CHAPTER 3

RESULTS

This chapter is composed of the results obtained from the experimental investigation. The results are shown in tabular form from Table 3-1 through Table 3-7.

TABLE 3-1. Deflections of Single Mitered Pipe Bend

(PIPE BENDS NO. 1a,1b through NO. 6a,6b)

Load, Kg.	Deflections with internal pressure, cm. (Experimental)							
	Zero pressure		10 ksc		20 ksc		25 ksc	
	1a	1b	1a	1b	1a	1b	1a	1b
20	0.028	0.040	0.028	0.040	0.030	0.039	0.029	0.040
40	0.054	0.077	0.057	0.077	0.058	0.076	0.057	0.078
60	0.081	0.116	0.086	0.117	0.086	0.115	0.085	0.117
80	0.108	0.154	0.114	0.155	0.115	0.153	0.114	0.156
100	0.135	0.192	0.143	0.195	0.144	0.191	0.142	0.194
120	0.162	0.230	0.171	0.232	0.173	0.230	0.170	0.232
140	0.189	0.269	0.200	0.272	0.202	0.267	0.198	0.271
160	0.216	0.307	0.228	0.311	0.230	0.306	0.226	0.309
180	0.243	0.345	0.257	0.349	0.258	0.344	0.255	0.346
200	0.269	0.385	0.285	0.387	0.287	0.383	0.283	0.385

TABLE 3-1. (Continued)

Load, Kg.	Deflections with internal pressure, cm. (Experimental)							
	Zero pressure		10 ksc		20 ksc		25 ksc	
	2a	2b	2a	2b	2a	2b	2a	2b
25	0.015	0.018	0.015	0.020	0.015	0.019	0.016	0.019
50	0.030	0.040	0.030	0.041	0.028	0.039	0.030	0.040
75	0.045	0.058	0.044	0.062	0.046	0.060	0.045	0.061
100	0.059	0.078	0.059	0.081	0.061	0.080	0.060	0.081
125	0.074	0.098	0.073	0.103	0.075	0.101	0.074	0.102
150	0.088	0.118	0.089	0.121	0.090	0.120	0.089	0.120
175	0.102	0.138	0.102	0.142	0.104	0.140	0.103	0.141
200	0.117	0.156	0.116	0.162	0.119	0.160	0.118	0.161
225	0.132	0.175	0.132	0.183	0.133	0.180	0.132	0.182

TABLE 3-1. (Continued)

Load, Kg.	Deflections with internal pressure, cm. (Experimental)							
	Zero pressure		10 ksc		20 ksc		25 ksc	
	2a	2b	2a	2b	2a	2b	2a	2b
250	0.146	0.195	0.146	0.202	0.148	0.200	0.148	0.201
275	0.160	0.215	0.160	0.223	0.163	0.221	0.161	0.222
300	0.175	0.234	0.175	0.242	0.178	0.239	0.174	0.241
325	0.190	0.254	0.189	0.264	0.193	0.261	0.189	0.263
350	0.205	0.273	0.202	0.283	0.206	0.280	0.204	0.282
375	0.219	0.294	0.217	0.304	0.222	0.303	0.219	0.304

TABLE 3-1. (Continued)

Load, Kg.	Deflections with internal pressure, cm. (Experimental)							
	Zero pressure		10 ksc		20 ksc		25 ksc	
	3a	3b	3a	3b	3a	3b	3a	3b
25	0.013	0.019	0.014	0.020	0.014	0.018	0.015	0.020
50	0.027	0.037	0.026	0.035	0.028	0.035	0.027	0.037
75	0.041	0.055	0.041	0.053	0.043	0.053	0.042	0.055
100	0.055	0.072	0.053	0.071	0.056	0.071	0.056	0.074
125	0.068	0.091	0.068	0.089	0.068	0.089	0.069	0.092
150	0.082	0.109	0.081	0.105	0.081	0.106	0.083	0.111
175	0.095	0.126	0.097	0.123	0.095	0.123	0.096	0.128
200	0.110	0.145	0.109	0.142	0.109	0.142	0.108	0.146
225	0.122	0.163	0.123	0.161	0.123	0.161	0.123	0.165
250	0.136	0.180	0.136	0.178	0.136	0.178	0.137	0.183

