

2713
REPORT NO. GDC-DDG-67-006 - END

3 THE STABILITY OF ECCENTRICALLY
STIFFENED CIRCULAR CYLINDERS. 2#

VOLUME 3: 2#
APPENDIX 6

Prepared for the
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9 20 June 1967 10 CV

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APPENDIX A

SUPPLEMENTARY CRITICAL STRESS CURVES

A.1 GENERAL

The curves of this appendix present the critical stress values of SECTION 5.1 in a slightly different format from that of Figures 4, 5, and 6. In particular, the abscissa has been changed from (R/N^*t) to simply (R/t) . This results in an increased number of design curves since it is then necessary to provide separate families for selected fixed values of N^* . All of the curves given here were obtained from digital computer program 4196 used in conjunction with an automatic plotting machine.

A.2 CURVES

A.2.1 7075-T6 ALUMINUM ALLOY

Table XV lists the families provided here for longitudinally stiffened cylinders made of 7075-T6 aluminum alloy. These curves are based upon the following values for the indicated material properties:

	E	$= 10.5 \times 10^6$	psi
	ν	$= .33$	
	σ_{cy}	$= 67,000$	psi
Ramberg-Osgood	n	$= 10$	
Ramberg-Osgood	$\sigma_{.7}$	$= 70,000$	psi

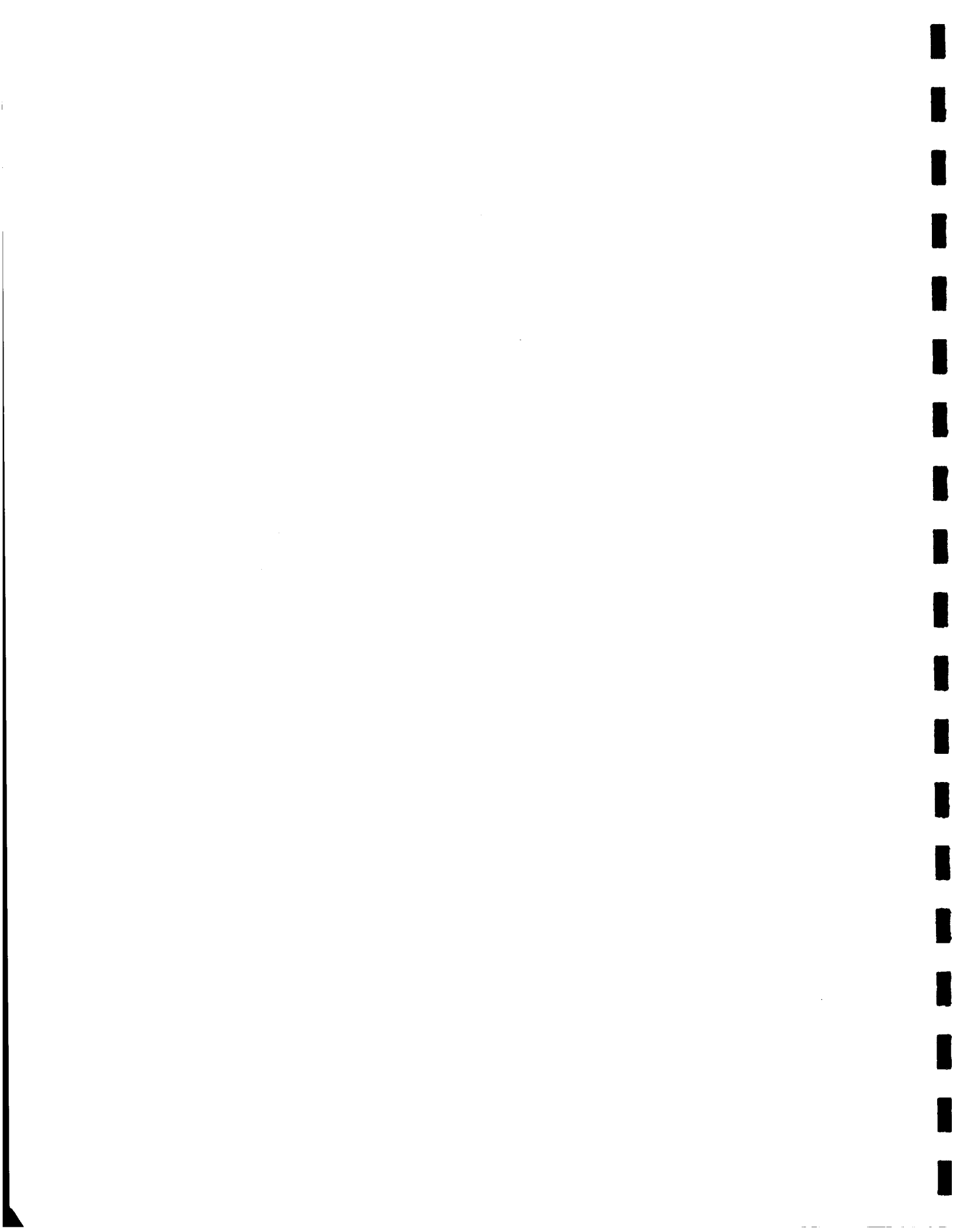
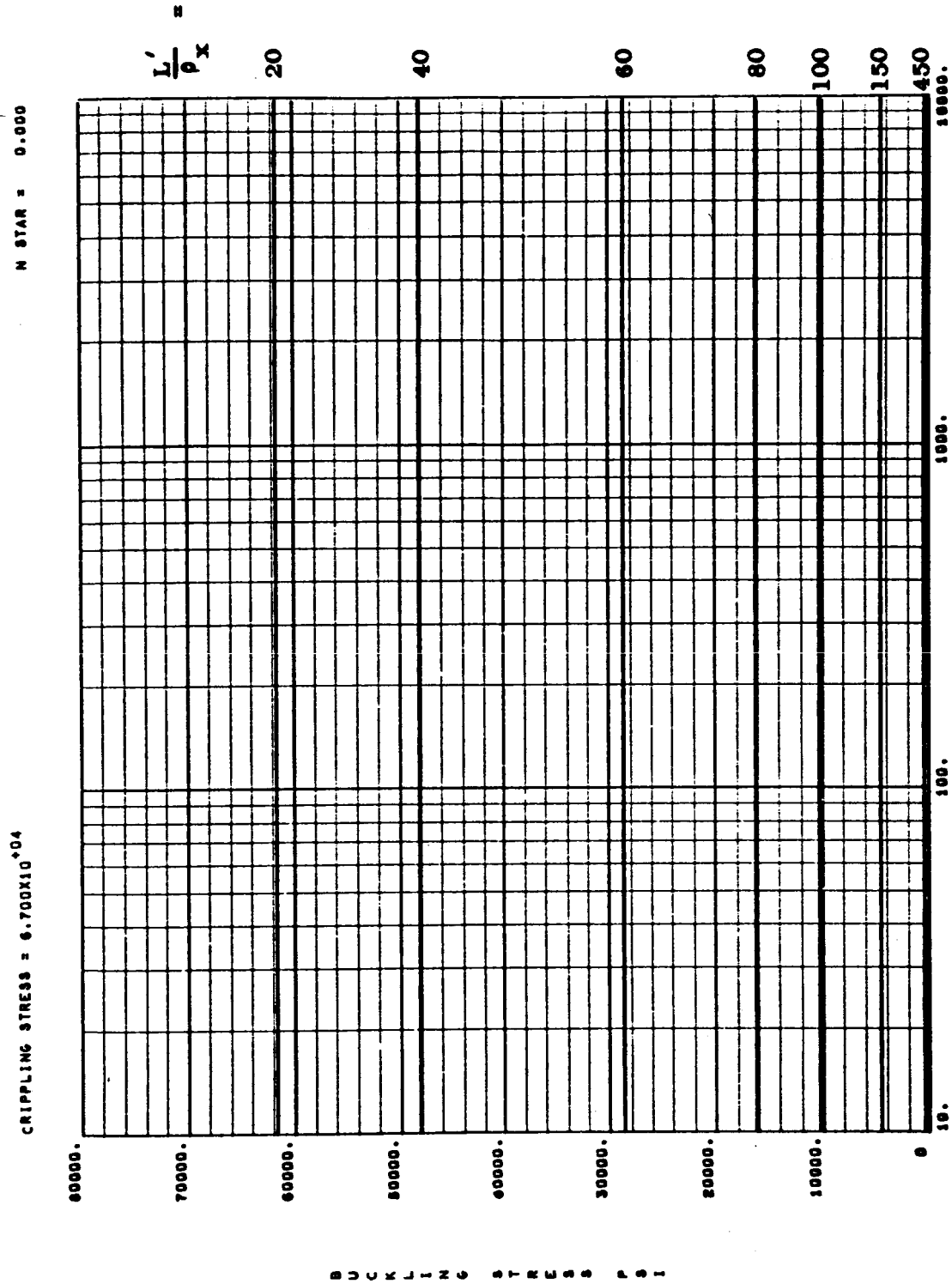


