A16.8611.2 *Nominal elastic stresses*

A16.8611.21 Nominal elastic stresses – Internal pressure P

For **internal pressure P**, the nominal elastic membrane stresses σ_{no1m}, σ_{no2m} and bending stresses σ_{no1b}, σ_{no2b} are given in **table A16.8611.21**.

Table A16.8611.21: internal pressure P - nominal elastic stresses

$\sigma_{no1m}(P)$	membrane longitudinal	$\frac{P \cdot r_i}{2 \cdot h(\varphi)}$
$\sigma_{no1b}(P)$	bending longitudinal	0
$\sigma_{no2m}(P)$	membrane circumferential	$\frac{P \cdot r_i}{h(\varphi)} \cdot \left[\frac{2 \cdot R_c + r_i \cdot \sin\varphi}{2 \cdot (R_c + r_m \cdot \sin\varphi)} \right]$
$\sigma_{no2b}(P)$	bending circumferential	0

A16.8611.22 Nominal elastic stresses – In plane bending moment M_2

For in plane bending moment M_2, the nominal elastic stresses, elastic nominal stresses are a function of the elbow angle ψ_c and of the considered section.

- **For elbows angle 45°, 90°, 180° ($\psi_c = \pi/4, \pi/2, \pi$)**, in the entrance section ($\psi = 0$) and the mid section ($\psi = \psi_c/2$), the elastic nominal membrane stresses σ_{no1m}, σ_{no2m}, nominal bending stresses σ_{no1b}, σ_{no2b} and nominal shear membrane stresses σ_{no12m} and σ_{no12b} are given by trigonometric series functions of the defect azimuth φ :
  - stresses σ_{no1b}, σ_{no2b} and σ_{no1m}, σ_{no2m} :

$$\sigma_{no} = \frac{M_2}{Z} \cdot \left[s_1 \cdot \sin(\varphi) + s_3 \cdot \sin(3\varphi) + s_5 \cdot \sin(5\varphi) + c_o + c_2 \cdot \cos(2\varphi) + c_4 \cdot \cos(4\varphi) \right]$$

  - stresses σ_{no12b} and σ_{no12m} :

$$\sigma_{no} = \frac{M_2}{Z} \cdot \left[c_1 \cdot \cos(\varphi) + c_3 \cdot \cos(3\varphi) + c_5 \cdot \cos(5\varphi) + s_2 \cdot \sin(2\varphi) + s_4 \cdot \sin(4\varphi) + s_6 \cdot \sin(6\varphi) \right]$$

  The coefficients $s_{1,..,6}$ and $c_{o,..,5}$ for each elastic nominal stress component are functions of the elbow parameters λ and $X = r_m/h$:

$$s_i \text{ or } c_i = a + \left[b \cdot \lambda^2 + c \cdot \lambda + d + e \cdot X + \frac{f}{X} \right] \cdot \lambda^{\left(p \cdot X^2 + q \cdot X + r\right)}$$

  Where the coefficients (a, b, c, d, e, f) and (p, q, r) are given in tables **A16.8611.22a to f**.
- **For elbows angle ψ_c between $\pi/6$ and π,** in the entrance section ($\psi = 0$) and the mid section ($\psi = \psi_c/2$), the stresses are obtained from the values of these stresses for elbow angles $\psi_c = \pi/4$, $\psi_c = \pi/2$ and $\psi_c = \pi$, according to :
  - for $\pi/6 \le \psi_c \le \pi/2$: $\sigma_{no}(\psi_c) = \sigma_{no}(\frac{\pi}{2}) + \frac{4}{\pi} \cdot \left(\frac{\pi}{2} - \psi_c \right) \cdot \left[\sigma_{no}(\frac{\pi}{4}) - \sigma_{no}(\frac{\pi}{2}) \right]$
  - for $\pi/2 \le \psi_c \le \pi$: $\sigma_{no}(\psi_c) = \sigma_{no}(\pi) + \frac{2}{\pi} \cdot (\pi - \psi_c) \cdot \left[\sigma_{no}(\frac{\pi}{2}) - \sigma_{no}(\pi) \right]$
- **In a given** section represented by its angle ψ ($0 \le \psi \le \psi_c$), the longitudinal and circumferential stresses are obtained from the stresses values in the two main sections of the elbow (entrance : $\psi = 0$ and median $\psi = \psi_c/2$), with the following equation :

$$\sigma_{no}(\psi) = \sigma_{no}(0) + \left[\sigma_{no}(\frac{\psi_c}{2}) - \sigma_{no}(0) \right] \cdot \sin\left(\pi . \frac{\psi}{\psi_c} \right)$$

