS

POSITION NO.	MAXIMUM	MINIMUM
1	3.6	-2.1
2	50.2	-3.8
3	48.3	-4.6
4	115.1	-10.1
5	114.6	-10.1
6	98.3	-10.1
7	78.9	-10.1
8	112.6	-10.1
9	77.2	-10.1
10	71.6	-10.1
11	74.0	-10.1
12	54.9	-10.1
13	7.6	-10.1
14	25.2	5.0
15	8.4	-5.3
16	8.3	-4.1
17	7.2	4.2
18	6.9	5.4
19	0.7	0.7
28	4.5	4.5
36	6.6	6.6

*** END OF THIS SIMULATION ***
A PLOT FILE (gk_ic2.PLT) HAS BEEN CREATED WITH THE FOLLOWING DATA:

ITEM NO.	SPECIFIC RESULT
1	HEAD AT POS. # 4
2	FLOW AT POS. # 4

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 ***** SIC PROGRAM:  STEADY STATE - SURGE INITIAL CONDITIONS *****
                     Version 1.32, Nov. 1991
DATE = 01-05-2001

INPUT DATA FILE NAME FOR THIS SIMULATION = gk_ic3.SIC
OUTPUT DATA FILE NAME FOR THIS SIMULATION = gk_ic3.TIC

NUMBER OF PIPES = 20
NUMBER OF JUNCTION NODES = 18
   FLOW UNITS = CUBIC METERS / SECONDS
   PRESSURE UNITS = KPA
  THE HAZEN WILLIAMS HEAD LOSS RELATION IS USED FOR THIS SIMULATION

CLOSED LINES -  10

**** SUMMARY OF INPUT DATA ***

PIPE  NODE NODE LENGTH   DIAM.  PIPE   SUM-M  PUMP   FGN
 NO.   #1   #2   (MT.)   (MM.) RES.   FACT.  TYPE  GRADE
   1    0    1     5.0  500.0 110.0    2.0    0.0    9.3
   2    1    2     0.0    0.0   0.0    0.0    1.0
   3    2    3     5.0  500.0 110.0    4.0    0.0
   4    3    4     0.0    0.0   0.0    0.3    0.0
   5    4    5    31.0  600.0 110.0    0.0    0.0
   7    5    6   325.0  800.0 110.0    0.0    0.0
   9    6    7  2175.0  800.0 110.0    0.0    0.0
  10    7    8   965.0  800.0 110.0    0.0    0.0
  11    8    9   800.0  500.0 110.0    0.0    0.0
  13    9   10     3.0  500.0 110.0    0.0    0.0
  14   10   11    50.0  500.0 110.0    0.0    0.0
  15   11   12     3.0  500.0 110.0   16.0    0.0
  16   12    0     3.0  500.0 110.0    0.0    0.0   26.3
  17    7   13   900.0  600.0 110.0    0.0    0.0
  19   13   14   791.0  600.0 110.0    0.0    0.0
  20   14   15  4460.0  600.0 110.0    0.0    0.0
  21   15   16     3.0  600.0 110.0    0.0    0.0
  22   16   17    50.0  500.0 110.0    0.0    0.0
  23   17   18     3.0  600.0 110.0    0.0    0.0
  24   18    0     3.0  600.0 110.0    0.0    0.0   25.2

 FUNCTION OF ZERO LENGTH LINE SET UP:
    LINE NO.  2  IS A COMPONENT BETWEEN TWO LINE SEGMENTS
    LINE NO.  4  IS A COMPONENT BETWEEN TWO LINE SEGMENTS

*** DATA FOR PUMPS FOR THIS SYSTEM ***

PUMP TYPE # 1  IS DESCRIBED BY THE FOLLOWING DATA:
 HEAD     DISCHARGE
 61            0
 45.71         .7
 41            .8

THE FOLLOWING COEFFICIENTS ARE CALCULATED FOR THE PUMP CHARACTERISTIC:
       . A =  61
         B =  .257
         C = -31.571

JUNCT. NO.   DEMAND   ELEVATION
    1           0.0        8.6
    2           0.0        8.6
    3           0.0        8.6
    4           0.0        8.6
    5           0.0        8.6
    6           0.0       21.5
    7           0.0       12.8
    8           0.0        2.0
```

9	0.0	21.7
10	0.0	21.7
11	0.0	21.7
12	0.0	21.7
13	0.0	17.6
14	0.0	0.6
15	0.0	18.6
16	0.0	18.6
17	0.0	18.6
18	0.0	18.6

THERE IS A SEPARATE PRESSURE ZONE SUPPLIED THROUGH PIPE # 16

**** THE RESULTS FOR THE STEADY STATE SIMULATION FOLLOW ****

NO. OF TRIALS = 8 - ACCURACY ATTAINED = 0

PIPE NO.	NODE #1	NODE #2	FLOW RATE	HEAD LOSS	MINOR LOSS	PUMP HEAD	LINE VELOCITY	HL 1000
1	0	1	0.47	0.06	0.58	0.00	2.39	12.74
2	1	2	0.47	0.00	0.00	54.18	0.00	0.00
3	2	3	0.47	0.06	1.16	0.00	2.39	12.74
4	3	4	0.47	0.00	0.05	0.00	0.00	0.00
5	4	5	0.47	0.16	0.00	0.00	1.66	5.24
7	5	6	0.47	0.42	0.00	0.00	0.93	1.29
9	6	7	0.47	2.81	0.00	0.00	0.93	1.29
LINE NO. 10 IS SHUT OFF								
11	8	9	0.00	0.00	0.00	0.00	0.00	0.00
13	9	10	0.00	0.00	0.00	0.00	0.00	0.00
14	10	11	0.00	0.00	0.00	0.00	0.00	0.00
15	11	12	0.00	0.00	0.00	0.00	0.00	0.00
16	12	0	0.00	0.00	0.00	0.00	0.00	0.00
17	7	13	0.47	4.72	0.00	0.00	1.66	5.24
19	13	14	0.47	4.15	0.00	0.00	1.66	5.24
20	14	15	0.47	23.39	0.00	0.00	1.66	5.24
21	15	16	0.47	0.02	0.00	0.00	1.66	5.24
22	16	17	0.47	0.64	0.00	0.00	2.39	12.74
23	17	18	0.47	0.02	0.00	0.00	1.66	5.24
24	18	0	0.47	0.02	0.00	0.00	1.66	5.24

JUNCTION NO.	ELEVATION (MT.)	DEMAND	PRESSURE (KPA)	PRESSURE HEAD	HYDRAULIC GRADE	DEMAND RESISTANCE
1	8.6	0.0	0.8	0.1	8.6	
2	8.6	0.0	532.2	54.3	62.8	
3	8.6	0.0	520.1	53.0	61.6	
4	8.6	0.0	519.6	53.0	61.5	
5	8.6	0.0	518.0	52.8	61.4	
6	21.5	0.0	387.1	39.5	60.9	
7	12.8	0.0	444.3	45.3	58.1	
8	2.0	0.0	238.1	24.3	26.3	
9	21.7	0.0	44.3	4.5	26.3	
10	21.7	0.0	44.3	4.5	26.3	
11	21.7	0.0	44.3	4.5	26.3	
12	21.7	0.0	44.3	4.5	26.3	
13	17.6	0.0	351.3	35.8	53.4	
14	0.6	0.0	477.6	48.7	49.3	
15	18.6	0.0	71.1	7.3	25.9	
16	18.6	0.0	71.0	7.2	25.9	
17	18.6	0.0	64.7	6.6	25.2	
18	18.6	0.0	64.6	6.6	25.2	

THE NET SYSTEM DEMAND = 0
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

PIPE NO.	FLOW
1	0.47
16	0.00
24	-0.47

***** DATA FOR CARRYING OUT A SURGE ANALYSIS FOLLOWS:

THE TIME INCREMENT SELECTED FOR SURGE ANALYSIS = .0085 SEC.

*** TABLE OF ASSIGNED POSITIONS, LENGTHS AND INITIAL CONDITIONS FOR SURGE4 ***

SECTION NUMBER	ORIGINAL NODES		ASSIGNED NODES		ORIGINAL LENGTH	ASSIGNED LENGTH	WAVE SPEED	INITIAL CONDITIONS Q	H1	H2
1	0	1	19	1	5	10	1177	0.47	0.73	0.08
2	1	2	1	2	0	0	1177	0.47	0.08	54.26
3	2	3	2	3	5	10	1177	0.47	54.26	53.04
4	3	4	3	4	0	0	1177	0.47	53.04	52.98
5	4	5	4	5	31	30	1177	0.47	52.98	52.82
6	5	6	20	6	325	320	1177	0.47	52.82	39.47
7	6	7	21	7	2175	2171	1177	0.47	39.47	45.31
8	7	8	22	8	965	960	1177	0.00	45.31	24.28
9	8	9	23	9	800	800	1177	0.00	24.28	4.52
10	9	10	24	10	3	10	1177	0.00	4.52	4.52
11	10	11	25	11	50	50	1177	0.00	4.52	4.52
12	11	12	26	12	3	10	1177	0.00	4.52	4.52
13	12	0	27	28	3	10	1177	0.00	4.52	4.52
14	7	13	29	13	900	900	1177	0.47	45.31	35.82
15	13	14	30	14	791	790	1177	0.47	35.82	48.70
16	14	15	31	15	4460	4462	1177	0.47	48.70	7.25
17	15	16	32	16	3	10	1177	0.47	7.25	7.24
18	16	17	33	17	50	50	1177	0.47	7.24	6.60
19	17	18	34	18	3	10	1177	0.47	6.60	6.59
20	18	0	35	36	3	10	1177	0.47	6.59	6.57

NOTES:
1. Head computations at FGN'S use elevation of other end of pipe section
2. Pipe section resistances are based on initial conditions (Q <> 0)
3. Resistances for zero flow sections based on velocity (4 ft/s or 1 m/s)
4. The use of the Hazen Williams head loss relation results in values

***** THE INITIAL CONDITION DATA FILE FOR SURGE4 IS NOW BEING GENERATED *****

1. SYSTEM DATA:
2.
Number of line segments = -18
Number of components = 2
Number of junctions = 17
Number of SDO's = 0
Time increment = .0085

NOTE: USERS MUST PROVIDE THE ADDITIONAL SYSTEM DATA

2. LINE SEGMENT DATA:

FIRST POSITION	SECOND POSITION	NO. OF TIME INCREMENTS	C/GA	INITIAL FLOW	SEGMENT RESISTANCE
19	1	1	611.2385	0.4689	2.9345
2	3	1	611.2385	0.4689	5.5793
4	5	3	424.4712	0.4689	0.7392
20	6	32	238.7651	0.4689	1.9091
21	7	217	238.7651	0.4689	12.7762
22	8	96	238.7651	0.0000	5.9941
23	9	80	611.2385	0.0000	64.7431
24	10	1	611.2385	0.0000	0.2428

25	11	5	611.2385	0.0000	4.0464
26	12	1	611.2385	0.0000	21.4012
27	28	1	611.2385	0.0000	0.2428
29	13	90	424.4712	0.4689	21.4604
30	14	79	424.4712	0.4689	18.8613
31	15	446	424.4712	0.4689	106.3483
32	16	1	424.4712	0.4689	0.0715
33	17	5	611.2385	0.4689	2.8972
34	18	1	424.4712	0.4689	0.0715
35	36	1	424.4712	0.4689	0.0715

The total number of wave travel increments = 1061

3. COMPONENT DATA:

1st	2nd	characteristics			Heads	
POS.	POS.	A	B	C	H1	H2
1.0	2	61.000	0.257	-31.571	0.085	54.262
3.0	4	0.000	0.000	-0.250	53.035	52.980

5. JUNCTION DATA:

POS. NO. 1st PIPE	NO. OF LEGS	INITIAL HEAD	ADDITIONAL POS. NO's
5	-2	52.82	20
6	-2	39.47	21
7	-3	45.31	22 29
8	-2	24.28	23
9	-2	4.52	24
10	-2	4.52	25
11	-2	4.52	26
12	-2	4.52	27
13	-2	35.82	30
14	-2	48.70	31
15	-2	7.25	32
16	-2	7.24	33
17	-2	6.60	34
18	-2	6.59	35
19	0	0.73	
28	0	4.52	
36	0	6.57	

NOTE: HEAD values noted above at reservoirs connections may be incorrect
- elevations of reservoir connections are undefined in the SIC data.

6. SDO DATA - NO SDO'S WERE SET UP IN THE SIC DATA FILE

8. CHECK VALVE DATA
ALL Check Valve data must be provided by the User - with SURGEDAT

NOTE: Users must provide the following data using SURGEDAT

9a. VARIABLE INPUT DATA
9b. time - ratio data
10. TABULATED OUTPUT DATA
11. PLOTTED OUTPUT DATA
12. SCREEN PLOT DATA

>>>> THE INITIAL CONDITION FILE FOR SURGEDAT (gk_ic3.ICF) IS NOW GENERATED *****

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      ************** - SURGE PROGRAM - VERSION 4.4 - *************
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DATE =     -    TIME = 14:53:25

INPUT DATA FILE NAME = gk_ic3.DAT
OUTPUT DATA FILE NAME = gk_ic3.OUT

TOTAL SIMULATION TIME = 100                TIME INCREMENT = .01

SI UNITS ARE SPECIFIED:   FLOW = CMS   -   HEAD = M.

**** SUMMARY OF PIPE SYSTEM DATA ****


    NUMBERS OF SPECIFIC ELEMENTS

LINE SEGMENTS = 18      COMPONENTS = 2
JUNCTIONS = 17          BYPASS LINES = 0
SIDE ORIFICES = 0      RELIEF VALVES = 0
CHECK VALVES = 1       VARIABLE INPUTS= 1


                LINE SEGMENT DATA

POSITION     TRAVEL       C/GA      INITIAL     SEGMENT
OF ENDS    INCREMENTS              FLOWRATE   RESISTANCE
 19    1        1         611.24       0.47        2.93
  2    3        1         611.24       0.47        5.58
  4    5        3         424.47       0.47        0.74
 20    6       32         238.77       0.47        1.91
 21    7      217         238.77       0.47       12.78
 22    8       96         238.77       0.00        5.99
 23    9       80         611.24       0.00       64.74
 24   10        1         611.24       0.00        0.24
 25   11        5         611.24       0.00        4.05
 26   12        1         611.24       0.00       21.40
 27   28        1         611.24       0.00        0.24
 29   13       90         424.47       0.47       21.46
 30   14       79         424.47       0.47       18.86
 31   15      446         424.47       0.47      106.35
 32   16        1         424.47       0.47        0.07
 33   17        5         611.24       0.47        2.90
 34   18        1         424.47       0.47        0.07
 35   36        1         424.47       0.47        0.07


                COMPONENT DATA

POSITION NUMBERS = 1  2
      A =  61  B =  .257  C = -31.571
INITIAL FLOWRATE = .47    INITIAL HEADS = 0 - 54.2

POSITION NUMBERS = 3  4
      A =  0  B =  0  C = -.25
INITIAL FLOWRATE = .47    INITIAL HEADS = 53 - 52.9


                JUNCTION DATA

 JUNCTION      NUMBER      INITIAL      CONNECTING
 LOCATION      OF LEGS      HEAD         POSITIONS
     5           2          52.8       20
     6           2          39.5       21
     7           3          45.3       22    29
     8           2          24.3       23
     9           2           4.5       24
    10           2           4.5       25
    11           2           4.5       26
```

12	2	4.5	27
13	2	35.8	30
14	2	48.7	31
15	2	7.3	32
16	2	7.2	33
17	2	6.6	34
18	2	6.6	35
19	0	0.7	
28	0	4.5	
36	0	6.6	

CHECK VALVE DATA

THERE IS A CHECK VALVE AT POSITION 3
TIME DELAY FOR VALVE = .1 - CV RESISTANCE = .25
NOTE: THIS CHECK VALVE WILL NOT REOPEN ONCE CLOSURE OCCURS
THE INITIAL HEAD LOSS DUE TO THE CHECK VALVE RESISTANCE = .05

NOTE: CHECK VALVE RESISTANCES MUST BE INCLUDED WITH THE COMPONENT DATA

VARIABLE INPUT DATA

INPUT # 1 - PUMP START UP OR SHUT DOWN IS SPECIFIED AT POSITION NO. 1
REFERENCE VALUES FOR PUMP COEFFICIENTS (N/NR (R) =1):
A = 61 B = .257 C = -31.571

TIME - RATIO INPUT DATA

TIME	RATIO
1	1
2	0

THE FOLLOWING INITIAL VALUE IS CALCULATED FOR THIS VARIABLE INPUT:
... These should agree with initial values previously input (in parenthesis)
THE INITIAL VALUES FOR PUMP COEFF. - A = 61 (61) B = .257 (.257)

**** SUMMARY OF INITIAL CONDITIONS FOR LINE SEGMENTS ****

END POSITION DESIGNATIONS: J - JUNCTION, C - COMPONENT, S - SDO
* - THIS DENOTES AN UNDESIGNATED END POSITION (UNACCEPTABLE) - CORRECT DATA

END POSITIONS #1	END POSITIONS #2	FLOW 1 to 2	HEAD #1	HEAD #2	HEAD LOSS	ELEVATION DIFFERENCE
19 J	1 C	0.47	0.7	0.1	0.6	0.0
2 C	3 C	0.47	54.3	53.0	1.2	0.0
4 C	5 J	0.47	53.0	52.8	0.2	-0.0
20 J	6 J	0.47	52.8	39.5	0.4	12.9
21 J	7 J	0.47	39.5	45.3	2.8	-8.7
22 J	8 J	0.00	45.3	24.3	0.0	21.0
23 J	9 J	0.00	24.3	4.5	0.0	19.8
24 J	10 J	0.00	4.5	4.5	0.0	0.0
25 J	11 J	0.00	4.5	4.5	0.0	0.0
26 J	12 J	0.00	4.5	4.5	0.0	0.0
27 J	28 J	0.00	4.5	4.5	0.0	0.0
29 J	13 J	0.47	45.3	35.8	4.7	4.8
30 J	14 J	0.47	35.8	48.7	4.1	-17.0
31 J	15 J	0.47	48.7	7.3	23.4	18.1
32 J	16 J	0.47	7.3	7.2	0.0	0.0
33 J	17 J	0.47	7.2	6.6	0.6	0.0
34 J	18 J	0.47	6.6	6.6	0.0	0.0
35 J	36 J	0.47	6.6	6.6	0.0	-0.0

****** FLOWRATE AND PRESSURE RESULTS ******

TIME	H- 4	Q- 4
0.200	53.0	0.469
0.400	53.0	0.469
0.600	53.0	0.469
0.800	53.0	0.469
1.000	53.0	0.469
1.200	37.2	0.416
1.400	21.6	0.349
1.600	9.6	0.297
1.800	2.0	0.262
2.000	-1.3	0.245
2.200	-1.6	0.242
2.400	-1.6	0.242
2.600	0.1	0.230
2.800	-0.5	0.211
3.000	-0.9	0.207
3.200	-1.5	0.209
3.400	0.5	0.199
3.600	0.0	0.182
3.800	-0.3	0.177
4.000	-0.9	0.180
4.200	0.6	0.172
4.400	0.4	0.157
4.600	0.5	0.150
4.800	-0.7	0.153
5.000	0.7	0.148
5.200	0.6	0.134
5.400	0.4	0.125
5.600	-0.2	0.130
5.800	0.8	0.126
6.000	0.5	0.115
6.200	0.6	0.104
6.400	-0.2	0.107
6.600	0.9	0.105
6.800	1.0	0.096
7.000	0.8	0.084
7.200	0.3	0.087
7.400	1.1	0.085
7.600	1.3	0.078
7.800	0.9	0.066
8.000	-0.0	0.067
8.200	0.7	0.066
8.400	1.3	0.061
8.600	1.1	0.048
8.800	0.3	0.050
9.000	0.7	0.049
9.200	1.4	0.044
9.400	1.3	0.032
9.600	0.6	0.032
9.800	0.5	0.031
10.000	1.4	0.028
10.200	1.4	0.015
10.400	0.9	0.014
10.600	0.5	0.015
10.800	1.2	0.012
11.000	1.1	-0.001
CV CLOSURE OCCURS AT POSITION # 3		
11.200	1.6	0.000
11.400	0.9	0.000
11.600	2.1	0.000
11.800	3.6	0.000
12.000	4.4	0.000
12.200	4.4	0.000
12.400	0.3	0.000
12.600	1.9	0.000
12.800	0.9	0.000
13.000	3.6	0.000

13.200	3.4	0.000
13.400	5.0	0.000
13.600	3.9	0.000
13.800	0.7	0.000
14.000	2.0	0.000
14.200	1.0	0.000
14.400	4.9	0.000
14.600	3.8	0.000
14.800	5.3	0.000
15.000	2.8	0.000
15.200	1.8	0.000
15.400	1.7	0.000
15.600	1.4	0.000
15.800	5.2	0.000
16.000	4.2	0.000
16.200	5.1	0.000
16.400	1.4	0.000
16.600	2.4	0.000
16.800	1.0	0.000
17.000	2.0	0.000
17.200	4.6	0.000
17.400	4.3	0.000
17.600	4.4	0.000
17.800	0.4	0.000
18.000	2.1	0.000
18.200	0.5	0.000
18.400	3.2	0.000
18.600	3.9	0.000
18.800	4.2	0.000
19.000	3.5	0.000
19.200	0.6	0.000
19.400	1.2	0.000
19.600	0.7	0.000
19.800	4.5	0.000
20.000	3.7	0.000
20.200	4.2	0.000
20.400	2.4	0.000
20.600	1.5	0.000
20.800	0.6	0.000
21.000	1.7	0.000
21.200	5.4	0.000
21.400	4.2	0.000
21.600	4.5	0.000
21.800	1.5	0.000
22.000	2.4	0.000
22.200	0.5	0.000
22.400	3.1	0.000
22.600	5.3	0.000
22.800	4.8	0.000
23.000	4.5	0.000
23.200	0.9	0.000
23.400	2.4	0.000
23.600	68.8	0.000
23.800	74.8	0.000
24.000	74.8	0.000
24.200	68.6	0.000
24.400	61.7	0.000
24.600	64.6	0.000
24.800	67.7	0.000
25.000	65.0	0.000
25.200	63.9	0.000
25.400	67.8	0.000
25.600	69.6	0.000
25.800	70.7	0.000
26.000	70.8	0.000
26.201	68.6	0.000
26.401	68.5	0.000
26.601	70.4	0.000

26.801	65.7	0.000
27.001	66.2	0.000
27.201	73.7	0.000
27.401	73.0	0.000
27.601	71.0	0.000
27.801	68.1	0.000
28.001	51.7	0.000
28.201	52.7	0.000
28.401	58.7	0.000
28.601	41.7	0.000
28.801	56.4	0.000
29.001	48.6	0.000
29.201	47.6	0.000
29.401	53.1	0.000
29.601	59.8	0.000
29.801	-10.1	0.017
30.001	-4.6	0.000
30.201	17.4	0.000
30.401	14.8	0.000
30.601	96.5	0.000
30.801	74.8	0.000
31.001	72.4	0.000
31.201	77.3	0.000
31.401	83.6	0.000
31.601	77.0	0.000
31.801	86.4	0.000
32.001	93.8	0.000
32.201	105.9	0.000
32.401	71.2	0.000
32.601	58.9	0.000
32.801	54.9	0.000
33.000	62.3	0.000
33.200	72.2	0.000
33.400	73.7	0.000
33.600	69.5	0.000
33.800	68.4	0.000
34.000	63.0	0.000
34.200	47.4	0.000
34.400	53.0	0.000
34.600	57.6	0.000
34.800	55.9	0.000
35.000	55.2	0.000
35.200	52.8	0.000
35.400	59.2	0.000
35.600	52.8	0.000
35.800	39.3	0.000
36.000	27.3	0.000
36.200	35.2	0.000
36.400	37.1	0.000
36.600	48.4	0.000
36.800	36.0	0.000
37.000	33.5	0.000
37.200	19.6	0.000
37.400	42.4	0.000
37.600	59.4	0.000
37.800	45.0	0.000
38.000	48.4	0.000
38.200	47.6	0.000
38.400	79.5	0.000
38.600	69.6	0.000
38.799	76.3	0.000
38.999	95.8	0.000
39.199	75.4	0.000
39.399	37.1	0.000
39.599	32.2	0.000
39.799	28.0	0.000
39.999	31.9	0.000
40.199	29.0	0.000

