Table 65 **Imperfect unstiffened** 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 4 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, "unstiffened, 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 **boldface.**
==
 STRUCTURAL ANALYSIS FOR DESIGN ITERATION NO.   0:
  STRUCTURAL ANALYSIS WITH UNPERTURBED DECISION VARIABLES
 VAR. CURRENT   DEFINITION
 NO. VALUE
  1 2.0761E-01 skin thickness at xinput: THKSKN(1)
  2 1.9924E-01 skin thickness at xinput: THKSKN(2)
  3 6.4936E-01 skin thickness at xinput: THKSKN(3) **←thick band**
  4 2.9672E-01 skin thickness at xinput: THKSKN(4)
  5 3.0366E-01 skin thickness at xinput: THKSKN(5)
  6 2.6058E-01 skin thickness at xinput: THKSKN(6)
  7 2.6725E-01 skin thickness at xinput: THKSKN(7)
  8 1.9858E-01 skin thickness at xinput: THKSKN(8)
  9 1.9081E-01 skin thickness at xinput: THKSKN(9)
 10 1.9056E-01 skin thickness at xinput: THKSKN(10)
 11 2.1466E-01 skin thickness at xinput: THKSKN(11)
 12 1.4263E-01 skin thickness at xinput: THKSKN(12)
 13 2.1248E-01 skin thickness at xinput: THKSKN(13)

 14 1.0000E-06 height of isogrid members at xinput: HIGHST(1)
 15 1.0000E-06 height of isogrid members at xinput: HIGHST(2)
 16 1.0000E-06 height of isogrid members at xinput: HIGHST(3)
 17 1.0000E-06 height of isogrid members at xinput: HIGHST(4)
 18 1.0000E-06 height of isogrid members at xinput: HIGHST(5)
 19 1.0000E-06 height of isogrid members at xinput: HIGHST(6)
 20 1.0000E-06 height of isogrid members at xinput: HIGHST(7)
 21 1.0000E-06 height of isogrid members at xinput: HIGHST(8)
 22 1.0000E-06 height of isogrid members at xinput: HIGHST(9)
 23 1.0000E-06 height of isogrid members at xinput: HIGHST(10)
 24 1.0000E-06 height of isogrid members at xinput: HIGHST(11)
 25 1.0000E-06 height of isogrid members at xinput: HIGHST(12)
 26 1.0000E-06 height of isogrid members at xinput: HIGHST(13)

 27 9.0000E+00 spacing of the isogrid members: SPACNG
 28 1.0000E-05 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     1.034E+02  weight of the equivalent ellipsoidal head: WEIGHT
                    (Compare with WEIGHT = 96.46 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    -9.745E-03 (CLAPS1(1 )/CLAPS1A(1 )) / CLAPS1F(1 )-1; F.S.=1.00
 2     1.747E-01 (GENBK1(1 )/GENBK1A(1 )) / GENBK1F(1 )-1; F.S.=1.00
 3     2.021E+00 (SKNBK1(1,1)/SKNBK1A(1,1))/SKNBK1F(1,1)-1;F.S.=1.00
 4     2.849E-01 (SKNBK1(1,2)/SKNBK1A(1,2))/SKNBK1F(1,2)-1;F.S.=1.00
 5     1.647E+04 (STFBK1(1,1)/STFBK1A(1,1))/STFBK1F(1,1)-1;F.S.=1.00
 6     1.264E+04 (STFBK1(1,2)/STFBK1A(1,2))/STFBK1F(1,2)-1;F.S.=1.00
 7     4.601E-01 (SKNST1A(1,1)/SKNST1(1,1))/SKNST1F(1,1)-1;F.S.=1.00
 8     4.061E-02 (SKNST1A(1,2)/SKNST1(1,2))/SKNST1F(1,2)-1;F.S.=1.00
 9     5.505E-01 (STFST1A(1,1)/STFST1(1,1))/STFST1F(1,1)-1;F.S.=1.00
10     1.896E-01 (STFST1A(1,2)/STFST1(1,2))/STFST1F(1,2)-1;F.S.=1.00
11     1.771E+00 (WAPEX1A(1 )/WAPEX1(1 )) / WAPEX1F(1 )-1; F.S.=1.00

