APPENDIX 6A -SUBCOMPARTMENT DIFFERENTIAL PRESSURE CONSIDERATIONS

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6A.0 INTRODUCTION

NOTE: The subcompartment differential pressure inputs values and analysis results presented in this section for the recirculation line and feedwater line breaks are based on the original design basis conditions. The blowdown mass and energy releases for the recirculation line and feedwater line breaks were reanalyzed at power rerate conditions. Based on the power rerate analyses, the original analyzed load bounds rerate conditions. Therefore, the shield wall design is not affected by power rerate. The drywell head region pressurization analysis presented in this section was reanalyzed for power rerate conditions. The resulting pressure differential at power rerate conditions is well below pressure differential for the drywell head region.

Differential pressure analyses were performed for the RPV shield annulus and the drywell head region.

The RPV shield annulus, which is 48.95 feet high and 1.70 feet wide at the top, has the 28 inch recirculation pumps suction lines passing through it. The mass and energy release rates from a postulated recirculation outlet line break constitute the most severe transient in the reactor shield annulus. Therefore, this pipe break is selected when analyzing loading of the shield wall and the RPV support skirt for pipe breaks causing annulus pressurization. The estimation of mass and energy release is based on the guidelines set forth in GE's "Generic Annulus Pressurization Mass-Energy Release Methodology" (MFN178-78) and "Technical Description Annulus Pressurization Load Adequacy Evaluation" (NEDO-24548/78NED302). Table 6A-1 presents the full mass and energy release data estimated by applying the finite break opening time/instantaneous break opening time approaches. Because the break location is more than three-fourths of the distance through the penetration, it is conservatively assumed that 50% of the blowdown is released into the annulus, and the remaining 50% is vented to the drywell atmosphere. Table 6A-2 provides, as a function of time, the mass flux and areas used for each side of the break. Physical parameters pertinent to the blowdown rate estimation are noted in the table.

In addition to the analyses for the recirculation outlet line break in the annulus, similar analyses using the same methodology for blowdown rate estimation are performed for a postulated feedwater line break in the annulus. Table 6A-3 presents the mass and energy release rates generated by only applying the very conservative instantaneous break opening time method. Also, it is conservatively assumed in the analyses that the full blowdown is completely released into the annulus. The mass flux as a function of time and areas used for each side of the break are presented in Table 6A-4. Pertinent physical parameters are noted in the table.

Because the main steam lines are not inside the annulus and the recirculation inlet lines are smaller than the outlet lines, the annulus pressurization analyses for these two cases are not needed.

In considering the drywell head region, the maximum blowdown rate stems from a break in the RHR head spray line. The blowdown mass and energy release rates for this line are calculated using Moody Critical Flow of 2800 $lb_m/sec\text{-}ft^2$ and an enthalpy of 1192 Btu/lb_m for the original power level. Pressurization consequences at 3527 MWt are based on the original effects and a multiplier. This multiplier is calulated from the effects of the 3527 MWt on the blowdown mass and energy release rates.. Table 6A-5 shows the blowdown schedule for a 6 inch Schedule 80 line break with an effective break area of 0.181 ft^2. Since this line could singularly pressurize the drywell head region, it is chosen for analysis in a postulated break. The head spray line does not exist for Unit 2 and has been removed from Unit 1. However, the analysis is still applicable since it envelopes loads from rupture of any other pipe in this region.

All differential pressure analyses were performed according to the analytical techniques described in Reference 6A-1. These adjusted pressures are combined with the other appropriate loads (e.g., seismic and jet impingement) to develop design loads for the affected structures and components. Subcompartment venting is used to ensure that the differential pressures developed will remain below the structural capability of compartment walls.

Mass and energy release rates using the NEDO-20533 methodology for a recirculation line break are shown in Table 6.2-10. Short-term release rates based on NEDO-24548 are shown in Table 6A-1. Comparison of these two tables indicates that mass flow rates and enthalpy calculated using NEDO-24548 are less than the conservative values produced using assumptions consistent with NEDO-20533.

Recirculation line break blowdown data used for containment analysis are based on assumptions and calculations made specifically for the LGS units. These assumptions and calculations are discussed in NEDO-10320 (Reference 6.2-5), which follows the methodology outlined in NEDO-20533. This model has been shown to be quite conservative for long-term containment analysis.