40.399	29.3	0.000
40.599	25.6	0.000
40.799	-2.8	0.000
40.999	-4.2	-0.033
41.199	-5.4	0.000
41.399	8.5	0.000
41.599	6.0	0.000
41.799	17.2	0.000
41.999	8.3	0.000
42.199	-3.1	0.000
42.399	-10.1	0.000
42.599	-2.9	0.000
42.799	7.0	0.000
42.999	12.0	0.000
43.199	14.2	0.000
43.399	0.4	0.000
43.599	-4.1	0.000
43.799	-10.1	0.002
43.999	16.4	0.000
44.199	7.9	0.000
44.399	15.6	0.000
44.599	16.7	0.000
44.798	-10.1	-0.016
44.998	-3.7	0.000
45.198	-10.1	0.002
45.398	13.6	0.000
45.598	9.9	0.000
45.798	13.1	0.000
45.998	3.9	0.000
46.198	-10.1	0.011
46.398	-3.4	0.000
46.598	-10.1	-0.004
46.798	14.2	0.000
46.998	24.8	0.000
47.198	64.8	0.000
47.398	53.2	0.000
47.598	24.9	0.000
47.798	39.4	0.000
47.998	34.7	0.000
48.198	45.3	0.000
48.398	35.9	0.000
48.598	63.5	0.000
48.798	36.8	0.000
48.998	23.8	0.000
49.198	30.2	0.000
49.398	49.6	0.000
49.598	53.8	0.000
49.798	60.4	0.000
49.998	79.8	0.000
50.198	67.0	0.000
50.398	60.4	0.000
50.598	63.5	0.000
50.797	69.2	0.000
50.997	37.5	0.000
51.197	39.7	0.000
51.397	18.1	0.000
51.597	27.7	0.000
51.797	32.3	0.000
51.997	49.6	0.000
52.197	42.0	0.000
52.397	44.9	0.000
52.597	54.9	0.000
52.797	47.7	0.000
52.997	64.0	0.000
53.197	54.8	0.000
53.397	63.0	0.000
53.597	39.1	0.000
53.797	28.1	0.000

53.997	-10.1	0.013
54.197	74.2	0.000
54.397	53.0	0.000
54.597	53.8	0.000
54.797	45.5	0.000
54.997	49.0	0.000
55.197	65.1	0.000
55.397	65.8	0.000
55.597	63.5	0.000
55.797	72.6	0.000
55.997	40.3	0.000
56.197	34.4	0.000
56.397	36.5	0.000
56.597	45.2	0.000
56.796	57.2	0.000
56.996	61.6	0.000
57.196	37.0	0.000
57.396	39.9	0.000
57.596	58.6	0.000
57.796	34.2	0.000
57.996	48.6	0.000
58.196	19.3	0.000
58.396	31.6	0.000
58.596	22.7	0.000
58.796	14.2	0.000
58.996	54.4	0.000
59.196	39.0	0.000
59.396	41.2	0.000
59.596	52.9	0.000
59.796	46.1	0.000
59.996	63.0	0.000
60.196	70.2	0.000
60.396	55.5	0.000
60.596	27.5	0.000
60.796	22.9	0.000
60.996	27.8	0.000
61.196	44.2	0.000
61.396	31.7	0.000
61.596	39.3	0.000
61.796	43.6	0.000
61.996	41.5	0.000
62.196	43.1	0.000
62.396	45.2	0.000
62.596	63.7	0.000
62.795	76.8	0.000
62.995	32.5	0.000
63.195	51.3	0.000
63.395	56.7	0.000
63.595	41.9	0.000
63.795	52.3	0.000
63.995	42.3	0.000
64.195	38.9	0.000
64.395	47.0	0.000
64.595	29.8	0.000
64.795	27.6	0.000
64.995	30.0	0.000
65.196	20.1	0.000
65.396	22.4	0.000
65.596	41.3	0.000
65.796	29.2	0.000
65.996	55.3	0.000
66.196	49.7	0.000
66.396	28.6	0.000
66.596	21.1	0.000
66.796	26.4	0.000
66.996	25.7	0.000
67.196	9.3	0.000
67.396	5.3	0.000

67.596	-10.1	0.011
67.796	-3.7	0.000
67.996	3.3	0.000
68.196	8.8	0.000
68.396	18.9	0.000
68.596	19.8	0.000
68.796	-4.2	0.000
68.996	9.1	0.000
69.196	22.4	0.000
69.396	18.7	0.000
69.596	20.2	0.000
69.797	20.1	0.000
69.997	30.8	0.000
70.197	4.3	0.000
70.397	41.7	0.000
70.597	34.3	0.000
70.797	29.2	0.000
70.997	34.5	0.000
71.197	57.0	0.000
71.397	32.8	0.000
71.597	39.5	0.000
71.797	38.6	0.000
71.997	29.7	0.000
72.197	32.3	0.000
72.397	24.5	0.000
72.597	31.5	0.000
72.797	50.0	0.000
72.997	55.4	0.000
73.197	57.0	0.000
73.397	58.2	0.000
73.597	29.2	0.000
73.797	44.1	0.000
73.997	43.2	0.000
74.197	42.3	0.000
74.397	41.4	0.000
74.598	29.3	0.000
74.798	26.5	0.000
74.998	27.3	0.000
75.198	27.0	0.000
75.398	11.3	0.000
75.598	38.1	0.000
75.798	57.5	0.000
75.998	73.3	0.000
76.198	48.9	0.000
76.398	50.7	0.000
76.598	53.7	0.000
76.798	59.6	0.000
76.998	44.4	0.000
77.198	73.5	0.000
77.398	48.5	0.000
77.598	47.4	0.000
77.798	30.8	0.000
77.998	35.9	0.000
78.198	59.9	0.000
78.398	34.4	0.000
78.598	44.1	0.000
78.798	59.7	0.000
78.998	38.1	0.000
79.199	19.5	0.000
79.399	26.8	0.000
79.599	34.6	0.000
79.799	23.9	0.000
79.999	22.0	0.000
80.199	22.4	0.000
80.399	41.1	0.000
80.599	22.1	0.000
80.799	29.3	0.000
80.999	23.3	0.000

81.199	35.7	0.000
81.399	44.8	0.000
81.599	22.8	0.000
81.799	20.7	0.000
81.999	22.0	0.000
82.199	20.1	0.000
82.399	49.1	0.000
82.599	35.0	0.000
82.799	30.3	0.000
82.999	49.9	0.000
83.199	53.2	0.000
83.399	38.7	0.000
83.599	40.2	0.000
83.799	46.0	0.000
84.000	51.6	0.000
84.200	55.9	0.000
84.400	50.0	0.000
84.600	45.5	0.000
84.800	35.1	0.000
85.000	39.1	0.000
85.200	45.8	0.000
85.400	35.2	0.000
85.600	46.7	0.000
85.800	46.9	0.000
86.000	47.2	0.000
86.200	35.3	0.000
86.400	31.1	0.000
86.600	45.2	0.000
86.800	40.3	0.000
87.000	39.0	0.000
87.200	36.7	0.000
87.400	31.7	0.000
87.600	38.4	0.000
87.800	27.2	0.000
88.000	53.4	0.000
88.200	57.2	0.000
88.400	32.9	0.000
88.601	38.0	0.000
88.801	23.0	0.000
89.001	38.1	0.000
89.201	24.7	0.000
89.401	23.2	0.000
89.601	43.6	0.000
89.801	37.8	0.000
90.001	15.0	0.000
90.201	30.6	0.000
90.401	37.8	0.000
90.601	23.3	0.000
90.801	29.9	0.000
91.001	49.2	0.000
91.201	41.4	0.000
91.401	13.3	0.000
91.601	21.9	0.000
91.801	35.5	0.000
92.001	24.3	0.000
92.201	42.1	0.000
92.401	35.7	0.000
92.601	28.1	0.000
92.801	20.3	0.000
93.001	25.1	0.000
93.201	18.1	0.000
93.402	12.2	0.000
93.602	15.8	0.000
93.802	24.3	0.000
94.002	37.8	0.000
94.202	35.8	0.000
94.402	37.0	0.000
94.602	52.8	0.000

94.802	42.9	0.000
95.002	53.2	0.000
95.202	46.7	0.000
95.402	22.5	0.000
95.602	25.1	0.000
95.802	13.4	0.000
96.002	25.7	0.000
96.202	26.0	0.000
96.402	35.1	0.000
96.602	24.3	0.000
96.802	28.7	0.000
97.002	32.8	0.000
97.202	46.5	0.000
97.402	49.1	0.000
97.602	43.4	0.000
97.802	69.5	0.000
98.003	55.5	0.000
98.203	33.8	0.000
98.403	41.9	0.000
98.603	47.9	0.000
98.803	47.5	0.000
99.003	54.0	0.000
99.203	36.0	0.000
99.403	51.0	0.000
99.603	48.5	0.000
99.803	37.4	0.000

SUMMARY OF MAXIMUM AND MINIMUM HEADS

POSITION NO.	MAXIMUM	MINIMUM
1	2.4	-0.3
2	54.3	-1.3
3	53.0	-1.7
4	110.2	-10.1
5	108.6	-10.1
6	83.3	-10.1
7	87.3	-10.1
8	88.8	-10.1
9	59.0	-10.1
10	59.1	-10.1
11	59.1	-10.1
12	64.3	-10.1
13	90.2	-10.1
14	99.4	-10.1
15	57.5	-10.1
16	57.3	-10.1
17	53.2	-10.1
18	51.7	-10.1
19	0.7	0.7
28	4.5	4.5
36	6.6	6.6

*** END OF THIS SIMULATION ***

A PLOT FILE (gk_ic3.PLT) HAS BEEN CREATED WITH THE FOLLOWING DATA:

ITEM NO.	SPECIFIC RESULT
1	HEAD AT POS. # 4
2	FLOW AT POS. # 4

```
 ***** SIC PROGRAM:  STEADY STATE - SURGE INITIAL CONDITIONS *****
                     Version 1.32, Nov. 1991

DATE = 01-07-2001

INPUT DATA FILE NAME FOR THIS SIMULATION = gk_ic4.SIC
OUTPUT DATA FILE NAME FOR THIS SIMULATION = gk_ic4.TIC

NUMBER OF PIPES = 24
NUMBER OF JUNCTION NODES = 18
   FLOW UNITS = CUBIC METERS / SECONDS
   PRESSURE UNITS = KPA
  THE HAZEN WILLIAMS HEAD LOSS RELATION IS USED FOR THIS SIMULATION

CLOSED LINES -  6    8    12    18

**** SUMMARY OF INPUT DATA ***

PIPE  NODE NODE LENGTH   DIAM.  PIPE   SUM-M  PUMP   FGN
 NO.   #1   #2   (MT.)   (MM.)  RES.   FACT.  TYPE  GRADE
   1    0    1     5.0  500.0  110.0    2.0   0.0    9.3
   2    1    2     0.0    0.0    0.0    0.0   1.0
   3    2    3     5.0  500.0  110.0    4.0   0.0
   4    3    4     0.0    0.0    0.0    0.3   0.0
   5    4    5    31.0  600.0  110.0    0.0   0.0
   6    5    0     0.0    0.0    0.0    0.3   0.0   10.0
   7    5    6   325.0  800.0  110.0    0.0   0.0
   8    6    0     0.0    0.0    0.0    0.3   0.0   22.0
   9    6    7  2175.0  800.0  110.0    0.0   0.0
  10    7    8   965.0  500.0  110.0    0.0   0.0
  11    8    9   800.0  500.0  110.0    0.0   0.0
  12    9    0     0.0    0.0    0.0    0.3   0.0   22.0
  13    9   10     3.0  500.0  110.0    0.0   0.0
  14   10   11    50.0  500.0  110.0    0.0   0.0
  15   11   12     3.0  500.0  110.0   16.0   0.0
  16   12    0     3.0  500.0  110.0    0.0   0.0   26.3
  17    7   13   900.0  600.0  110.0    0.0   0.0
  18   13    0     0.0    0.0    0.0    0.3   0.0   18.0
  19   13   14   791.0  600.0  110.0    0.0   0.0
  20   14   15  4460.0  600.0  110.0    0.0   0.0
  21   15   16     3.0  600.0  110.0    0.0   0.0
  22   16   17    50.0  600.0  110.0    0.0   0.0
  23   17   18     3.0  600.0  110.0    0.0   0.0
  24   18    0     3.0  600.0  110.0    0.0   0.0   25.2

 FUNCTION OF ZERO LENGTH LINE SET UP:
    LINE NO.  2  IS A COMPONENT BETWEEN TWO LINE SEGMENTS
    LINE NO.  4  IS A COMPONENT BETWEEN TWO LINE SEGMENTS
    LINE NO.  6  IS A SDO CONNECTION(TO A RESERVOIR)
    LINE NO.  8  IS A SDO CONNECTION(TO A RESERVOIR)
    LINE NO.  12  IS A SDO CONNECTION(TO A RESERVOIR)
    LINE NO.  18  IS A SDO CONNECTION(TO A RESERVOIR)


*** DATA FOR PUMPS FOR THIS SYSTEM ***

PUMP TYPE # 1  IS DESCRIBED BY THE FOLLOWING DATA:
 HEAD     DISCHARGE
 61            0
 45.71         .7
 41            .8

THE FOLLOWING COEFFICIENTS ARE CALCULATED FOR THE PUMP CHARACTERISTIC:
        A =  61
        B =  .257
        C = -31.571
```

JUNCT. NO.	DEMAND	ELEVATION
1	0.0	8.6
2	0.0	8.6
3	0.0	8.6
4	0.0	8.6
5	0.0	8.6
6	0.0	21.5
7	0.0	12.8
8	0.0	2.0
9	0.0	21.7
10	0.0	21.7
11	0.0	21.7
12	0.0	21.7
13	0.0	17.6
14	0.0	0.6
15	0.0	18.6
16	0.0	18.6
17	0.0	18.6
18	0.0	18.6

**** THE RESULTS FOR THE STEADY STATE SIMULATION FOLLOW ****
NO. OF TRIALS = 8 - ACCURACY ATTAINED = 0

PIPE NO.	NODE #1	NODE #2	FLOW RATE	HEAD LOSS	MINOR LOSS	PUMP HEAD	LINE VELOCITY	HL 1000
1	0	1	0.70	0.13	1.31	0.00	3.58	26.99
2	1	2	0.70	0.00	0.00	45.57	0.00	0.00
3	2	3	0.70	0.13	2.62	0.00	3.58	26.99
4	3	4	0.70	0.00	0.12	0.00	0.00	0.00
5	4	5	0.70	0.34	0.00	0.00	2.49	11.11
LINE NO. 6	IS SHUT OFF							
7	5	6	0.70	0.89	0.00	0.00	1.40	2.74
LINE NO. 8	IS SHUT OFF							
9	6	7	0.70	5.95	0.00	0.00	1.40	2.74
10	7	8	0.36	7.58	0.00	0.00	1.84	7.86
11	8	9	0.36	6.29	0.00	0.00	1.84	7.86
LINE NO. 12	IS SHUT OFF							
13	9	10	0.36	0.02	0.00	0.00	1.84	7.86
14	10	11	0.36	0.39	0.00	0.00	1.84	7.86
15	11	12	0.36	0.02	2.76	0.00	1.84	7.86
16	12	0	0.36	0.02	0.00	0.00	1.84	7.86
17	7	13	0.34	2.63	0.00	0.00	1.21	2.92
LINE NO. 18	IS SHUT OFF							
19	13	14	0.34	2.31	0.00	0.00	1.21	2.92
20	14	15	0.34	13.03	0.00	0.00	1.21	2.92
21	15	16	0.34	0.01	0.00	0.00	1.21	2.92
22	16	17	0.34	0.15	0.00	0.00	1.21	2.92
23	17	18	0.34	0.01	0.00	0.00	1.21	2.92
24	18	0	0.34	0.01	0.00	0.00	1.21	2.92

JUNCTION NO.	ELEVATION (MT.)	DEMAND	PRESSURE (KPA)	PRESSURE HEAD	HYDRAULIC GRADE	DEMAND RESISTANCE
1	8.6	0.0	-7.0	-0.7	7.8	
2	8.6	0.0	439.9	44.9	53.4	
3	8.6	0.0	412.9	42.1	50.7	
4	8.6	0.0	411.7	42.0	50.5	
5	8.6	0.0	408.3	41.6	50.2	
6	21.5	0.0	272.8	27.8	49.3	
7	12.8	0.0	299.3	30.5	43.3	
8	2.0	0.0	331.4	33.8	35.8	
9	21.7	0.0	76.0	7.7	29.5	
10	21.7	0.0	75.7	7.7	29.5	
11	21.7	0.0	71.9	7.3	29.1	
12	21.7	0.0	44.6	4.5	26.3	
13	17.6	0.0	226.7	23.1	40.7	
14	0.6	0.0	371.0	37.8	38.4	
15	18.6	0.0	66.1	6.7	25.4	
16	18.6	0.0	66.0	6.7	25.4	
17	18.6	0.0	64.6	6.6	25.2	
18	18.6	0.0	64.5	6.6	25.2	

```
THE NET SYSTEM DEMAND = 0
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)
PIPE NO.        FLOW
    1            0.70
   16           -0.36
   24           -0.34

***** DATA FOR CARRYING OUT A SURGE ANALYSIS FOLLOWS:

THE TIME INCREMENT SELECTED FOR SURGE ANALYSIS =  .0085  SEC.

*** TABLE OF ASSIGNED POSITIONS, LENGTHS AND INITIAL CONDITIONS FOR SURGE4 ***
```

SECTION NUMBER	ORIGINAL NODES		ASSIGNED NODES		ORIGINAL LENGTH	ASSIGNED LENGTH	WAVE SPEED	INITIAL CONDITIONS Q	H1	H2
1	0	1	19	1	5	10	1177	0.70	0.73	-0.71
2	1	2	1	2	0	0	1177	0.70	-0.71	44.85
3	2	3	2	3	5	10	1177	0.70	44.85	42.10
4	3	4	3	4	0	0	1177	0.70	42.10	41.98
5	4	5	4	5	31	30	1177	0.70	41.98	41.64
6	5	0	20	21	0	0	1177	0.00	41.64	1.45
7	5	6	22	6	325	320	1177	0.70	41.64	27.82
8	6	0	23	24	0	0	1177	0.00	27.82	0.52
9	6	7	25	7	2175	2171	1177	0.70	27.82	30.52
10	7	8	26	8	965	960	1177	0.36	30.52	33.79
11	8	9	27	9	800	800	1177	0.36	33.79	7.74
12	9	0	28	29	0	0	1177	0.00	7.74	0.27
13	9	10	30	10	3	10	1177	0.36	7.74	7.72
14	10	11	31	11	50	50	1177	0.36	7.72	7.33
15	11	12	32	12	3	10	1177	0.36	7.33	4.54
16	12	0	33	34	3	10	1177	0.36	4.54	4.52
17	7	13	35	13	900	900	1177	0.34	30.52	23.12
18	13	0	36	37	0	0	1177	0.00	23.12	0.40
19	13	14	38	14	791	790	1177	0.34	23.12	37.84
20	14	15	39	15	4460	4462	1177	0.34	37.84	6.74
21	15	16	40	16	3	10	1177	0.34	6.74	6.73
22	16	17	41	17	50	50	1177	0.34	6.73	6.59
23	17	18	42	18	3	10	1177	0.34	6.59	6.58
24	18	0	43	44	3	10	1177	0.34	6.58	6.57

```
NOTES:
 1. Head computations at FGN'S use elevation of other end of pipe section
 2. Pipe section resistances are based on initial conditions (Q <> 0)
 3. Resistances for zero flow sections based on velocity (4 ft/s or 1 m/s)
 4. The use of the Hazen Williams head loss relation results in values

***** THE INITIAL CONDITION DATA FILE FOR SURGE4 IS NOW BEING GENERATED *****

1.  SYSTEM DATA:
   Number of line segments = -18
   Number of components =  2
   Number of junctions =  13
   Number of SDO's =  4
   Time increment =  .0085

NOTE: USERS MUST PROVIDE THE ADDITIONAL SYSTEM DATA

2. LINE SEGMENT DATA:
```

FIRST POSITION	SECOND POSITION	NO. OF TIME INCREMENTS	C/GA	INITIAL FLOW	SEGMENT RESISTANCE
19	1	1	611.2385	0.7032	2.9177
2	3	1	611.2385	0.7032	5.5625
4	5	3	424.4712	0.7032	0.6962
22	6	32	238.7651	0.7032	1.7980
25	7	217	238.7651	0.7032	12.0326
26	8	96	611.2385	0.3612	58.1175
27	9	80	611.2385	0.3612	48.1803
30	10	1	611.2385	0.3612	0.1807
31	11	5	611.2385	0.3612	3.0113

32	12	1	611.2385	0.3612	21.3391
33	34	1	611.2385	0.3612	0.1807
35	13	90	424.4712	0.3420	22.4870
38	14	79	424.4712	0.3420	19.7636
39	15	446	424.4712	0.3420	111.4355
40	16	1	424.4712	0.3420	0.0750
41	17	5	424.4712	0.3420	1.2493
42	18	1	424.4712	0.3420	0.0750
43	44	1	424.4712	0.3420	0.0750

The total number of wave travel increments = 1061

3. COMPONENT DATA:

1st	2nd	characteristics			Heads	
POS.	POS.	A	B	C	H1	H2
1.0	2	61.000	0.257	-31.571	-0.713	44.855
3.0	4	0.000	0.000	-0.250	42.104	41.980

5. JUNCTION DATA:

POS. NO. 1st PIPE	NO. OF LEGS	INITIAL HEAD	ADDITIONAL POS. NO's	
7	-3	30.52	26	35
8	-2	33.79	27	
10	-2	7.72	31	
11	-2	7.33	32	
12	-2	4.54	33	
14	-2	37.84	39	
15	-2	6.74	40	
16	-2	6.73	41	
17	-2	6.59	42	
18	-2	6.58	43	
19	0	0.73		
34	0	4.52		
44	0	6.57		

NOTE: HEAD values noted above at reservoirs connections may be incorrect
- elevations of reservoir connections are undefined in the SIC data.