TABLE 3-1. (Continued)

Load, Kg.	Deflections with internal pressure, cm. (Experimental)							
	Zero pressure		10 ksc		20 ksc		25 ksc	
	3a	3b	3a	3b	3a	3b	3a	3b
275	0.150	0.198	0.150	0.197	0.150	0.197	0.151	0.202
300	0.164	0.216	0.163	0.212	0.162	0.216	0.163	0.218
325	0.176	0.235	0.175	0.231	0.177	0.233	0.175	0.236
350	0.190	0.252	0.190	0.250	0.189	0.249	0.192	0.256
375	0.204	0.270	0.203	0.267	0.204	0.269	0.203	0.275
400	0.217	0.287	0.217	0.285	0.217	0.287	0.216	0.292
425	0.230	0.306	0.230	0.302	0.233	0.305	0.230	0.309
450	0.244	0.322	0.242	0.320	0.244	0.321	0.244	0.328
475	0.257	0.341	0.257	0.339	0.257	0.341	0.259	0.347

TABLE 3-1. (Continued)

Load, Kg.	Deflections with internal pressure, cm. (Experimental)							
	Zero pressure		10 ksc		20 ksc		25 ksc	
	4a	4b	4a	4b	4a	4b	4a	4b
50	0.015	0.029	0.016	0.028	0.015	0.030	0.017	0.029
100	0.030	0.057	0.030	0.060	0.030	0.058	0.031	0.058
150	0.045	0.082	0.046	0.089	0.046	0.087	0.047	0.088
200	0.060	0.111	0.063	0.116	0.061	0.115	0.063	0.115
250	0.076	0.140	0.078	0.147	0.077	0.144	0.078	0.143
300	0.091	0.170	0.094	0.177	0.093	0.173	0.093	0.171
350	0.106	0.199	0.109	0.206	0.108	0.200	0.108	0.199
400	0.122	0.227	0.124	0.234	0.123	0.229	0.123	0.227
450	0.137	0.253	0.140	0.264	0.138	0.257	0.139	0.256
500	0.153	0.282	0.155	0.292	0.153	0.285	0.153	0.283

TABLE 3-1. (Continued)

Load, Kg.	Deflections with internal pressure, cm. (Experimental)							
	Zero pressure		10 ksc		20 ksc		25 ksc	
	4a	4b	4a	4b	4a	4b	4a	4b
550	0.167	0.311	0.169	0.320	0.168	0.313	0.168	0.310
600	0.184	0.340	0.183	0.350	0.182	0.341	0.183	0.339
650	0.200	0.369	0.203	0.377	0.199	0.369	0.197	0.367
700	0.215	0.395	0.215	0.406	0.213	0.395	0.212	0.395
750	0.230	0.422	0.231	0.431	0.229	0.427	0.229	0.426
800	0.245	0.451	0.245	0.465	0.243	0.452	0.243	0.452
850	0.260	0.480	0.262	0.493	0.258	0.480	0.260	0.480
900	0.275	0.509	0.276	0.522	0.272	0.510	0.274	0.509
950	0.291	0.536	0.293	0.553	0.288	0.538	0.292	0.538

TABLE 3-1. (Continued)