However, for the special cases required to analyze pressurization of the annulus due to a recirculation line or feedwater line break, a more detailed model is used. The NEDO-24548 model for short-term mass and energy release includes the effects of inventory and subcooling for flow rates during the first 5 seconds. Credit may also be taken for a finite break opening time. Blowdown rates from NEDO-24548, which calculates the maximum quasi-steady mass flux based on the Moody steady slip flow model with subcooling, are also considered to be conservative estimates of the mass and energy released from the vessel.

6A.1 BIOLOGICAL SHIELD ANNULUS SUBCOMPARTMENT MODELING PROCEDURES AND ANALYSIS

NOTE: The subcompartment differential pressure inputs values and analysis results presented in this section for the recirculation line and feedwater line breaks are based on the original design basis conditions. The blowdown mass and energy releases for the recirculation line and feedwater line breaks were reanalyzed at power rerate conditions. Based on the power rerate analyses, the original analyzed loads bound rerate conditions. Therefore, the shield wall design is not affected by power rerate. The drywell head region pressurization analysis presented in this section was reanalyzed for power rerate conditions. The resulting pressure differential at power rerate conditions is well below pressure differential for the drywell head region.

An analysis was performed of the pressure distribution around the RPV after a recirculation line break. The general layout of the shield annulus is shown in Figures 3.8-1 through 3.8-8 and in 6A-1. Figure 6A-2 is a schematic of the RPV shield annulus model. The model consists of six major levels. Each level is subdivided into twelve 30^{o} segments to form a total of 72 nodes inside the annulus plus an additional node for the rest of the drywell.

The guidelines of GE's "Generic Annulus Pressurization Load Adequacy Evaluation" (NEDO-24548/78NED302) were followed in treating the entire drywell region (volume number 73) as a single compartment in the RPV shield annulus subcompartment analysis. Treating the drywell region as a single compartment reduces the drywell pressure response due to venting from the annulus, resulting in the greatest ΔP across the shield wall.

The 235,200 ft^3 size of the drywell region used in the analysis is a "free volume." The volume occupied by equipment, structures, and floors (i.e.; obstructions) contained within the drywell was excluded from the "free volume" estimate.

In general, the arrangement of the pipes in the annulus determines the most representative level division, since they constitute the only significant flow restrictions. This 73 node model is considered detailed enough to conservatively predict the maximum pressure loads on the compartment structure. Therefore, a nodalization sensitivity study is not needed.

For the purpose of determining peak pressure in the reactor vessel shield annulus, all insulation is assumed to move flush against the biological shield wall while still maintaining its original thickness. The volume of the insulation is excluded from the net volume of each subcompartment, and the projected area of the insulation that blocks the venting path is also excluded from the free venting area used in the analysis.

Venting to the drywell atmosphere is achieved only through the top of the biological shield annulus. For conservatism, venting through the reactor shield wall is not considered.

Initial conditions used in this analysis are 15.45 psia, 135^{o}F, and 30% relative humidity. Bases for these initial conditions are discussed in the drywell head region subcompartment analysis (Section 6A.2).

Tables 6A-6 and 6A-7 give the subcompartment volumes, flow areas, length/area (L/A) ratio, and flow coefficients (including origins) used in the analysis.

The resultant pressure distributions are shown in Figure 6A-3 for the recirculation outlet line break and Figure 6A-4 for the feedwater line break. The subcompartment pressures existing in each subcompartment at the time of peak differential pressure across the RPV are also shown in these figures. Additionally, the load forcing functions that include both peak and transient loadings on the RPV and the reactor shield wall are presented in Figures 6A-5 and 6A-6 for the recirculation outlet break and in Figures 6A-7 and 6A-8 for the feedwater line break. This forcing function represents the time-dependent resultant force on the structure and originates from the vector sum of the product of compartment pressure and area for each of the many nodes used to represent the surface.