6. SDO DATA

1st POS.	2nd POS.	EXT. POS.	ORIFICE RESISTANCE	LINE HEAD	EXTERNAL HEAD
-5	22	20	0.25	41.64	1.45
-6	25	23	0.25	27.82	0.52
-9	30	28	0.25	7.74	0.27
-13	38	36	0.25	23.12	0.40

ADDITIONAL SDO DATA IS NORMALLY REQUIRED - PROVIDE THIS DATA USING SURGEDAT

8. CHECK VALVE DATA
ALL Check Valve data must be provided by the User - with SURGEDAT

NOTE: Users must provide the following data using SURGEDAT

9a. VARIABLE INPUT DATA
9b. time - ratio data
10. TABULATED OUTPUT DATA
11. PLOTTED OUTPUT DATA
12. SCREEN PLOT DATA

>>>> THE INITIAL CONDITION FILE FOR SURGEDAT (gk_ic4.ICF) IS NOW GENERATED *****

```
      ************** - SURGE PROGRAM - VERSION 4.4 - *************
   COPYRIGHTED BY DON J. WOOD, JAMES E. FUNK - LEXINGTON, KENTUCKY, 1991

DATE =     -    TIME = 12:26:07

INPUT DATA FILE NAME = gk_ic4.DAT
OUTPUT DATA FILE NAME = gk_ic4.OUT

TOTAL SIMULATION TIME = 200                TIME INCREMENT = .01

SI UNITS ARE SPECIFIED:   FLOW = CMS   -   HEAD = M.

**** SUMMARY OF PIPE SYSTEM DATA ****

    NUMBERS OF SPECIFIC ELEMENTS

LINE SEGMENTS = 18      COMPONENTS = 2
JUNCTIONS = 13          BYPASS LINES = 0
SIDE ORIFICES = 4      RELIEF VALVES = 0
CHECK VALVES = 1       VARIABLE INPUTS= 1

                LINE SEGMENT DATA

POSITION     TRAVEL       C/GA      INITIAL     SEGMENT
OF ENDS    INCREMENTS               FLOWRATE   RESISTANCE
 19    1        1         611.24       0.70       2.92
  2    3        1         611.24       0.70       5.56
  4    5        3         424.47       0.70       0.70
 22    6       32         238.77       0.70       1.80
 25    7      217         238.77       0.70      12.03
 26    8       96         611.24       0.36      58.12
 27    9       80         611.24       0.36      48.18
 30   10        1         611.24       0.36       0.18
 31   11        5         611.24       0.36       3.01
 32   12        1         611.24       0.36      21.34
 33   34        1         611.24       0.36       0.18
 35   13       90         424.47       0.34      22.49
 38   14       79         424.47       0.34      19.76
 39   15      446         424.47       0.34     111.44
 40   16        1         424.47       0.34       0.07
 41   17        5         424.47       0.34       1.25
 42   18        1         424.47       0.34       0.07
 43   44        1         424.47       0.34       0.07

                COMPONENT DATA

POSITION NUMBERS = 1  2
      A =  61   B =  .257   C = -31.571
INITIAL FLOWRATE = .7     INITIAL HEADS =-.8 - 44.8

POSITION NUMBERS = 3  4
      A =  0   B =  0   C = -.25
INITIAL FLOWRATE = .7     INITIAL HEADS = 42.1 - 41.9

                JUNCTION DATA

 JUNCTION      NUMBER      INITIAL      CONNECTING
 LOCATION      OF LEGS      HEAD         POSITIONS
     7            3          30.5       26     35
     8            2          33.8       27
    10            2           7.7       31
    11            2           7.3       32
    12            2           4.5       33
    14            2          37.8       39
    15            2           6.7       40
    16            2           6.7       41
    17            2           6.6       42
```

18	2	6.6	43
19	0	0.7	
34	0	4.5	
44	0	6.6	

SIDE DISCHARGE ORIFICE DATA

DATA FOR SDO # 1
SDO LINE POSITION NUMBERS = 5 22 - DISCHARGE POSITION = 20
SDO RESISTANCES = .25 (OUTFLOW) - .25 (INFLOW)
ORIFICE FLOW = 0 LINE HEAD = 41.64 EXTERNAL HEAD = 45.6
THIS SDO REPRESENTS A SURGE TANK - ADDITIONAL DATA FOLLOWS:
TANK DIAMETER = 2.5 GAS VOLUME = 7 INITIAL GAS HEAD = 41.6

DATA FOR SDO # 2
SDO LINE POSITION NUMBERS = 6 25 - DISCHARGE POSITION = 23
ARV EFFECTIVE ORIFICE AREAS = .25 (OUTFLOW) - .25 (INFLOW)
THIS SDO REPRESENTS AN AIR RELIEF VALVE

DATA FOR SDO # 3
SDO LINE POSITION NUMBERS = 9 30 - DISCHARGE POSITION = 28
ARV EFFECTIVE ORIFICE AREAS = .25 (OUTFLOW) - .25 (INFLOW)
THIS SDO REPRESENTS AN AIR RELIEF VALVE

DATA FOR SDO # 4
SDO LINE POSITION NUMBERS = 13 38 - DISCHARGE POSITION = 36
ARV EFFECTIVE ORIFICE AREAS = .25 (OUTFLOW) - .25 (INFLOW)
THIS SDO REPRESENTS AN AIR RELIEF VALVE

CHECK VALVE DATA

THERE IS A CHECK VALVE AT POSITION 3
TIME DELAY FOR VALVE = .01 - CV RESISTANCE = .25
NOTE: THIS CHECK VALVE WILL NOT REOPEN ONCE CLOSURE OCCURS
THE INITIAL HEAD LOSS DUE TO THE CHECK VALVE RESISTANCE = .12

NOTE: CHECK VALVE RESISTANCES MUST BE INCLUDED WITH THE COMPONENT DATA

VARIABLE INPUT DATA

INPUT # 1 - PUMP START UP OR SHUT DOWN IS SPECIFIED AT POSITION NO. 1
REFERENCE VALUES FOR PUMP COEFFICIENTS (N/NR (R) =1):
A = 61 B = .257 C = -31.571

TIME - RATIO INPUT DATA

TIME	RATIO
1	1
2	0

THE FOLLOWING INITIAL VALUE IS CALCULATED FOR THIS VARIABLE INPUT:
... These should agree with initial values previously input (in parenthesis)
THE INITIAL VALUES FOR PUMP COEFF. - A = 61 (61) B = .257 (.257)

**** SUMMARY OF INITIAL CONDITIONS FOR LINE SEGMENTS ****

END POSITION DESIGNATIONS: J - JUNCTION, C - COMPONENT, S - SDO
* - THIS DENOTES AN UNDESIGNATED END POSITION (UNACCEPTABLE) - CORRECT DATA

END POSITIONS #1	#2	FLOW 1 to 2	HEAD #1	#2	HEAD LOSS	ELEVATION DIFFERENCE
19 J	1 C	0.70	0.7	-0.7	1.4	-0.0
2 C	3 C	0.70	44.9	42.1	2.8	0.0
4 C	5 S	0.70	42.0	41.6	0.3	-0.0
22 S	6 S	0.70	41.6	27.8	0.9	12.9
25 S	7 J	0.70	27.8	30.5	6.0	-8.6
26 J	8 J	0.36	30.5	33.8	7.6	-10.9
27 J	9 S	0.36	33.8	7.7	6.3	19.8
30 S	10 J	0.36	7.7	7.7	0.0	-0.0
31 J	11 J	0.36	7.7	7.3	0.4	-0.0
32 J	12 J	0.36	7.3	4.5	2.8	0.0
33 J	34 J	0.36	4.5	4.5	0.0	0.0
35 J	13 S	0.34	30.5	23.1	2.6	4.8
38 S	14 J	0.34	23.1	37.8	2.3	-17.0
39 J	15 J	0.34	37.8	6.7	13.0	18.1
40 J	16 J	0.34	6.7	6.7	0.0	-0.0
41 J	17 J	0.34	6.7	6.6	0.1	0.0
42 J	18 J	0.34	6.6	6.6	0.0	-0.0
43 J	44 J	0.34	6.6	6.6	0.0	-0.0

****** FLOWRATE AND PRESSURE RESULTS ******

TIME	H- 22	Q- 22	V- 20
1.000	45.1	0.718	7.1
CV CLOSURE OCCURS AT POSITION # 3			
2.000	41.6	0.703	7.5
3.000	37.0	0.683	8.2
4.000	33.2	0.667	8.9
5.000	30.1	0.655	9.5
6.000	27.3	0.644	10.2
7.000	25.0	0.636	10.8
8.000	22.9	0.629	11.4
9.000	21.0	0.634	12.1
10.000	19.3	0.627	12.7
11.000	17.9	0.610	13.3
12.000	16.5	0.595	13.9
13.000	15.3	0.586	14.5
14.000	14.2	0.573	15.1
15.000	13.2	0.559	15.7
16.000	12.3	0.547	16.2
17.000	11.5	0.527	16.8
18.000	10.7	0.497	17.3
19.000	10.1	0.459	17.7
20.000	9.5	0.413	18.2
21.000	9.0	0.362	18.6
22.000	8.6	0.305	18.9
23.000	8.3	0.245	19.2
24.000	8.1	0.182	19.4
25.000	7.9	0.116	19.5
26.000	7.8	0.049	19.6
27.001	7.8	-0.018	19.6
28.001	7.8	-0.084	19.6
29.001	8.0	-0.150	19.5
30.001	8.2	-0.212	19.3
31.001	8.5	-0.271	19.0
32.001	8.9	-0.325	18.7
33.000	9.3	-0.372	18.4
34.000	9.8	-0.412	18.0
35.000	10.4	-0.445	17.6
36.000	11.1	-0.469	17.1
37.000	11.8	-0.482	16.6

38.000	12.6	-0.487	16.2
38.999	13.4	-0.481	15.7
39.999	14.2	-0.465	15.2
40.999	15.0	-0.438	14.7
41.999	15.8	-0.401	14.3
42.999	16.6	-0.355	13.9
43.999	17.3	-0.299	13.6
44.998	17.9	-0.237	13.4
45.998	18.4	-0.167	13.2
46.998	18.7	-0.093	13.0
47.998	18.8	-0.017	13.0
48.998	18.8	0.060	13.0
49.998	18.5	0.134	13.1
50.997	18.1	0.204	13.3
51.997	17.6	0.267	13.5
52.997	16.9	0.322	13.8
53.997	16.2	0.365	14.1
54.997	15.4	0.399	14.5
55.997	14.6	0.422	14.9
56.996	13.8	0.434	15.4
57.996	13.0	0.436	15.8
58.996	12.3	0.428	16.2
59.996	11.7	0.412	16.6
60.996	11.1	0.388	17.0
61.996	10.6	0.357	17.4
62.995	10.1	0.320	17.8
63.995	9.7	0.279	18.1
64.995	9.4	0.232	18.3
65.996	9.1	0.183	18.5
66.996	8.9	0.131	18.7
67.996	8.8	0.077	18.8
68.996	8.7	0.023	18.8
69.997	8.7	-0.032	18.8
70.997	8.8	-0.086	18.8
71.997	9.0	-0.139	18.7
72.997	9.2	-0.189	18.5
73.997	9.4	-0.235	18.3
74.998	9.8	-0.277	18.0
75.998	10.2	-0.314	17.7
76.998	10.7	-0.344	17.4
77.998	11.2	-0.367	17.0
78.998	11.7	-0.384	16.7
79.999	12.3	-0.392	16.3
80.999	13.0	-0.392	15.9
81.999	13.6	-0.384	15.5
82.999	14.3	-0.366	15.1
84.000	15.0	-0.342	14.8
85.000	15.6	-0.308	14.4
86.000	16.2	-0.268	14.2
87.000	16.7	-0.221	13.9
88.000	17.1	-0.168	13.7
89.001	17.4	-0.111	13.6
90.001	17.6	-0.052	13.5
91.001	17.6	0.009	13.5
92.001	17.5	0.070	13.5
93.001	17.3	0.128	13.6
94.002	16.9	0.183	13.8
95.002	16.5	0.231	14.0
96.002	16.0	0.273	14.2
97.002	15.4	0.307	14.5
98.003	14.8	0.332	14.8
99.003	14.1	0.350	15.2
100.003	13.5	0.358	15.5
101.003	12.9	0.358	15.9
102.003	12.3	0.350	16.3
103.004	11.8	0.336	16.6
104.004	11.3	0.315	16.9

105.004	10.8	0.288	17.2
106.004	10.5	0.257	17.5
107.004	10.1	0.221	17.7
108.005	9.9	0.182	17.9
109.005	9.7	0.139	18.1
110.005	9.5	0.095	18.2
111.005	9.4	0.049	18.3
112.006	9.4	0.003	18.3
113.006	9.4	-0.043	18.3
114.006	9.5	-0.089	18.2
115.006	9.6	-0.132	18.1
116.006	9.8	-0.174	18.0
117.007	10.1	-0.211	17.8
118.007	10.4	-0.245	17.5
119.007	10.8	-0.274	17.3
120.007	11.2	-0.297	17.0
121.007	11.7	-0.314	16.7
122.008	12.2	-0.325	16.4
123.008	12.7	-0.329	16.1
124.008	13.2	-0.326	15.7
125.008	13.8	-0.316	15.4
126.009	14.3	-0.299	15.1
127.009	14.9	-0.275	14.8
128.009	15.4	-0.245	14.5
129.008	15.8	-0.209	14.3
130.008	16.2	-0.168	14.1
131.007	16.5	-0.122	14.0
132.007	16.7	-0.074	13.9
133.006	16.8	-0.023	13.8
134.006	16.8	0.027	13.8
135.005	16.7	0.077	13.9
136.005	16.5	0.125	14.0
137.004	16.2	0.168	14.1
138.003	15.8	0.207	14.3
139.003	15.3	0.240	14.6
140.002	14.8	0.267	14.8
141.002	14.3	0.286	15.1
142.001	13.8	0.299	15.4
143.001	13.3	0.304	15.7
144.000	12.7	0.303	16.0
145.000	12.3	0.295	16.3
145.999	11.8	0.281	16.6
146.998	11.4	0.263	16.9
147.998	11.0	0.238	17.1
148.997	10.7	0.210	17.3
149.997	10.4	0.178	17.5
150.996	10.2	0.144	17.7
151.996	10.1	0.107	17.8
152.995	9.9	0.068	17.9
153.995	9.9	0.029	17.9
154.994	9.9	-0.012	18.0
155.994	9.9	-0.051	17.9
156.993	10.0	-0.091	17.9
157.992	10.2	-0.127	17.7
158.992	10.4	-0.162	17.6
159.991	10.6	-0.194	17.4
160.991	10.9	-0.221	17.2
161.990	11.2	-0.244	17.0
162.990	11.6	-0.262	16.7
163.989	12.0	-0.275	16.5
164.989	12.5	-0.282	16.2
165.988	12.9	-0.283	15.9
166.988	13.4	-0.278	15.6
167.987	13.9	-0.267	15.3
168.986	14.4	-0.249	15.1
169.986	14.8	-0.226	14.8
170.985	15.2	-0.198	14.6

171.985	15.6	-0.165	14.5
172.984	15.8	-0.129	14.3
173.984	16.1	-0.089	14.2
174.983	16.2	-0.047	14.1
175.983	16.3	-0.004	14.1
176.982	16.2	0.040	14.1
177.981	16.1	0.082	14.2
178.981	15.9	0.122	14.3
179.980	15.6	0.157	14.4
180.980	15.2	0.190	14.6
181.979	14.8	0.216	14.8
182.979	14.4	0.237	15.0
183.978	14.0	0.253	15.3
184.978	13.5	0.262	15.5
185.977	13.1	0.265	15.8
186.977	12.6	0.262	16.1
187.976	12.2	0.254	16.3
188.975	11.8	0.240	16.6
189.975	11.5	0.223	16.8
190.974	11.2	0.200	17.0
191.974	10.9	0.175	17.2
192.973	10.7	0.146	17.4
193.973	10.5	0.115	17.5
194.972	10.4	0.082	17.6
195.972	10.3	0.047	17.7
196.971	10.2	0.012	17.7
197.970	10.2	-0.023	17.7
198.970	10.3	-0.058	17.6
199.969	10.4	-0.092	17.6

SUMMARY OF MAXIMUM AND MINIMUM HEADS

POSITION NO.	MAXIMUM	MINIMUM
1	64.8	-10.1
2	64.8	-10.1
3	83.3	-10.1
4	66.4	-5.7
5	45.6	7.8
6	31.8	-0.0
7	34.4	5.7
8	37.6	19.5
9	11.4	3.1
10	11.4	3.1
11	11.0	3.6
12	8.1	2.8
13	26.9	1.0
14	41.6	18.6
15	10.2	4.6
16	10.2	4.7
17	10.0	4.8
18	10.0	4.8
19	0.7	0.7
34	4.5	4.5
44	6.6	6.6

*** END OF THIS SIMULATION ***

A PLOT FILE (gk_ic4.PLT) HAS BEEN CREATED WITH THE FOLLOWING DATA:

ITEM NO.	SPECIFIC RESULT
1	HEAD AT POS. # 22
2	FLOW AT POS. # 22

GOTHATUWA GROUND RESERVOIR SITE – GRAVITY DRAIN FOR OVERFLOW / WASHOUT

Gothatuwa Ground Reservoir and Water Tower

Design of Gravity Drain for Overflow and Washout

Design flow: assume flow control valve fully open and 2 pumps at Ambatalle

2 x 14 m3/min = 0.47 m3/sec

Manning n value for RCC Hume pipes: 0.012

Gravity drain design completed using mannings equation, $V = 1/n \times R^{2/3} \times S^{1/2}$ where R= D/4 for full pipe

Segment No.	From	To	Length (m)	Slope	dia. (m)	A (m2)	pipe full		
							R (m2/m)	Q (m3/s)	V m/s
1	MH1	MH2	42.4	0.005	0.600	0.283	0.150	0.47	1.66
2	MH2	MH3	22.5	0.005	0.600	0.283	0.150	0.47	1.66
3	MH3	MH4	20.0	0.036	0.450	0.159	0.113	0.59	3.68
4	MH4	MH5	48.0	0.036	0.450	0.159	0.113	0.59	3.68
5	MH5	MH6	50.0	0.036	0.450	0.159	0.113	0.59	3.68
6	MH6	MH7	59.5	0.042	0.450	0.159	0.113	0.63	3.98
7	MH7	Outfall	12.0	0.015	0.500	0.196	0.125	0.50	2.55

GOTHATUWA GROUND RESERVOIR, PUMP HOUSE AND GOTHATUWA NEW WATER TOWER - TIME SERIES ANALYSIS OF STORAGE AND PUMP CYCLES

Time Series Analysis for Year 2020

Maximum daily demand 30,910 m^3/d
Transmission main inflow 1287.9 m^3/h
Hourly Pumping rate 1,080 m^3/h

Time, h	Hourly Demand Coefficient	Inflow, m3	Total Daily Inflow, m3/d	Storage Volume in Ground Reservoir, m^3	No. of Pumping Units for the Hour	Total Pumping Rate per Hour, m3	Total Pumping Rate per day, m3	Storage Volume in Water Towers, m^3	To Distribution Network, m^3	Total Flow to Distribution Network, m^3/d	Total Storage (Ground Reservoir and Water Tower)
0	0.40	1,287.9	1,288	2,000	1.00	1,080	1,080	565	515	515	2,565
1	0.40	1,287.9	2,576	2,478	0.75	810	1,890	860	515	1,030	3,338
2	0.40	1,287.9	3,864	3,226	0.50	540	2,430	885	515	1,546	4,110
3	0.50	1,287.9	5,152	3,974	0.50	540	2,970	781	644	2,189	4,754
4	0.80	1,287.9	6,440	4,182	1.00	1,080	4,050	830	1030	3,220	5,012
5	1.20	1,287.9	7,728	4,120	1.25	1,350	5,400	635	1546	4,765	4,754
6	1.60	1,287.9	9,015	3,248	2.00	2,160	7,560	734	2061	6,826	3,982
7	1.30	1,287.9	10,303	2,915	1.50	1,620	9,180	680	1674	8,500	3,595
8	1.00	1,287.9	11,591	3,123	1.00	1,080	10,260	472	1288	9,788	3,595
9	0.80	1,287.9	12,879	3,331	1.00	1,080	11,340	521	1030	10,819	3,853
10	0.90	1,287.9	14,167	2,999	1.50	1,620	12,960	982	1159	11,978	3,982
11	1.35	1,287.9	15,455	2,667	1.50	1,620	14,580	864	1739	13,716	3,531
12	1.30	1,287.9	16,743	2,335	1.50	1,620	16,200	809	1674	15,391	3,144
13	0.90	1,287.9	18,031	2,543	1.00	1,080	17,280	730	1159	16,550	3,273
14	0.90	1,287.9	19,319	2,751	1.00	1,080	18,360	651	1159	17,709	3,402
15	0.90	1,287.9	20,607	2,959	1.00	1,080	19,440	572	1159	18,868	3,531
16	0.95	1,287.9	21,895	2,627	1.50	1,620	21,060	968	1224	20,092	3,595
17	1.40	1,287.9	23,183	2,295	1.50	1,620	22,680	785	1803	21,895	3,080
18	1.50	1,287.9	24,470	1,423	2.00	2,160	24,840	1,014	1932	23,826	2,436
19	1.60	1,287.9	25,758	550	2.00	2,160	27,000	1,113	2061	25,887	1,663
20	1.40	1,287.9	27,046	758	1.00	1,080	28,080	390	1803	27,690	1,148
21	1.00	1,287.9	28,334	966	1.00	1,080	29,160	182	1288	28,978	1,148
22	0.80	1,287.9	29,622	1,174	1.00	1,080	30,240	232	1030	30,008	1,406
23	0.70	1,287.9	30,910	1,792	0.62	670	30,910	0	902	30,910	1,792
24	0.40	1,287.9		2,000	1.00	1,080		565	515		2,565
25	0.40	1,287.9		2,478	0.75	810		860	515		3,338
26	0.40	1,287.9		3,226	0.50	540		885	515		4,110
27	0.50	1,287.9		3,974	0.50	540		781	644		4,754
28	0.80	1,287.9		4,182	1.00	1,080		830	1030		5,012
29	1.20	1,287.9		4,120	1.25	1,350		635	1546		4,754
30	1.60	1,287.9		3,248	2.00	2,160		734	2061		3,982
31	1.30	1,287.9		2,915	1.50	1,620		680	1674		3,595
32	1.00	1,287.9		3,123	1.00	1,080		472	1288		3,595
33	0.80	1,287.9		3,331	1.00	1,080		522	1030		3,853
34	0.90	1,287.9		2,999	1.50	1,620		982	1159		3,982
35	1.35	1,287.9		2,667	1.50	1,620		864	1739		3,531
36	1.30	1,287.9		2,335	1.50	1,620		809	1674		3,144
37	0.90	1,287.9		2,543	1.00	1,080		730	1159		3,273
38	0.90	1,287.9		2,751	1.00	1,080		651	1159		3,402
39	0.90	1,287.9		2,959	1.00	1,080		572	1159		3,531
40	0.95	1,287.9		2,627	1.50	1,620		969	1224		3,595
41	1.40	1,287.9		2,295	1.50	1,620		785	1803		3,080
42	1.50	1,287.9		1,423	2.00	2,160		1,014	1932		2,436
43	1.60	1,287.9		550	2.00	2,160		1,113	2061		1,663
44	1.40	1,287.9		758	1.00	1,080		390	1803		1,148
45	1.00	1,287.9		966	1.00	1,080		182	1288		1,148
46	0.80	1,287.9		1,174	1.00	1,080		232	1030		1,406
47	0.70	1,287.9	30,910	1,792	0.62	670	30,910	0	902	30,910	1,792
48	0.40	1,287.9		2,000	1.00	1,080		565	515		2,565
49	0.40	1,287.9		2,478	0.75	810		860	515		3,338
50	0.40	1,287.9		3,226	0.50	540		885	515		4,110
51	0.50	1,287.9		3,974	0.50	540		781	644		4,754
52	0.80	1,287.9		4,182	1.00	1,080		830	1030		5,012
53	1.20	1,287.9		4,120	1.25	1,350		635	1546		4,754
54	1.60	1,287.9		3,247	2.00	2,160		734	2061		3,982
55	1.30	1,287.9		2,915	1.50	1,620		680	1674		3,595
56	1.00	1,287.9		3,123	1.00	1,080		472	1288		3,595
57	0.80	1,287.9		3,331	1.00	1,080		522	1030		3,853
58	0.90	1,287.9		2,999	1.50	1,620		982	1159		3,982
59	1.35	1,287.9		2,667	1.50	1,620		864	1739		3,531
60	1.30	1,287.9		2,335	1.50	1,620		809	1674		3,144
61	0.90	1,287.9		2,543	1.00	1,080		730	1159		3,273
62	0.90	1,287.9		2,751	1.00	1,080		651	1159		3,402
63	0.90	1,287.9		2,959	1.00	1,080		572	1159		3,531
64	0.95	1,287.9		2,627	1.50	1,620		969	1224		3,595
65	1.40	1,287.9		2,295	1.50	1,620		785	1803		3,080
66	1.50	1,287.9		1,423	2.00	2,160		1,014	1932		2,436
67	1.60	1,287.9		550	2.00	2,160		1,113	2061		1,663
68	1.40	1,287.9		758	1.00	1,080		390	1803		1,148
69	1.00	1,287.9		966	1.00	1,080		182	1288		1,148
70	0.80	1,287.9		1,174	1.00	1,080		232	1030		1,406
71	0.70	1,287.9		1,792	0.62	670		0	902		1,792
72	0.40	1,287.9	30,910	2,000	1.00	1,080	30,910	565	515	30,910	2,565

```
[TITLE]
Gothatuwa 2020, 2 duty pumps in parallel, + 1 stand-by

[JUNCTIONS]
;--------------------
;       Elev     Demand
; ID     m        l/s
;--------------------
  2     21.0      0
  3     26.2      0
  5     23.0      0
  6     19.5       325         1


[TANKS]
;-----------------------------------------
;      Elev    Init     Min       Max      Diam.
; ID    m      Level    Level     Level      m
;-----------------------------------------
   1    21
   4    41.50   6.0     .25        6.0      19.55


[PIPES]
;-------------------------------------------------
;       Start     End      Length     Diam     Rough.
;ID     Node      Node       m         mm      Coeff.
;-------------------------------------------------
10         2         3       20        500       110      4.0
20         3         4       18.5      450       110
30         4         5       18.5      450       110
40         5         6       1000      500       110

[PUMPS]
-------------------------------
     Start   End      Design H-Q
 ID  Node    Node     m        l/s
-------------------------------
      1       2       30     300
      1       2       30     300

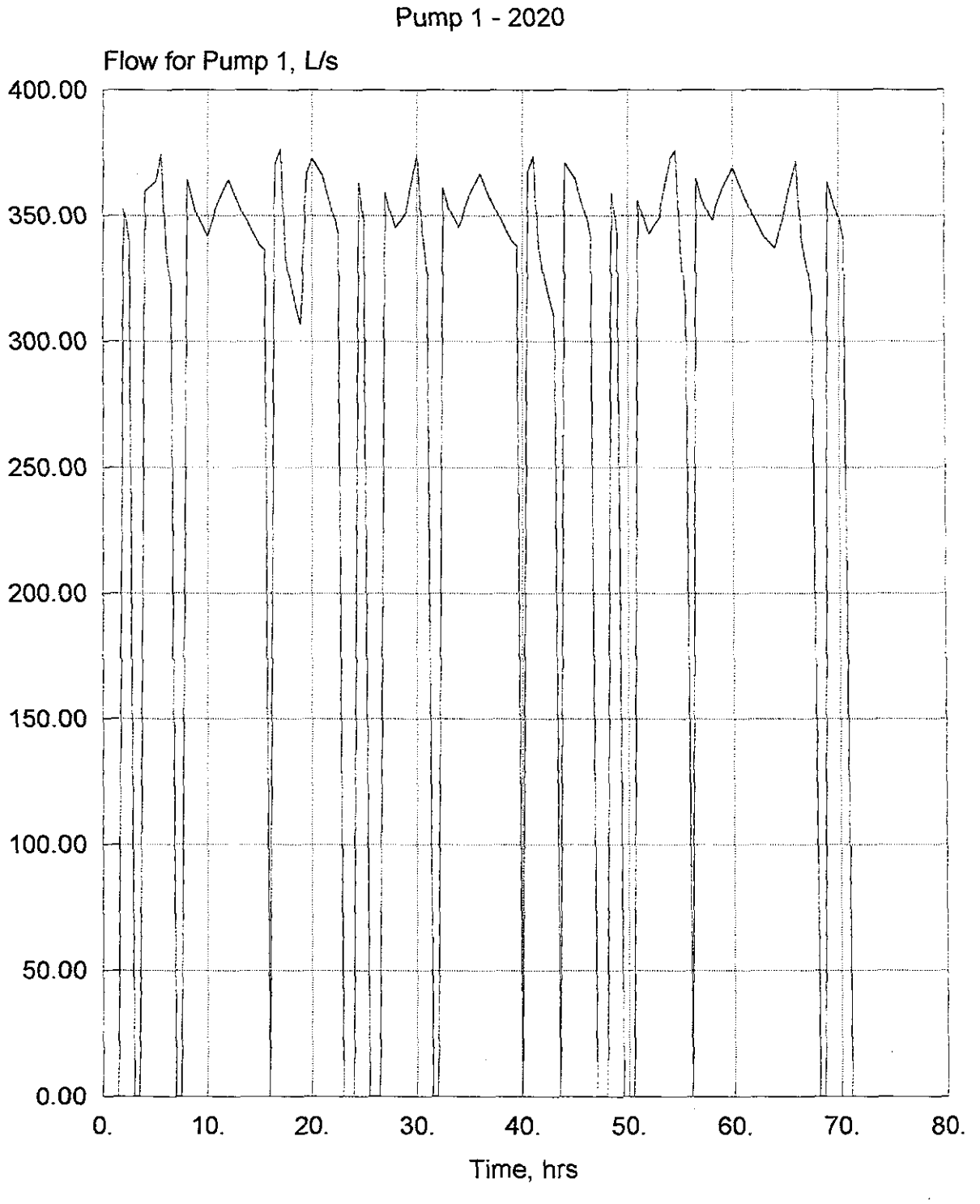
 CONTROLS]
 ----------------------------------------
  Pump 1 is on when Tank level < 3.5 m
  Pump 2 is on when Tank level < 2.5 m
 ----------------------------------------
 LINK 1 OPEN IF NODE 4 BELOW 3.5
 Link 1 CLOSED IF NODE 4 ABOVE 6.0
 LINK 2 OPEN IF NODE 4 BELOW 2.5
 LINK 2 CLOSED IF NODE 4 ABOVE 6.0


 PATTERNS]
```

```
;-----------------------------------------
; ID  Multipliers.....
;-----------------------------------------
  1    0.4 0.4 0.5 0.8 1.2 1.6
  1    1.3 1.0 0.8 0.9 1.35
  1    1.3 0.9 0.9 0.9 0.95
  1    1.4 1.5 1.6 1.4 1.0
  1    0.8 0.7 0.4


[TIMES]
;-------------------------------------------------
 DURATION 72          ; 72 hour simulation period
 PATTERN TIMESTEP 1;    1 hour pattern time period
 REPORT TIMESTEP 30 MIN
[OPTIONS]
;-------------------------------------------------
 UNITS     SI
map  Gotnet.map

[END]
```


