Table 52 **Isogrid-stiffened imperfect** equivalent ellipsoidal shell. Optimum design and margins obtained with the use of plus and minus axisymmetric **modes 1, 2, 3, and 4** and a single execution of SUPEROPT, which required 8 days on an efficient LINUX workstation. The starting design before the single execution of SUPEROPT is the optimum design obtained with the use of plus and minus axisymmetric modes 1 and 2 only. (See the part of Table 33 with the heading, "isogrid-stiffened, imperfect" for that "2-mode" optimum design.) This output is an abridged and edited version of the output file from GENOPT called "eqellipse.OPM", where "eqellipse" is the user-selected name of the specific case. Critical margins are in **bold face.**

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STRUCTURAL ANALYSIS WITH UNPERTURBED DECISION VARIABLES

VAR. NO.	CURRENT VALUE	DEFINITION
1	1.0000E-01	skin thickness at xinput: THKSKN(1)
2	1.7331E-01	skin thickness at xinput: THKSKN(2)
3	1.7043E-01	skin thickness at xinput: THKSKN(3)
4	1.0000E-01	skin thickness at xinput: THKSKN(4)
5	1.0838E-01	skin thickness at xinput: THKSKN(5)
6	1.0000E-01	skin thickness at xinput: THKSKN(6)
7	1.0000E-01	skin thickness at xinput: THKSKN(7)
8	1.0041E-01	skin thickness at xinput: THKSKN(8)
9	1.0189E-01	skin thickness at xinput: THKSKN(9)
10	1.3543E-01	skin thickness at xinput: THKSKN(10)
11	3.2880E-01	skin thickness at xinput: THKSKN(11)
12	1.0392E-01	skin thickness at xinput: THKSKN(12)
13	1.4583E-01	skin thickness at xinput: THKSKN(13)
14	7.6638E-01	height of isogrid members at xinput: HIGHST(1)
15	6.7191E-01	height of isogrid members at xinput: HIGHST(2)
16	1.0913E+00	height of isogrid members at xinput: HIGHST(3)
17	1.8160E+00	height of isogrid members at xinput: HIGHST(4)
18	1.1539E+00	height of isogrid members at xinput: HIGHST(5)
19	9.4803E-01	height of isogrid members at xinput: HIGHST(6)
20	1.0537E+00	height of isogrid members at xinput: HIGHST(7)
21	9.4296E-01	height of isogrid members at xinput: HIGHST(8)
22	7.4648E-01	height of isogrid members at xinput: HIGHST(9)
23	5.7603E-01	height of isogrid members at xinput: HIGHST(10)
24	2.3650E-01	height of isogrid members at xinput: HIGHST(11)
25	3.4127E-01	height of isogrid members at xinput: HIGHST(12)
26	6.3875E-01	height of isogrid members at xinput: HIGHST(13)
27	2.9523E+00	spacing of the isogrid members: SPACNG
28	9.3750E-02	thickness of an isogrid stiffening member: THSTIF

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******************** DESIGN OBJECTIVE ********************
   CURRENT VALUE OF THE OBJECTIVE FUNCTION:
VAR.   CURRENT
NO.      VALUE            DEFINITION
 1    9.151E+01  weight of the equivalent ellipsoidal head: WEIGHT
                   (Compare with WEIGHT = 86.1 lb in Table 33)

***** RESULTS FOR LOAD SET NO.  1  (+mode 1 and +mode 2)******
MARGINS CORRESPONDING TO CURRENT DESIGN (F.S.= FACTOR OF SAFETY)
MARGIN CURRENT
NO.      VALUE            DEFINITION
 1    6.727E-01 (CLAPS1(1 )/CLAPS1A(1 )) / CLAPS1F(1 )-1; F.S.=1.00
 2    1.893E+00 (GENBK1(1 )/GENBK1A(1 )) / GENBK1F(1 )-1; F.S.=1.00
 3    1.718E+00 (SKNBK1(1,1)/SKNBK1A(1,1))/SKNBK1F(1,1)-1;F.S.=1.00
 4    1.717E+00 (SKNBK1(1,2)/SKNBK1A(1,2))/SKNBK1F(1,2)-1;F.S.=1.00
 5    1.564E+00 (STFBK1(1,1)/STFBK1A(1,1))/STFBK1F(1,1)-1;F.S.=1.00
 6    7.395E-01 (STFBK1(1,2)/STFBK1A(1,2))/STFBK1F(1,2)-1;F.S.=1.00
 7    4.344E-01 (SKNST1A(1,1)/SKNST1(1,1))/SKNST1F(1,1)-1;F.S.=1.00
 8    2.736E-01 (SKNST1A(1,2)/SKNST1(1,2))/SKNST1F(1,2)-1;F.S.=1.00
 9    2.941E-01 (STFST1A(1,1)/STFST1(1,1))/STFST1F(1,1)-1;F.S.=1.00
10   -2.916E-02 (STFST1A(1,2)/STFST1(1,2))/STFST1F(1,2)-1;F.S.=1.00
11    1.441E+00 (WAPEX1A(1 )/WAPEX1(1 )) / WAPEX1F(1 )-1; F.S.=1.00