The components of these nodal areas are calculated in the following manner:

$$(A_x)_i = R_i H_i \operatorname{Sin} (\theta_{1_i} - \theta_{2_i}) \quad \text{(EQ. 6A-1)}$$

$$(A_y)_i = R_i H_i \operatorname{Cos} (\theta_{2_i} - \theta_{1_i}) \quad \text{(EQ. 6A-2)}$$

where:

R_i	=	Radius of the i^{th} geometry node, in
H_i	=	Height of the i^{th} geometry node, in
$\theta_{1_i} + \theta_{2_i}$	=	Swept angle of geometry node i

Therefore, the force generated by a pressure, (P), acting on a nodal area (A) has the following components:

$(F_x)_i \qquad = P_j\,(A_x)_i \qquad$ (EQ. 6A-3)

$(F_y)_i \qquad = P_j\,(A_y)_i \qquad$ (EQ. 6A-4)

The compartment pressure transients resulting from a break in the reactor shield annulus generate a nodal force distribution over exposed surfaces. The resultant of this nodal force distribution is presented in Figures 6A-5, 6A-6, 6A-7 and 6A-8. This nodal force distribution is included in the analysis of nonaxisymmetric loadings on the containment internal structures, which is discussed in Sections 3.8.3.3 and 3.8.3.4.

Blowdown jet loads that include jet impingement and reaction forces against the reactor vessel are also analyzed for the feedwater line break for reference and comparison. Note that these analyses are based on the very conservative assumptions that the first pipe restraint nearest the nozzle fails. For this break, approximately 9.5" pipe center line offset limited by the shield plug opening produces a net break area of 88.53 in^2, which consequently results into a total maximum jet load against the vessel and a maximum reaction force of 158,500 lb_f and 93,230 lb_f, respectively. Note that this blowdown jet load is relatively small compared with the peak load contributed by the unbalanced reactor annulus pressurization due to the same break.

6A.2 DRYWELL HEAD REGION SUBCOMPARTMENT ANALYSIS

The design basis pressure differential between the drywell head region and the rest of the containment is a structural requirement of the drywell head. A pressure analysis of the drywell head region for a postulated head spray line break was performed. The effects of a 6 inch RHR head spray line break bound those of a 2 inch core vent line, which is the only other line that runs through the drywell head region.

Figure 6A-9 illustrates the basic arrangement of the head region. Venting from the head region is accomplished through ventilation openings as shown in Figure 6A-9. These vent openings provide a total of 18.64 ft^2 of vent area with a flow coefficient of 0.64 to relieve pressure buildup caused by the postulated break. Figure 6A-10 is the schematic flow diagram with vent flow areas and discharge coefficient used in the drywell head venting analysis.

For the drywell head region subcompartment analysis, the possibility that insulation from the RPV could break loose and block the vent paths was not considered because the postulated rupture of the RHR head spray line is outside the insulation above the top of the RPV. The jet from the vessel side of the break is above the top of the insulation, which precludes the metallic insulation sections from breaking loose due to the outward flow of the jet. Forces on the insulation from flow from the other side of the break as well as from the subsequent pressurization in the drywell head region would be inward toward the RPV, rather than outward toward the vent paths.

There is only a small amount of insulation on the drywell head region lines. In the event that this insulation should fail to remain on the pipe due to direct jet impingement, the vent paths leading from the drywell region would not become blocked for the following reasons. The openings of each of the six vents and two exhaust lines from the drywell head region are above the floor and have a ¾ inch mesh screen installed over them. To block the vent paths, a substantial amount of insulation would need to fall directly onto the vent path opening and break through the screen. This is considered improbable because there is only a small amount of pipe insulation in this region and not all of the failed insulation would fall on any one vent path opening.

To determine peak pressure in the drywell head, all insulation is assumed to remain in place. Initial conditions of 15.4 psia, 135°F, and 20% relative humidity are used in this analysis.

The initial conditions used for both the RPV shield annulus and drywell head region analyses reflect conservative assumptions to minimize the total heat capacity of the subcompartment, which satisfies SRP Section 6.2.1.2, Item II.B.1. The COPDA (NE699/D2) subcompartment analysis code is designed to handle realistic conditions. Recommended minimum relative humidity for COPDA, which is described in Reference 6A-1, is in the range of 25% to 30%. The available heat capacity at P=15.45 psia, T=135°F, and RH=30% is less than 3% greater than the heat capacity at 14.8 psia, 135°F, and RH=0%, and will not significantly affect the results of the analysis.