Pump 1 - 2020
Flow for Pump 1, L/s
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
0.
10.
20.
30.
40.
50.
60.
70.
80.
Time, hrs

Gothatuwa 2020, 2 duty pumps in parallel, + 1 stand-by
"18Vüüüüüüüüü•18Vüüüüüüüüü•18Wüüüüüüüüü•47Vüüüüüüü½J Ç
Time Series for Pump 1

Time hrs	Diameter mm	Flow L/s	Velocity m/sec	Head m
0:00	0.00	0.00	0.00	0.00
0:30	0.00	0.00	0.00	0.00
1:00	0.00	0.00	0.00	0.00
1:30	0.00	0.00	0.00	0.00
2:00	0.00	352.83	0.00	26.17
2:30	0.00	338.99	0.00	27.23
3:00	0.00	0.00	0.00	0.00
3:30	0.00	0.00	0.00	0.00
4:00	0.00	359.45	0.00	25.64
4:30	0.00	361.58	0.00	25.47
5:00	0.00	363.55	0.00	25.31
5:30	0.00	374.22	0.00	24.44
6:00	0.00	337.07	0.00	27.38
6:30	0.00	320.99	0.00	28.55
7:00	0.00	0.00	0.00	0.00
7:30	0.00	0.00	0.00	0.00
8:00	0.00	363.86	0.00	25.29
8:30	0.00	356.60	0.00	25.87
9:00	0.00	349.72	0.00	26.41
9:30	0.00	345.58	0.00	26.73
10:00	0.00	341.70	0.00	27.03
10:30	0.00	348.77	0.00	26.48
11:00	0.00	355.20	0.00	25.98
11:30	0.00	359.93	0.00	25.61
12:00	0.00	364.28	0.00	25.26
12:30	0.00	359.29	0.00	25.66
13:00	0.00	354.58	0.00	26.03
13:30	0.00	350.15	0.00	26.38
14:00	0.00	345.98	0.00	26.70
14:30	0.00	342.07	0.00	27.00
15:00	0.00	338.41	0.00	27.28
15:30	0.00	336.20	0.00	27.44
16:00	0.00	0.00	0.00	0.00
16:30	0.00	370.39	0.00	24.76
17:00	0.00	376.10	0.00	24.28
17:30	0.00	333.70	0.00	27.63
18:00	0.00	322.17	0.00	28.47
18:30	0.00	313.95	0.00	29.05
19:00	0.00	306.65	0.00	29.55
19:30	0.00	366.43	0.00	25.08
20:00	0.00	372.46	0.00	24.59
20:30	0.00	369.24	0.00	24.85
21:00	0.00	366.21	0.00	25.10
21:30	0.00	358.84	0.00	25.69
22:00	0.00	351.85	0.00	26.24
22:30	0.00	342.84	0.00	26.94
23:00	0.00	0.00	0.00	0.00
23:30	0.00	0.00	0.00	0.00

Time Series for Pump 1

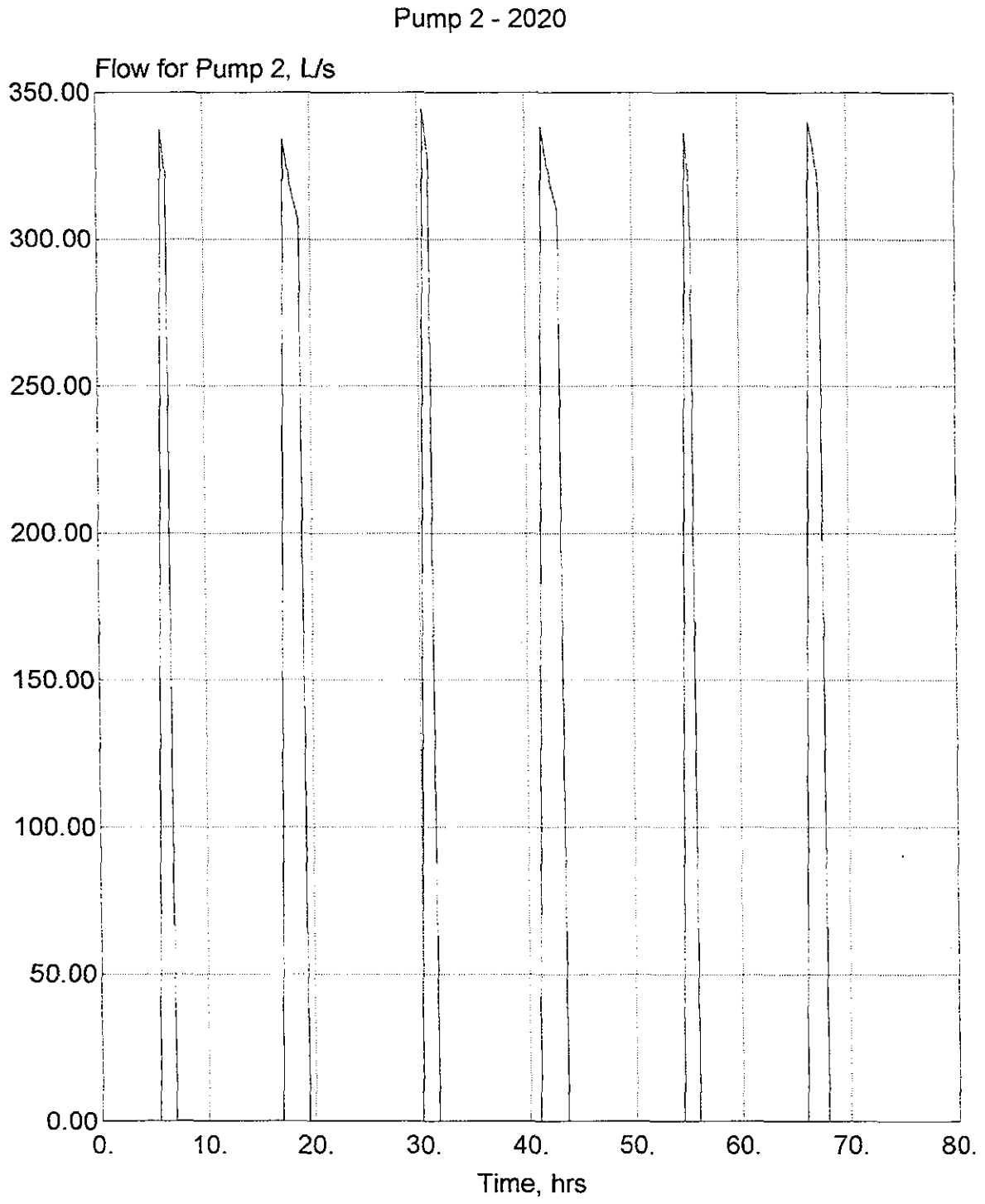
Time hrs	Diameter mm	Flow L/s	Velocity m/sec	Head m
24:00	0.00	0.00	0.00	0.00
24:30	0.00	363.29	0.00	25.34
25:00	0.00	346.76	0.00	26.64
25:30	0.00	0.00	0.00	0.00
26:00	0.00	0.00	0.00	0.00
26:30	0.00	0.00	0.00	0.00
27:00	0.00	358.87	0.00	25.69
27:30	0.00	351.87	0.00	26.24
28:00	0.00	345.24	0.00	26.76
28:30	0.00	348.49	0.00	26.51
29:00	0.00	351.47	0.00	26.27
29:30	0.00	363.33	0.00	25.33
30:00	0.00	374.03	0.00	24.46
30:30	0.00	344.10	0.00	26.84
31:00	0.00	327.46	0.00	28.09
31:30	0.00	0.00	0.00	0.00
32:00	0.00	0.00	0.00	0.00
32:30	0.00	360.79	0.00	25.54
33:00	0.00	353.69	0.00	26.10
33:30	0.00	349.31	0.00	26.44
34:00	0.00	345.20	0.00	26.76
34:30	0.00	351.95	0.00	26.24
35:00	0.00	358.10	0.00	25.75
35:30	0.00	362.60	0.00	25.39
36:00	0.00	366.73	0.00	25.06
36:30	0.00	361.60	0.00	25.47
37:00	0.00	356.76	0.00	25.86
37:30	0.00	352.20	0.00	26.22
38:00	0.00	347.91	0.00	26.55
38:30	0.00	343.88	0.00	26.86
39:00	0.00	340.10	0.00	27.15
39:30	0.00	337.78	0.00	27.32
40:00	0.00	0.00	0.00	0.00
40:30	0.00	367.40	0.00	25.00
41:00	0.00	373.35	0.00	24.51
41:30	0.00	338.16	0.00	27.29
42:00	0.00	326.21	0.00	28.18
42:30	0.00	317.56	0.00	28.79
43:00	0.00	309.85	0.00	29.33
43:30	0.00	0.00	0.00	0.00
44:00	0.00	370.77	0.00	24.73
44:30	0.00	367.66	0.00	24.98
45:00	0.00	364.72	0.00	25.22
45:30	0.00	357.43	0.00	25.80
46:00	0.00	350.50	0.00	26.35
46:30	0.00	341.56	0.00	27.04
47:00	0.00	0.00	0.00	0.00
47:30	0.00	0.00	0.00	0.00

Time Series for Pump 1

Time hrs	Diameter mm	Flow L/s	Velocity m/sec	Head m
48:00	0.00	0.00	0.00	0.00
48:30	0.00	359.16	0.00	25.67
49:00	0.00	342.74	0.00	26.95
49:30	0.00	0.00	0.00	0.00
50:00	0.00	0.00	0.00	0.00
50:30	0.00	0.00	0.00	0.00
51:00	0.00	356.05	0.00	25.91
51:30	0.00	349.19	0.00	26.45
52:00	0.00	342.71	0.00	26.95
52:30	0.00	346.16	0.00	26.69
53:00	0.00	349.33	0.00	26.44
53:30	0.00	361.41	0.00	25.49
54:00	0.00	372.29	0.00	24.60
54:30	0.00	375.67	0.00	24.32
55:00	0.00	336.07	0.00	27.45
55:30	0.00	313.60	0.00	29.07
56:00	0.00	0.00	0.00	0.00
56:30	0.00	364.36	0.00	25.25
57:00	0.00	357.08	0.00	25.83
57:30	0.00	352.50	0.00	26.19
58:00	0.00	348.20	0.00	26.53
58:30	0.00	354.68	0.00	26.02
59:00	0.00	360.59	0.00	25.55
59:30	0.00	364.89	0.00	25.21
60:00	0.00	368.84	0.00	24.88
60:30	0.00	363.59	0.00	25.31
61:00	0.00	358.64	0.00	25.71
61:30	0.00	353.97	0.00	26.08
62:00	0.00	349.57	0.00	26.42
62:30	0.00	345.44	0.00	26.74
63:00	0.00	341.57	0.00	27.04
63:30	0.00	339.14	0.00	27.22
64:00	0.00	336.88	0.00	27.39
64:30	0.00	345.59	0.00	26.73
65:00	0.00	353.46	0.00	26.12
65:30	0.00	362.88	0.00	25.37
66:00	0.00	371.42	0.00	24.67
66:30	0.00	339.94	0.00	27.16
67:00	0.00	329.90	0.00	27.91
67:30	0.00	316.58	0.00	28.86
68:00	0.00	0.00	0.00	0.00
68:30	0.00	0.00	0.00	0.00
69:00	0.00	363.27	0.00	25.34
69:30	0.00	356.04	0.00	25.91
70:00	0.00	349.19	0.00	26.45
70:30	0.00	340.31	0.00	27.13
71:00	0.00	0.00	0.00	0.00
71:30	0.00	0.00	0.00	0.00

Time Series for Pump 1

Time hrs	Diameter mm	Flow L/s	Velocity m/sec	Head m
72:00	0.00	0.00	0.00	0.00


Pump 2 - 2020
Flow for Pump 2, L/s
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
0.
10.
20.
30.
40.
50.
60.
70.
80.
Time, hrs

Gothatuwa 2020, 2 duty pumps in parallel, + 1 stand-by

Time Series for Pump 2

Time hrs	Diameter mm	Flow L/s	Velocity m/sec	Head m
0:00	0.00	0.00	0.00	0.00
0:30	0.00	0.00	0.00	0.00
1:00	0.00	0.00	0.00	0.00
1:30	0.00	0.00	0.00	0.00
2:00	0.00	0.00	0.00	0.00
2:30	0.00	0.00	0.00	0.00
3:00	0.00	0.00	0.00	0.00
3:30	0.00	0.00	0.00	0.00
4:00	0.00	0.00	0.00	0.00
4:30	0.00	0.00	0.00	0.00
5:00	0.00	0.00	0.00	0.00
5:30	0.00	0.00	0.00	0.00
6:00	0.00	337.07	0.00	27.38
6:30	0.00	320.99	0.00	28.55
7:00	0.00	0.00	0.00	0.00
7:30	0.00	0.00	0.00	0.00
8:00	0.00	0.00	0.00	0.00
8:30	0.00	0.00	0.00	0.00
9:00	0.00	0.00	0.00	0.00
9:30	0.00	0.00	0.00	0.00
10:00	0.00	0.00	0.00	0.00
10:30	0.00	0.00	0.00	0.00
11:00	0.00	0.00	0.00	0.00
11:30	0.00	0.00	0.00	0.00
12:00	0.00	0.00	0.00	0.00
12:30	0.00	0.00	0.00	0.00
13:00	0.00	0.00	0.00	0.00
13:30	0.00	0.00	0.00	0.00
14:00	0.00	0.00	0.00	0.00
14:30	0.00	0.00	0.00	0.00
15:00	0.00	0.00	0.00	0.00
15:30	0.00	0.00	0.00	0.00
16:00	0.00	0.00	0.00	0.00
16:30	0.00	0.00	0.00	0.00
17:00	0.00	0.00	0.00	0.00
17:30	0.00	333.70	0.00	27.63
18:00	0.00	322.17	0.00	28.47
18:30	0.00	313.95	0.00	29.05
19:00	0.00	306.65	0.00	29.55
19:30	0.00	0.00	0.00	0.00
20:00	0.00	0.00	0.00	0.00
20:30	0.00	0.00	0.00	0.00
21:00	0.00	0.00	0.00	0.00
21:30	0.00	0.00	0.00	0.00
22:00	0.00	0.00	0.00	0.00
22:30	0.00	0.00	0.00	0.00
23:00	0.00	0.00	0.00	0.00
23:30	0.00	0.00	0.00	0.00

Time Series for Pump 2

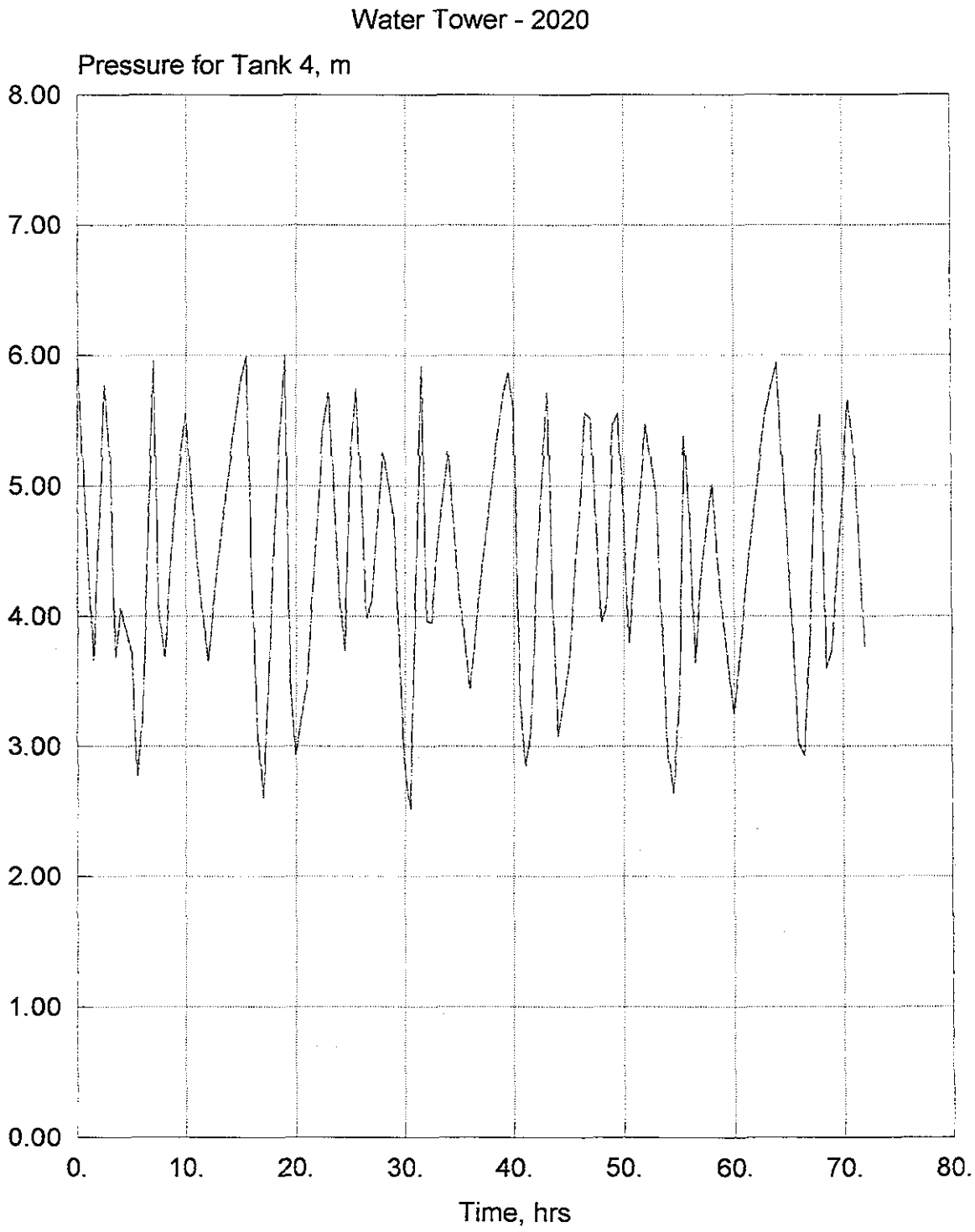
Time hrs	Diameter mm	Flow L/s	Velocity m/sec	Head m
24:00	0.00	0.00	0.00	0.00
24:30	0.00	0.00	0.00	0.00
25:00	0.00	0.00	0.00	0.00
25:30	0.00	0.00	0.00	0.00
26:00	0.00	0.00	0.00	0.00
26:30	0.00	0.00	0.00	0.00
27:00	0.00	0.00	0.00	0.00
27:30	0.00	0.00	0.00	0.00
28:00	0.00	0.00	0.00	0.00
28:30	0.00	0.00	0.00	0.00
29:00	0.00	0.00	0.00	0.00
29:30	0.00	0.00	0.00	0.00
30:00	0.00	0.00	0.00	0.00
30:30	0.00	344.10	0.00	26.84
31:00	0.00	327.46	0.00	28.09
31:30	0.00	0.00	0.00	0.00
32:00	0.00	0.00	0.00	0.00
32:30	0.00	0.00	0.00	0.00
33:00	0.00	0.00	0.00	0.00
33:30	0.00	0.00	0.00	0.00
34:00	0.00	0.00	0.00	0.00
34:30	0.00	0.00	0.00	0.00
35:00	0.00	0.00	0.00	0.00
35:30	0.00	0.00	0.00	0.00
36:00	0.00	0.00	0.00	0.00
36:30	0.00	0.00	0.00	0.00
37:00	0.00	0.00	0.00	0.00
37:30	0.00	0.00	0.00	0.00
38:00	0.00	0.00	0.00	0.00
38:30	0.00	0.00	0.00	0.00
39:00	0.00	0.00	0.00	0.00
39:30	0.00	0.00	0.00	0.00
40:00	0.00	0.00	0.00	0.00
40:30	0.00	0.00	0.00	0.00
41:00	0.00	0.00	0.00	0.00
41:30	0.00	338.16	0.00	27.29
42:00	0.00	326.21	0.00	28.18
42:30	0.00	317.56	0.00	28.79
43:00	0.00	309.85	0.00	29.33
43:30	0.00	0.00	0.00	0.00
44:00	0.00	0.00	0.00	0.00
44:30	0.00	0.00	0.00	0.00
45:00	0.00	0.00	0.00	0.00
45:30	0.00	0.00	0.00	0.00
46:00	0.00	0.00	0.00	0.00
46:30	0.00	0.00	0.00	0.00
47:00	0.00	0.00	0.00	0.00
47:30	0.00	0.00	0.00	0.00

Time Series for Pump 2

Time hrs	Diameter mm	Flow L/s	Velocity m/sec	Head m
48:00	0.00	0.00	0.00	0.00
48:30	0.00	0.00	0.00	0.00
49:00	0.00	0.00	0.00	0.00
49:30	0.00	0.00	0.00	0.00
50:00	0.00	0.00	0.00	0.00
50:30	0.00	0.00	0.00	0.00
51:00	0.00	0.00	0.00	0.00
51:30	0.00	0.00	0.00	0.00
52:00	0.00	0.00	0.00	0.00
52:30	0.00	0.00	0.00	0.00
53:00	0.00	0.00	0.00	0.00
53:30	0.00	0.00	0.00	0.00
54:00	0.00	0.00	0.00	0.00
54:30	0.00	0.00	0.00	0.00
55:00	0.00	336.07	0.00	27.45
55:30	0.00	313.60	0.00	29.07
56:00	0.00	0.00	0.00	0.00
56:30	0.00	0.00	0.00	0.00
57:00	0.00	0.00	0.00	0.00
57:30	0.00	0.00	0.00	0.00
58:00	0.00	0.00	0.00	0.00
58:30	0.00	0.00	0.00	0.00
59:00	0.00	0.00	0.00	0.00
59:30	0.00	0.00	0.00	0.00
60:00	0.00	0.00	0.00	0.00
60:30	0.00	0.00	0.00	0.00
61:00	0.00	0.00	0.00	0.00
61:30	0.00	0.00	0.00	0.00
62:00	0.00	0.00	0.00	0.00
62:30	0.00	0.00	0.00	0.00
63:00	0.00	0.00	0.00	0.00
63:30	0.00	0.00	0.00	0.00
64:00	0.00	0.00	0.00	0.00
64:30	0.00	0.00	0.00	0.00
65:00	0.00	0.00	0.00	0.00
65:30	0.00	0.00	0.00	0.00
66:00	0.00	0.00	0.00	0.00
66:30	0.00	339.94	0.00	27.16
67:00	0.00	329.90	0.00	27.91
67:30	0.00	316.58	0.00	28.86
68:00	0.00	0.00	0.00	0.00
68:30	0.00	0.00	0.00	0.00
69:00	0.00	0.00	0.00	0.00
69:30	0.00	0.00	0.00	0.00
70:00	0.00	0.00	0.00	0.00
70:30	0.00	0.00	0.00	0.00
71:00	0.00	0.00	0.00	0.00
71:30	0.00	0.00	0.00	0.00