Load, Kg.	Deflections with internal pressure, cm. (Experimental)							
	Zero pressure		10 ksc		20 ksc		25 ksc	
	5a	5b	5a	5b	5a	5b	5a	5b
50	0.013	0.024	0.012	0.022	0.014	0.024	0.012	0.024
100	0.025	0.047	0.025	0.044	0.025	0.047	0.024	0.044
150	0.037	0.070	0.036	0.067	0.039	0.070	0.034	0.066
200	0.050	0.092	0.048	0.088	0.052	0.092	0.046	0.089
250	0.062	0.115	0.060	0.112	0.064	0.113	0.059	0.111
300	0.074	0.136	0.070	0.132	0.077	0.136	0.072	0.131
350	0.086	0.160	0.083	0.156	0.089	0.158	0.083	0.154
400	0.098	0.182	0.096	0.176	0.102	0.182	0.095	0.171
450	0.110	0.205	0.109	0.200	0.114	0.206	0.108	0.201

TABLE 3-1. (Continued)

Load, Kg.	Deflections with internal pressure, cm. (Experimental)							
	Zero pressure		10 ksc		20 ksc		25 ksc	
	5a	5b	5a	5b	5a	5b	5a	5b
500	0.123	0.226	0.120	0.221	0.127	0.228	0.119	0.223
550	0.135	0.250	0.133	0.245	0.138	0.248	0.133	0.247
600	0.147	0.271	0.145	0.266	0.151	0.273	0.144	0.268
650	0.160	0.295	0.158	0.289	0.163	0.294	0.157	0.291
700	0.172	0.316	0.169	0.311	0.174	0.317	0.168	0.312
750	0.185	0.340	0.182	0.333	0.188	0.341	0.180	0.333
800	0.196	0.362	0.193	0.354	0.202	0.363	0.191	0.355
850	0.209	0.384	0.206	0.376	0.215	0.386	0.203	0.377
900	0.220	0.407	0.217	0.399	0.225	0.408	0.214	0.399

TABLE 3-1. (Continued)

Load, Kg.	Deflections with internal pressure, cm. (Experimental)							
	Zero pressure		10 ksc		20 ksc		25 ksc	
	6a	6b	6a	6b	6a	6b	6a	6b
100	0.012	0.026	0.010	0.025	0.010	0.025	0.010	0.023
200	0.018	0.051	0.017	0.050	0.017	0.049	0.016	0.045
300	0.028	0.077	0.026	0.080	0.025	0.073	0.023	0.067
400	0.036	0.101	0.035	0.105	0.032	0.096	0.029	0.089
500	0.045	0.128	0.043	0.130	0.040	0.119	0.036	0.111
600	0.055	0.152	0.052	0.155	0.048	0.144	0.044	0.135
700	0.063	0.179	0.060	0.179	0.055	0.167	0.050	0.156
800	0.072	0.203	0.069	0.205	0.063	0.191	0.058	0.178
900	0.081	0.228	0.078	0.232	0.071	0.214	0.065	0.200

TABLE 3-1. (Continued)

Load, Kg.	Deflections with internal pressure, cm. (Experimental)							
	Zero pressure		10 ksc		20 ksc		25 ksc	
	6a	6b	6a	6b	6a	6b	6a	6b
1000	0.090	0.253	0.086	0.257	0.078	0.238	0.071	0.224
1100	0.099	0.280	0.095	0.283	0.086	0.263	0.078	0.246
1200	0.107	0.305	0.104	0.308	0.094	0.286	0.085	0.267
1300	0.116	0.330	0.112	0.334	0.102	0.310	0.093	0.290
1400	0.126	0.355	0.121	0.360	0.110	0.334	0.100	0.313
1500	0.135	0.380	0.130	0.385	0.118	0.357	0.106	0.335
1600	0.143	0.405	0.139	0.412	0.125	0.381	0.113	0.356
1700	0.153	0.431	0.147	0.437	0.134	0.405	0.120	0.379
1800	0.165	0.455	0.156	0.463	0.141	0.429	0.127	0.402

TABLE 3-2 The Comparison of Calculated to Von Karman's, American Standard Code and Kellogg's Flexibility Factors at Various Equivalent Radius

(R=r)