TABLE XV - Table of Contents for Supplementary
Curves of Compressive Buckling Stress
for Longitudinally Stiffened Cylinders;
Material - 7075-T6 Aluminum Alloy

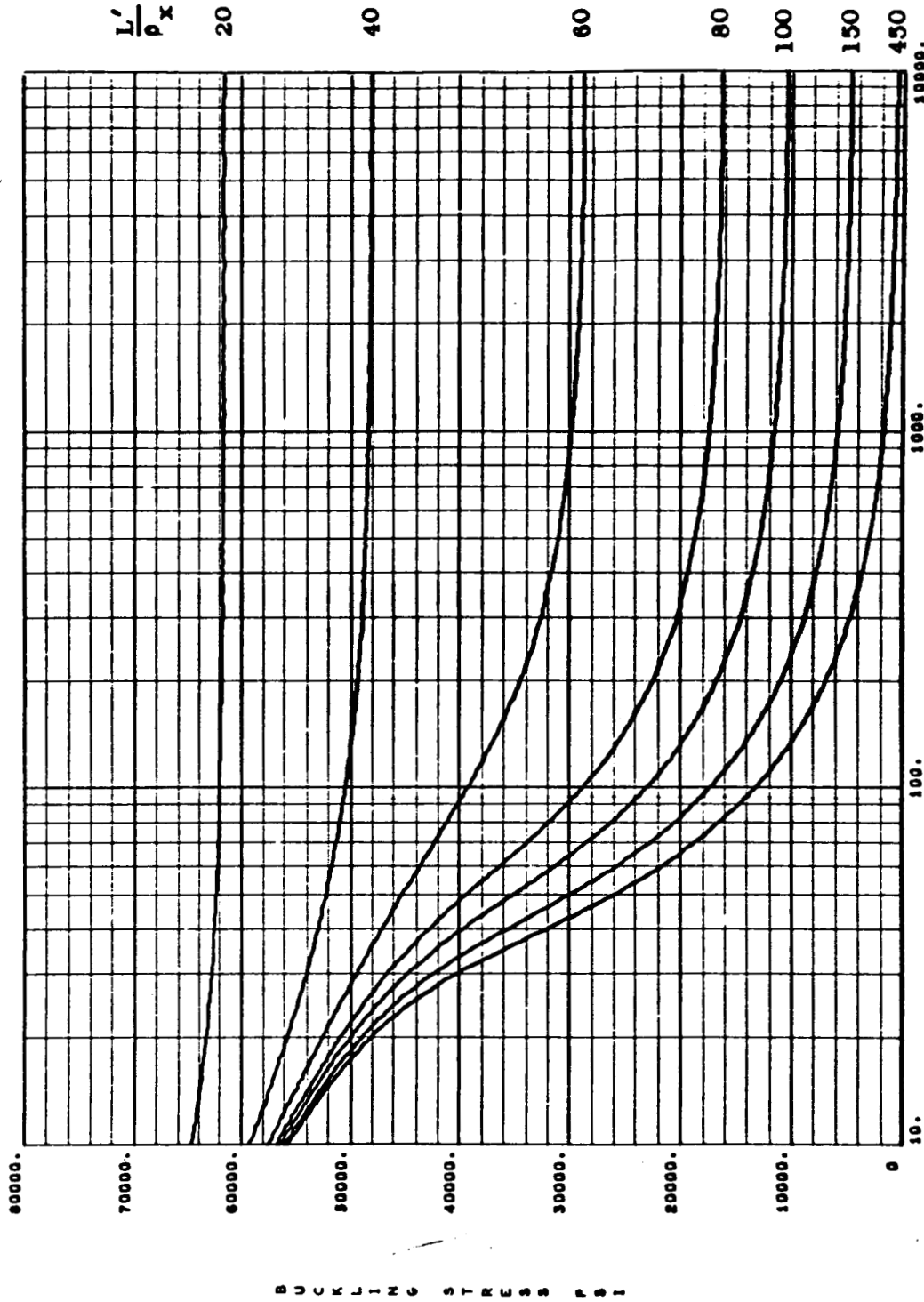
<u>Figure Number</u>	<u>Crippling Stress, σ_{cc}</u>	<u>N*</u>	<u>Page</u>
16(a)	67,000	0.0	A-5
16(b)	67,000	0.2	A-6
16(c)	67,000	0.4	A-7
16(d)	67,000	0.6	A-8
16(e)	67,000	0.8	A-9
16(f)	67,000	1.0	A-10
16(g)	67,000	1.2	A-11
16(h)	67,000	1.4	A-12
16(i)	67,000	1.6	A-13
16(j)	67,000	1.8	A-14
16(k)	67,000	2.0	A-15
17(a)	60,000	0.0	A-16
17(b)	60,000	0.2	A-17
17(c)	60,000	0.4	A-18
17(d)	60,000	0.6	A-19
17(e)	60,000	0.8	A-20
17(f)	60,000	1.0	A-21
17(g)	60,000	1.2	A-22
17(h)	60,000	1.4	A-23
17(i)	60,000	1.6	A-24
17(j)	60,000	1.8	A-25
17(k)	60,000	2.0	A-26
18(a)	50,000	0.0	A-27
18(b)	50,000	0.2	A-28
18(c)	50,000	0.4	A-29
18(d)	50,000	0.6	A-30
18(e)	50,000	0.8	A-31
18(f)	50,000	1.0	A-32
18(g)	50,000	1.2	A-33
18(h)	50,000	1.4	A-34
18(i)	50,000	1.6	A-35
18(j)	50,000	1.8	A-36
18(k)	50,000	2.0	A-37