12    6.727E-01 (CLAPS2(1 )/CLAPS2A(1 )) / CLAPS2F(1 )-1; F.S.=1.00
13    2.275E+00 (GENBK2(1 )/GENBK2A(1 )) / GENBK2F(1 )-1; F.S.=1.00
14    2.185E+00 (SKNBK2(1,1)/SKNBK2A(1,1))/SKNBK2F(1,1)-1;F.S.=1.00
15    2.102E+00 (SKNBK2(1,2)/SKNBK2A(1,2))/SKNBK2F(1,2)-1;F.S.=1.00
16    8.140E-01 (STFBK2(1,1)/STFBK2A(1,1))/STFBK2F(1,1)-1;F.S.=1.00
17    2.308E+00 (STFBK2(1,2)/STFBK2A(1,2))/STFBK2F(1,2)-1;F.S.=1.00
18    6.314E-01 (SKNST2A(1,1)/SKNST2(1,1))/SKNST2F(1,1)-1;F.S.=1.00
19    1.372E-01 (SKNST2A(1,2)/SKNST2(1,2))/SKNST2F(1,2)-1;F.S.=1.00
20    4.272E-01 (STFST2A(1,1)/STFST2(1,1))/STFST2F(1,1)-1;F.S.=1.00
21   -7.224E-03 (STFST2A(1,2)/STFST2(1,2))/STFST2F(1,2)-1;F.S.=1.00
22    1.520E+00 (WAPEX2A(1 )/WAPEX2(1 )) / WAPEX2F(1 )-1; F.S.=1.00


***** RESULTS FOR LOAD SET NO.  2  (–mode 1 and –mode 2)******
MARGINS CORRESPONDING TO CURRENT DESIGN (F.S.= FACTOR OF SAFETY)
MARGIN CURRENT
NO.      VALUE            DEFINITION
 1    2.529E-01 (CLAPS1(2 )/CLAPS1A(2 )) / CLAPS1F(2 )-1; F.S.=1.00
 2    1.213E+00 (GENBK1(2 )/GENBK1A(2 )) / GENBK1F(2 )-1; F.S.=1.00
 3    1.400E+00 (SKNBK1(2,1)/SKNBK1A(2,1))/SKNBK1F(2,1)-1;F.S.=1.00
 4    2.457E+00 (SKNBK1(2,2)/SKNBK1A(2,2))/SKNBK1F(2,2)-1;F.S.=1.00
 5    3.531E-02 (STFBK1(2,1)/STFBK1A(2,1))/STFBK1F(2,1)-1;F.S.=1.00
 6    3.200E-02 (STFBK1(2,2)/STFBK1A(2,2))/STFBK1F(2,2)-1;F.S.=1.00
 7    4.540E-02 (SKNST1A(2,1)/SKNST1(2,1))/SKNST1F(2,1)-1;F.S.=1.00
 8    1.416E-01 (SKNST1A(2,2)/SKNST1(2,2))/SKNST1F(2,2)-1;F.S.=1.00
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9 8.374E-04 (STFST1A(2,1)/STFST1(2,1))/STFST1F(2,1)-1;F.S.=1.00
10 -1.885E-03 (STFST1A(2,2)/STFST1(2,2))/STFST1F(2,2)-1;F.S.=1.00
11 4.757E-01 (WAPEX1A(2)/WAPEX1(2)) / WAPEX1F(2)-1; F.S.=1.00