Time Series for Pump 2

Time hrs	Diameter mm	Flow L/s	Velocity m/sec	Head m
72:00	0.00	0.00	0.00	0.00


Water Tower - 2020
Pressure for Tank 4, m
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.
10.
20.
30.
40.
50.
60.
70.
80.
Time, hrs

Gothatuwa 2020, 2 duty pumps in parallel, + 1 stand-by

Time Series for Tank 4

Time hrs	Demand L/s	Elevation m	Grade m	Pressure m
0:00	-130.00	41.50	47.50	6.00
0:30	-130.00	41.50	46.72	5.22
1:00	-130.00	41.50	45.94	4.44
1:30	-130.00	41.50	45.16	3.66
2:00	190.33	41.50	46.13	4.63
2:30	176.49	41.50	47.27	5.77
3:00	-260.00	41.50	46.74	5.24
3:30	-260.00	41.50	45.18	3.68
4:00	-30.55	41.50	45.56	4.06
4:30	-28.42	41.50	45.38	3.88
5:00	-156.45	41.50	45.21	3.71
5:30	-145.78	41.50	44.27	2.77
6:00	251.64	41.50	44.70	3.20
6:30	219.48	41.50	46.21	4.71
7:00	-325.00	41.50	47.45	5.95
7:30	-325.00	41.50	45.50	4.00
8:00	103.86	41.50	45.18	3.68
8:30	96.60	41.50	45.81	4.31
9:00	57.22	41.50	46.39	4.89
9:30	53.08	41.50	46.73	5.23
10:00	-97.05	41.50	47.05	5.55
10:30	-89.98	41.50	46.46	4.96
11:00	-67.30	41.50	45.92	4.42
11:30	-62.57	41.50	45.52	4.02
12:00	71.78	41.50	45.15	3.65
12:30	66.79	41.50	45.58	4.08
13:00	62.08	41.50	45.98	4.48
13:30	57.65	41.50	46.35	4.85
14:00	53.48	41.50	46.70	5.20
14:30	49.57	41.50	47.02	5.52
15:00	29.66	41.50	47.31	5.81
15:30	27.45	41.50	47.49	5.99
16:00	-455.00	41.50	45.74	4.24
16:30	-84.61	41.50	44.61	3.11
17:00	-111.40	41.50	44.10	2.60
17:30	179.91	41.50	45.02	3.52
18:00	124.34	41.50	46.10	4.60
18:30	107.90	41.50	46.85	5.35
19:00	158.29	41.50	47.49	5.99
19:30	-88.57	41.50	44.96	3.46
20:00	47.46	41.50	44.43	2.93
20:30	44.24	41.50	44.71	3.21
21:00	106.21	41.50	44.98	3.48
21:30	98.84	41.50	45.61	4.11
22:00	124.35	41.50	46.21	4.71
22:30	115.34	41.50	46.95	5.45
23:00	-130.00	41.50	47.21	5.71
23:30	-130.00	41.50	46.43	4.93

Time Series for Tank 4

Time hrs	Demand L/s	Elevation m	Grade m	Pressure m
24:00	-130.00	41.50	45.65	4.15
24:30	233.29	41.50	45.23	3.73
25:00	216.76	41.50	46.63	5.13
25:30	-130.00	41.50	47.24	5.74
26:00	-162.50	41.50	46.46	4.96
26:30	-162.50	41.50	45.49	3.99
27:00	98.87	41.50	45.61	4.11
27:30	91.87	41.50	46.21	4.71
28:00	-44.76	41.50	46.76	5.26
28:30	-41.51	41.50	46.49	4.99
29:00	-168.53	41.50	46.24	4.74
29:30	-156.67	41.50	45.23	3.73
30:00	-48.47	41.50	44.29	2.79
30:30	265.69	41.50	44.02	2.52
31:00	329.91	41.50	45.61	4.11
31:30	-325.00	41.50	47.41	5.91
32:00	-260.00	41.50	45.46	3.96
32:30	100.79	41.50	45.45	3.95
33:00	61.19	41.50	46.05	4.55
33:30	56.81	41.50	46.42	4.92
34:00	-93.55	41.50	46.76	5.26
34:30	-86.80	41.50	46.20	4.70
35:00	-64.40	41.50	45.68	4.18
35:30	-59.90	41.50	45.29	3.79
36:00	74.23	41.50	44.93	3.43
36:30	69.10	41.50	45.38	3.88
37:00	64.26	41.50	45.79	4.29
37:30	59.70	41.50	46.18	4.68
38:00	55.41	41.50	46.54	5.04
38:30	51.38	41.50	46.87	5.37
39:00	31.35	41.50	47.18	5.68
39:30	29.03	41.50	47.37	5.87
40:00	-455.00	41.50	47.08	5.58
40:30	-87.60	41.50	44.87	3.37
41:00	-114.15	41.50	44.35	2.85
41:30	188.83	41.50	44.59	3.09
42:00	132.42	41.50	45.73	4.23
42:30	115.12	41.50	46.52	5.02
43:00	164.70	41.50	47.21	5.71
43:30	-455.00	41.50	45.57	4.07
44:00	45.77	41.50	44.58	3.08
44:30	42.66	41.50	44.85	3.35
45:00	104.72	41.50	45.11	3.61
45:30	97.43	41.50	45.74	4.24
46:00	123.00	41.50	46.32	4.82
46:30	114.06	41.50	47.06	5.56
47:00	-130.00	41.50	47.02	5.52
47:30	-130.00	41.50	46.24	4.74

Time Series for Tank 4

Time hrs	Demand L/s	Elevation m	Grade m	Pressure m
48:00	-130.00	41.50	45.46	3.96
48:30	229.16	41.50	45.59	4.09
49:00	212.74	41.50	46.96	5.46
49:30	-130.00	41.50	47.05	5.55
50:00	-162.50	41.50	46.27	4.77
50:30	-162.50	41.50	45.29	3.79
51:00	96.05	41.50	45.85	4.35
51:30	89.19	41.50	46.43	4.93
52:00	-47.29	41.50	46.96	5.46
52:30	-43.84	41.50	46.68	5.18
53:00	-170.67	41.50	46.42	4.92
53:30	-158.59	41.50	45.39	3.89
54:00	-50.21	41.50	44.44	2.94
54:30	-46.83	41.50	44.14	2.64
55:00	347.14	41.50	44.79	3.29
55:30	302.21	41.50	46.88	5.38
56:00	-260.00	41.50	46.22	4.72
56:30	104.36	41.50	45.14	3.64
57:00	64.58	41.50	45.76	4.26
57:30	60.00	41.50	46.15	4.65
58:00	-90.55	41.50	46.51	5.01
58:30	-84.07	41.50	45.97	4.47
59:00	-61.91	41.50	45.46	3.96
59:30	-57.61	41.50	45.09	3.59
60:00	76.34	41.50	44.75	3.25
60:30	71.09	41.50	45.21	3.71
61:00	66.14	41.50	45.63	4.13
61:30	61.47	41.50	46.03	4.53
62:00	57.07	41.50	46.40	4.90
62:30	52.94	41.50	46.74	5.24
63:00	32.82	41.50	47.06	5.56
63:30	30.39	41.50	47.25	5.75
64:00	-118.12	41.50	47.44	5.94
64:30	-109.41	41.50	46.73	5.23
65:00	-134.04	41.50	46.07	4.57
65:30	-124.62	41.50	45.27	3.77
66:00	-148.58	41.50	44.52	3.02
66:30	159.88	41.50	44.42	2.92
67:00	204.80	41.50	45.38	3.88
67:30	178.16	41.50	46.61	5.11
68:00	-325.00	41.50	47.04	5.54
68:30	-325.00	41.50	45.09	3.59
69:00	103.27	41.50	45.23	3.73
69:30	96.04	41.50	45.85	4.35
70:00	121.69	41.50	46.43	4.93
70:30	112.81	41.50	47.16	5.66
71:00	-130.00	41.50	46.82	5.32
71:30	-130.00	41.50	46.04	4.54

Time Series for Tank 4

Time hrs	Demand L/s	Elevation m	Grade m	Pressure m
72:00	-130.00	41.50	45.26	3.76

PART III

MISCELLANEOUS

MALIGAKANDA OFFICE BUILDING
- CATALOGUE FOR LIGHTING FIXTURES AND DIESEL GENERATOR

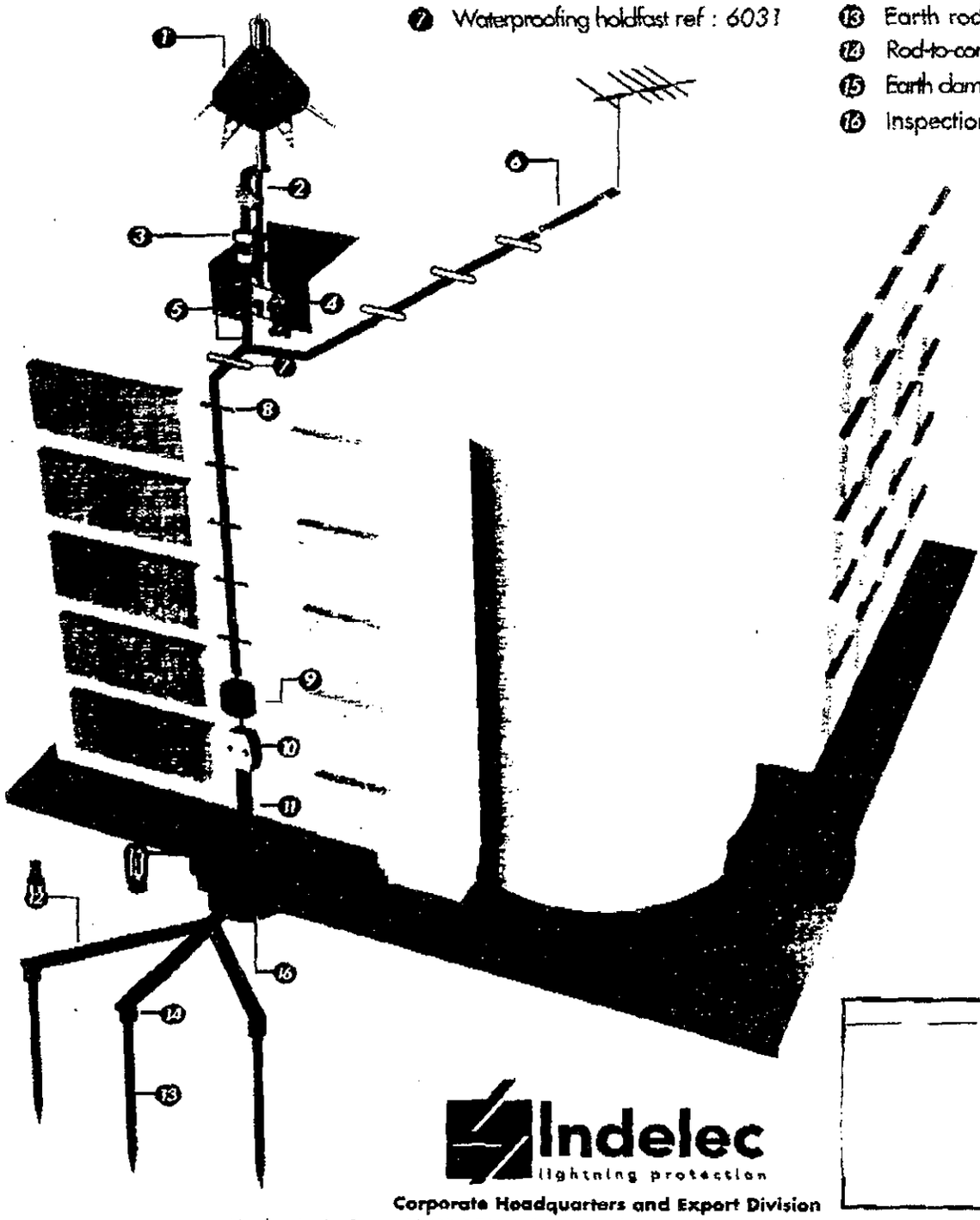
(1)

PROTECTION OF A BUILDING

using a PREVECTRON® EARLY STREAMER EMISSION (E.S.E) LIGHTNING CONDUCTOR

KEY

❶	Prevectron S 6.60	*ref : 1241*	❽	Galvanized steel hook	*ref : 6002*
❷	Elevation pole	*ref : 2023*		Lead plug	*ref : 6005*
❸	Clamping collar	*ref : 6058*	❾	Lightning flash counter	*ref : 8010*
❹	Side mounting brackets	*ref : 3013*	❿	Test clamp	*ref : 7001*
❺	Copper conductor	*ref : 5001*	⓫	Protection sheath	*ref : 7011*
❻	Aerial mast diverter	*ref : 8760*	⓬	Copper earthing	*ref : 7021*
❼	Waterproofing holdfast	*ref : 6031*	⓭	Earth rod	*ref : 7030*
			⓮	Rod-to-conductor clamp	*ref : 7039*
			⓯	Earth clamp	*ref : 8004*
			⓰	Inspection housing	*ref : 7052*

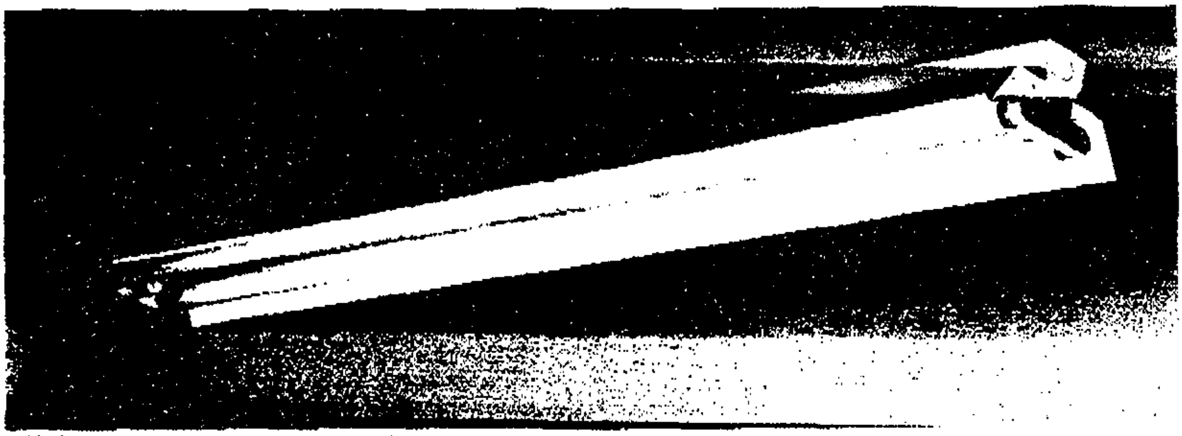


Indelec
lightning protection

Corporate Headquarters and Export Division
61, chemin des Postes 59500 DOUAI (France) - Tél : (33) 327.944.944 - Fax : (33) 327.944.945

2

BATTEN WITH DOUBLE SIDED REFLECTOR



TEDR

DESCRIPTION :

Commercial /Industrial fluorescent batten luminaires with double-sided reflector, conforming to relevant IEC & BS standards. Available for single & twin fluorescent lamps of 18/20W, 36/40W & 58/65W rating.

SALIENT FEATURES

- Good shielding
- Sturdy construction
- Switch start circuit
- Push fit type starter seat & lamp holder
- Mains connector ensures positive contact
- Heat resistant wiring
- Wide choice of lamps
- Easy to install & maintain
- IP20

MATERIAL & FINISH

Body, cover & Reflector : Fabricated from high quality CRCA sheet steel, pretreated, phosphated & powder coated.
Lamp & starter holders : Heat resistant polycarbonate.

OPTIONS

HPF, Extra- Low loss ballast, Electronic ballast, Dimmable ballast, Silicone rubber wiring, Emergency version. Other Voltages/ frequency, Anodised aluminium reflector. Custom made version of the above product can also be offered.

REFLECTOR

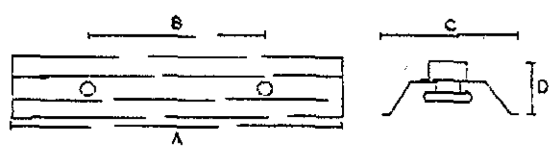
Reflector provides better optical control & the radial light distribution ensures higher uniform spacing to mounting height ratio & better vertical illumination.

MOUNTING

Suitable for surface mounting or through 20mm conduit suspension. A 20mm knockout is provided to facilitate cable entry.

APPLICATIONS

For cost effective lighting of working areas with low to medium visual requirements, such as in sheet metal processing areas, Industrial sheds, workshops, assembly plants, stores, warehouses etc.

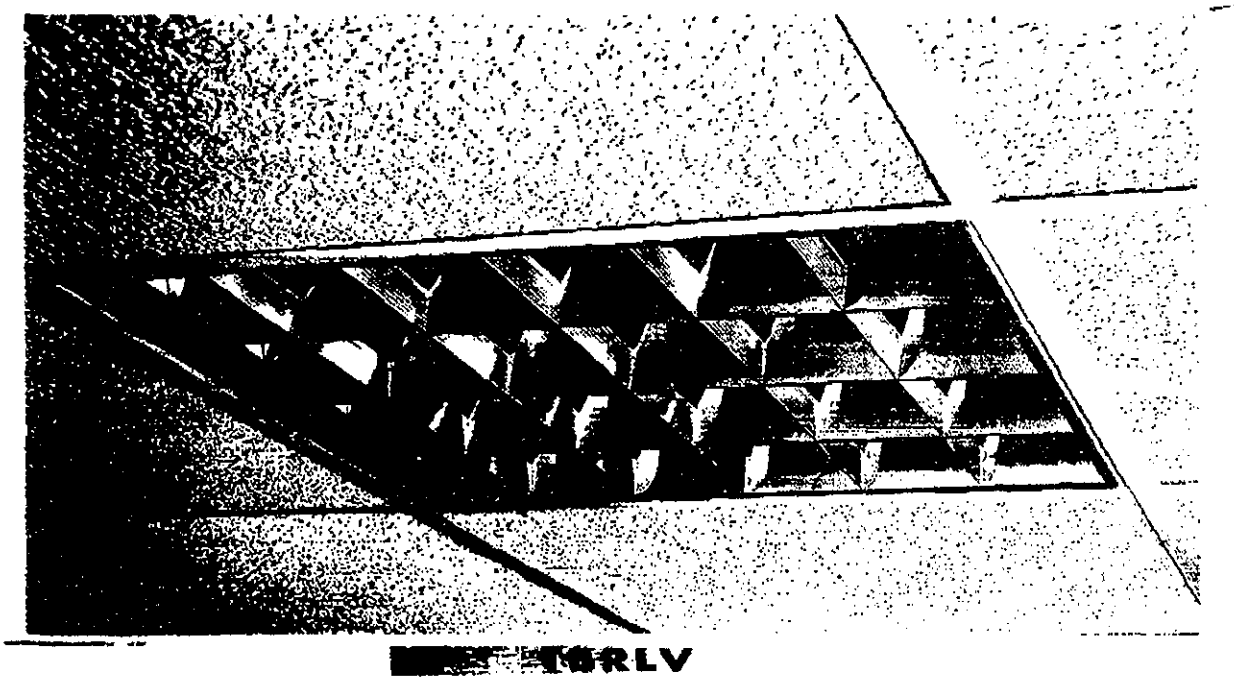


DIMENSION & TECHNICAL DATA :

Model	Lamp		Dimension (mm)			
	Type	No.	A	B	C	D
TEDR120	FTL18/20W	1	616	-	190	88
TEDR220	FTL18/20W	2	616	-	190	88
TEDR140	FTL36/40W	1	1226	608	190	88
TEDR240	FTL36/40W	2	1226	608	190	88
TEDR165	FTL58/65W	1	1526	608	190	88
TEDR265	FTL58/65W	2	1526	608	190	88

(Data subject to change without notice)

RECESSED MOUNTED - MIRROR OPTIC LUMINAIRE



[redacted]-T8RLV

DESCRIPTION :

Decorative / Commercial fluorescent luminaire for recessed mounting in modular false ceiling (exposed 'T' & concealed 'T') with high performance mirror optic reflector system. Suitable for upto 4 nos of fluorescent lamps of 18/20W, 36/40W & 58/65W rating, conforming to the relevant IEC & BS standards.

SALIENT FEATURES:

- High downward light output
- *Low surface luminance*
- Good glare control
- Push fit type starter seat & lamp holders
- Wide choice of lamps
- Heat resistant wiring
- *Easy to install and maintain*
- Wishbone springs for easy maintenance
- IP 20

MATERIAL & FINISH

Housing : *Fabricated from high quality CRCA sheet steel,* pretreated, phosphated & powder coated.
Lamp & starter holders: Heat resistant polycarbonate.
Optical assembly : Very high purity pre-anodised aluminium reflector & serrated X'mas tree cross louvres.

OPTIONS

HPF circuit or HF electronic control gear, emergency version, Dimmable ballast, Silicone rubber wiring, Other voltages/frequency, Provision for Clip-on ceiling. Custom made version of the above product can also be offered.

OPTICAL SYSTEM

Scientifically designed optical contour minimises spill-over light & gives excellent flux utilisation. Batwing light distribution gives higher uniform spacing to mounting height ratio & provides better balance between horizontal & vertical lighting.

MOUNTING:

A 20mm knockout is provided on the housing for cable entry. Provision for fixing of side brackets facilitate installation of luminaire directly on to false ceiling frame.

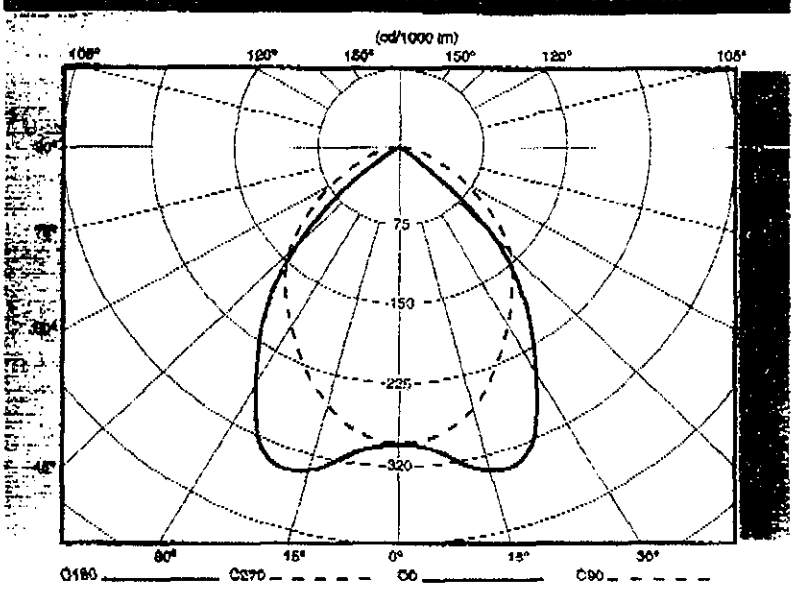
APPLICATIONS

Used for all economic energy saving & low luminance lighting *installations for medium visual requirements, such as offices,* sales & display areas, also for banking & counter halls, hotels, restaurants & living rooms etc.