12     1.408E-01 (CLAPS2(1 )/CLAPS2A(1 )) / CLAPS2F(1 )-1; F.S.=1.00
13     5.584E-01 (GENBK2(1 )/GENBK2A(1 )) / GENBK2F(1 )-1; F.S.=1.00
14     1.853E+00 (SKNBK2(1,1)/SKNBK2A(1,1))/SKNBK2F(1,1)-1;F.S.=1.00
15     2.771E-01 (SKNBK2(1,2)/SKNBK2A(1,2))/SKNBK2F(1,2)-1;F.S.=1.00
16     3.293E+04 (STFBK2(1,1)/STFBK2A(1,1))/STFBK2F(1,1)-1;F.S.=1.00
17     1.709E+04 (STFBK2(1,2)/STFBK2A(1,2))/STFBK2F(1,2)-1;F.S.=1.00
18     9.631E-01 (SKNST2A(1,1)/SKNST2(1,1))/SKNST2F(1,1)-1;F.S.=1.00
19     1.727E-01 (SKNST2A(1,2)/SKNST2(1,2))/SKNST2F(1,2)-1;F.S.=1.00
20     2.100E+00 (STFST2A(1,1)/STFST2(1,1))/STFST2F(1,1)-1;F.S.=1.00
21     6.089E-01 (STFST2A(1,2)/STFST2(1,2))/STFST2F(1,2)-1;F.S.=1.00
22     1.978E+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     3.636E-03 (CLAPS1(2 )/CLAPS1A(2 )) / CLAPS1F(2 )-1; F.S.=1.00
 2     9.333E-02 (GENBK1(2 )/GENBK1A(2 )) / GENBK1F(2 )-1; F.S.=1.00
 3     2.553E+00 (SKNBK1(2,1)/SKNBK1A(2,1))/SKNBK1F(2,1)-1;F.S.=1.00
 4     2.742E-01 (SKNBK1(2,2)/SKNBK1A(2,2))/SKNBK1F(2,2)-1;F.S.=1.00
 5     1.945E+04 (STFBK1(2,1)/STFBK1A(2,1))/STFBK1F(2,1)-1;F.S.=1.00
 6     1.244E+04 (STFBK1(2,2)/STFBK1A(2,2))/STFBK1F(2,2)-1;F.S.=1.00
 7     1.295E-01 (SKNST1A(2,1)/SKNST1(2,1))/SKNST1F(2,1)-1;F.S.=1.00
 8     1.289E-01 (SKNST1A(2,2)/SKNST1(2,2))/SKNST1F(2,2)-1;F.S.=1.00
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 9    5.060E-01 (STFST1A(2,1)/STFST1(2,1))/STFST1F(2,1)-1;F.S.=1.00
10    1.707E-01 (STFST1A(2,2)/STFST1(2,2))/STFST1F(2,2)-1;F.S.=1.00
11    1.755E-01 (WAPEX1A(2 )/WAPEX1(2 )) / WAPEX1F(2 )-1; F.S.=1.00

12    9.564E-02 (CLAPS2(2 )/CLAPS2A(2 )) / CLAPS2F(2 )-1; F.S.=1.00
13    5.403E-01 (GENBK2(2 )/GENBK2A(2 )) / GENBK2F(2 )-1; F.S.=1.00
14    1.964E+00 (SKNBK2(2,1)/SKNBK2A(2,1))/SKNBK2F(2,1)-1;F.S.=1.00
15    2.812E-01 (SKNBK2(2,2)/SKNBK2A(2,2))/SKNBK2F(2,2)-1;F.S.=1.00
16    2.349E+04 (STFBK2(2,1)/STFBK2A(2,1))/STFBK2F(2,1)-1;F.S.=1.00
17    1.465E+04 (STFBK2(2,2)/STFBK2A(2,2))/STFBK2F(2,2)-1;F.S.=1.00
18    1.080E-01 (SKNST2A(2,1)/SKNST2(2,1))/SKNST2F(2,1)-1;F.S.=1.00
19    1.350E-01 (SKNST2A(2,2)/SKNST2(2,2))/SKNST2F(2,2)-1;F.S.=1.00
20    4.773E-01 (STFST2A(2,1)/STFST2(2,1))/STFST2F(2,1)-1;F.S.=1.00
21    3.795E-01 (STFST2A(2,2)/STFST2(2,2))/STFST2F(2,2)-1;F.S.=1.00
22    3.082E-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    1.149E-01 (CLAPS1(3 )/CLAPS1A(3 )) / CLAPS1F(3 )-1; F.S.=1.00
 2    5.390E-01 (GENBK1(3 )/GENBK1A(3 )) / GENBK1F(3 )-1; F.S.=1.00
 3    1.598E+00 (SKNBK1(3,1)/SKNBK1A(3,1))/SKNBK1F(3,1)-1;F.S.=1.00
 4    2.743E-01 (SKNBK1(3,2)/SKNBK1A(3,2))/SKNBK1F(3,2)-1;F.S.=1.00
 5    2.836E+04 (STFBK1(3,1)/STFBK1A(3,1))/STFBK1F(3,1)-1;F.S.=1.00
 6    1.429E+04 (STFBK1(3,2)/STFBK1A(3,2))/STFBK1F(3,2)-1;F.S.=1.00
 7    7.534E-01 (SKNST1A(3,1)/SKNST1(3,1))/SKNST1F(3,1)-1;F.S.=1.00
 8    7.949E-02 (SKNST1A(3,2)/SKNST1(3,2))/SKNST1F(3,2)-1;F.S.=1.00
 9    1.670E+00 (STFST1A(3,1)/STFST1(3,1))/STFST1F(3,1)-1;F.S.=1.00
10    3.453E-01 (STFST1A(3,2)/STFST1(3,2))/STFST1F(3,2)-1;F.S.=1.00
11    1.875E+00 (WAPEX1A(3 )/WAPEX1(3 )) / WAPEX1F(3 )-1; F.S.=1.00