The initial pressure of 15.45 psia (0.75 psig) is the nominal drywell pressure under normal operating conditions for this unit. The pressure alarm setpoints are at 14.8 psia (0.1 psig) and 16.2 psia (1.5 psig). The heat capacity gain due to the higher initial pressure of 0.75 psig is less than 0.2% compared to the heat capacity available for T=135°F, RH=30%, and P=14.8 psia.

The drywell air cooling system is designed to limit the maximum average bulk temperature in the drywell to 135°F, with local maxima not exceeding 150°F (Section 9.4.5.2). For a given relative humidity, an increase in the initial temperatures is accompanied by an increase in the steam partial pressure. Consequently, the heat capacity in the compartment increases due to a greater steam mass. For this reason, the maximum bulk temperature of 135°F is used rather than the 150°F local maximum.

For the RPV shield annulus subcompartment analysis, it should be noted that Reference 6A-2 concludes that loads from such annulus pressurization analyses are insensitive to minor variations in initial (P), (T), and (ϕ).

The pressure transient of this analysis is presented in Figure 6A-11. It can be seen that the maximum pressure in the drywell head region is 25.91 psia and occurs 0.82 seconds after the head spray line break. The maximum pressure of 25.91 psia includes an increase of 2.61 psia as a result of power rerate. Considering the containment pressure to be atmospheric (no drywell air displaced into the rest of containment), a differential of 11.2 psid is obtained between the drywell head and the rest of containment. This pressure differential is well below the design pressure differential of 16.0 psid.

6A.3 REFERENCES

6A-1 "Subcompartment Pressure Analyses," BN-TOP-4, Rev 1, Bechtel Power Corporation, San Francisco, California, (November 1972).

6A-2 NUREG/CR-2633, "Containment Reactor Cavity Subcompartment Analysis Procedures for a Boiling Water Reactor", (May 1982).

Table 6A-1

REACTOR PRIMARY SYSTEM BLOWDOWN FLOW RATES AND FLUID ENTHALPY - RECIRCULATION LINE BREAK

TIME (s)	MASS (lb_m/s)	ENTHALPY (Btu/lb_m)
0.000	0.0000	0.000
$2.5500x10^{-3}$	$1.3400x10^{3}$	527.9
$3.9000x10^{-3}$	$2.6750x10^{3}$	527.9
$4.9600x10^{-3}$	$4.0100x10^{3}$	527.9
$5.8600x10^{-3}$	$5.3500x10^{3}$	527.9
$7.3700x10^{-3}$	$8.0200x10^{3}$	527.9
$9.2400x10^{-3}$	$1.2025x10^{4}$	527.9
$1.1800x10^{-2}$	$1.9285x10^{4}$	527.9
$1.3800x10^{-2}$	$2.6560x10^{4}$	527.9
$1.5800x10^{-2}$	$3.2355x10^{4}$	527.9
$1.8000x10^{-2}$	$4.5975x10^{4}$	527.9
$2.0800x10^{-2}$	$4.5975x10^{4}$	527.9
$2.0800x10^{-2}$	$2.2400x10^{4}$	527.9
$2.1800x10^{-2}$	$2.4130x10^{4}$	527.9
$2.2800x10^{-2}$	$2.5840x10^{4}$	527.9
$2.3800x10^{-2}$	$2.7520x10^{4}$	527.9
$2.5800x10^{-2}$	$3.0780x10^{4}$	527.9
$2.7800x10^{-2}$	$3.3880x10^{4}$	527.9
$3.0800x10^{-2}$	$3.8170x10^{4}$	527.9
$3.5800x10^{-2}$	$4.4220x10^{4}$	527.9
$3.7000x10^{-2}$	$4.5975x10^{4}$	527.9
$4.1400x10^{-1}$	$4.5975x10^{4}$	527.9
$4.1400x10^{-1}$	$3.4370x10^{4}$	527.9
1.0000	$3.4370x10^{4}$	527.9

NOTE: The information presented in this table is based on original plant conditions. The values in the table do provide a reasonable representation of the general blowdown characteristics.