Flexibility factor,K				
Pipe No.	Calculated	Karman's	American Standard Code	Kellogg's
1a	5.6692954	11.762868	11.191311	7.4933324
2a	10.709619	12.245617	11.653126	7.7501198
3a	12.559075	13.660384	12.993752	8.4863102
4a	8.8425333	20.644296	19.626898	11.966902
5a	9.704759	18.631864	17.723925	10.991871
6a	3.8221665	21.652706	20.56877	12.443614
1b	10.873087	11.762868	11.191311	7.4933324
2b	15.611484	12.245617	11.653126	7.7501198
3b	18.197844	13.660384	12.993752	8.4863102
4b	19.218366	20.644296	19.626898	11.966902
5b	20.754382	18.631864	17.723925	10.991871
6b	15.676791	21.652706	20.56877	12.443614

TABLE 3-2. (Continued)

(R = 2r)

Flexibility factor,K				
Pipe No.	Calculated	Karman's	American Standard Code	Kellogg's
1a	2.7414851	5.8330094	5.5956558	4.205482
2a	5.103963	6.0853132	5.8265633	4.3496176
3a	5.9727569	6.8112803	6.4968763	4.7627851
4a	4.1490112	10.320504	9.8134493	6.7162134
5a	4.5528979	9.3204824	8.8619628	6.1690064
6a	1.7788686	10.811253	10.284385	6.9837535
1b	5.2578683	5.8330094	5.5956558	4.205482
2b	7.4400811	6.0853132	5.8265633	4.3496176
3b	8.6544033	6.8112803	6.4968763	4.7627851
4b	9.0174631	10.320504	9.8134493	6.7162134
5b	9.7367268	9.3204824	8.8619628	6.1690064
6b	7.2961117	10.811253	10.284385	6.9837535

TABLE 3-2. (Continued)

(R = 3r)

Flexibility factor, K				
Pipe No.	Calculated	Karman's	American Standard Code	Kellogg's
1a	1.7683773	3.7653584	3.7304372	2.9996664
2a	3.2462308	3.9360249	3.8843755	3.1024713
3a	3.7911108	4.4334972	4.3312509	3.3971718
4a	2.5998841	6.8605152	6.5422995	4.7905097
5a	2.8525667	6.1740198	5.9079752	4.400198
6a	1.1061441	7.1975473	6.8562567	4.9813363
1b	3.3915541	3.7653584	3.7304372	2.9996664
2b	4.7320524	3.9360249	3.8843755	3.1024713
3b	5.4932424	4.4334972	4.3312509	3.3971718
4b	5.6505893	6.8605152	6.5422995	4.7905097
5b	6.1004362	6.1740198	5.9079752	4.400198
6b	4.536901	7.1975473	6.8562567	4.9813363

TABLE 3-2. (Continued)

(R = 4r)

Pipe No.	Flexibility factor, K			
	Calculated	Karman's	American Standard Code	Kellogg's
1a	1.2838272	2.7584449	2.7978279	2.3602484
2a	2.32484	2.8790611	2.9132816	2.4411357
3a	2.7097828	3.2370263	3.2484381	2.6730209
4a	1.8356654	5.0735381	4.9067246	3.7693457
5a	2.0138031	4.5446018	4.4309814	3.4622331
6a	0.7753368	5.3341917	5.1421925	3.9194956
1b	2.46224	2.7584449	2.7978279	2.3602484
2b	3.3889348	2.8790611	2.9132816	2.4411357
3b	3.9264202	3.2370263	3.2484381	2.6730209
4b	3.9896362	5.0735381	4.9067246	3.7693457
5b	4.3066748	4.5446018	4.4309814	3.4622331
6b	3.1800798	5.3341917	5.1421925	3.9194956

TABLE 3-2. (Continued)

(R = 5r)