  Shear stresses are obtained from their values in the entrance section of the elbow ($\psi = 0$), with the following equation :

$$\sigma_{no}(\psi) = \frac{1}{2} \sigma_{no}(0) \left[\cos\left(\pi \frac{\psi}{\psi_c} \right) + \left(1 - \frac{2\psi}{\psi_c} \right) \right]$$

- **The domain of validity** of these equations is :

$3 \le r_m/h \le 20$ $0.1 \le \lambda \le 1$ $\pi/6 \le \psi_c \le \pi$

Table A16.8611.22a: 45° elbow ($\psi_c = \pi/4$) – Moment M_2, coefficients for the entrance section ($\psi = 0$)

		a	b	c	d	e	f	p	q	r
$\sigma_{no1m}(M°_2)$ *Longitudinal membrane*	s1	-0.98378	0.00515	-0.02043	-0.02875	1.00E-03	0.17972	-2.09E-03	1.35E-03	-0.03114
	s3	0.85418	-0.10054	0.17694	-1.06341	3.91E-03	0.27351	1.02E-03	-3.86E-02	0.04281
	s5	0.00836	-0.01004	0.00376	0.00182	-3.33E-04	0.00542	9.55E-03	-2.74E-01	-0.12665
	c0	0.00040	-0.00004	-0.00085	-0.00074	6.39E-05	0.00398	2.34E-01	-8.67E-01	-4.83268
	c2	-0.31145	-0.17108	0.51751	-0.02919	6.15E-04	-0.25125	6.40E-04	-4.00E-02	-0.08270
	c4	-0.39029	0.45316	-0.07698	-0.00313	2.51E-04	0.02725	-1.43E-05	-8.46E-03	-2.07984
$\sigma_{no1b}(M°_2)$ *Longitudinal bending*	s1	-0.52015	0.12180	0.40193	0.01331	-2.70E-04	-0.84740	-2.09E-03	7.59E-02	-1.90309
	s3	-0.05092	0.05015	-0.01566	-0.02397	1.68E-03	0.16398	1.98E-03	3.23E-02	-2.42678
	s5	0.01719	0.00866	-0.03264	0.01427	-3.14E-04	-0.01869	7.84E-03	-2.22E-01	-0.04562
	c0	-0.03947	0.05994	-0.03083	-0.03014	1.98E-03	0.23675	7.13E-04	6.82E-02	-2.44582
	c2	-0.36232	0.08041	0.24922	-0.12920	-1.34E-03	-0.39203	-2.63E-03	1.01E-01	-1.58809
	c4	-1.66623	0.07394	1.64967	-0.06441	2.21E-04	0.01198	-2.01E-04	7.03E-03	-1.11378
$\sigma_{no2m}(M°_2)$ *Circumferential membrane*	s1	-0.04919	0.04014	0.01387	0.01965	-5.52E-04	-0.23326	3.95E-03	-1.06E-01	-1.12095
	s3	-0.01681	0.01924	-0.00552	0.01598	-5.03E-04	-0.11862	1.32E-02	-3.79E-01	-0.15570
	s5	-0.00553	-0.00308	0.01141	-0.00603	1.49E-04	0.00716	6.33E-03	-1.92E-01	-0.04552