12 3.307E-01 (CLAPS2(2)/CLAPS2A(2)) / CLAPS2F(2)-1; F.S.=1.00
13 1.435E+00 (GENBK2(2)/GENBK2A(2)) / GENBK2F(2)-1; F.S.=1.00
14 1.142E+00 (SKNBK2(2,1)/SKNBK2A(2,1))/SKNBK2F(2,1)-1;F.S.=1.00
15 1.840E+00 (SKNBK2(2,2)/SKNBK2A(2,2))/SKNBK2F(2,2)-1;F.S.=1.00
16 5.232E-01 (STFBK2(2,1)/STFBK2A(2,1))/STFBK2F(2,1)-1;F.S.=1.00
17 -2.328E-02 (STFBK2(2,2)/STFBK2A(2,2))/STFBK2F(2,2)-1;F.S.=1.00
18 1.460E-01 (SKNST2A(2,1)/SKNST2(2,1))/SKNST2F(2,1)-1;F.S.=1.00
19 3.428E-01 (SKNST2A(2,2)/SKNST2(2,2))/SKNST2F(2,2)-1;F.S.=1.00
20 3.564E-01 (STFST2A(2,1)/STFST2(2,1))/STFST2F(2,1)-1;F.S.=1.00
21 -2.614E-02 (STFST2A(2,2)/STFST2(2,2))/STFST2F(2,2)-1;F.S.=1.00
22 4.979E-01 (WAPEX2A(2)/WAPEX2(2)) / WAPEX2F(2)-1; F.S.=1.00

***** RESULTS FOR LOAD SET NO. 3 (+mode 3 and +mode 4)******
MARGINS CORRESPONDING TO CURRENT DESIGN (F.S.= FACTOR OF SAFETY)
MARGIN CURRENT
NO. VALUE DEFINITION
1 6.727E-01 (CLAPS1(3)/CLAPS1A(3)) / CLAPS1F(3)-1; F.S.=1.00
2 2.146E+00 (GENBK1(3)/GENBK1A(3)) / GENBK1F(3)-1; F.S.=1.00
3 1.697E+00 (SKNBK1(3,1)/SKNBK1A(3,1))/SKNBK1F(3,1)-1;F.S.=1.00
4 2.051E+00 (SKNBK1(3,2)/SKNBK1A(3,2))/SKNBK1F(3,2)-1;F.S.=1.00
5 1.331E+00 (STFBK1(3,1)/STFBK1A(3,1))/STFBK1F(3,1)-1;F.S.=1.00
6 7.390E-01 (STFBK1(3,2)/STFBK1A(3,2))/STFBK1F(3,2)-1;F.S.=1.00
7 4.033E-01 (SKNST1A(3,1)/SKNST1(3,1))/SKNST1F(3,1)-1;F.S.=1.00
8 1.467E-01 (SKNST1A(3,2)/SKNST1(3,2))/SKNST1F(3,2)-1;F.S.=1.00
9 3.280E-01 (STFST1A(3,1)/STFST1(3,1))/STFST1F(3,1)-1;F.S.=1.00
10 4.217E-03 (STFST1A(3,2)/STFST1(3,2))/STFST1F(3,2)-1;F.S.=1.00
11 1.351E+00 (WAPEX1A(3)/WAPEX1(3)) / WAPEX1F(3)-1; F.S.=1.00

12 6.727E-01 (CLAPS2(3)/CLAPS2A(3)) / CLAPS2F(3)-1; F.S.=1.00
13 2.092E+00 (GENBK2(3)/GENBK2A(3)) / GENBK2F(3)-1; F.S.=1.00
14 1.506E+00 (SKNBK2(3,1)/SKNBK2A(3,1))/SKNBK2F(3,1)-1;F.S.=1.00
15 2.248E+00 (SKNBK2(3,2)/SKNBK2A(3,2))/SKNBK2F(3,2)-1;F.S.=1.00
16 3.713E-01 (STFBK2(3,1)/STFBK2A(3,1))/STFBK2F(3,1)-1;F.S.=1.00
17 3.515E-01 (STFBK2(3,2)/STFBK2A(3,2))/STFBK2F(3,2)-1;F.S.=1.00
18 3.170E-01 (SKNST2A(3,1)/SKNST2(3,1))/SKNST2F(3,1)-1;F.S.=1.00
19 2.664E-01 (SKNST2A(3,2)/SKNST2(3,2))/SKNST2F(3,2)-1;F.S.=1.00
20 -4.672E-03 (STFST2A(3,1)/STFST2(3,1))/STFST2F(3,1)-1;F.S.=1.00
21 -2.886E-03 (STFST2A(3,2)/STFST2(3,2))/STFST2F(3,2)-1;F.S.=1.00
22 1.121E+00 (WAPEX2A(3)/WAPEX2(3)) / WAPEX2F(3)-1; F.S.=1.00