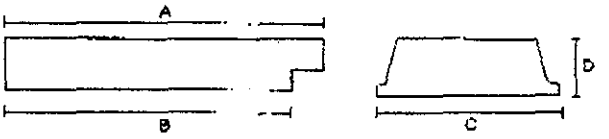
4

LUMINAIRE : TBR 420LV
OPTICS : Standard 24 Cell Louvre
LAMP : 4 x 18W Fluorescent

INTENSITY DISTRIBUTION IN cd/1000 lm



ROOM INDEX	REFLECTION FACTORS								
r (ceil)	70	70	70	50	50	50	30	30	0
r (wall)	50	30	10	50	30	10	30	10	0
r (work)	10	10	10	10	10	10	10	10	0
ROOM INDEX	**UTILIZATION FACTORS**								
0.6	32	28	25	31	27	25	27	25	23
0.8	39	35	32	38	34	31	34	31	30
1.0	44	40	37	43	39	37	39	36	35
1.25	49	46	43	48	45	43	45	42	41
1.5	52	49	47	51	48	46	48	46	45
2.0	56	53	51	54	52	50	51	50	48
2.5	58	56	54	57	55	53	54	53	51
3.0	60	58	57	59	57	56	56	55	54
4.0	61	60	58	60	59	58	58	57	55
5.0	62	61	60	61	60	59	59	58	57



DIMENSION & TECHNICAL DATA :

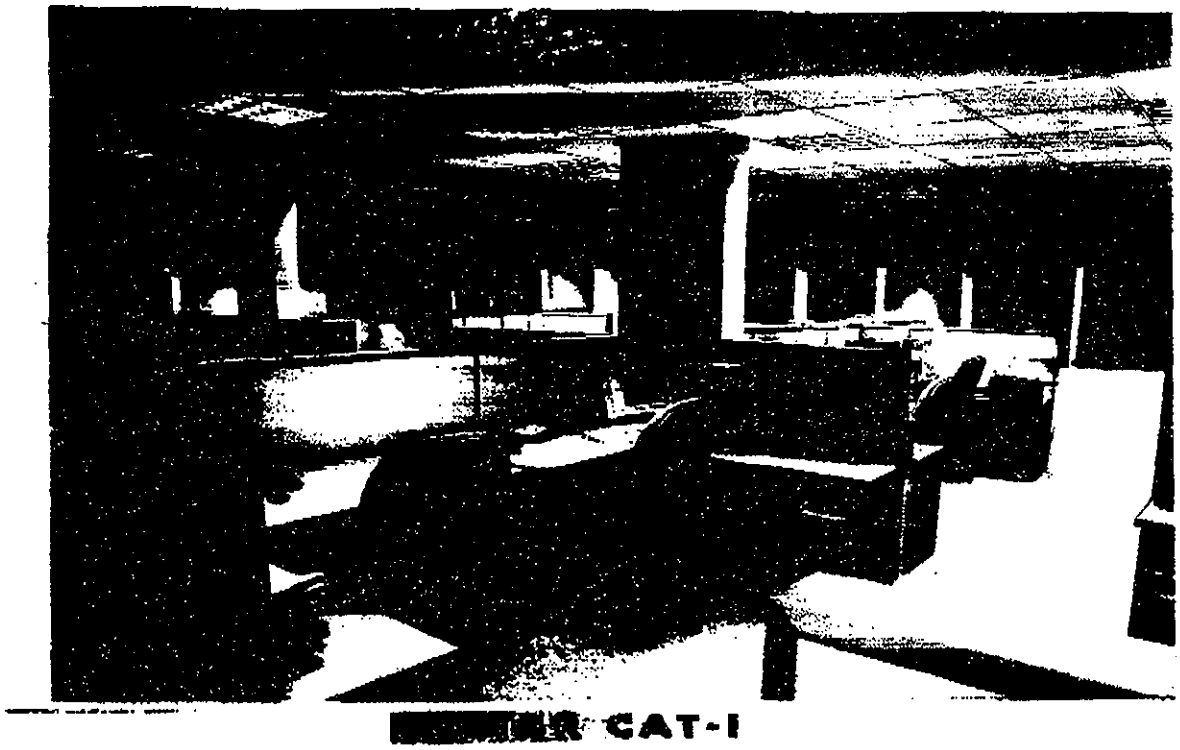
Model	Lamp		Dimension (mm)			
	Type	No.	A	B	C	D
TBR220LV	FTL18/20W	2	611	597	297	90
TBR420LV	FTL18/20W	4	611	597	597	90
TBR240LV	FTL36/40W	2	1221	1198	297	90
TBR440LV	FTL36/40W	4	1221	1198	597	90
TBR265LV	FTL58/65W	2	1521	1498	297	90
TBR465LV	FTL58/65W	4	1521	1498	597	90

(Data subject to change without notice)

Add suffix to model ref. 16/24/36 for louvres with respective number of cells eg. TBR420LV24 for 4 x 18W TBR with 24 cell mirror louvres.

5

RECESSED MOUNTED - MIRROR OPTIC LUMINAIRE - CATEGORY I



CAT-I

DESCRIPTION :

Decorative /Commercial fluorescent luminaire for recessed mounting in modular false ceiling (exposed 'T' & concealed 'T') with high performance mirror optic reflector system. Suitable for upto 4 nos of fluorescent lamps of 18/20W, 36/40W & 58/65W rating, conforming to the relevant IEC & BS standards.

SALIENT FEATURES

- Very low surface luminance
- Excellent glare control
- Push-fit type starter seat & lamp holders
- Mains connector ensures positive contact
- Wide choice of lamps
- Heat resistant wiring
- Easy to install and maintain
- Wishbone springs for easy maintenance
- IP20

MATERIAL & FINISH

Housing : Fabricated from high quality CRCA sheet steel, pretreated & powder coated.
Lamp & starter holders: Heat resistant polycarbonate.
Optical assembly : Very high purity pre-anodised aluminium reflector & louvre assembly complying to LG3 CAT 1.

OPTIONS

HPF circuit or HF electronic control gear, emergency version, other voltages/frequency, Provision for Clip-on ceiling. Custom made version of the above product can also be offered.

OPTICAL SYSTEM

The louvre assembly comprises of double parabolic louvres, shielding the lamp in the critical direction of view & re-directing the light in the direction of interest. This louvre assembly gives low luminosity level & excellent glare control thus giving the room a more friendly atmosphere. Provides high standard glare free lighting of work stations with critical visual requirements. This optical assembly reduces the possibilities of image formation on VDTs and thereby limits the annoying reflected glare on the screen.

MOUNTING

A 20mm knockout is provided on the housing for cable entry. Provision for fixing of side brackets facilitate installation of luminaire directly on to false ceiling frame.

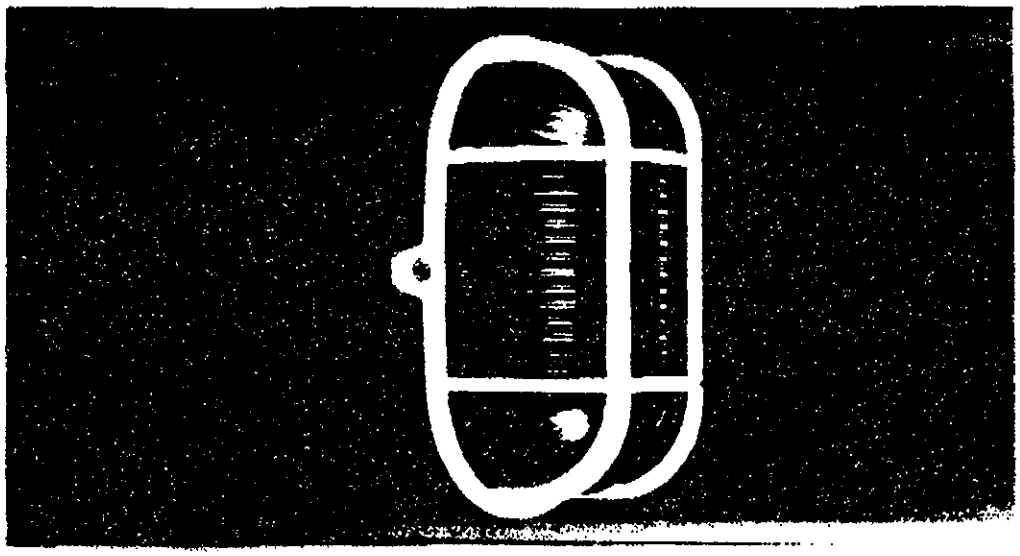
APPLICATIONS

Such luminaires would be specified where there is a high density of screens in an area & the VDT terminal usage is sustained over a long period or is of intense nature or where errors are critical. Examples would be the entry of continuous data in an insurance office, or the constant screen interrogation in a financial dealer room. More specialised computers also require this Category luminaires.

6

UTILITY LIGHTS

GENERAL PURPOSE BULK HEAD LUMINAIRE



TEBH

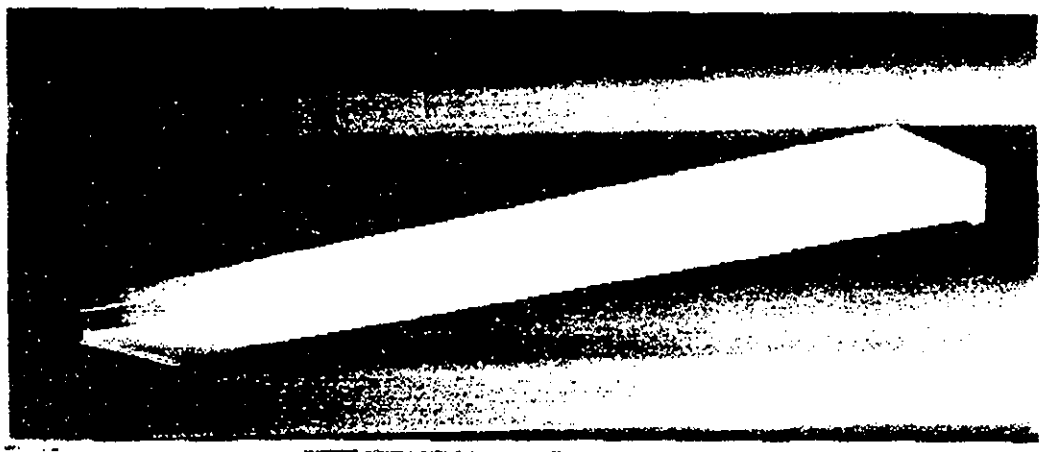
- Enclosed luminaire suitable for General Service Lamps (40/60/100W) or Compact Fluorescent Lamps (9/11W)
- Available both in polycarbonate & cast aluminium
- Clear ribbed Glass/PMMA polycarbonate diffuser cover
- Suitable for ceiling or wall mounting
- Guard for protection
- Integral ballast (if required)

EMERGENCY LIGHTING LUMINAIRES

- Surface mounted emergency luminaire suitable for 8W fluorescent lamp
- Self contained, non maintained 3 hour duration
- Maintained version also available
- Body, diffuser: polycarbonate
- Luminaire equipped with nickel cadmium battery & LED indicator

7

DECORATIVE SURFACE MOUNTED OPAL LUMINAIRE



TED OPL

DESCRIPTION :

Aesthetically designed, easy to install surface mounted luminaire with high performance opal diffuser for a wide range of commercial and domestic applications, conforming to relevant IEC & BS standards. Available for single and twin fluorescent lamps of 18/20W, 36/40W & 58/65W rating.

SALIENT FEATURES

- Balanced luminance distribution
- Soft and diffused lighting
- Excellent glare control
- Sturdy construction
- Switch start circuit
- Push-fit type starter seat & lamp holders
- Mains connector ensures positive contact
- Wide choice of lamps
- Heat resistant wiring
- Easy to install and maintain
- IP20

MATERIAL & FINISH

Housing: Fabricated from high quality CRCA sheet steel, pretreated, phosphated & powder coated.
Lamp & starter holders: Heat resistant polycarbonate.
Opal diffuser: UV stabilized diffuser has remarkable light softening characteristics combined with a very low luminosity at angles approaching the horizontal surface.
End caps : ABS white colour.

OPTIONS

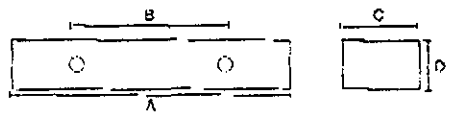
HPF, Extra Low-loss ballast, Electronic ballast, Dimmable ballast, Silicone rubber wiring, Emergency version, other voltages/ frequency. Custom made version of the above product can also be offered.

MOUNTING

Suitable for surface mounting. A 20mm knockout provided on the rear side of the housing facilitates cable entry.

APPLICATIONS

These luminaires are used in situations where the requirement calls for glare-free, soft & diffused lighting. These luminaires will meet most of the lighting requirement in offices, banks, schools, hospitals, shopping complexes, sales & leisure areas like halls, lobbies etc.



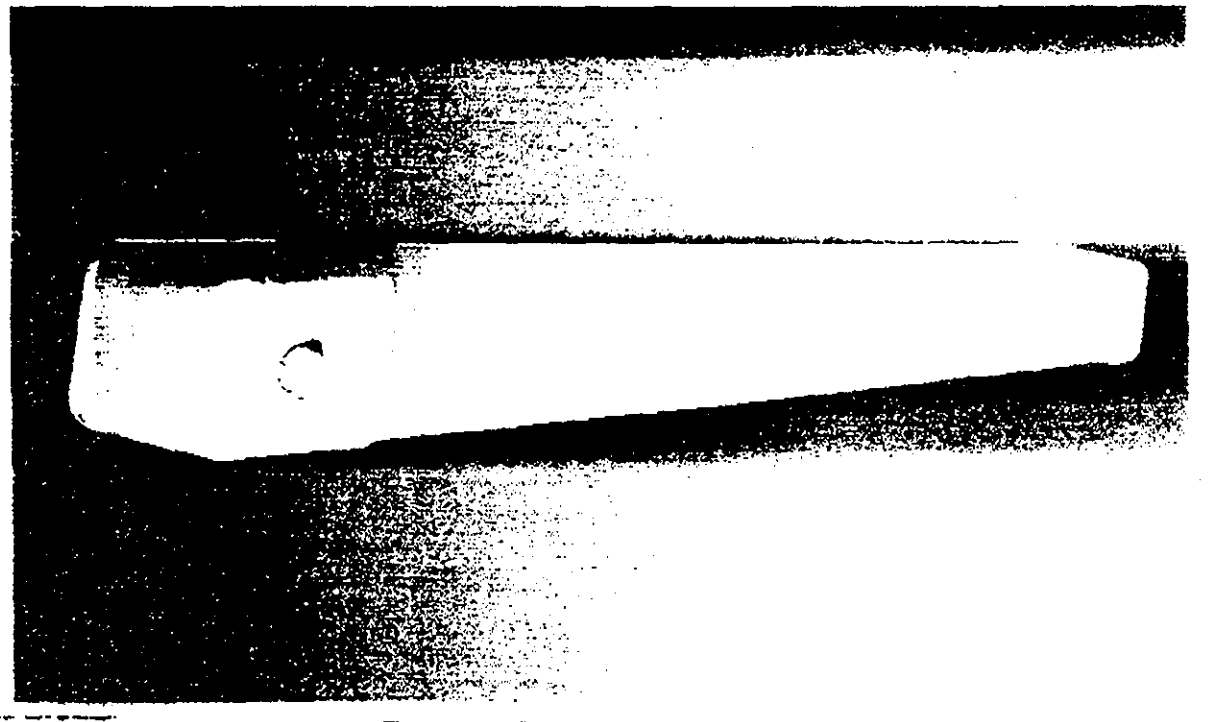
DIMENSION & TECHNICAL DATA :

Model	Lamp		Dimension (mm)			
	Type	No.	A	B	C	D
TED120-OPL	FTL18/20W	1	624	440	90	85
TED220-OPL	FTL18/20W	2	618	440	150	65
TED140-OPL	FTL36/40W	1	1234	840	90	85
TED240-OPL	FTL36/40W	2	1228	840	150	65
TED165-OPL	FTL58/65W	1	1534	1140	90	85
TED265-OPL	FTL58/65W	2	1528	1140	150	65

(Data subject to change without notice)

DECORATIVE MIRROR LIGHT LUMINAIRE

8



TEML-S

DESCRIPTION :

Decorative surface mounted luminaire with diffuser cover suitable for single 11/15W compact fluorescent lamp & 18/36W fluorescent lamp.

SALIENT FEATURES

- Available with earthed socket & rocker switch
- Available in white colour
- Aesthetically appealing design
- Sturdy construction
- Switch start circuit
- Push-fit type starter seat & lamp holders
- Mains connector ensures positive contact
- Heat resistant wiring
- IP40

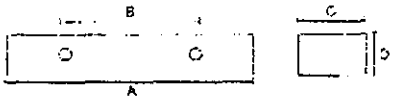
MATERIAL & FINISH

Channel : Luminaire body made from sheet steel & white stove enamelled.

Diffuser : specially designed PMMA opal diffuser.

APPLICATIONS

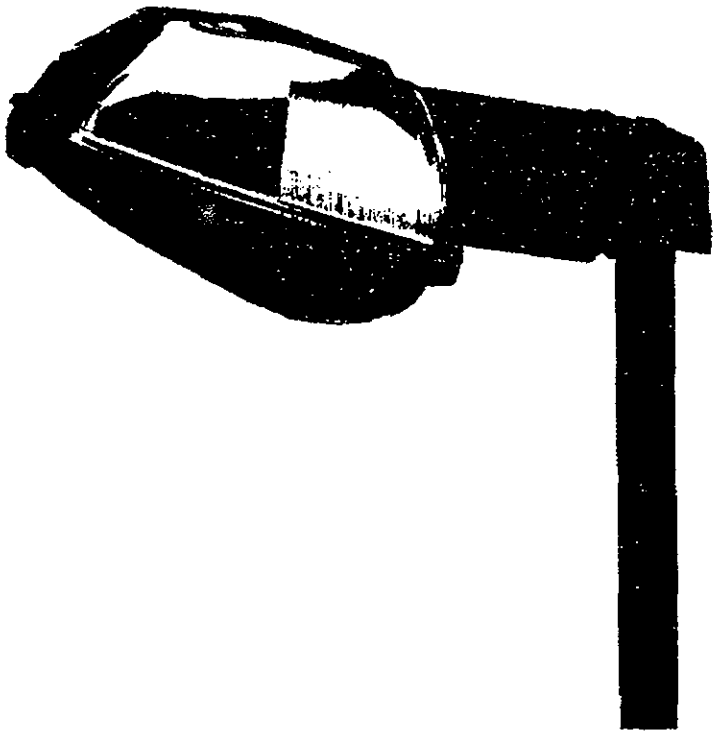
This elegant, slim luminaire is intended for interior use. It is suitable for the illumination of individual work places & general areas. An ideal luminaire for recreation rooms, wardrobes, bathrooms, kitchens etc.



DIMENSION & TECHNICAL DATA :

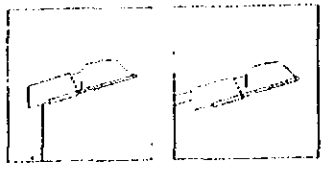
Model	Lamp		Dimension (mm)			
	Type	No.	A	B	C	D
TEML-S111	CFL	1	340	190	67	80
TEML-S115	CFL	1	519	330	67	80
TEML-S118	CFL	1	670	500	67	80
TEML-S136	CFL	1	1280	800	67	80

(Data subject to change without notice)



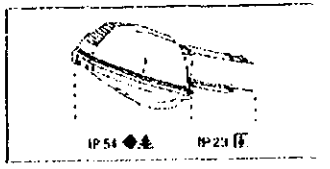
■ Fittings for lighting of public, commercial and industrial areas.
The fittings are suitable for 70 to 250W high pressure sodium lamps, 250W metal halide lamps and 80 to 250W mercury vapour lamps. Body in die cast aluminium painted black 99.85% aluminium reflector. The connection plate is in polyamide for ease of installation.
The protection bowl must be ordered separately.

☐ *Straßenleuchten zur Beleuchtung von öffentlichen, privaten und industriellen Flächen. In der Serie MYRA sind Natriumdampflampen 70÷250W, Metalldampflampen 250W und Quecksilberdampflampen 80÷250W verwendbar. Gehäuse Aluminium-Druckguß, pulverbeschichtet schwarz. Reflektor aus reinem Aluminium. Die Anschlußplatte ist aus Fiberglas-Nylon und leicht zu montieren.*
Die Schutzhaube muß gesondert bestellt werden.

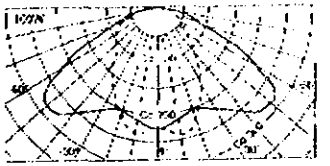


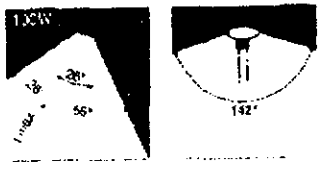
■ The range is suitable for pole mounting with side entry or post-top reversible installation (dia 48-60 mm).

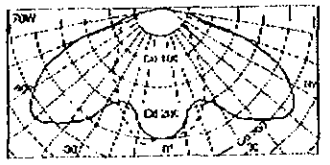
☐ *Die Serie ist für Seiten oder Topmontage auf Masten 48-60 mm geeignet.*

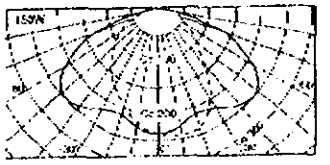


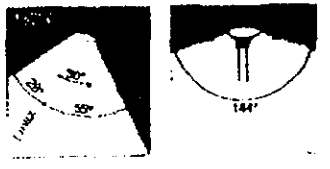
05528017	MYRA 11/70 -N- CR	70W NAV-E/SON E27
05530017	MYRA 11/100 -N- CR	100W NAV-E/SON E40
05532017	MYRA 11/150 -N- CR	150W NAV-E/SON E40











PROFORMA INVOICE

Our Ref: CU/GEN/2111100
29th November 2000

Managing Director
Ceywater Consultants (Pvt) Limited
372/2 Nawala Road
Rajagiriya
Tel : 876750
E-mail : ceywater@slt.lk

Attn: Mr Karunaratne

Dear Sir,

SUPPLY OF 1 NO. CUMMINS / ONAN MODEL DGCB, 64 KVA PRIME RATED GENERATING SET

TECHNICAL OFFER	:	One No. new and complete "Cummins" model DGCB, prime rated at 64 kVA, 3 phase; 50 Hertz; 230/400 Volts at 0.8 power factor.
PRIME POWER RATING	:	The Prime Power rating is applicable for supplying electrical power in lieu of commercially purchased power. Prime power is the maximum power available at variable load for an unlimited number of hours. A 10% over load capability is available for 1 hour in every 12 hours.
ENGINE	:	Cummins model 4BT3.9G2 Turbo-charged, direct injection Diesel Engine developing 76 BHP at 1500 RPM. Unit mounted tropicalised radiator system. Complete with replaceable type fuel, Lube oil and air filter and battery charging alternator.
ALTERNATOR	:	Brushless 4 pole Alternator rated at 64 kVA. See specification sheet for details.

ACCESSORIES :

* AC Meter Package consists of the following:
  - AC Voltmeter (dual range)
  - AC Ammeter (dual range)
  - Voltmeter/Ammeter phase selector switch with off position
  - Frequency Meter
  - AC Rheostat + / - 5% voltage adjust

* 3 pole MCCB with shunt trip
* Residential Muffler
* Stainless Steel Flexible connector
* Run – stop remote switch
* Lamp test switch
* Fault reset switch
* Coolant temperature guage
* Oil pressure gauge
* Field circuit breaker
* DC Voltmeter
* Running time meter

* 12 light engine monitoring system consists of the following:
  - Run
  - Pre – warning for low oil pressure
  - Pre – warning for high coolant temperature
  - Low oil pressure shutdown
  - High coolant temperature shutdown
  - Over crank shutdown
  - Over speed shutdown
  - Low fuel
  - Low coolant temperature
  - Two customer selected faults

* Anti – condensation heater (Alternator)
* Batteries
* Manuals

Generally in accordance with Manufacturer's standard specification sheets attached.

PRICE	:	**CIF Colombo for 1 unit US$ 11,900.00** **(US$ Eleven Thousand Nine Hundred Only)**
OPTIONAL	:	250 Amp wall mounted 4 pole ATS with indicators, 5 Amp Battery Charger, selector switch and phase failure relay.
ADDITIONAL PRICE	:	Add to CIF US$ 2,250.00 (US$ Two Thousand Two Hundred & Fifty Only)
VALIDITY	:	30 days from date of offer
DELIVERY	:	Approximately 8 weeks from date of receipt of acceptable Letter of Credit at our Principals. However delivery can be improved subject to order confirmation.
TERMS OF PAYMENT	:	Be confirmed irrevocable Letter of Credit in favour of our Principals. Cummins Power Generations (S) Pte Ltd. 44 Pioneer Sector Singapore 628395 All Bank charges to applicant's account.
WARRANTY	:	12 months from date of commissioning at site.
COUNTRY OF ORIGIN	:	Singapore

Yours faithfully,
TRADE PROMOTERS LIMITED

Jeevalal de Alwis
SALES EXECUTIVE

Note: 70 kVA generator with same specifications as above
Price CIF Colombo US$ 12,600.00

Our Ref: CU/GEN/2111100
29th November 2000

Managing Director
Ceywater Consultants (Pvt) Limited
372/2 Nawala Road
Rajagiriya

Attn: Mr Karunaratne

Dear Sir,

COST OF CUSTOMS CLEARING, TRANSPORT & COMMISSIONING OF 64 KVA GENERATING SET AT MALIGAKANDA

We are pleased to forward our quotation for commissioning of the above generator at your site. Our quotation is inclusive of the following items.