	c0	0.03002	-0.02288	0.00988	-0.03758	1.04E-03	0.33462	2.95E-03	-1.29E-01	-0.78999
	c2	0.09331	0.01618	-0.10744	0.02091	-9.89E-04	0.32748	8.20E-04	-7.37E-02	0.46649
	c4	0.02139	0.02025	-0.05431	0.01606	-3.71E-05	-0.01744	-4.89E-03	1.20E-01	-1.12418
$\sigma_{no2b}(M°_2)$ *Circumferential bending*	s1	-0.02758	0.02096	0.01072	0.00637	-2.31E-04	-0.12181	-1.85E-03	7.87E-02	-2.30248
	s3	-0.04772	-0.04015	0.08539	0.08967	-4.97E-03	0.13221	-3.09E-03	1.54E-02	-1.24963
	s5	-0.07853	0.09310	-0.02421	0.00934	6.24E-04	-0.01723	-1.04E-03	6.94E-02	-2.46390
	c0	-0.01147	0.00547	-0.00117	-0.01356	7.72E-04	0.05943	3.10E-02	-6.45E-01	-0.26337
	c2	2.81915	-0.60430	1.86157	-4.99997	9.94E-03	0.78362	4.53E-04	-1.61E-02	0.07701
	c4	0.08699	-0.09041	0.16761	-0.18931	1.14E-03	0.13941	6.40E-03	-2.20E-01	0.89099
$\sigma_{no12m}(M°_2)$ *Shear membrane*	c1	0,05031	-0,03250	-0,02283	-0,01075	3,29E-04	0,12183	2,52E-03	-0,07743	1,98517
	c3	-0,81145	0,01190	-0,06130	0,80606	1,94E-03	0,13363	5,32E-04	-0,01853	0,01027
	c5	0,00354	-0,00511	0,00064	0,00212	-1,55E-04	0,00795	-8,30E-04	0,11411	0,04281
	s2	0,13507	0,09783	-0,27395	0,15468	-3,35E-03	0,01587	-6,04E-03	0,18096	-1,15169
	s4	0,01732	0,02893	-0,07700	0,04709	-6,92E-04	-0,03235	-3,90E-03	0,12564	0,13728
	s6	-0,00141	0,00417	-0,00393	0,00051	3,60E-05	0,00157	-1,00E-02	0,29417	0,07604
$\sigma_{no12b}(M°_2)$ *Shear bending*	c1	-0,00398	0,00447	-0,00245	0,01552	-9,94E-04	-0,05323	-7,51E-02	0,99971	0,68509
	c3	0,08787	-0,07481	0,17828	-0,25226	2,48E-03	0,05248	-1,62E-03	0,05153	0,02336
	c5	-0,01080	-0,01907	0,04326	-0,01741	1,25E-04	0,01867	-5,84E-03	0,18141	0,02112
	s2	-0,20042	0,26169	-0,74119	0,48414	5,67E-03	0,14342	1,98E-02	-0,41493	-2,10782
	s4	0,04948	-0,00765	-0,00476	-0,03704	-8,04E-06	0,01927	-1,54E-03	0,07049	0,02123
	s6	0,00130	0,00112	-0,00417	0,00200	-4,50E-05	0,00042	-1,06E-02	0,22439	0,63140