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY
Figure 16(a)

CRIPPLING STRESS = 6.700×10^4

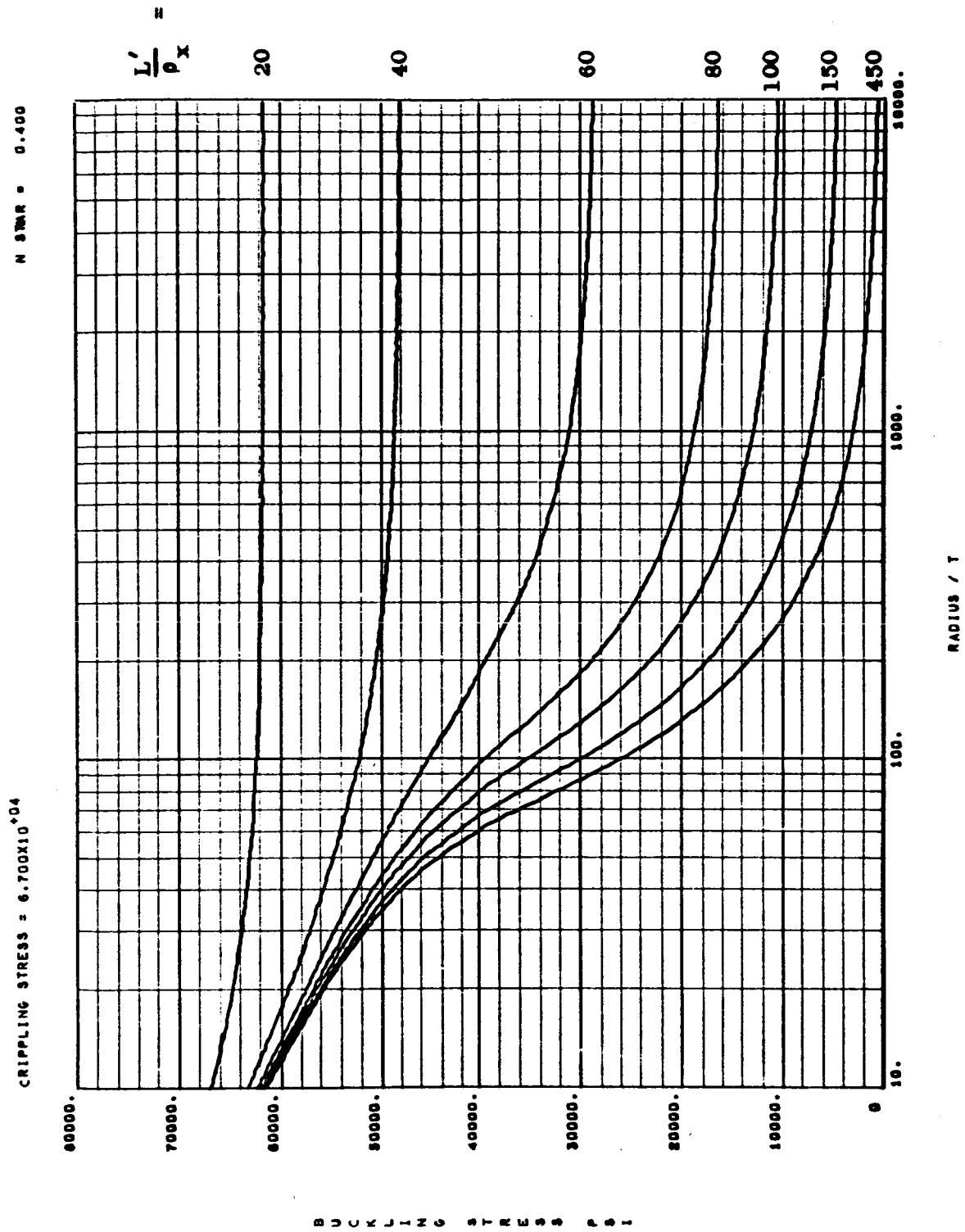
N 534R = 0.200



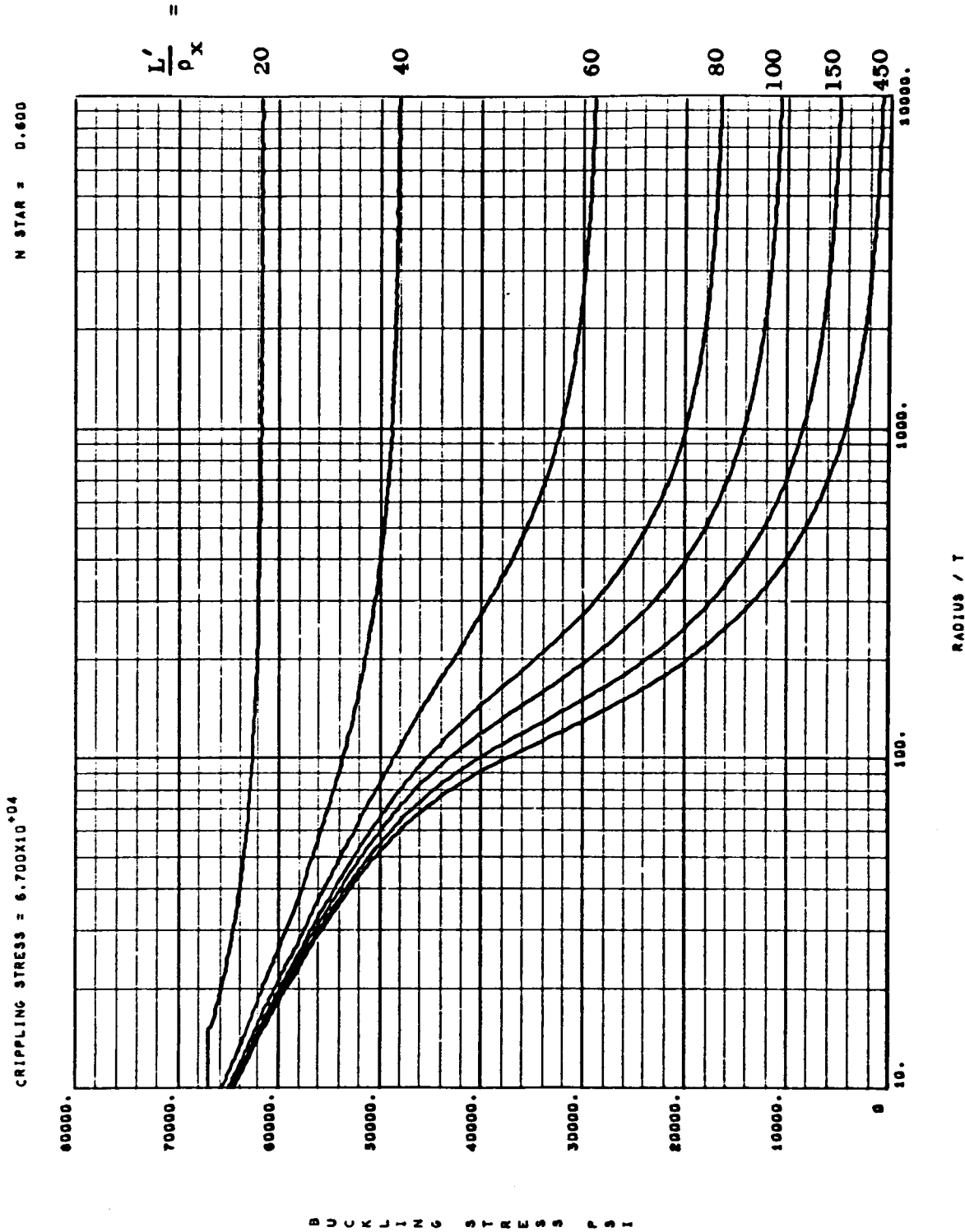
RADIUS / T

COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS

MATERIAL - 7075-T6 ALUMINUM ALLOY
Figure 16(b)

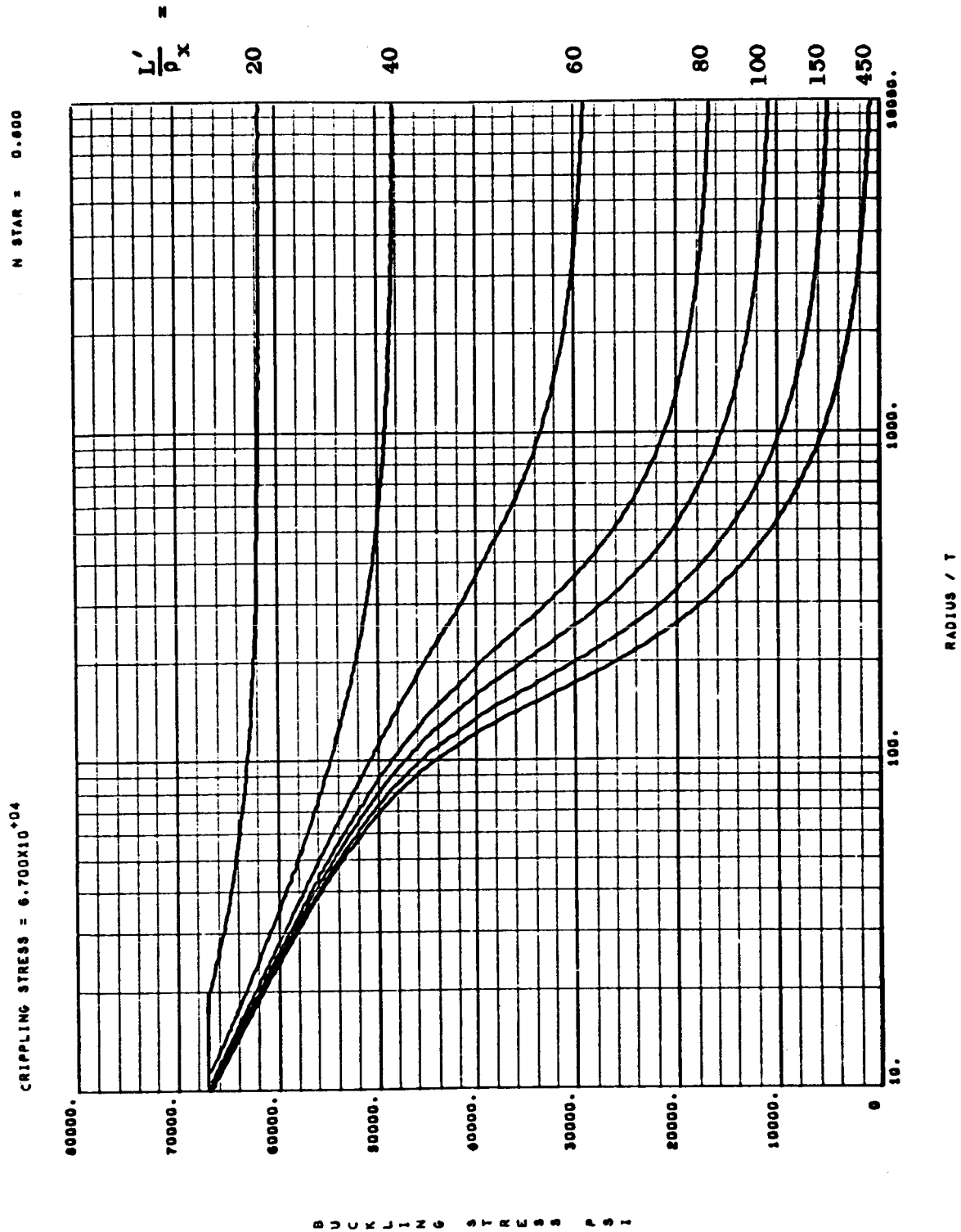


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY
Figure 16(c)