(A)

1. Clearing, handling and documentation charges.
2. *Transport to site.*
3. Unloading the genset at site.

Total Cost (Item 1-3) **Rs. 22,000.00**

Please note that this price does not include customs duty, GST, cess, defence levy and bank charges.

(B)

1. *Supply and installation of standard cast iron earth electrodes.*
2. Supply laying and termination of power/control cables from generator to changeover panel. (Maximum distance 5 meters)
3. Supply and laying of fuel pipes from day tank to generator.
4. Supply of fuel day tank for 8 hour operation.
5. Fabrication of Radiator hot air duct. (Maximum distance between room wall and radiator 2 feet.)
6. Testing and commissioning.

Total Cost (Item 1-6) **Rs. 60,000.00**

G.S.T. 12.5% (A+B) **Rs. 11,000.00**

Notes:

1. Item 3 power cables – 35 sq.mm. 4 core XLPL/PVC/PVC cables.
2. The above prices do not include the prices of any civil work, carpentry work, diesel and cable trays.
3. Load test at site will be carries out with the available load at site for a period of one hour.

PAYMENT TERMS 75% advance payment with order confirmation
25% balance after commissioning

Yours faithfully,
TRADE PROMOTERS LIMITED

Jeevalal de Alwis
SALES EXECUTIVE

MALIGAKANDA OFFICE BUILDING - CATALOGUE FOR WATER PUMPS AND FIRE PUMPS

Construction

Vertical, single-stage, submersible centrifugal pumps with horizontal or vertical discharge port designed for free-standing installation or installation by means of an auto-coupling guide rail system.

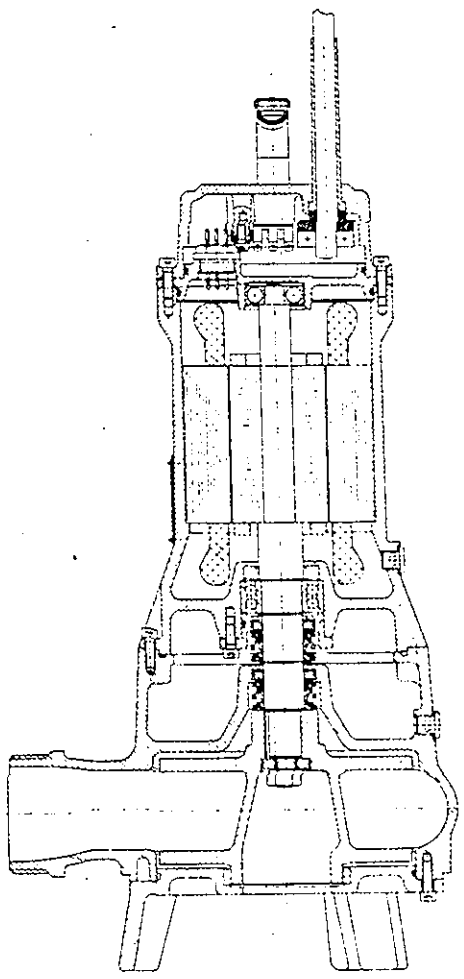
The pumps are directly connected to an asynchronous submersible motor for 1 x 230 V +6/–10%, 3 x 230 V +6/–10% or 3 x 400 V +6/–10%, 50 Hz.

Enclosure Class: IP 68.

Insulation Class: F (155°C).

Single-phase AP12, AP35 and AP50 incorporate thermal overload protection and require no additional motor protection.
All explosion-proof AP pumps, AP100 APG and APL pumps have a thermal switch built into the motor windings. The thermal switch is connected to the control circuit of the motor starter.

Sectional Drawing



TM00 3552 5093

AP51.65.17

Motor Cables

AP12, AP35, AP50:
Single-phase: 3/10 m, H07RNF 4 x 1.0 mm².
Three-phase: 10 m, H07RNF 4 x 1.0 mm².
AP100: 10 m, 7 x 1.5 mm²/
16 x 1.5 mm².
APG.50.xx.3: 10 m, H07RNF 7 x 1.5 mm².
Explosion-proof pumps: 10 m, NSSHÖU-I 7 x 1.5 mm².
Remaining AP pumps: 10 m, H07RNF 4 x 1.5 mm².

APL/APLD units:
Mains to controller: 0.8 m, H07RNF 5 x 1.5 mm².
Controller to motor: 3 m, H07RNF 7 x 1.5 mm².

Installation

The pumps are suitable for free-standing installation as well as installation on an auto-coupling guide rail system, which is available as an accessory.

Pumps in permanent installations can be installed by means of a stationary auto-coupling at the bottom of the pit. A twin guide rail going to the top of the pit ensures that the pump is positioned correctly when lowered from the top of the pit down to the auto-coupling and connected to the pipe system. Due to this system, the pump can easily be pulled up for service.

For free-standing installation the AP70, AP100 and APG pumps must be fitted with a base stand, see Accessories.

Type Key

Example: **AP51.65.12.A1**

- Type range
- Max. particle size (mm)
- Nominal diameter (mm) of discharge port
- Power output P_2 /100 (W)
- A = With level switch
- 1 = Single-phase voltage supply

Example: **APG.50.19.3Ex**

- Type range
- With cutter system
- Nominal diameter (mm) of discharge port
- Power output P_2 /100 (W)
- 3 = Three-phase voltage supply
- Explosion-proof version

Example: **APLD.82.21.3**

- Type range
- Lifting stations
- = With one pump
  D = With two pumps
- 81 = 180 mm horizontal inlet level
  82 = 250 mm horizontal inlet level
- Power output P_2 /100 (W)
- 3 = Three-phase voltage supply

AP10

The pumps are used for pumping wastewater, sludge-containing water, ground water and surface water in places such as:

- sumps
- shafts
- ducts
- tunnels
- excavations
- basements
- cellars
- underground car parks

AP10 pumps are ideal for general flood relief applications and for miscellaneous industrial applications.

Pump and Stator Housing

The pump housing and stator housing of the standard versions as well as the explosion-proof versions are made of cast iron.

The standard pumps have oil-filled stator housings.
The explosion-proof versions are dry, i.e. not oil-filled.

Discharge

All AP10 pumps have a horizontal discharge port for threaded connection.

AP10.50.EX: R 2.

AP10.65: R 2½.

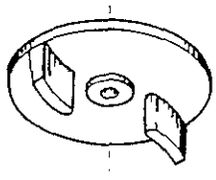
Shaft and Bearings

The shaft is made of chromium steel and rotates in maintenance-free prelubricated ball bearings.

The lower bearing comprises a double row of ball bearings.

Impeller

The impeller is a semi-open multivane cast iron impeller with a clearance of 10 mm. Cast iron is chosen to give high resistance to mechanically wearing particles.



TM00 3553 5093

An adjustable cast iron wear plate is fitted at the inlet side of the impeller.

Shaft Seals

Standard: Two mechanical bellows seals and a lip seal.

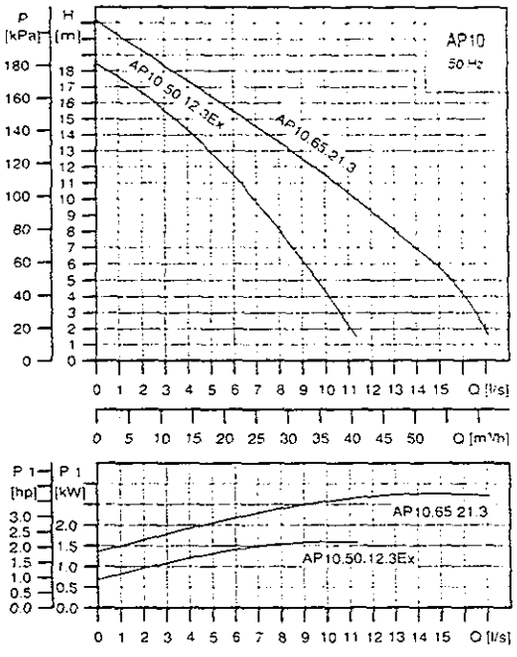
The primary and the secondary shaft seals are made of silicon carbide/silicon carbide. The chamber between the shaft seals is oil-filled. Between the lower ball bearing and the stator housing there is a lip seal.

Ex version: Combination of mechanical shaft seal and lip seal.

The primary shaft seal is made of silicon carbide/silicon carbide. The secondary shaft seal is a lip seal. The chamber between the shaft seals is oil-filled.

Materials

Description	Materials	DIN W.-Nr.	AISI/ASTM
Stator housing	Cast iron GG25	0.6025	ASTM 25B
Pump housing	Cast iron GG25	0.6025	ASTM 25B
Impeller	Cast iron GG25	0.6025	ASTM 25B
Wear plate	Cast iron GG25	0.6025	ASTM 25B
Shaft	Chromium steel	1.4104	AISI 430F
Bearings	Heavy-duty prelubricated ball bearings		
Screws	Stainless steel	1.4301	AISI 304



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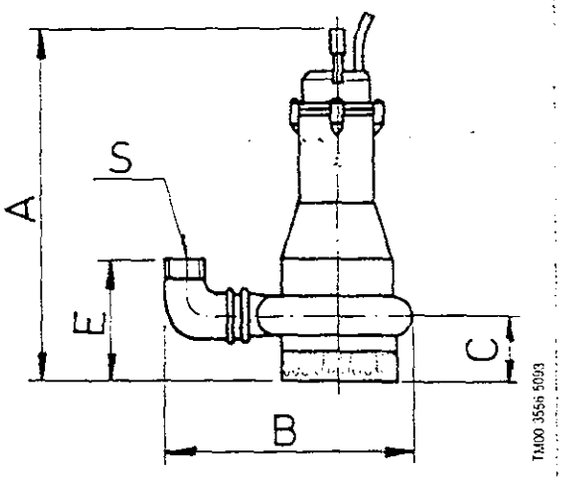

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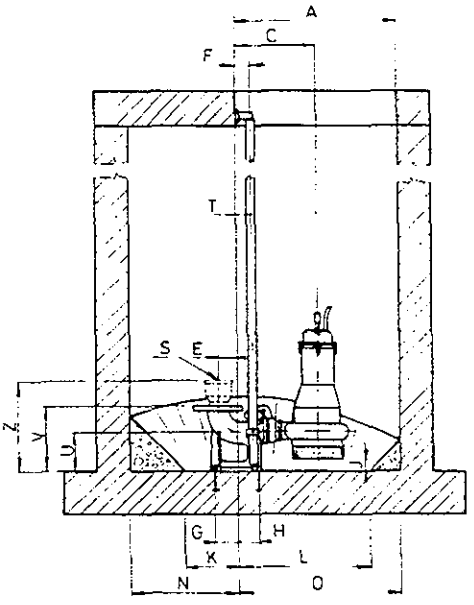
Elbows are accessories.

Pump Type	Voltage	P_1 [kW]	P_2 [kW]	n [min⁻¹]	I_n [A]	Cos φ	$\frac{I_{start}}{I_n}$	Dimensions [mm]					Weight* [kg]
								A	B	C	E	S	
AP10.50.12.3Ex	3 x 400 V	1.60	1.20	2850	2.9	0.84	4.6	577	300	87	161	R 2	30
AP10.65.21.3	3 x 230 V	2.50	2.10	2800	7.8	0.84	4.7	551	380	108	198	R 2½	27
AP10.65.21.A3	3 x 230 V	2.50	2.10	2800	7.8	0.84	4.7	551	380	108	198	R 2½	27
AP10.65.21.3	3 x 400 V	2.50	2.10	2800	4.5	0.84	4.6	551	380	108	198	R 2½	27
AP10.65.21.A3	3 x 400 V	2.50	2.10	2800	4.5	0.84	4.6	551	380	108	198	R 2½	27

* Pump inclusive of cable and controller, if any.

AP10 Installations



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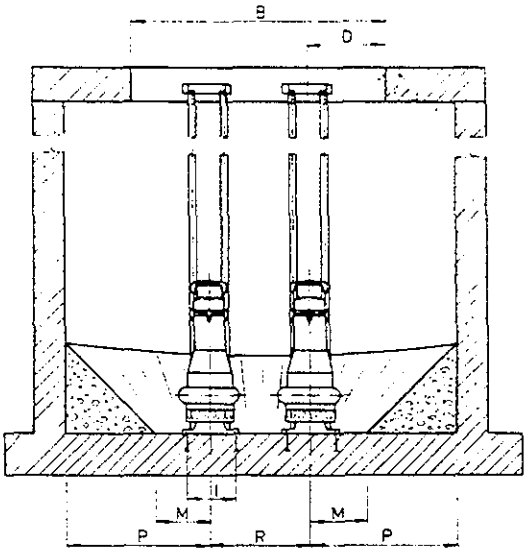

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One-Pump Installation on Auto-Coupling

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	R	S	T	U	V	Z
AP10.50.12.Ex	ø600	ø600	245	300	45	45	65	-	115	74	150	450	200	300	700	500	-	Rp 2	½"	160	250	300
AP10.65.21	ø600	ø600	300	297	70	60	82	68	180	32	150	510	220	350	650	500	-	DN65	1"	160	250	-

Two-Pump Installation on Auto-Coupling

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	R	S	T	U	V	Z
AP10.50.12.Ex	445	600	245	135	45	45	65	-	115	74	150	450	200	300	700	335	330	Rp 2	½"	160	250	300
AP10.65.21	600	975	300	297	70	60	82	68	180	32	150	510	220	375	875	435	380	DN65	1"	160	250	-

NK

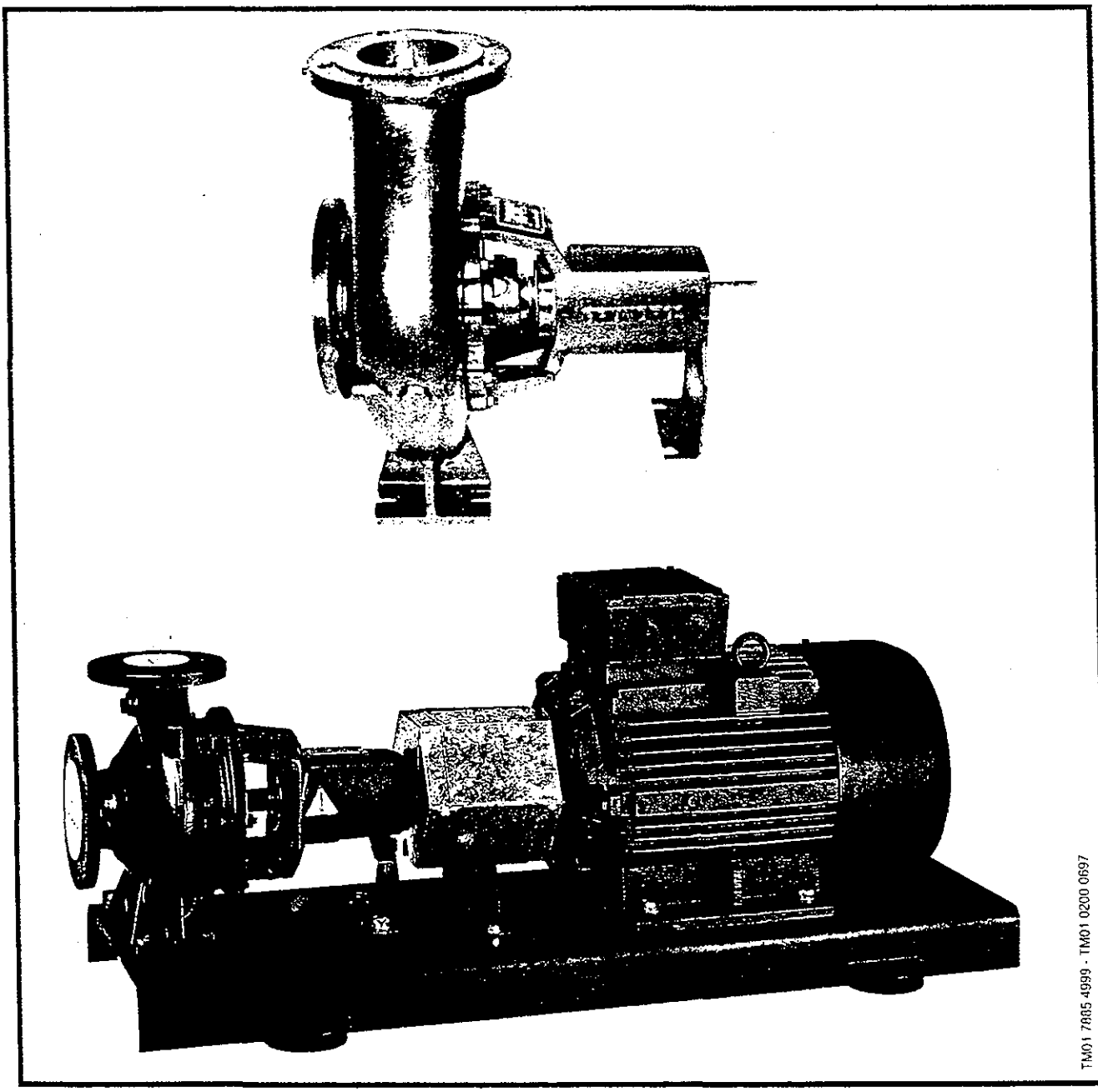
Standard pumps

Water supply, boosting, circulation of water in heating and air-conditioning systems.
Liquid transfer in industry, agriculture, horticulture, etc.

In accordance with EN 733.

Pump flange sizes:	DN 32-300
Maximum system pressure:	16 bar
Liquid temperature:	–10°C to +140°C

50 Hz



TM01 7885 4999 - TM01 0200 0697

Applications

The pump is suitable for the pumping of thin, clean and non-aggressive liquids without solid particles or fibres in:

- District heating
- Water supply
- Airconditioning
- Cooling plants
- Industry
- Fire fighting
- Environment engineering

Operating conditions

Flow	Max. 2000 m³/h.
Head	Max. 150 m.
Liquid temperature	-10°C up to +140°C.
Operating pressure	Max. 10 or 16 bar. Operating pressure = inlet pressure + pressure against a closed valve (Q = 0).
Inlet pressure	Max. 9 bar. Max. 7 bar for 400 mm impellers or bigger.

Pump

Non-self-priming single-stage centrifugal volute pump with axial suction port, radial discharge port and horizontal shaft components.

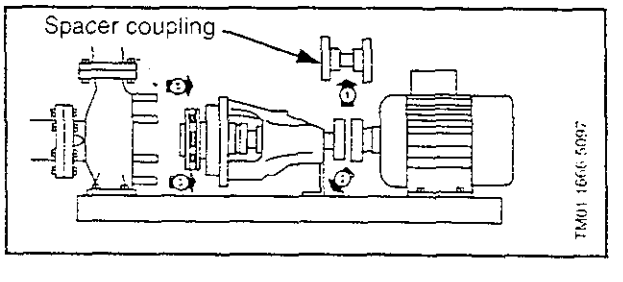
The NK pumps have dimensions and nominal performances according to EN 733 (10 bar) but are designed for 16 bar operation wherever the shaft seal type allows it. NKG pumps according to DIN 24 256 (16 bar) are described in a separate booklet. Pumps up to 25 bar operating pressure are available on request.

Types outside of the official DIN-norm (NK 200 and up) will be called "oversize". Dimensions can differ from other suppliers.

The suction and discharge flanges are according to EN 7005 PN 10 or 16. All pumps are dynamically balanced according to ISO 1940 class 6.3 and impellers are hydraulically balanced.

Pump and motor are mounted on a common baseplate in accordance with EN 23 661 in all-welded steel. Oversizes have profile base frames.

Due to the pump design the complete bearing assembly including impeller and shaft seal can be dismantled without removing the volute casing from the pipe system (back-pull-out system ③).



Flexible coupling

Standard version or a spacer coupling which allows the motor to remain in place during the above mentioned dismantling to avoid subsequent alignment.

If the pump housing, motor or the entire unit is moved, alignment is always neccessary.

Bearing assembly with shaft

The bearing assembly includes two sturdy antifriction bearings lubricated for life. Oversize pumps with shaft d5 = 55 mm however, have open bearings with grease nipples.

A thrower on the shaft prevents liquid from entering the bearing housing.

In stuffing box versions the shaft is protected by a stainless steel sleeve at the shaft seal.

All the NK pumps according to EN 733 are covered by only four sizes of shaft, shaft seal and bearings, and the oversizes by an additional three sizes.

Due to the ample sizes of the bearings and shaft the NK pumps can be driven by a belt drive, belt variator or a diesel engine, if required.

Shaft seal

The standard version is provided with a mechanical Burgmann shaft seal according to DIN 24 960, Grundfos type BAQE. Depending on pumped liquid and operating conditions other types and stuffing boxes are available. **Shaft sleeve is available on request.**

Motor

The motor is a totally enclosed, fan-cooled squirrel-cage Grundfos MMG motor dimensioned to IEC publication 72 and complying with IEC 34 and DIN 42 950.

Mounting designation	B3 (IM 1001)
Enclosure class	IP 55
Insulation class	F (100°C)
Ambient temperature	Max. 40°C
Voltages, 50 Hz	3 x 220-240/380-415 V, 3 x 380-415 Δ V,
Thermistor	TP 211 according to DIN 44 082 when P2 ≥ 3 kW

NK units with 60 Hz motors and NKE units with MGE motors are also available, but are described in separate booklets.

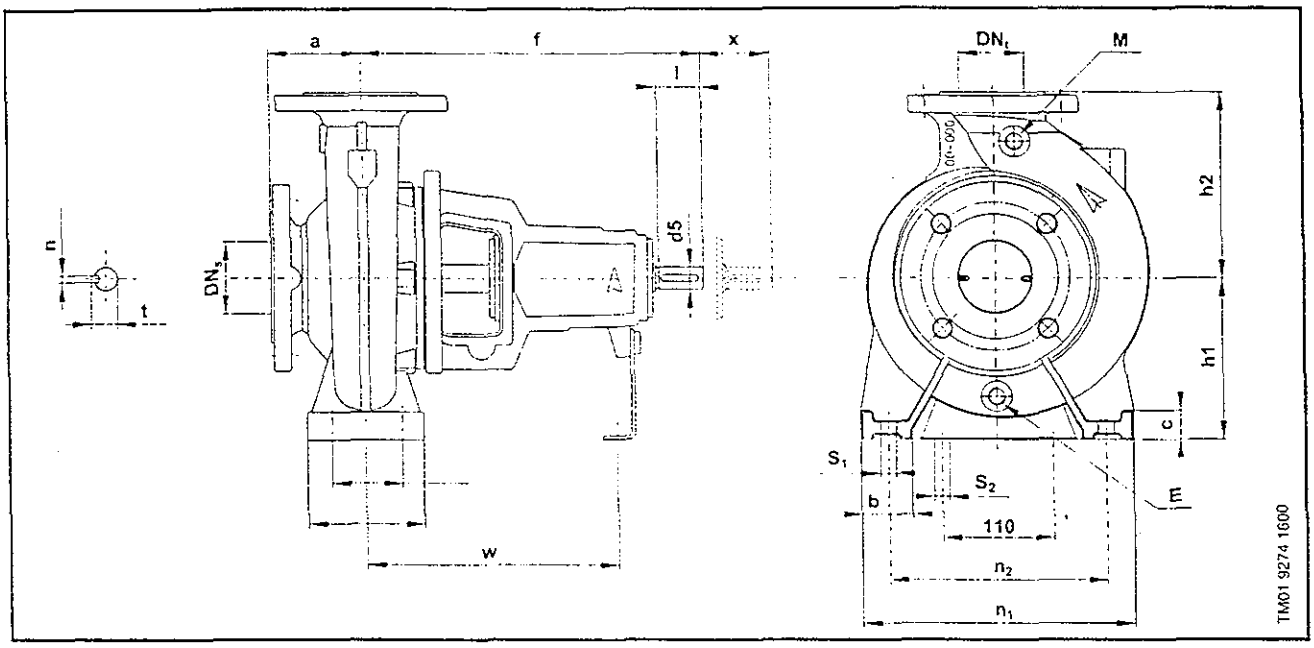
Other brands of motors can be mounted on request.

Surface treatment

All stationary cast iron parts are dip-painted with water-based, ether-epoxy no-lead painting. The thickness of the film is 25 µm ± 5 µm.

Finally, the product is spray-painted with black water-based, ether-epoxy no-lead painting. The thickness of the dry coating is 35 µm ± 5 µm.