Table A16.8611.22b: 45° elbow ($\psi_c = \pi/4$) – Moment M_2, coefficients for the median section ($\psi = \psi_c/2$)

		a	b	c	d	e	f	p	q	r
$\sigma_{no1m}(M°_2)$ *Longitudinal membrane*	s1	-0.64685	-0.01009	0.02003	-0.38804	7.83E-04	0.19565	-5.96E-05	4.14E-04	0.03372
	s3	-2.00924	2.05590	-0.24147	-0.02303	9.78E-04	0.35455	2.46E-04	6.05E-03	-1.99467
	s5	-0.91081	0.06727	0.88958	-0.01502	-1.87E-03	-0.07224	5.72E-06	9.76E-04	-1.13481
	c0	0.00210	-0.00132	-0.00094	-0.00159	6.18E-05	0.01078	1.27E-02	5.54E-01	-6.49160
	c2	1.30538	0.32061	-1.70062	-0.17771	1.03E-02	-0.01923	-1.74E-04	-1.17E-02	-0.78320
	c4	-0.13231	0.20496	-0.09954	-0.02270	1.13E-03	0.11712	-5.63E-03	1.15E-01	-2.48872
$\sigma_{no1b}(M°_2)$ *Longitudinal bending*	s1	-1.29072	0.22592	1.10226	-0.13151	4.40E-03	-0.95130	7.67E-04	-1.04E-02	-1.26347
	s3	-1.24967	0.21161	1.04762	-0.01554	-5.55E-04	0.21630	-7.95E-06	-5.34E-04	-1.21680
	s5	0.01998	-0.03261	0.01425	0.00044	-4.26E-05	0.00020	1.72E-03	-5.70E-02	-2.25665
	c0	0.23178	-0.14084	-0.11273	-0.01969	5.87E-04	0.43105	1.82E-03	-3.81E-02	-1.52629
	c2	-3.06900	2.44671	0.20400	-0.03112	1.31E-03	-0.21258	8.70E-05	2.49E-03	-1.84115
	c4	-3.10915	0.05792	3.12746	-0.09659	5.22E-04	0.04533	-1.00E-04	5.45E-03	-1.06964
$\sigma_{no2m}(M°_2)$ *Circumferential membrane*	s1	-0.10769	-0.01771	0.15083	-0.04117	1.36E-03	-0.19517	5.63E-03	-1.62E-01	-0.00883
	s3	-0.36370	0.02743	0.36798	-0.06606	1.86E-03	-0.02281	4.54E-04	-6.27E-03	-1.15293
	s5	-0.23603	0.24496	-0.01215	-0.00150	4.02E-05	0.01516	3.21E-04	-1.14E-02	-1.98111
	c0	0.03522	-0.01816	0.01681	-0.02064	-1.20E-04	0.45853	-2.29E-03	-1.92E-02	-0.97571
	c2	-0.24204	-0.07685	0.32176	0.12363	-4.49E-03	0.17534	5.15E-05	-2.22E-02	-0.39686
	c4	-0.02616	0.00912	0.02136	-0.00834	3.02E-04	0.01200	9.33E-03	-2.53E-01	-0.61493
$\sigma_{no2b}(M°_2)$ *Circumferential bending*	s1	-0.16604	0.11344	0.05266	-0.00278	1.33E-04	-0.19874	7.65E-04	-1.13E-02	-1.62419
	s3	-2.91851	-0.15346	3.10880	0.28080	-1.47E-02	-0.23379	6.47E-05	-1.42E-02	-0.91959
	s5	0.23722	-0.32694	0.10331	-0.00072	-1.04E-04	-0.03912	-7.79E-04	9.07E-03	-2.40797
	c0	-0.03010	0.03135	-0.01201	-0.02105	1.36E-03	0.09014	2.07E-02	-3.84E-01	-1.61672
	c2	7.34726	-0.79392	2.77151	-10.90659	-1.87E-03	2.06764	2.97E-04	-1.09E-02	0.11948
	c4	0.29301	-0.17842	0.41116	-0.55184	-2.43E-04	0.14751	3.54E-03	-1.33E-01	0.60916
$\sigma_{no12m}(M°_2)$ *Shear membrane*	c1	0	0	0	0	0	0	0	0	0
	c3	0	0	0	0	0	0	0	0	0
	c5	0	0	0	0	0	0	0	0	0
	s2	0	0	0	0	0	0	0	0	0
	s4	0	0	0	0	0	0	0	0	0
	s6	0	0	0	0	0	0	0	0	0
$\sigma_{no12b}(M°_2)$ *Shear bending*	c1	0	0	0	0	0	0	0	0	0
	c3	0	0	0	0	0	0	0	0	0
	c5	0	0	0	0	0	0	0	0	0
	s2	0	0	0	0	0	0	0	0	0
	s4	0	0	0	0	0	0	0	0	0
	s6	0	0	0	0	0	0	0	0	0