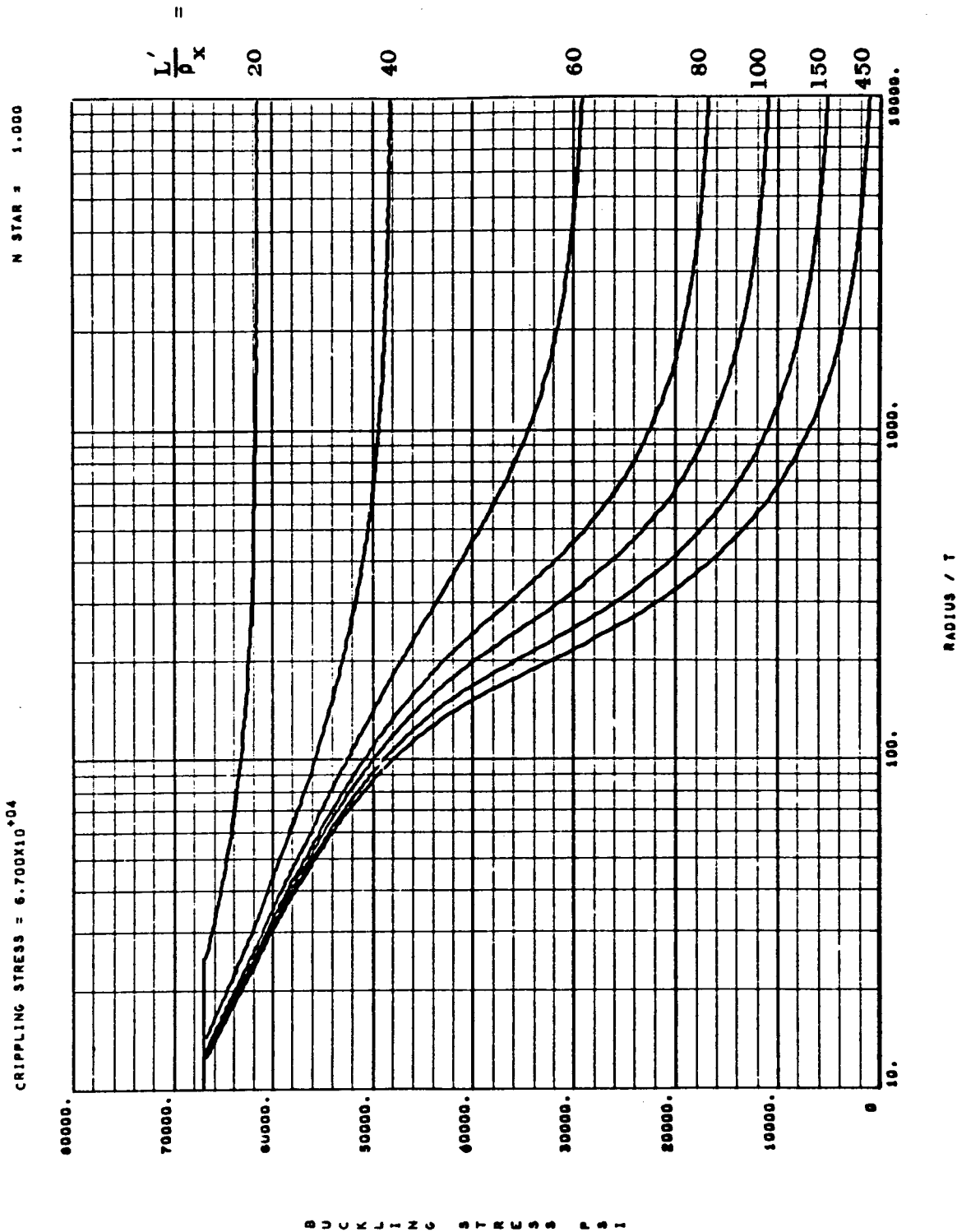


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL -7075-T6 ALUMINUM ALLOY

Figure 16(d)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY
Figure 16 (e)



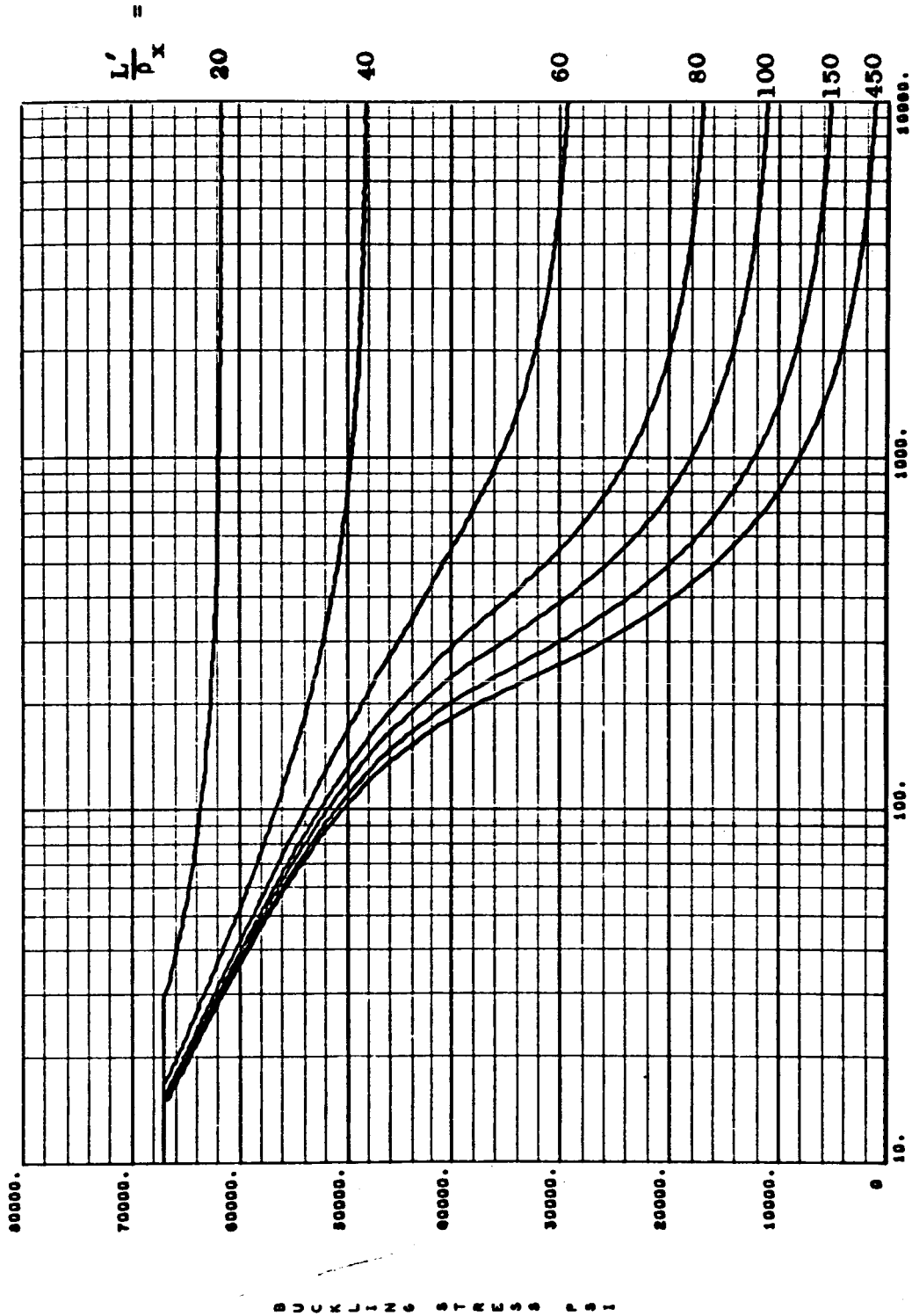
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS

MATERIAL - 7075-T6 ALUMINUM ALLOY

Figure 16(f)

N STAR = 1.200

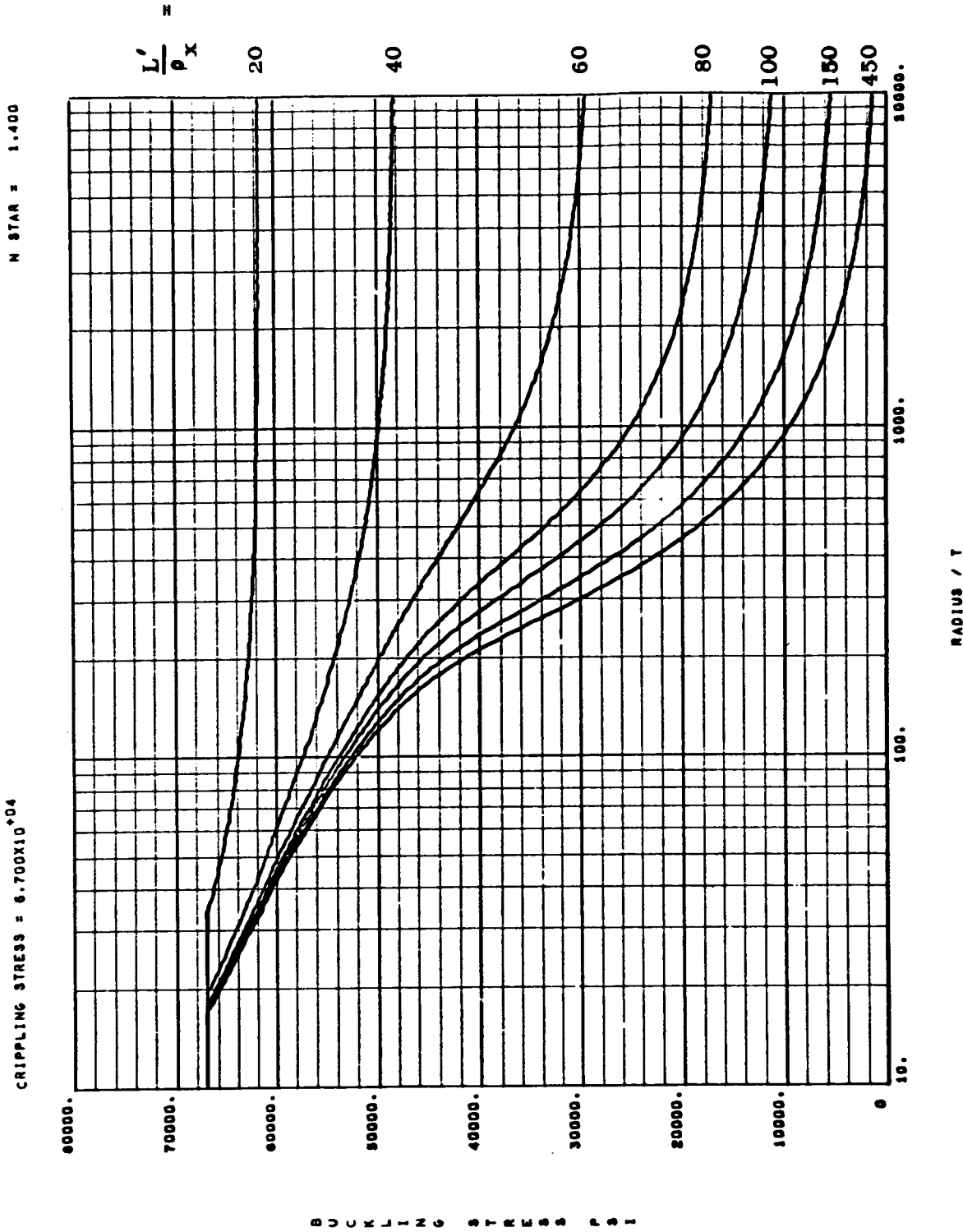
CRIPPLING STRESS = 6.700×10^4



COMPRESSIVE BUCKLING STRESS FOR LONGITUDINALLY STIFFENED CYLINDERS

MATERIAL - 7075-T6 ALUMINUM ALLOY

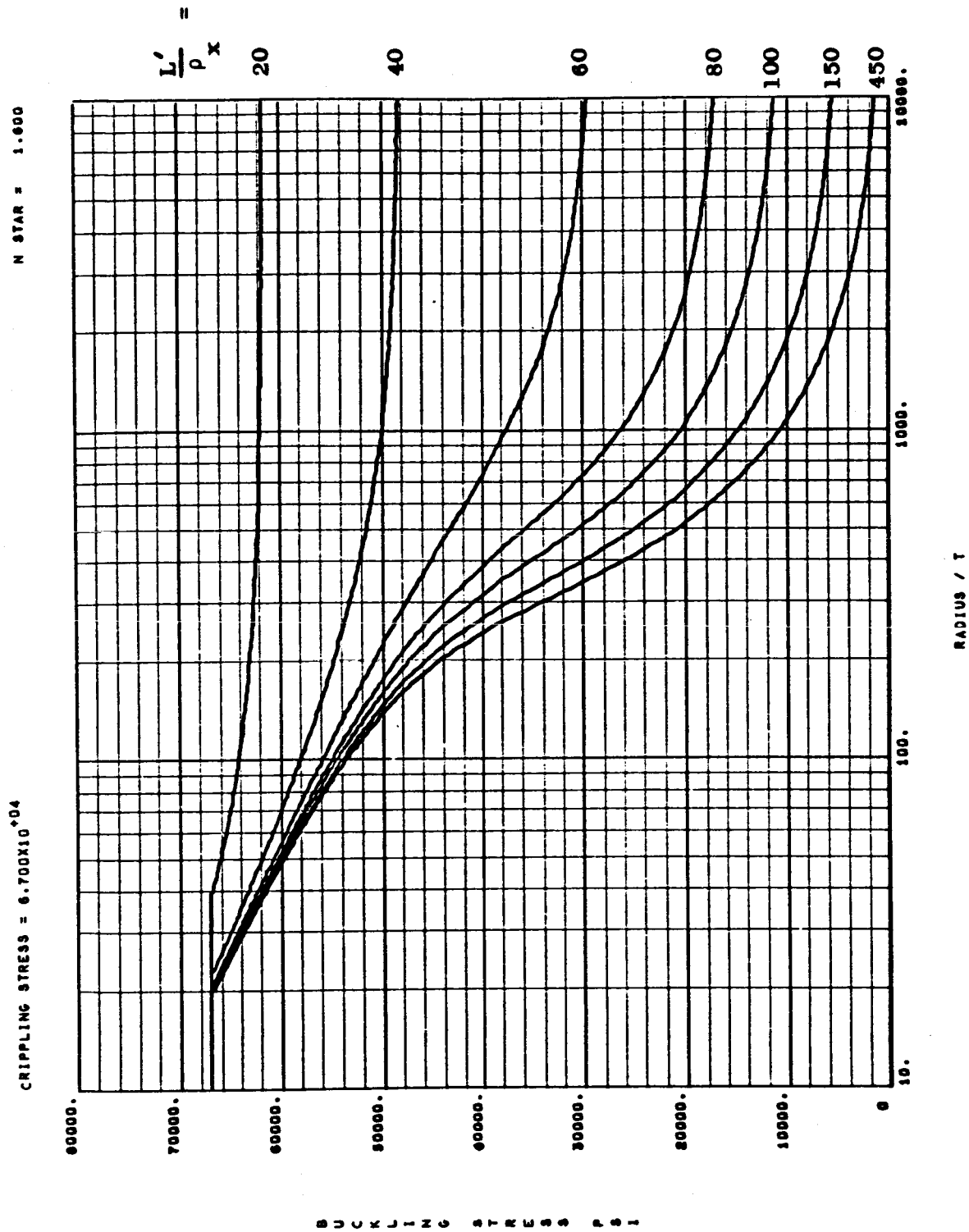
Figure 16(g)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS

MATERIAL - 7075-T6 ALUMINUM ALLOY

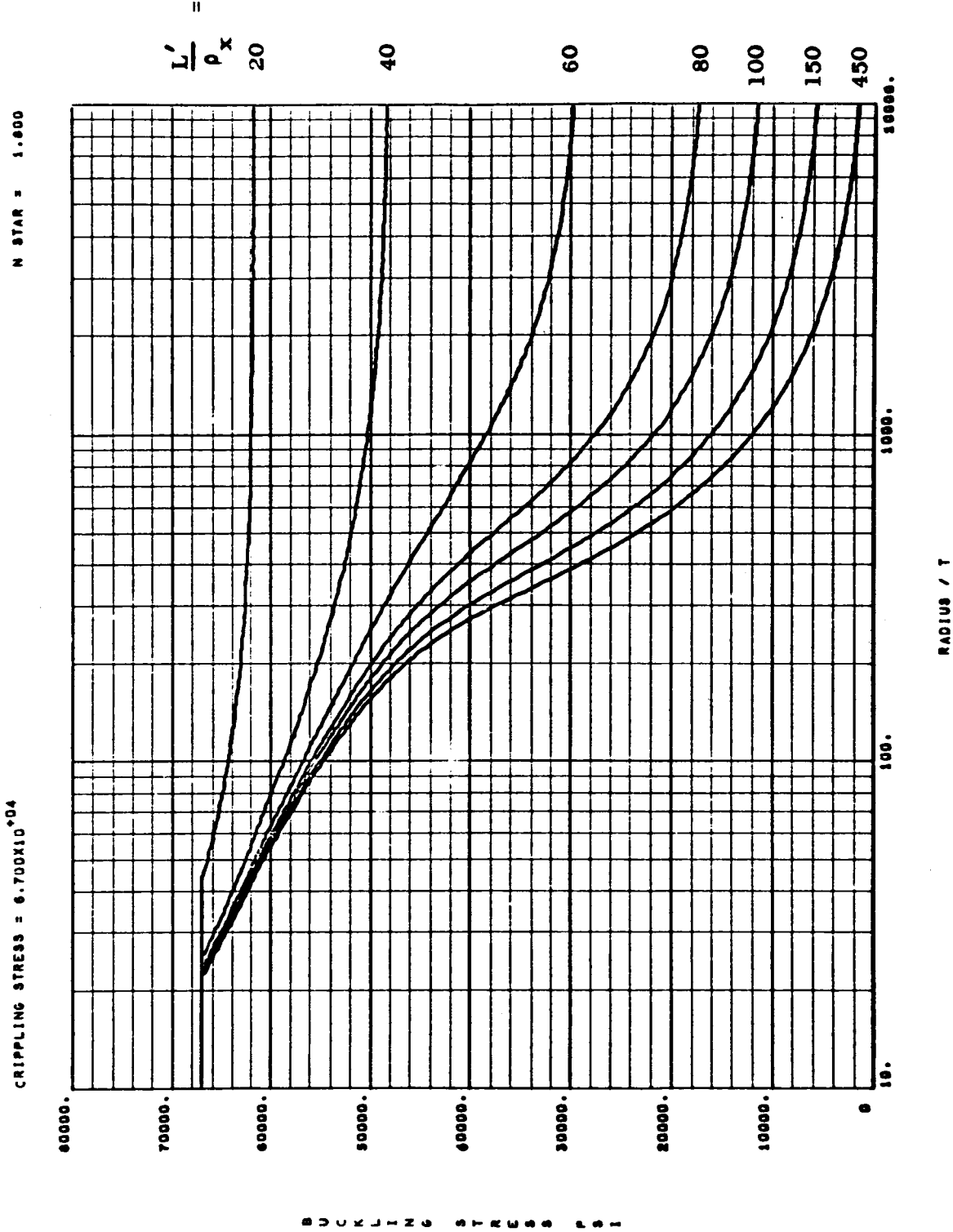
Figure 16(h)