12   -4.655E-02 (CLAPS2(3 )/CLAPS2A(3 )) / CLAPS2F(3 )-1; F.S.=1.00
13    2.822E-01 (GENBK2(3 )/GENBK2A(3 )) / GENBK2F(3 )-1; F.S.=1.00
14    1.429E+00 (SKNBK2(3,1)/SKNBK2A(3,1))/SKNBK2F(3,1)-1;F.S.=1.00
15    2.767E-01 (SKNBK2(3,2)/SKNBK2A(3,2))/SKNBK2F(3,2)-1;F.S.=1.00
16    2.256E+04 (STFBK2(3,1)/STFBK2A(3,1))/STFBK2F(3,1)-1;F.S.=1.00
17    1.425E+04 (STFBK2(3,2)/STFBK2A(3,2))/STFBK2F(3,2)-1;F.S.=1.00
18    9.047E-02 (SKNST2A(3,1)/SKNST2(3,1))/SKNST2F(3,1)-1;F.S.=1.00
19    2.820E-03 (SKNST2A(3,2)/SKNST2(3,2))/SKNST2F(3,2)-1;F.S.=1.00
20    1.124E+00 (STFST2A(3,1)/STFST2(3,1))/STFST2F(3,1)-1;F.S.=1.00
21    3.419E-01 (STFST2A(3,2)/STFST2(3,2))/STFST2F(3,2)-1;F.S.=1.00
22    7.046E-01 (WAPEX2A(3 )/WAPEX2(3 )) / WAPEX2F(3 )-1; F.S.=1.00
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***** RESULTS FOR LOAD SET NO.  4  (—mode 3 and —mode 4)******
MARGINS CORRESPONDING TO CURRENT DESIGN (F.S.= FACTOR OF SAFETY)
MARGIN CURRENT
NO.     VALUE           DEFINITION
 1    1.333E-01 (CLAPS1(4 )/CLAPS1A(4 )) / CLAPS1F(4 )-1; F.S.=1.00
 2    5.521E-01 (GENBK1(4 )/GENBK1A(4 )) / GENBK1F(4 )-1; F.S.=1.00
 3    2.017E+00 (SKNBK1(4,1)/SKNBK1A(4,1))/SKNBK1F(4,1)-1;F.S.=1.00
 4    2.839E-01 (SKNBK1(4,2)/SKNBK1A(4,2))/SKNBK1F(4,2)-1;F.S.=1.00
 5    2.355E+04 (STFBK1(4,1)/STFBK1A(4,1))/STFBK1F(4,1)-1;F.S.=1.00
 6    1.436E+04 (STFBK1(4,2)/STFBK1A(4,2))/STFBK1F(4,2)-1;F.S.=1.00
 7    1.477E-01 (SKNST1A(4,1)/SKNST1(4,1))/SKNST1F(4,1)-1;F.S.=1.00
 8    1.261E-01 (SKNST1A(4,2)/SKNST1(4,2))/SKNST1F(4,2)-1;F.S.=1.00
 9    5.302E-01 (STFST1A(4,1)/STFST1(4,1))/STFST1F(4,1)-1;F.S.=1.00
10    3.515E-01 (STFST1A(4,2)/STFST1(4,2))/STFST1F(4,2)-1;F.S.=1.00
11    4.009E-01 (WAPEX1A(4 )/WAPEX1(4 )) / WAPEX1F(4 )-1; F.S.=1.00

12    1.128E-03 (CLAPS2(4 )/CLAPS2A(4 )) / CLAPS2F(4 )-1; F.S.=1.00
13    3.145E-01 (GENBK2(4 )/GENBK2A(4 )) / GENBK2F(4 )-1; F.S.=1.00
14    1.303E+00 (SKNBK2(4,1)/SKNBK2A(4,1))/SKNBK2F(4,1)-1;F.S.=1.00
15    2.801E-01 (SKNBK2(4,2)/SKNBK2A(4,2))/SKNBK2F(4,2)-1;F.S.=1.00
16    1.753E+04 (STFBK2(4,1)/STFBK2A(4,1))/STFBK2F(4,1)-1;F.S.=1.00
17    1.395E+04 (STFBK2(4,2)/STFBK2A(4,2))/STFBK2F(4,2)-1;F.S.=1.00
18    1.202E-01 (SKNST2A(4,1)/SKNST2(4,1))/SKNST2F(4,1)-1;F.S.=1.00
19    5.220E-03 (SKNST2A(4,2)/SKNST2(4,2))/SKNST2F(4,2)-1;F.S.=1.00
20    4.935E-01 (STFST2A(4,1)/STFST2(4,1))/STFST2F(4,1)-1;F.S.=1.00
21    3.129E-01 (STFST2A(4,2)/STFST2(4,2))/STFST2F(4,2)-1;F.S.=1.00
22    7.572E-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.