Table A16.8611.22c: 90°elbow ($\psi_c = \pi/2$) - Moment M_2 coefficients for the entrance section ($\psi = 0$)

		a	b	c	d	e	f	p	q	r
$\sigma_{no1m}(M°_2)$ *Longitudinal membrane*	s1	-0.97668	0.00872	-0.03109	-0.03096	1.10E-03	0.18816	-5.44E-04	-2.92E-02	-0.03326
	s3	-0.27269	-0.32708	0.87873	-0.37809	1.34E-03	0.16222	2.34E-03	-6.74E-02	-0.20051
	s5	0.00457	-0.02404	0.02362	-0.01249	1.27E-05	0.05656	1.03E-02	-2.89E-01	-0.12294
	c0	0.00036	0.00012	-0.00100	-0.00070	6.06E-05	0.00405	2.34E-01	-8.67E-01	-4.83268
	c2	0.08307	-0.11826	0.02616	0.00018	5.40E-05	-0.06748	-5.82E-03	1.26E-01	-2.19435
	c4	-0.29138	0.32156	-0.03168	0.00223	1.03E-04	-0.06517	-6.59E-05	-5.68E-04	-2.03590
$\sigma_{no1b}(M°_2)$ *Longitudinal bending*	s1	-0.46118	0.11850	0.35018	0.03023	-8.97E-04	-0.92857	-3.99E-03	1.31E-01	-2.24010
	s3	0.06022	-0.02588	-0.03055	-0.07030	2.94E-03	0.22820	1.30E-03	-1.06E-01	-0.21644
	s5	-0.00013	-0.00380	0.00259	-0.00652	2.94E-04	0.03444	2.24E-02	-4.53E-01	-0.95653
	c0	0.07970	-0.04447	-0.04906	-0.01579	4.91E-04	0.23739	-8.80E-03	2.67E-01	-3.26146
	c2	-0.32203	0.17343	0.05397	-0.02311	-3.36E-03	-0.47975	-2.86E-03	1.21E-01	-2.01943
	c4	-0.27527	-0.04050	0.37461	-0.08777	1.33E-03	0.05680	1.91E-03	-4.79E-02	-0.88895
$\sigma_{no2m}(M°_2)$ *Circumferential membrane*	s1	-0.08022	0.05282	0.03608	0.02064	-6.21E-04	-0.23600	-3.72E-03	1.08E-01	-2.15326
	s3	-0.01956	0.02123	-0.00228	0.01648	-5.27E-04	-0.12311	1.35E-02	-3.81E-01	-0.15604
	s5	-0.00793	0.00916	0.00005	0.00024	7.45E-06	-0.01326	4.55E-03	-1.22E-01	-1.39794
	c0	0.04344	-0.03694	0.01128	-0.04244	1.23E-03	0.35282	2.93E-03	-1.29E-01	-0.79565
	c2	0.20349	0.03968	-0.24059	0.01362	-5.97E-04	0.36083	3.44E-03	-1.02E-01	-0.23350
	c4	-0.05648	0.02170	0.01945	0.02014	-1.52E-04	-0.00819	-2.78E-04	2.04E-02	-1.25020
$\sigma_{no2b}(M°_2)$ *Circumferential bending*	s1	0.02974	-0.03062	0.00530	0.01966	-1.31E-03	-0.15308	2.34E-05	7.00E-02	-2.44682
	s3	0.34999	-0.27288	-0.05647	-0.03416	9.13E-04	0.39646	-6.16E-04	8.61E-03	-1.67134
	s5	-0.04565	0.07138	-0.04774	0.02118	3.15E-04	0.00203	-1.56E-03	9.43E-02	-2.48243
	c0	-0.01624	0.01112	-0.00385	-0.02012	1.22E-03	0.08406	3.14E-02	-6.49E-01	-0.26452
	c2	-0.56778	-0.51594	1.70338	-1.35146	1.56E-03	0.09351	2.63E-05	3.35E-03	-0.33303
	c4	-0.12277	-0.20087	0.47641	-0.19855	7.57E-04	0.22704	3.13E-03	-9.00E-02	-0.51811
$\sigma_{no12m}(M°_2)$ *Shear membrane*	c1	0,03375	-0,02113	-0,01803	-0,01310	4,20E-04	0,12929	1,00E-02	-0,27901	2,95562
	c3	-0,05827	-0,09856	0,25251	-0,14743	1,73E-03	0,11019	-2,51E-03	0,06744	0,15342
	c5	0,01790	-0,01771	0,00254	-0,01501	5,06E-04	0,05873	-1,05E-03	0,11554	0,04282
	s2	-0,03487	0,02407	-0,08198	0,17696	-1,60E-03	0,06161	-1,88E-04	-0,00066	0,30524
	s4	-0,22632	0,14537	0,08035	0,00750	-2,54E-04	0,00972	5,50E-04	-0,01856	1,75024
	s6	-0,00595	0,00897	-0,00515	0,00222	-2,39E-05	-0,00229	-1,00E-02	0,29417	0,07602
$\sigma_{no12b}(M°_2)$ *Shear bending*	c1	-0,00395	0,00577	-0,00353	0,02105	-1,35E-03	-0,07232	-6,69E-02	0,86522	1,00118
	c3	-0,21800	-0,09224	0,35689	-0,09190	1,70E-03	-0,02575	-2,86E-03	0,07694	0,26158
	c5	-0,09930	0,01124	0,10637	-0,03079	6,28E-04	0,03747	-1,56E-03	0,03427	1,23007
	s2	0,23960	-0,10045	0,31086	-0,61659	4,93E-03	-0,01357	2,50E-04	-0,01065	0,11873
	s4	0,01504	-0,04383	0,06435	-0,04701	2,45E-04	0,07552	-5,18E-03	0,15336	0,04869
	s6	-0,00114	-0,00343	0,00287	0,01059	-4,97E-04	-0,02253	3,77E-03	0,04049	0,00762

Table A16.8611.22d: 90°elbow ($\psi_c = \pi/2$) - Moment M_2 coefficients for the median section ($\psi = \psi_c/2$)