Pipe No.	Flexibility factor, K			
	Calculated	Karman's	American Standard Code	Kellogg's
1a	0.9946118	2.2024444	2.2382623	1.9597427
2a	1.777519	2.2902823	2.3306253	2.0269071
3a	2.0679645	2.554621	2.5987505	2.2194414
4a	1.3845689	3.9815712	3.9253797	3.1297357
5a	1.5187372	3.5605424	3.5447851	2.8747371
6a	0.5807915	4.1911459	4.113754	3.2544068
1b	1.9075565	2.2024444	2.2382623	1.9597427
2b	2.5911014	2.2902823	2.3306253	2.0269071
3b	2.9964385	2.554621	2.5987505	2.2194414
4b	3.0092227	3.9815712	3.9253797	3.1297357
5b	3.2479378	3.5605424	3.5447851	2.8747371
6b	2.3821432	4.1911459	4.113754	3.2544068

TABLE 3-2. (Continued)

(R = 6r)

Flexibility factor,K				
Pipe No.	Calculated	Karman's	American Standard Code	Kellogg's
1a	0.8029946	1.8683214	1.8652186	1.6835072
2a	1.4168786	1.9342696	1.9421877	1.7412023
3a	1.6454338	2.1346785	2.1656254	1.9065992
4a	1.0894134	3.2616271	3.2711497	2.6885857
5a	1.1948357	2.9219533	2.9539876	2.4695249
6a	0.4540107	3.4325897	3.4281283	2.7956799
1b	1.5400557	1.8683214	1.8652186	1.6835072
2b	2.0653935	1.9342696	1.9421877	1.7412023
3b	2.3842001	2.1346785	2.1656254	1.9065992
4b	2.3677317	3.2616271	3.2711497	2.6885857
5b	2.5552493	2.9219533	2.9539876	2.4695249
6b	1.8621458	3.4325897	3.4281283	2.7956799

TABLE 3-2. (Continued)

(R = 7r)

Pipe No.	Flexibility factor, K			
	Calculated	Karman's	American Standard Code	Kellogg's
1a	0.6670922	1.6539536	1.5987588	1.4805608
2a	1.1626354	1.7048909	1.6647323	1.531301
3a	1.3478467	1.8607512	1.8562503	1.6767584
4a	0.8828962	2.7646882	2.8038426	2.3644743
5a	0.9682225	2.4876154	2.5319893	2.1718257
6a	0.3656784	2.9055057	2.9383957	2.4586597
1b	1.2794098	1.6539536	1.5987588	1.4805608
2b	1.6947814	1.7048909	1.6647323	1.531301
3b	1.9530025	1.8607512	1.8562503	1.6767584
4b	1.9188871	2.7646882	2.8038426	2.3644743
5b	2.0706199	2.4876154	2.5319893	2.1718257
6b	1.4998471	2.9055057	2.9383957	2.4586597

TABLE 3-2. (Continued)

(R = 8r)

Flexibility factor,K				
Pipe No.	Calculated	Karman's	American Standard Code	Kellogg's
1a	0.565966	1.5201287	1.3989139	1.3246464
2a	0.9746692	1.5494035	1.4566408	1.3700432
3a	1.1280598	1.6734348	1.624219	1.500184
4a	0.7314131	2.4096698	2.4533623	2.1154772
5a	0.8020117	2.1810716	2.2154907	1.9431128
6a	0.3011673	2.5267768	2.5710962	2.1997423
1b	1.0854608	1.5201287	1.3989139	1.3246464
2b	1.4207818	1.5494035	1.4566408	1.3700432
3b	1.6345358	1.6734348	1.624219	1.500184
4b	1.5896537	2.4096698	2.4533623	2.1154772
5b	1.7151645	2.1810716	2.2154907	1.9431128
6b	1.2352516	2.5267768	2.5710962	2.1997423

TABLE 3-3. The Comparison Between Experimental And Theoretical Flexibility Factor With Internal Pressure.