Table 6A-2

RECIRCULATION OUTLET LINE BREAK BLOWDOWN
MASS FLUX TIME HISTORY(1)(2)

TIME (s)	MASS FLUX ($lb_m/s/ft^2$)	EFFECTIVE BREAK AREA (ft^2)
VESSEL SIDE:		
0.00255	21200	0.0316
0.00496	21200	0.0964
0.00737	21200	0.1892
0.01180	21200	0.4548
0.01580	21200	0.7631
0.02080	21200	1.0843
0.02081	8410	1.3317
0.02180	8410	1.4346
0.02380	8410	1.6361
0.02780	8410	2.0142
0.03580	8410	2.6280
0.03700	8410	2.7333
0.41400	8410	3.6440
0.41410	8410	3.6440
1.0	8410	3.6440
PUMP SIDE:		
0.00255	21200	0.0316
0.00496	21200	0.0964
0.00737	21200	0.1892
0.01180	21200	0.4548
0.01580	21200	0.7631
0.02080	21200	1.0843
0.02081	8410	1.3317
0.02180	8410	1.4346
0.02380	8410	1.6361
0.02780	8410	2.0142
0.03580	8410	2.6290
0.03700	8410	2.7333
0.41400	8410	1.8220
0.41410	8410	0.4420
1.0	8410	0.4420

NOTE: The information presented in this table is based on original plant conditions. The values in the table do provide a reasonable representation of the general blowdown characteristics.

Table 6A-2 (Cont'd)

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(1) Listed below are pertinent physical parameters used in the blowdown estimation:

A	=	3.644	ft^2	Minimum cross-sectional area between vessel and break
D	=	2.154	ft	Pipe I.D. at the break location
h_o	=	527.85	Btu/lb_m	Vessel enthalpy
L_I	=	2.917	ft	Inventory length
P_o	=	1031.2	psia	Vessel pressure
P_{sat}	=	908	psia	Saturation pressure
ν	=	0.02127	ft^3/lb_m	Specific volume of the fluid initially in the pipe
V	=	135	ft^3	Inventory volume

(2) The postulated break location is at the nozzle safe-end to the pipe weld, which is located about 4.5 inches from the drywell side of the shield wall. A double-ended guillotine break was assumed. This is conservative because there is insufficient clearance for complete separation of the pipe and nozzle.

NOTE: The information presented in this table is based on original plant conditions.

Table 6A-3

REACTOR PRIMARY SYSTEM BLOWDOWN FLOW RATES AND
FLUID ENTHALPY - FEEDWATER LINE BREAK

TIME (s)	MASS FLOW (lb_m/s)	ENTHALPY (Btu/lb_m)
0.0	0	404.5
0.0001	20348	404.5
0.0217	20348	404.5
0.0218	18454	404.5
1.0	18454	404.5

NOTE: The information presented in this table is based on original plant conditions. The values in the table do provide a reasonable representation of the general blowdown characteristics.

Table 6A-4

FEEDWATER LINE BREAK BLOWDOWN MASS FLUX TIME HISTORY[1]

TIME (s)	MASS FLUX ($lb_m/s/ft^2$)	EFFECTIVE BREAK AREA (ft^2)
VESSEL SIDE:		
0.0001	18250	0.3717
0.0217	18250	0.3717
0.0218	18250	0.2679
1.0	18250	0.2679
SUPPLY PIPE SIDE[2]		
0.0001	18250	0.7433
1.0	18250	0.7433

(1) Listed below are some pertinent physical parameters used in the blowdown estimation

A	=	0.7433 ft^2		Minimum cross-sectional area between vessel and break
D	=	0.9728 ft		Pipe I.D. at the break location
h_o	=	404.5		Btu/lb_m Vessel enthalpy
L_I	=	12	ft	Inventory length
P_o	=	1053	psia	Vessel pressure
P_{sat}	=	326	psia	Saturation pressure
ν	=	0.01888	ft^3/lb_m	Specific volume of the feedwater
V	=	2.79	ft^3	Inventory volume

(1) The most restricted flow area on the feedwater supply pipe side is the break area itself. Full break area steady-state blowdown from this side is conservatively assumed to be reached immediately after the pipe rupture.

NOTE: The information presented in this table is based on original plant conditions. The values in the table do provide a reasonably represent the general characteristics of the blowdown mass flux time history.