Pump dimensions and weights

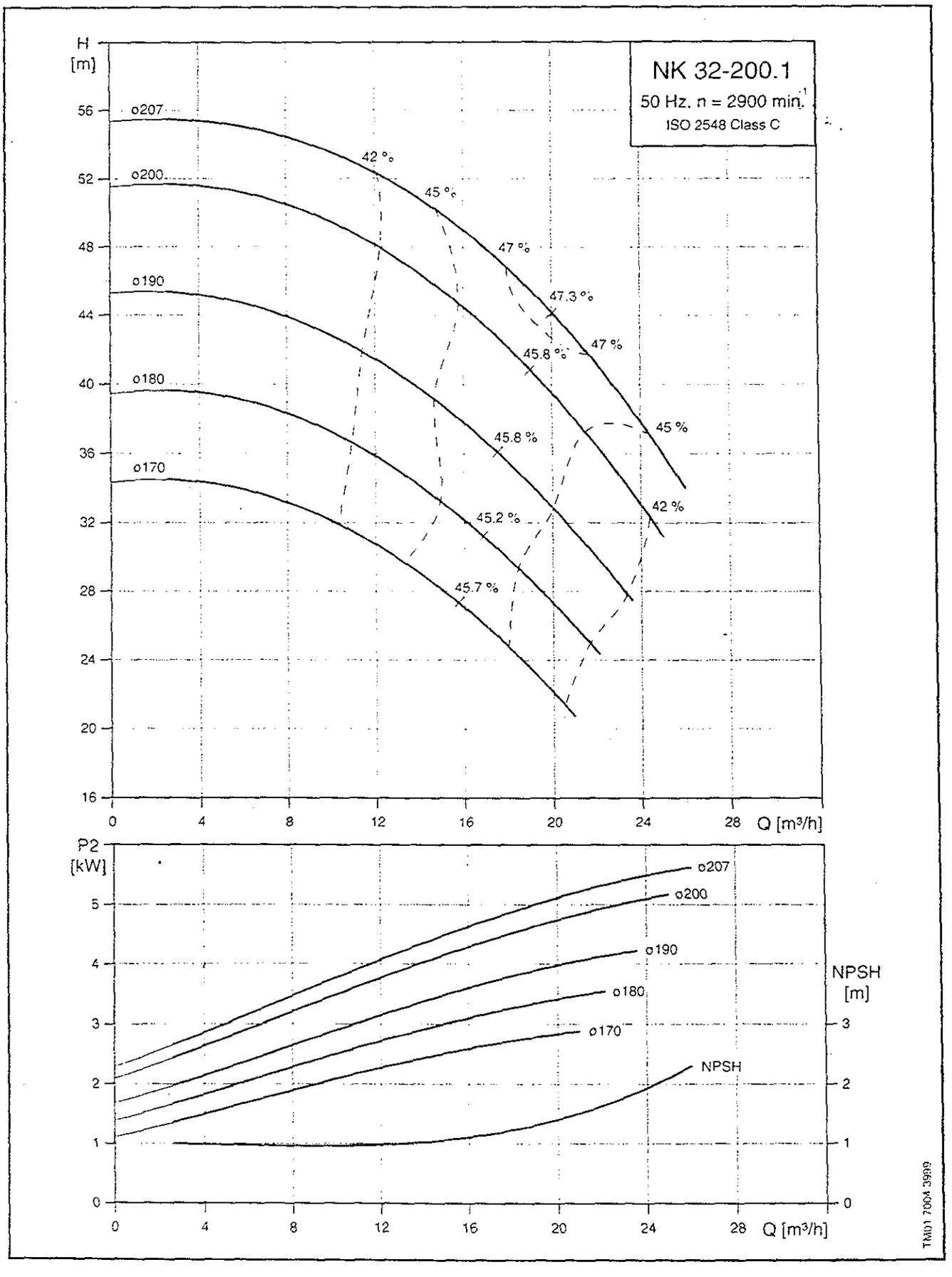


E	Drain plug
M	Pressure gauge tapping

Type	Dimensions [mm]						Supporting feet [mm]									Shaft [mm]					Weight [kg]
	DN$_S$	DN$_1$	a	f	h$_1$	h$_2$	b	m$_1$	m$_2$	n$_1$	n$_2$	w	S$_1$	S$_2$	C	D5	l	x	t	n	
NK 32-125.1	50	32	80	360	112	140	50	100	70	190	140	260	M12	M12	14	24	50	100	27	8	34
NK 32-125																					34
NK 32-160.1					132	160				240	190				18						37
NK 32-160																					37
NK 32-200.1					160	180															47
NK 32-200																					47
NK 40-125	65	40	80	360	112	140	50	100	70	210	160	260	M12	M12	18	24	50	100	27	8	34
NK 40-160					132	160				240	190										39
NK 40-200			100		160	180				265	212										49
NK 40-250					180	225	65	125	95	320	250				19						64
NK 50-125	65	50	100	360	132	160	50	100	70	240	190	260	M12	M12	18	24	50	100	27	8	34
NK 50-160					160	180				265	212										42
NK 50-200						200															56
NK 50-250					180	225	65	125	95	320	250				19						67
NK 65-125	80	65	100	360	160	180	65	125	95	280	212	260	M12	M12	19	24	50	100	27	8	41
NK 65-160						200															46
NK 65-200					180	225				320	250							140			55
NK 65-250				470	200	250	80	160	120	360	280	340	M16		23	32	80		37	10	89
NK 65-315*			125		225	280				400	315										177
NK 80-160	100	80	125	360	180	225	65	125	95	320	250	260	M12	M12	19	24	50	140	27	8	55
NK 80-200				470		250				345	280	340	M16		23	32	80		37	10	73
NK 80-250					200	280	80	160	120	400	315										93
NK 80-315*					250	315															123
NK 100-200	125	100	125	470	200	280	80	160	120	360	280	340	M16	M12	23	32	80	140	37	10	83
NK 100-250			140		225					400	315				24						101
NK 100-315*					250	315									23						130
NK 125-250** *	150	125	140	470	250	355	80	160	120	400	315	340	M16	M12	23	32	80	140	37	10	118
NK 150-200	200	150	160	470	280	400	100	200	150	550	450	340	M20	M12	27	32	80	140	37	10	210

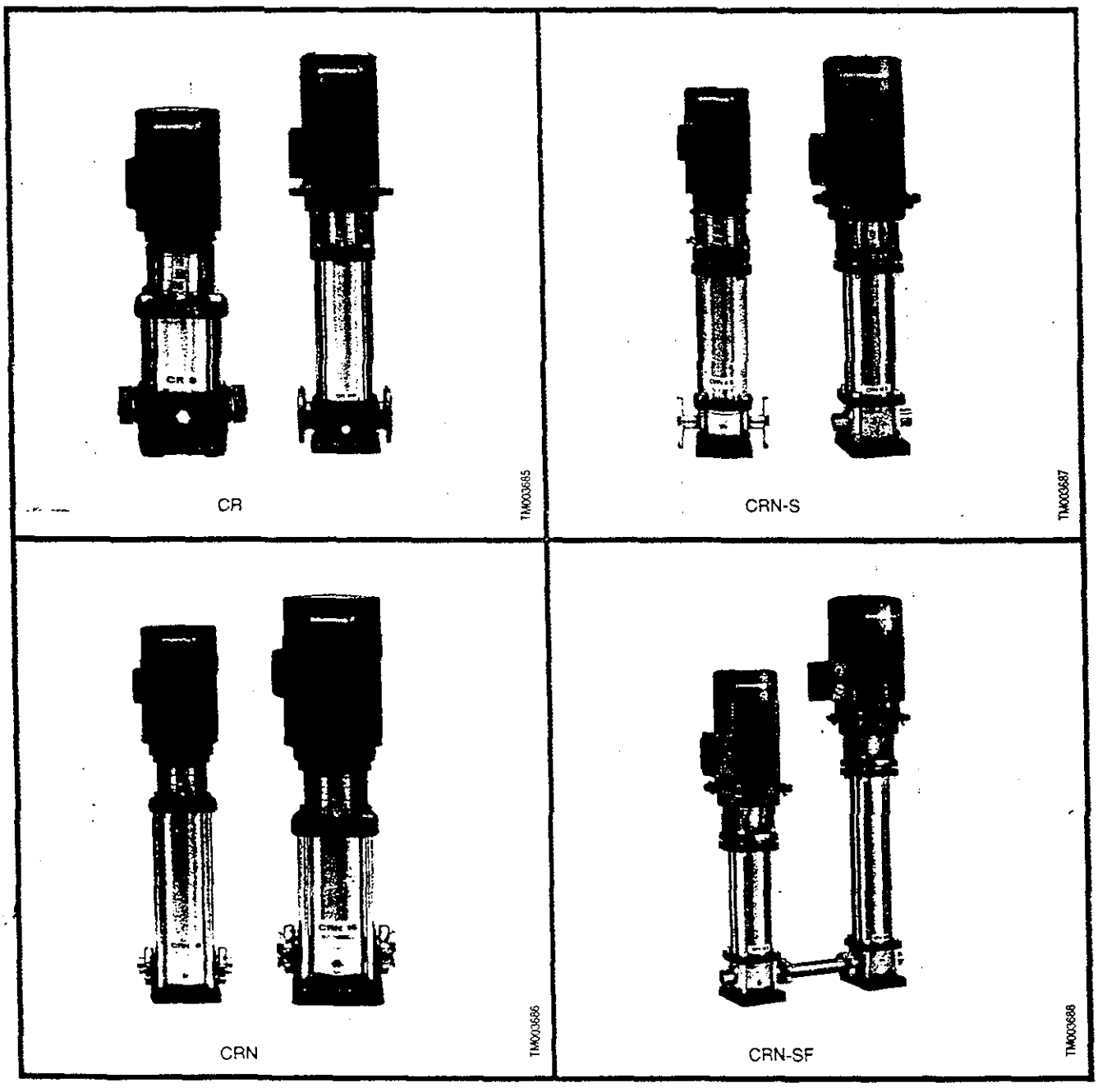
* 4-pole only

** 4-pole and 6-pole only


NK 32-200.1
50 Hz, n = 2900 min.-1
ISO 2548 Class C
H [m]
ø207
ø200
ø190
ø180
ø170
42 %
45 %
47 %
47.3 %
45.8 %
47 %
45 %
45.8 %
42 %
45.2 %
45.7 %
Q [m³/h]
P2 [kW]
NPSH [m]
NPSH
TM01 7004 3999

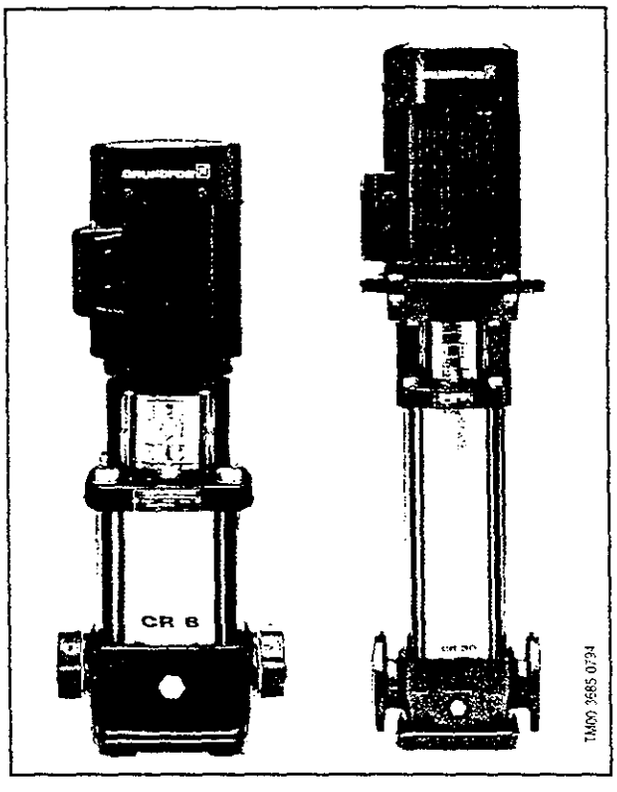
CR/CRN

Vertical Multistage Centrifugal Pumps 50 Hz



GRUNDFOS

CR



Applications

For liquid transfer, circulation and pressure boosting of cold and hot clean water.

Typical applications:

- Municipal water supply and pressure boosting
- Domestic water supply
- Boiler feed and condensate systems
- Cooling water systems
- Irrigation and dewatering
- Fire fighting
- Washing plants ahd washdown
- Vehicle washing
- Pumping of cooling and cutting liquids

Pump

The CR pump is a non self-priming, vertical multistage centrifugal pump fitted with a GRUNDFOS standard motor.

The pump consists of a base and a pump head. The pump body and the outer sleeve are fixed between the base and the pump head by means of staybolts. The base has in-line suction and discharge ports.

The pump has a maintenance-free mechanical shaft seal with dimensions to DIN 24960.

Pipework Connection

Pump Type	Oval Flange Max. 16 bar	DIN Flange Max. 25 bar
CR 2	Rp 1	DN 25
CR 4	Rp 1¼	DN 32
CR 8	Rp 1½ & Rp 2	DN 40
CR 16		DN 50
CR 30		DN 65
CR 60		DN 100

Operating Conditions

Liquid Temperature: –15°C to +120°C.

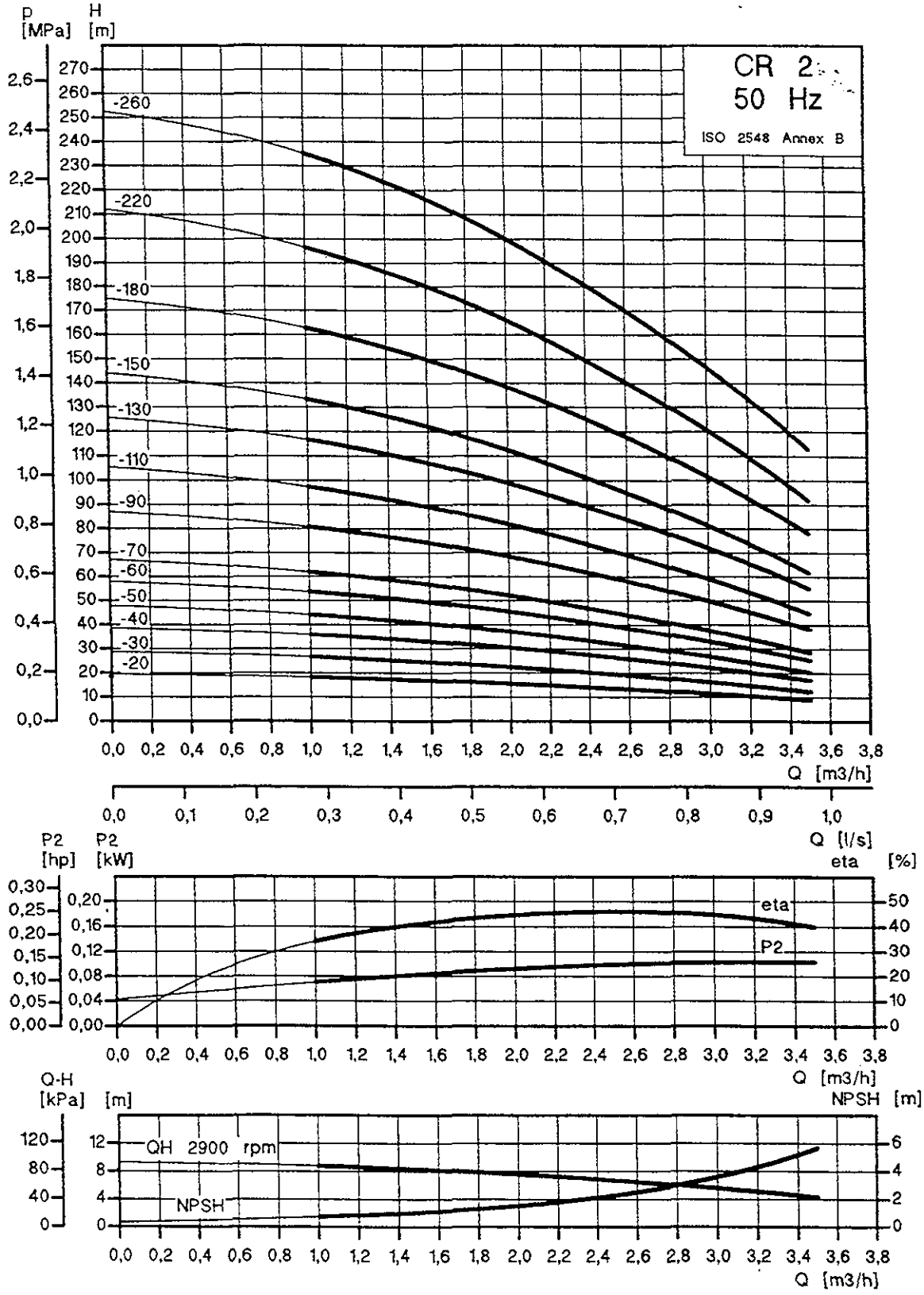
Ambient Temperature: Maximum +40°C.

Minimum Inlet Pressure: According to the NPSH curve + a safety margin of minimum 0.5 metres head.

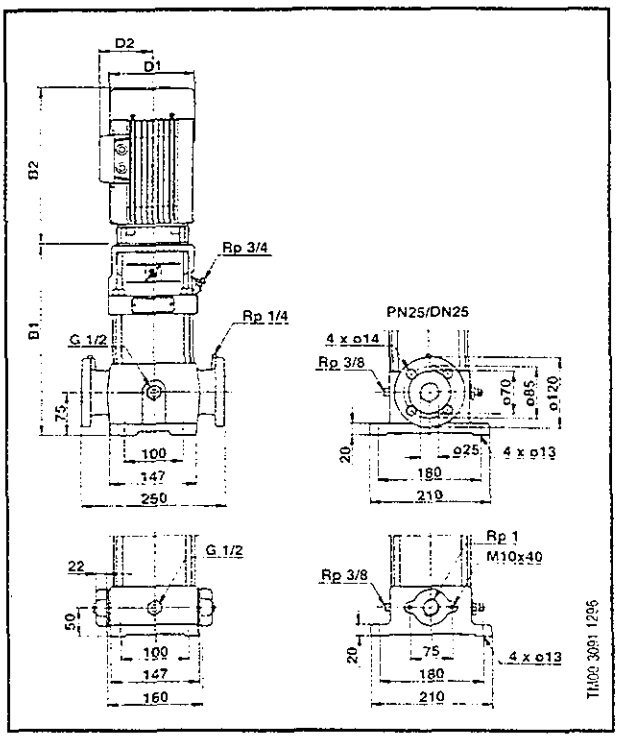
Materials (Basic Version A)

Description	Materials	DIN W.-Nr.	AISI/ASTM
Pump head	Cast iron GG20	0.6020	ASTM 25B
Coupling guard	Stainless steel	1.4301	AISI 304
Shaft	Stainless steel	1.4301 1.4401 1.4057	AISI 304 AISI 316 AISI 431
Impeller	Stainless steel	1.4301	AISI 304
Intermediate chamber	Stainless steel	1.4301	AISI 304
Outer sleeve	Stainless steel	1.4301	AISI 304
Staybolts	Stainless steel Steel 50	1.4057 1.0531	AISI 431
Base	Cast iron GG 20	0.6020	ASTM 25B
O-rings	EPDM or FPM (Viton)		

Performance Curves



Dimensional Sketches



Dimensions and Weights

Pump Type	Dimensions [mm]							Net Weight [kg]	
	* B1	B2	* B1 + B2	** B1	** B1 + B2	D1	D2	*	**
CR 2-20	220	190	410	245	435	140	110	20	25
CR 2-30	240	190	430	265	455	140	110	20	25
CR 2-40	260	190	450	285	475	140	110	20	25
CR 2-50	275	190	465	300	490	140	110	20	25
CR 2-60	300	230	530	325	555	140	110	20	25
CR 2-70	315	230	545	340	570	140	110	25	30
CR 2-90	350	230	580	375	605	140	110	30	35
CR 2-110	385	230	615	410	640	140	110	30	35
CR 2-130	440	280	720	465	745	180	110	30	35
CR 2-150	475	280	755	500	780	180	110	30	35
CR 2-180		280		555	835	180	110		50
CR 2-220		280		625	905	180	110		55
CR 2-260		335		705	1040	180	110		60

* CR 2 with oval flanges
** CR 2 with DIN flanges

Pipework connection:

DIN 2566 with threaded socket
DIN 2634 with socket for welding

Electrical Data 3 x 380-415 V, 50 Hz

Pump Type	Motor [kW]	Motor [hp]	Full Load Current $I_{1/1}$ [A]	Power Factor Cos $\varphi_{1/1}$	Motor Efficiency η[%]	$\frac{I_{start}}{I_{1/1}}$
CR 2-20	0.37	0.50	0.96	0.84-0.76	72	4.8-5.2
CR 2-30	0.37	0.50	0.96	0.84-0.76	72	4.8-5.2
CR 2-40	0.55	0.75	1.44	0.84-0.76	72	4.8-5.2
CR 2-50	0.55	0.75	1.44	0.84-0.76	72	4.8-5.2
CR 2-60	0.75	1.0	1.86	0.86-0.78	74	5.0-5.5
CR 2-70	0.75	1.0	1.86	0.86-0.78	74	5.0-5.5
CR 2-90	1.1	1.5	2.65	0.87-0.79	76	5.2-5.7
CR 2-110	1.1	1.5	2.65	0.87-0.79	76	5.2-5.7
CR 2-130	1.5	3.6	3.60	0.85-0.78	77	6.1-6.6
CR 2-150	1.5	3.6	3.60	0.85-0.78	77	6.1-6.6
CR 2-180	2.2	5.1	5.10	0.86-0.77	81	7.2-7.6
CR 2-220	2.2	5.1	5.10	0.86-0.77	81	7.2-7.6
CR 2-260	3.0	6.5	6.60	0.88-0.82	83	8.1-9.1

Summery of pumps / Vent. Fans.

Maligakkadu Office Building

1) Fire pumps: Main pump : 60 L/min @ 45 m

~~Main~~ Approx. power : 4 kw

Typical selection: GRUNDFOS NK 32 200.1 type

Jokey pump : 30 L/min @ 60 m

Approx pw : 3 kw

Typical selection: GRUNDFOS CR3 5A with 3x400 Vac / 1.1 kW motor

2) Water supply pumps :

Qty : 02 Nos.

Capacity : 5 m^3/hr @ 19 m

Approx power : 2.5 kw

Typical selection : AP10.65.11.3 3x400V 0.1 kW

3) Vent fan:

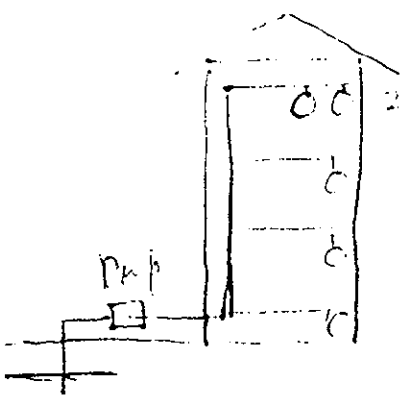
Qty : 04 Nos

Capacity : 50 m^3/min, @ 75 Pa

Typical Model : BXV 400 – 150 – 10
1450 rpm / -20°

Motor Power : 0.22 kw

Maligakanda fire pumps



Vol of ground sump: 12 m³

Typical dimensions: 3 x 2 x 2.5

Effective volume: 3 x 2 x 2

Sump capacity: 24000 l

Pump hp: 5 hp

Total static head to highest point = 16.5 m

Residual Pressure = 2.5 bar = 25 m

Suction head = 2 m

Frictional losses - (60 l/min, 50 mm)

Total head: 16.65 + 2 + 25 + h_f = 41.65 + h_f

H_T ≈ 43

Q = 60 l/min

Power = 4 kW

Selection: GRUNDFOS - 50-Line 50x32-160, 2900 rpm, 4 kW

Static pressure at top floor level: 6.65 + 3.5 x 3 = 16.65 m

Min Residual press. to be maintained at delivery point = 1.5 bar = 15 m

Frictional losses:

Design flow rate of each hose reel: 30 l/min

two ... 60 l/min

Malgalanda Office Bldg

High lift pumping sch.

No of pumps : 02 (1 duty / 1 stby)

Vol of O/H tank : 5 m³

Vol of grnd sump : 10 m³

Pumping capacity : 5 m³ / 4 hrs

Q = 1.25 m³/hr

H_s = 14.7 m

H_f = 2 m

H_{extra} = 2 m

H Total = 18.7 m ≈ 19 m

Typical Pump selection :

Maligakanda Ventilation

1) LOBBY, WAITING AREA, CORRIDOR:

Total floor area $= (6 \times 5.5) \times 3 + 1 \times (6 + 6 + 5)$

$= 33 \times 3 + 17$

$= 116 \text{ m}^2$

Air volume $= 116 \times 3.5$

$= 406 \text{ m}^3$

@ 6 air changes/hr.

Vol. flow rate $= 2436 \text{ m}^3/\text{hr}$

$= 40.6 \text{ m}^3/\text{min}$

Recommended capacity of vent fan = 50 m^3/min

~~Approx.~~

Typical Model

WÖLTER, BxV ~~355-150-10~~ 400-150-10

1450 rpm,

Blade angle : 25°

Motor power : 0.22 kw