Pipe No.	Flexibility factor with internal pressure, Kp					
	10 ksc.		20 ksc.		25 ksc.	
	Experimental	Theoretical	Experimental	Theoretical	Experimental	Theoretical
1a	0.8924928	0.799402	0.9189965	0.7958305	0.8883315	0.7940566
2a	1.4080042	1.4099559	1.4370167	1.4030802	1.4325794	1.3996573
3a	1.6434045	1.6350658	1.6645223	1.6248277	1.6718328	1.619743
4a	1.1144689	1.0713188	1.0933437	1.0537843	1.1134863	1.0428002
5a	1.1553565	1.179526	1.2453173	1.1646037	1.1359406	1.157269
6a	0.413283	0.4458424	0.3560911	0.4379628	0.2971661	0.434133
1b	1.2958331	1.2732789	1.2634334	1.2671877	1.2938547	1.2520875
2b	1.7886072	1.686139	1.7474359	1.6775844	1.7662011	1.6733522
3b	1.9190685	1.940265	1.9134129	1.9276962	1.990596	1.9214507
4b	1.9929434	1.8859137	1.949943	1.85411	1.9391929	1.8385797
5b	1.9966715	2.0420364	2.0700947	2.0142314	1.8938791	2.0005844
6b	1.5200877	1.4715816	1.3979464	1.4443619	1.2848785	1.4311483

TABLE 3-4. Variation of strains and stresses around the pipe cross-section under in-plane bending load. (F = 1,000 kg.)

Position, degree	Longitudinal strain, e_l (cm./cm.)	Circumferential strain, e_c (cm./cm.)	Longitudinal stress, S_l (ksc.)	Circumferential stress, S_c (ksc.)
0°	-0.00001	0.00007	25.495823	155.29274
45°	0.00043	-0.00016	885.4004	-71.851865
90°	0.00041	-0.00017	832.09095	-108.93669
135°	0.00005	0.00001	122.84351	57.945052
180°	-0.00033	0.00021	-618.85316	257.27603
225°	-0.00077	0.00088	-1172.8078	1504.2535
270°	-0.00034	0.00011	-711.56524	18.542416
315°	0.00003	-0.00003	48.673844	-48.673844
360°	-0.00001	0.00007	25.495823	155.29274

TABLE 3-4. (Continued)

(F = 2,000 kg.)

Position, degree	Longitudinal strain, e_l (cm./cm.)	Circumferential strain, e_c (cm./cm.)	Longitudinal stress, S_l (ksc.)	Circumferential stress, S_c (ksc.)
0°	-0.00003	-0.00006	-111.2545	-159.92834
45°	0.00073	-0.00070	1205.257	-1114.8628
90°	0.00126	-0.00077	2385.0163	-908.57842
135°	0.00059	-0.00022	1214.5283	-99.66549
180°	-0.00062	0.00148	-407.93316	2999.2359
225°	-0.00136	0.00166	-1997.9454	2901.8882
270°	-0.00099	0.00015	-2190.3229	-340.7169
315°	-0.00029	0.00008	-616.53535	-16.224614
360°	-0.00003	-0.00006	-111.2545	-159.92834

TABLE 3-5. Variation of strains and stresses around the pipe cross-section under internal pressure. (p = 10 ksc.)

Position, degree	Longitudinal strain, e_l (cm./cm.)	Circumferential strain, e_c (cm./cm.)	Longitudinal stress, S_l (ksc.)	Circumferential stress, S_c (ksc.)
0°	0.0000284	0.0001208	149.73001	299.69181
45°	0.000045	0.0000943	169.66311	249.85906
90°	0.0000559	0.0000997	198.86742	269.79216
135°	0.0000815	0.0000877	249.85906	259.82561
180°	0.0000075	0.0001185	99.66549	279.75871
225°	0.0000315	0.0000962	139.76346	244.7599
270°	0.0000355	0.0001403	179.62966	349.75633
315°	0.0000485	0.00001256	199.56276	324.72407
360°	0.0000284	0.0001208	149.73001	299.69181

TABLE 3-5. (Continued)

(p = 20 ksc.)