Table 6A-5

HEAD SPRAY LINE BREAK[(1)(2)]

TIME (s)	STEAM FLOW lb_m/s)	STEAM ENTHALPY (Btu/lb)
0.0	506.8	1192
20.0	506.8	1192

(1) Head spray line break is based on 6 inch Schedule 80 pipe with Moody Blowdown corresponding to 2800 $lb_m/sec\text{-}ft^2$. Overall containment response is that of a "small break accident."

(2) This table is based on the original design basis power. the effects of rerate power conditions blowdown are shown in Figure 6A-11.

Table 6A-6

COMPARTMENT VOLUMES USED IN REACTOR VESSEL SHIELD ANNULUS SUBCOMPARTMENT ANALYSIS

COMPARTMENT NO.	DESIGNATION	VOLUME, ft^3
1	V1	54
2	V2	54
3	V3	54
4	V4	54
5	V5	54
6	V6	54
7	V7	54
8	V8	54
9	V9	54
10	V10	54
11	V11	54
12	V12	54
13	V13	69
14	V14	76
15	V15	75
16	V16	76
17	V17	76
18	V18	69
19	V19	69
20	V20	76
21	V21	75
22	V22	76
23	V23	76
24	V24	69
25	V25	59
26	V26	57
27	V27	57
28	V28	57
29	V29	57
30	V30	57
31	V31	57
32	V32	57
33	V33	57
34	V34	57
35	V35	57
36	V36	59
37	V37	60
38	V38	58
39	V39	60
40	V40	76
41	V41	58

Table 6A-6 (Cont'd)

COMPARTMENT NO.	DESIGNATION	VOLUME, ft^3
42	V42	60
43	V43	76
44	V44	58
45	V45	60
46	V46	76
47	V47	58
48	V48	60
49	V49	77
50	V50	71
51	V51	73
52	V52	77
53	V53	75
54	V54	77
55	V55	77
56	V56	74
57	V57	77
58	V58	73
59	V59	71
60	V60	77
61	V61	34
62	V62	34
63	V63	34
64	V64	34
65	V65	34
66	V66	34
67	V67	34
68	V68	34
69	V69	34
70	V70	34
71	V71	34
72	V72	34
73	V73	235200

Table 6A-7

FLOW AREA AND COEFFICIENTS USED IN
REACTOR VESSEL SHIELD ANNULUS SUBCOMPARTMENT ANALYSIS

FLOW PATHS	FLOW AREA (ft^2)	K FACTOR	DESCRIPTION	L/A (ft^{-1})	FLOW COEFFICIENT
1-2,1-12, 2-3,3-4, 4-5,5-6, 6-7,7-8, 8-9,9-10, 10-11,11-12	10	0.13 1.0	30° turn Final expansion	0.62	0.94
1-13,2-14, 3-15,4-16, 5-17,6-18, 7-19,8-20, 9-21,10-22, 11-23,12-24	8.5	0.05 1.0	Friction Final expansion	1.01	0.97
2-73,3-73, 5-73,6-73, 8-73,9-73, 11-73,12-73	2	0.42 1.0	Contraction Final expansion	0.73	0.83
13-24, 18-19	9.5	0.13 1.12 1.0	30° turn Around pipe Final expansion	0.54	0.66
13-14,15-16, 16-17,17-18, 19-20,20-21, 22-23,23-24	13	0.13 0.1 1.0	30° turn Around pipe Final expansion	0.43	0.9
14-15, 21-22	12	0.1 0.1 0.13 1.0	Around pipe Around instrument pipe 30° turn Final expansion	0.43	0.86
13-25,18-30, 19-31,24-36	4.5	1.35 0.28 1.0	Around pipe Around pipe Final expansion	1.57	0.61
14-26,16-28, 17-29,20-32, 22-34,23-35,	5.5	0.28 0.28 1.0	Around pipe Around pipe Final expansion	1.17	0.8

Table 6A-7 (Cont'd)