		a	b	c	d	e	f	p	q	r
$\sigma_{no1m}(M°_2)$ *Longitudinal membrane*	s1	-0.64755	-0.01602	0.03955	-0.40441	8.94E-04	0.21730	1.01E-04	-4.84E-03	0.09485
	s3	-1.90960	2.20730	-0.54401	0.01771	3.00E-06	0.25576	-1.27E-03	3.88E-02	-2.18699
	s5	0.03872	-0.09027	0.10142	-0.03599	-1.29E-03	0.02089	2.32E-03	-7.12E-02	-0.84941
	c0	0.00257	-0.00118	-0.00172	-0.00247	1.04E-04	0.01599	1.27E-02	5.54E-01	-6.49169
	c2	0.04415	0.06219	-0.07734	-0.06112	4.29E-03	-0.40655	-5.00E-03	4.22E-02	-0.90747
	c4	-0.12309	0.19819	-0.08231	-0.02867	1.63E-03	0.01282	-7.09E-03	1.48E-01	-2.48477
$\sigma_{no1b}(M°_2)$ *Longitudinal bending*	s1	-0.62243	0.18318	0.46861	-0.01655	4.71E-04	-1.38500	-2.11E-03	7.42E-02	-1.83270
	s3	-1.29503	0.30792	1.02147	-0.13877	3.93E-03	0.39620	2.85E-05	6.46E-03	-1.34660
	s5	0.01844	-0.03445	0.01524	-0.00469	8.57E-05	0.04104	1.84E-03	-5.65E-02	-2.25716
	c0	0.25344	-0.20539	-0.07231	-0.03743	1.14E-03	0.48543	-2.45E-03	8.09E-02	-2.31044
	c2	-1.29197	0.97291	-0.07884	0.05133	-1.09E-03	-0.67031	-2.03E-03	6.44E-02	-1.92702
	c4	-1.20003	-0.17290	1.52700	-0.22042	2.79E-03	0.15620	4.32E-04	-5.71E-03	-0.97678
$\sigma_{no2m}(M°_2)$ *Circumferential membrane*	s1	-0.03847	0.04435	0.00441	0.04351	-1.26E-03	-0.41700	4.00E-03	-1.21E-01	-0.82532
	s3	0.00303	0.00774	-0.00775	0.00470	1.54E-04	-0.15447	-3.79E-03	4.41E-02	-1.88251
	s5	-0.24801	0.25033	-0.00332	-0.00613	2.21E-04	0.01542	6.82E-04	-1.94E-02	-1.92114
	c0	0.02984	-0.01769	0.01858	-0.04721	9.04E-04	0.57812	-1.29E-03	-3.29E-02	-1.04838
	c2	0.30333	0.15175	-0.47668	0.07921	-1.95E-03	0.63744	8.93E-03	-2.83E-01	1.36310
	c4	-0.02093	-0.00786	0.02589	0.01647	-7.50E-04	-0.01689	2.49E-03	-1.15E-01	-0.59249
$\sigma_{no2b}(M°_2)$ *Circumferential bending*	s1	-0.12560	0.11098	0.01793	0.01064	-2.30E-04	-0.28550	-2.18E-03	6.92E-02	-2.08105
	s3	0.71987	0.52902	-1.41100	0.31890	-8.57E-03	0.26948	2.76E-03	-1.03E-01	0.44780
	s5	0.23084	-0.32860	0.10361	0.00463	-4.63E-04	-0.00779	-7.32E-04	8.15E-03	-2.40840
	c0	-0.03424	0.03190	-0.01219	-0.02693	1.74E-03	0.11008	2.30E-02	-4.25E-01	-1.67065
	c2	6.48564	-1.59077	5.23941	-11.97941	2.15E-02	1.69141	3.97E-04	-1.43E-02	0.17335
	c4	0.28283	-0.50829	0.98433	-0.81358	9.36E-04	0.31535	3.30E-03	-1.10E-01	0.13997
$\sigma_{no12m}(M°_2)$ *Shear membrane*	c1	0	0	0	0	0	0	0	0	0
	c3	0	0	0	0	0	0	0	0	0
	c5	0	0	0	0	0	0	0	0	0
	s2	0	0	0	0	0	0	0	0	0
	s4	0	0	0	0	0	0	0	0	0
	s6	0	0	0	0	0	0	0	0	0
$\sigma_{no12b}(M°_2)$ *Shear bending*	c1	0	0	0	0	0	0	0	0	0
	c3	0	0	0	0	0	0	0	0	0
	c5	0	0	0	0	0	0	0	0	0
	s2	0	0	0	0	0	0	0	0	0
	s4	0	0	0	0	0	0	0	0	0
	s6	0	0	0	0	0	0	0	0	0

Table A16.8611.22e: 180° elbow ($\psi_c = \pi$) - Moment M_2 coefficients for the entrance section ($\psi = 0$)