***** RESULTS FOR LOAD SET NO. 4 (–mode 3 and –mode 4)******
MARGINS CORRESPONDING TO CURRENT DESIGN (F.S.= FACTOR OF SAFETY)

MARGIN NO.	CURRENT VALUE	DEFINITION
1	6.727E-01	(CLAPS1(4)/CLAPS1A(4)) / CLAPS1F(4)-1; F.S.=1.00
2	1.585E+00	(GENBK1(4)/GENBK1A(4)) / GENBK1F(4)-1; F.S.=1.00
3	1.596E+00	(SKNBK1(4,1)/SKNBK1A(4,1))/SKNBK1F(4,1)-1;F.S.=1.00
4	2.040E+00	(SKNBK1(4,2)/SKNBK1A(4,2))/SKNBK1F(4,2)-1;F.S.=1.00
5	6.818E-01	(STFBK1(4,1)/STFBK1A(4,1))/STFBK1F(4,1)-1;F.S.=1.00
6	1.044E+00	(STFBK1(4,2)/STFBK1A(4,2))/STFBK1F(4,2)-1;F.S.=1.00
7	**1.718E-01**	**(SKNST1A(4,1)/SKNST1(4,1))/SKNST1F(4,1)-1;F.S.=1.00**
8	2.837E-01	(SKNST1A(4,2)/SKNST1(4,2))/SKNST1F(4,2)-1;F.S.=1.00
9	3.995E-01	(STFST1A(4,1)/STFST1(4,1))/STFST1F(4,1)-1;F.S.=1.00
10	**8.480E-03**	**(STFST1A(4,2)/STFST1(4,2))/STFST1F(4,2)-1;F.S.=1.00**
11	6.907E-01	(WAPEX1A(4)/WAPEX1(4)) / WAPEX1F(4)-1; F.S.=1.00
12	6.727E-01	(CLAPS2(4)/CLAPS2A(4)) / CLAPS2F(4)-1; F.S.=1.00
13	1.862E+00	(GENBK2(4)/GENBK2A(4)) / GENBK2F(4)-1; F.S.=1.00
14	1.806E+00	(SKNBK2(4,1)/SKNBK2A(4,1))/SKNBK2F(4,1)-1;F.S.=1.00
15	1.867E+00	(SKNBK2(4,2)/SKNBK2A(4,2))/SKNBK2F(4,2)-1;F.S.=1.00
16	**1.457E-01**	**(STFBK2(4,1)/STFBK2A(4,1))/STFBK2F(4,1)-1;F.S.=1.00**
17	6.958E-01	(STFBK2(4,2)/STFBK2A(4,2))/STFBK2F(4,2)-1;F.S.=1.00
18	2.331E-01	(SKNST2A(4,1)/SKNST2(4,1))/SKNST2F(4,1)-1;F.S.=1.00
19	**1.917E-01**	**(SKNST2A(4,2)/SKNST2(4,2))/SKNST2F(4,2)-1;F.S.=1.00**
20	**-4.004E-03**	**(STFST2A(4,1)/STFST2(4,1))/STFST2F(4,1)-1;F.S.=1.00**
21	**-2.182E-03**	**(STFST2A(4,2)/STFST2(4,2))/STFST2F(4,2)-1;F.S.=1.00**
22	8.256E-01	(WAPEX2A(4)/WAPEX2(4)) / WAPEX2F(4)-1; F.S.=1.00

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NOTE: The design margins listed above are divided into two groups of 11 margins each: Margins 1 – 11 and Margins 12 – 22. The first group of 11 margins are obtained with use of the axisymmetric mode 1 (or mode 3) imperfection, and the second group of 11 margins are obtained with use of the axisymmetric mode 2 (or mode 4) imperfection.