FLOW PATHS	FLOW AREA (ft^2)	K FACTOR	DESCRIPTION	L/A (ft^{-1})	FLOW COEFFICIENT
		0.28	Around pipe		
		0.28	Around pipe		
15-27,		0.31	Around pipe		
21-33	4.5	1.0	Final expansion	1.31	0.73
25-36,		0.13	30^o turn		
30-31	11	1.0	Final expansion	0.55	0.94
25-26,26-27,					
27-28,28-29,					
29-30,31-32,		0.13	30^o turn		
32-33,33-34,		0.16	Around pipe		
34-35,35-36,	9.5	1.0	Final expansion	0.58	0.88
25-37,26-38,					
27-39,28-40,					
29-41,30-42,					
31-43,32-44,					
33-45,34-46,		0.07	Friction		
33-47,36-48	8.5	1.0	Final expansion	0.92	0.96
		0.13	30^o turn		
37-48,38-39		0.01	Around instrument pipe		
41-42,45-46	10.5	1.0	Final expansion	0.55	0.93
		0.13	30^o turn		
37-38,40-41,		0.16	Around pipe		
44-45,47-48	9.5	1.0	Final expansion	0.57	0.88
39-40,42-43,		0.13	30^o turn		
43-44,46-47	11	1.0	Final expansion	0.55	0.94
		0.01	Around instrument pipe		
37-49,		0.07	Friction		
48-60	8	1.0	Final expansion	1.07	0.96
38-50,41-53,		1.11	Around pipe		
44-56,47-59	6	1.0	Final expansion	1.14	0.68
39-51,42-54,		0.08	Around instrument pipe		
45-57	8	1.0	Final expansion	1.07	0.96

Table 6A-7 (Cont'd)

FLOW PATHS	FLOW AREA (ft^2)	K FACTOR	DESCRIPTION	L/A (ft^{-1})	FLOW COEFFICIENT
40-52,43-55		0.07	Around pipe		
46-58	8.5	1.0	Final expansion	1.06	0.96
		0.13	30^o turn		
		0.15	Around pipe		
49-50		0.15	Around pipe		
59-60	11.5	1.0	Final expansion	0.46	0.83
		0.125	30^o turn		
		0.01	Around instrument pipe		
49-60	14	1.0	Final expansion	0.42	0.93
		0.13	30^o turn		
		0.01	Around instrument pipe		
		0.47	Around pipe		
50-51	10.5	1.0	Final expansion	0.48	0.78
		0.13	30^o turn		
51-52,52-53,		0.15	Around pipe		
56-57	13	1.0	Final expansion	0.44	0.88
		0.13	30^o turn		
		0.01	Around instrument pipe		
		0.15	Around pipe		
53-54,57-58	12.5	1.0	Final expansion	0.45	0.88
		0.13	30^o turn		
54-55	14.5	1.0	Final expansion	0.42	0.94
		0.13	30^o turn		
		0.15	Around pipe		
		0.12	Around CRD		
		0.15	Around pipe		
55-56	10.5	1.0	Final expansion	0.5	0.8
		0.13	30^o turn		
		0.47	Around pipe		
58-59	11	1.0	Final expansion	0.47	0.79
49-61,52-64,					
53-65,55-67,		0.49	Around pipe		
57-69	6.5	1.0	Final expansion	0.96	0.81

Table 6A-7 (Cont'd)

FLOW PATHS	FLOW AREA (ft^2)	K FACTOR	DESCRIPTION	L/A (ft^{-1})	FLOW COEFFICIENT
		0.49	Around pipe		
54-66,		0.08	Around instrument pipe		
60-72	6	1.0	Final expansion	1.0	0.79
		0.49	Around pipe		
		0.17	Around CRD		
56-68	5.5	1.0	Final expansion	1.07	0.77
		0.11	30^o turn		
61-62,63-64		0.96	Around pipe		
67-68,69-70	5	1.0	Final expansion	1.03	0.69
61-72,62-63					
64-65,66-67		0.11	30^o turn		
68-69,70-71	6.5	1.0	Final expansion	0.9	0.94
		0.11	30^o turn		
		0.96	Around pipe		
65-66,		0.1	Around instrument pipe		
71-72	4.5	1.0	Final expansion	1.1	0.67
61-73,63-73					
64-73,66-73					
67-73,69-73		0.12	Contraction		
70-73,72-73	6	1.0	Final expansion	0.28	0.94
62-73,65-73		0.05	Contraction		
68-73,71-73	7.5	1.0	Final expansion	0.28	0.97
		0.49	Around pipe		
50-62,51-63,		0.49	Around pipe		
58-70,59-71	5	1.0	Final expansion	1.28	0.71