		a	b	c	d	e	f	p	q	r
$\sigma_{no1m}(M°_2)$ *Longitudinal membrane*	s1	-0.98030	0.01173	-0.03066	-0.02681	9.35E-04	0.17247	-6.07E-03	1.37E-01	-1.04711
	s3	-0.81217	-0.35359	1.33022	-0.26477	1.86E-03	0.12685	1.70E-03	-4.23E-02	-0.49209
	s5	-0.00289	-0.02732	0.03704	-0.02256	3.24E-04	0.08184	8.62E-03	-2.51E-01	-0.12819
	c0	0.00048	0.00034	-0.00097	-0.00039	2.96E-05	0.00302	2.34E-01	-8.67E-01	-4.83268
	c2	-0.03448	-0.00761	0.02152	-0.01018	1.01E-03	0.00729	-1.19E-02	4.68E-01	-5.56157
	c4	-0.40380	0.44723	-0.04669	0.01669	-4.12E-04	-0.10756	-5.67E-04	1.17E-02	-2.08745
$\sigma_{no1b}(M°_2)$ *Longitudinal bending*	s1	-0.41714	0.07258	0.35118	0.03095	-1.03E-03	-0.92479	-5.24E-03	1.64E-01	-2.32815
	s3	-0.32265	0.04261	0.31492	-0.08509	2.77E-03	0.12112	1.85E-03	-3.93E-02	-1.09777
	s5	0.00384	-0.01098	0.00654	-0.01627	1.02E-03	0.05574	7.51E-02	-9.51E-01	-0.53927
	c0	0.08520	-0.04719	-0.04895	-0.01697	5.32E-04	0.24128	-9.37E-03	2.80E-01	-3.26424
	c2	-0.39175	0.11182	0.21741	-0.07768	-2.23E-03	-0.41416	-3.69E-03	1.33E-01	-1.75616
	c4	-0.68105	-0.10549	0.85252	-0.09155	1.33E-03	0.03965	1.12E-03	-3.11E-02	-0.79937
$\sigma_{no2m}(M°_2)$ *Circumferential membrane*	s1	-0.06675	0.03708	0.03690	0.02008	-6.25E-04	-0.22132	-5.07E-03	1.43E-01	-2.13809
	s3	-0.00247	-0.00016	0.00044	0.01050	-3.49E-04	-0.07587	1.30E-02	-3.66E-01	-0.15213
	s5	-0.00207	0.00546	-0.00171	0.00385	-1.15E-04	-0.03034	6.01E-03	-1.60E-01	-1.41292
	c0	0.03701	-0.02977	0.01207	-0.04070	1.16E-03	0.34561	2.67E-03	-1.22E-01	-0.79298
	c2	0.23684	0.03191	-0.26124	0.00679	-3.96E-04	0.34448	1.59E-03	-4.60E-02	-0.64725
	c4	-0.09889	0.02848	0.04730	0.01885	3.47E-04	0.02111	-6.00E-04	3.64E-02	-1.29946
$\sigma_{no2b}(M°_2)$ *Circumferential bending*	s1	-0.03891	0.02495	0.02370	0.00471	-2.00E-04	-0.14501	-4.70E-03	1.56E-01	-2.55911
	s3	0.29109	-0.25589	0.02269	-0.10591	4.11E-03	0.41409	-6.51E-03	1.21E-01	-1.90811
	s5	-0.02878	0.07330	-0.08273	0.03307	5.10E-04	0.01437	-4.35E-03	1.78E-01	-2.67979
	c0	-0.01593	0.01140	-0.00385	-0.02039	1.24E-03	0.08448	3.14E-02	-6.49E-01	-0.26454
	c2	-0.61577	-0.58149	1.83768	-1.36903	7.58E-04	0.14160	-2.66E-05	1.51E-03	-0.22115
	c4	-0.88927	-0.15227	1.21556	-0.24912	3.05E-03	0.25094	1.49E-03	-3.54E-02	-0.91990
$\sigma_{no12m}(M°_2)$ *Shear membrane*	c1	0.03328	-0.02072	-0.01770	-0.01421	4.69E-04	0.12987	1.06E-02	-0.29171	2.95346
	c3	-0.25010	-0.11138	0.41645	-0.11915	2.81E-03	0.10850	-3.22E-03	0.07943	0.31797
	c5	0.02107	-0.01847	0.00225	-0.01948	7.48E-04	0.06227	-6.90E-04	0.11692	0.04305
	s2	-0.03657	0.02526	-0.10939	0.21888	-2.33E-03	0.01173	-1.35E-03	0.04144	-0.17169
	s4	1.29190	0.13522	-1.43965	0.00479	5.48E-04	0.04627	-2.20E-04	0.00890	0.84895
	s6	-0.00055	0.00607	-0.00709	0.00448	-9.12E-05	-0.01392	-1.05E-02	0.29748	0.07686
$\sigma_{no12b}(M°_2)$ *Shear bending*	c1	-0.00200	-0.00065	-0.00036	0.01212	-8.12E-04	-0.04035	-1.07E-01	1.25014	1.27802
	c3	-0.14259	-0.11727	0.32049	-0.08821	7.12E-04	-0.06089	-4.00E-03	0.12570	-0.45597
	c5	-0.15688	-0.00245	0.18285	-0.04271	1.03E-03	0.05415	-1.96E-03	0.04549	0.99895
	s2	0.27201	-0.09383	0.26899	-0.60958	4.50E-03	-0.01531	4.69E-04	-0.01798	0.19989
	s4	-0.00680	-0.03724	0.07361	-0.03738	1.09E-04	0.04978	1.76E-04	-0.02223	1.50004
	s6	-0.00039	-0.00529	0.00486	0.00849	-4.16E-04	-0.02016	3.39E-03	0.04064	0.00766