Position, degree	Longitudinal strain, e_l (cm./cm.)	Circumferential strain, e_c (cm./cm.)	Longitudinal stress, S_l (ksc.)	Circumferential stress, S_c (ksc.)
0°	0.0000397	0.0002098	237.80649	513.85672
45°	0.000064	0.0001749	269.79216	449.88538
90°	0.0001076	0.0002136	397.73484	569.71575
135°	0.0001208	0.0002225	434.58789	599.6154
180°	0.0000668	0.0002086	299.69181	529.84956
225°	0.0000521	0.0002216	274.65954	549.78265
270°	0.0000673	0.0002429	324.72407	609.58195
315°	0.0000644	0.0002308	309.65836	579.6823
360°	0.0000397	0.0002098	237.80649	513.85672

TABLE 3-6. Variation of strains and stresses around the pipe cross-section under combined internal pressure and in-plane bending load. (F = 1,000 kg, p = 10 ksc.)

Position, degree	Longitudinal strain, e_l (cm./cm.)	Circumferential strain, e_c (cm./cm.)	Longitudinal stress, S_l (ksc.)	Circumferential stress, S_c (ksc.)
0°	-0.00008	0.000142	-86.685798	273.50064
45°	0.00005	-0.00005	81.123073	-81.123073
90°	0.000465	-0.000182	951.22598	-98.506589
135°	0.000388	-0.000066	853.41473	116.81722
180°	0.000041	0.000077	148.57111	206.97972
225°	-0.00058	0.000865	-742.85557	1601.6012
270°	-0.00053	0.000115	-1148.4709	101.98329
315°	-0.00014	0.00003	-303.63207	-27.813625
360°	-0.00008	0.000142	-86.685798	273.50064

TABLE 3-6. (Continued)

(F = 2,000 kg, p = 10 ksc.)

Position, degree	Longitudinal strain, e_l (cm./cm.)	Circumferential strain, e_c (cm./cm.)	Longitudinal stress, S_l (ksc.)	Circumferential stress, S_c (ksc.)
0°	-0.000026	-0.000201	-200.02632	-483.95707
45°	0.00083	-0.000765	1391.8401	-1195.9858
90°	0.00143	-0.00103	2596.2561	-1392.999
135°	0.00070	-0.000338	1387.4363	-296.67866
180°	-0.000677	0.001398	-597.06582	2769.5417
225°	-0.00145	0.00167	-2199.5941	2862.4855
270°	-0.000835	-0.000095	-2001.4221	-800.80062
315°	-0.000019	-0.00051	-398.66196	-1195.2905
360°	-0.000026	-0.000201	-200.02632	-483.95707

TABLE 3-6. (Continued)

(F = 1,000 kg, p = 20 ksc.)

Position, degree	Longitudinal strain, e_l (cm./cm.)	Circumferential strain, e_c (cm./cm.)	Longitudinal stress, S_l (ksc.)	Circumferential stress, S_c (ksc.)
0°	-0.00012	0.00021	-132.11471	403.29756
45°	0.000333	-0.000174	650.83882	-171.74913
90°	0.000485	-0.000254	947.51479	-251.48152
135°	0.000111	-0.000111	180.09322	-180.09322
180°	-0.000372	0.000468	-536.80296	826.06466
225°	-0.00070	0.00090	-996.6549	1599.2834
270°	-0.000452	0.000287	-848.08378	350.91523
315°	0.000009	-0.000175	-100.82439	-399.3573
360°	-0.00012	0.00021	-132.11471	403.29756

TABLE 3-6. (Continued)

(F = 2,000 kg, p = 20 ksc.)