Table A16.8611.22f: 180° elbow ($\psi_c = \pi$) - Moment M_2 coefficients for the median section ($\psi = \psi_c/2$)

		a	b	c	d	e	f	p	q	r
$\sigma_{no1m}(M°_2)$ *Longitudinal membrane*	s1	-0.64607	-0.02109	0.05966	-0.42646	1.15E-03	0.23443	2.32E-04	-9.43E-03	0.15246
	s3	-3.64574	3.98328	-0.58109	0.02750	-3.15E-05	0.07440	-5.64E-04	1.40E-02	-2.06718
	s5	-0.10566	-0.12517	0.31107	-0.10610	1.58E-04	0.16238	3.20E-03	-9.04E-02	-0.78048
	c0	0.00221	-0.00118	-0.00180	-0.00310	1.71E-04	0.01765	1.28E-02	5.54E-01	-6.49174
	c2	-0.04517	-0.08399	0.12763	-0.00453	-9.39E-06	-0.14151	-9.25E-03	3.11E-01	-3.97757
	c4	-0.04493	0.07671	-0.02459	-0.02004	1.06E-03	-0.13370	-3.49E-03	1.43E-01	-2.48291
$\sigma_{no1b}(M°_2)$ *Longitudinal bending*	s1	-0.82052	0.36142	0.49185	0.02490	-6.83E-04	-1.55225	-2.68E-03	8.81E-02	-1.99313
	s3	-0.53901	-0.07648	0.70826	-0.20828	5.44E-03	0.31039	6.33E-04	-9.92E-03	-1.01420
	s5	0.00218	-0.01802	0.01324	-0.01208	2.94E-04	0.08995	1.02E-03	-2.77E-02	-2.24411
	c0	0.22435	-0.16792	-0.08572	-0.03661	1.15E-03	0.50567	-4.51E-03	1.40E-01	-2.59179
	c2	-0.53181	0.49071	-0.37427	0.13763	-5.67E-03	-0.72009	1.33E-03	6.58E-03	-1.85388
	c4	-0.77418	-0.31482	1.30584	-0.30703	4.72E-03	0.14823	3.11E-03	-7.90E-02	-0.51551
$\sigma_{no2m}(M°_2)$ *Circumferential membrane*	s1	0.00374	-0.02997	0.05095	0.03045	-2.05E-03	-0.34653	-6.17E-03	2.50E-01	-2.39441
	s3	0.02085	-0.02562	0.00605	0.02002	-5.97E-04	-0.17718	6.00E-04	-3.95E-02	-1.89373
	s5	-0.25272	0.24688	0.00953	-0.00475	2.05E-04	-0.01577	6.26E-04	-1.42E-02	-1.91494
	c0	0.02810	-0.02333	0.02260	-0.05504	1.20E-03	0.61915	-1.08E-03	-2.82E-02	-1.06636
	c2	0.43709	0.06888	-0.52744	0.07013	-2.10E-03	0.71632	3.21E-03	-9.16E-02	-0.40658
	c4	0.11684	0.01334	-0.16373	0.06173	-1.40E-03	-0.04433	1.80E-03	-4.63E-02	-0.91297
$\sigma_{no2b}(M°_2)$ *Circumferential bending*	s1	-0.17747	0.16490	0.01742	0.01950	-4.92E-04	-0.32605	-2.33E-03	7.02E-02	-2.15145
	s3	-2.72389	-0.25978	3.02476	-0.04490	7.59E-04	0.74383	-2.14E-04	7.78E-03	-0.98558
	s5	0.03879	-0.08609	0.04456	0.00441	-4.34E-04	0.03434	-3.30E-03	8.96E-02	-3.07307
	c0	-0.03735	0.03699	-0.01460	-0.02723	1.77E-03	0.11288	2.29E-02	-4.24E-01	-1.67294
	c2	-1.03383	-1.17094	3.66182	-2.94985	5.65E-03	0.42970	7.69E-04	-2.07E-02	0.08202
	c4	-0.61513	-0.82902	2.09923	-0.76758	1.76E-03	0.50197	2.98E-03	-8.42E-02	-0.34558
$\sigma_{no12m}(M°_2)$ *Shear membrane*	c1	0	0	0	0	0	0	0	0	0
	c3	0	0	0	0	0	0	0	0	0
	c5	0	0	0	0	0	0	0	0	0
	s2	0	0	0	0	0	0	0	0	0
	s4	0	0	0	0	0	0	0	0	0
	s6	0	0	0	0	0	0	0	0	0
$\sigma_{no12b}(M°_2)$ *Shear bending*	c1	0	0	0	0	0	0	0	0	0
	c3	0	0	0	0	0	0	0	0	0
	c5	0	0	0	0	0	0	0	0	0
	s2	0	0	0	0	0	0	0	0	0
	s4	0	0	0	0	0	0	0	0	0
	s6	0	0	0	0	0	0	0	0	0