Position, degree	Longitudinal strain, e_l (cm./cm.)	Circumferential strain, e_c (cm./cm.)	Longitudinal stress, S_l (ksc.)	Circumferential stress, S_c (ksc.)
0°	-0.000014	0.000264	151.12069	602.16498
45°	0.000445	-0.000478	699.04911	-798.48282
90°	0.00109	-0.000758	1999.336	-998.9727
135°	0.000792	-0.000216	1685.5056	50.064525
180°	-0.000208	0.001056	252.17686	2302.9681
225°	-0.001175	0.00176	-1499.6179	3262.3064
270°	-0.00119	0.000366	-2503.6898	20.860218
315°	-0.000415	-0.000199	-1100.2606	-749.80897
360°	-0.000014	0.000264	151.12069	602.16498

TABLE 3-7. Comparison between theoretical and experimental stress intensification factor, i_p (both longitudinal and circumferential) for single mitered pipe bend (p = 10 ksc.)

Position, degree	F = 1,000 kg.			
	Longitudinal, i_p		Circumferential, i_p	
	Theoretical	Experimental	Theoretical	Experimental
0°	0.041041	-0.1434155	0.2499772	0.4524875
45°	1.4252436	0.1342124	-0.115661	-0.1342124
90°	1.3394304	1.5737364	-0.1753571	-0.1629722
135°	0.1977431	1.4119145	0.093275	0.1932658
180°	-0.996178	0.2458004	0.4141413	0.3424333
225°	-1.887888	-1.2290022	2.4214216	2.6497364
270°	-1.1454182	-1.9000642	0.029848	0.1687241
315°	0.078351	-0.5023378	-0.078351	-0.0460156
360°	0.041041	-0.1434155	0.2499772	0.4524875
Position, degree	F = 2,000 kg.			
	Longitudinal, i_p		Circumferential, i_p	
	Theoretical	Experimental	Theoretical	Experimental
0°	-0.089544	-0.1654647	-0.1287195	-0.4003364
45°	0.970061	1.1513507	-0.8973065	-0.9893372
90°	1.9196017	2.149316	-0.7312768	-1.1523094
135°	0.9775231	1.1477078	-0.0802165	-0.2454169
180°	-0.3283283	-0.4939017	2.4139598	2.2910059
225°	-1.6080628	-1.8195368	2.3356086	2.3678904
270°	-1.7628995	-1.655606	-0.2742287	-0.6624341
315°	-0.4962234	-0.329779	-0.0130584	-0.988762
360°	-0.089544	-0.1654647	-0.1287195	-0.4003364

TABLE 3-7. (Continued)

(p = 20 ksc.)

Position, degree	F = 1,000 kg.			
	Longitudinal, i_p		Circumferential, i_p	
	Theoretical	Experimental	Theoretical	Experimental
0°	0.039961	-0.2185744	0.2433991	0.6672274
45°	1.3877381	1.076767	-0.1126174	-0.2841468
90°	1.3041832	1.5675965	-0.1707425	-0.4160584
135°	0.1925395	0.2979515	0.0908205	-0.2979515
180°	-0.9699635	-0.8881027	0.4032432	1.3666658
225°	-1.838208	-1.6488953	2.3577017	2.6459017
270°	-1.1152764	-1.4030949	0.0290625	0.5805645
315°	0.0762892	-0.1668068	-0.0762892	-0.6607035
360°	0.039961	-0.2185744	0.2433991	0.6672274
Position, degree	F = 2,000 kg.			
	Longitudinal, i_p		Circumferential, i_p	
	Theoretical	Experimental	Theoretical	Experimental
0°	-0.0871876	0.1250092	-0.1253322	0.4981198
45°	0.9445337	0.5782637	-0.8736938	-0.6605168
90°	1.8690872	1.6538804	-0.7120332	-0.826365
135°	0.9517995	1.3942752	-0.0781056	0.0414141
180°	-0.3196883	0.2086044	2.3504362	1.9050493
225°	-1.5657465	-1.2405061	2.2741469	2.6986282
270°	-1.7165086	-2.0710893	-0.2670123	0.0172558
315°	-0.4831653	-0.9101518	-0.0127148	-0.6202531
360°	-0.0871876	0.1250092	-0.1253322	0.4981198