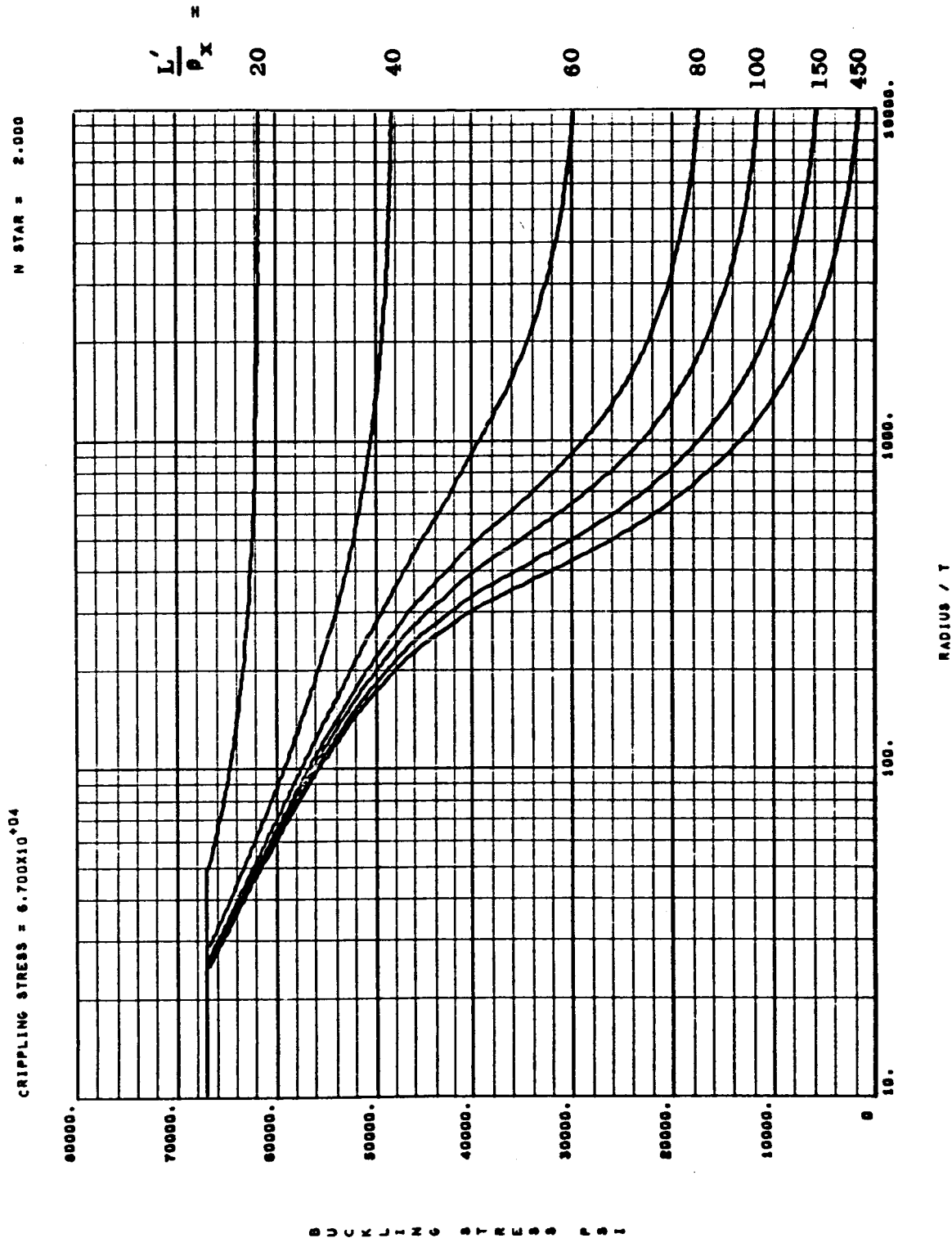
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS

MATERIAL - 7075-T6 ALUMINUM ALLOY

Figure 16 (i)



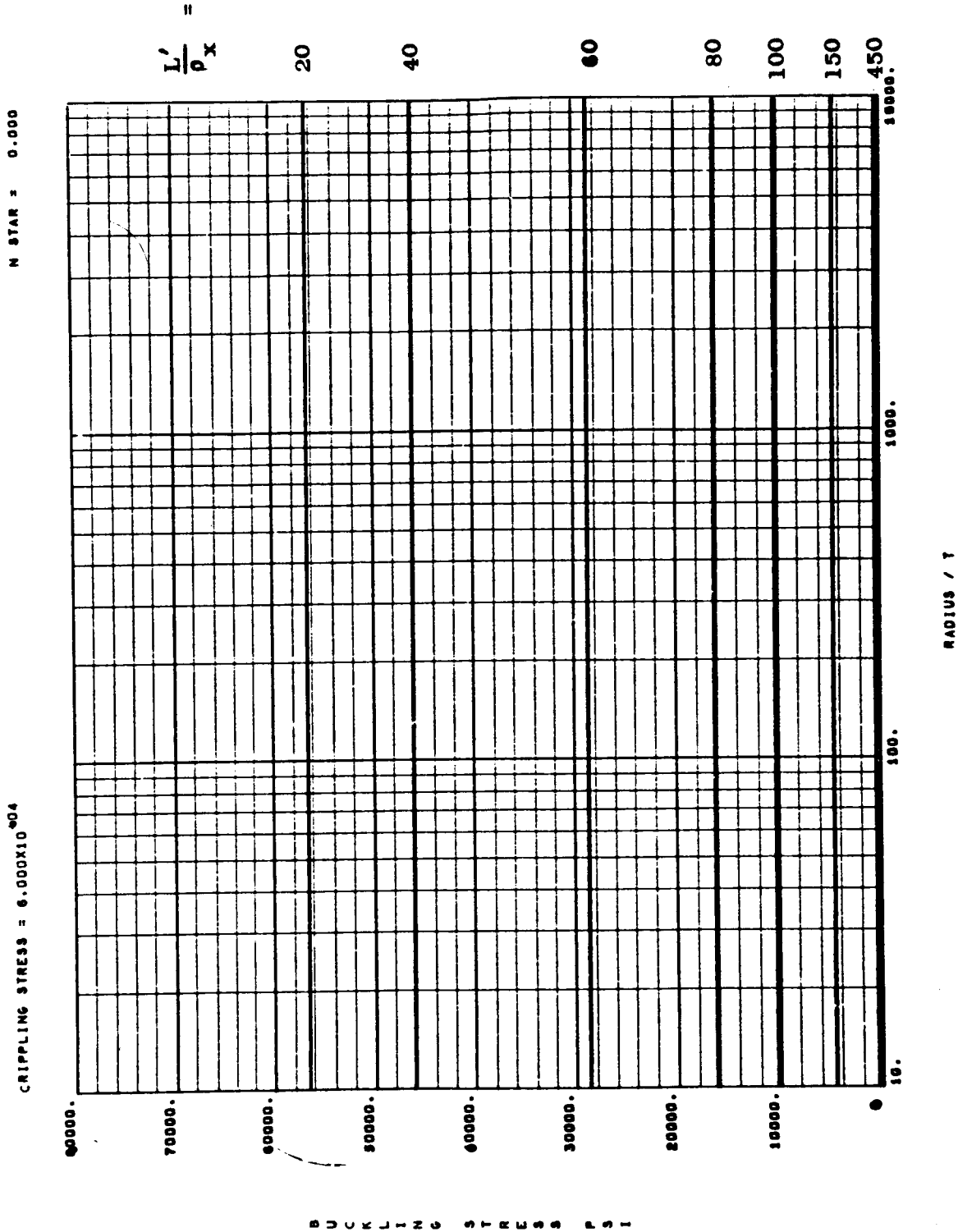
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY
Figure 16(j)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS

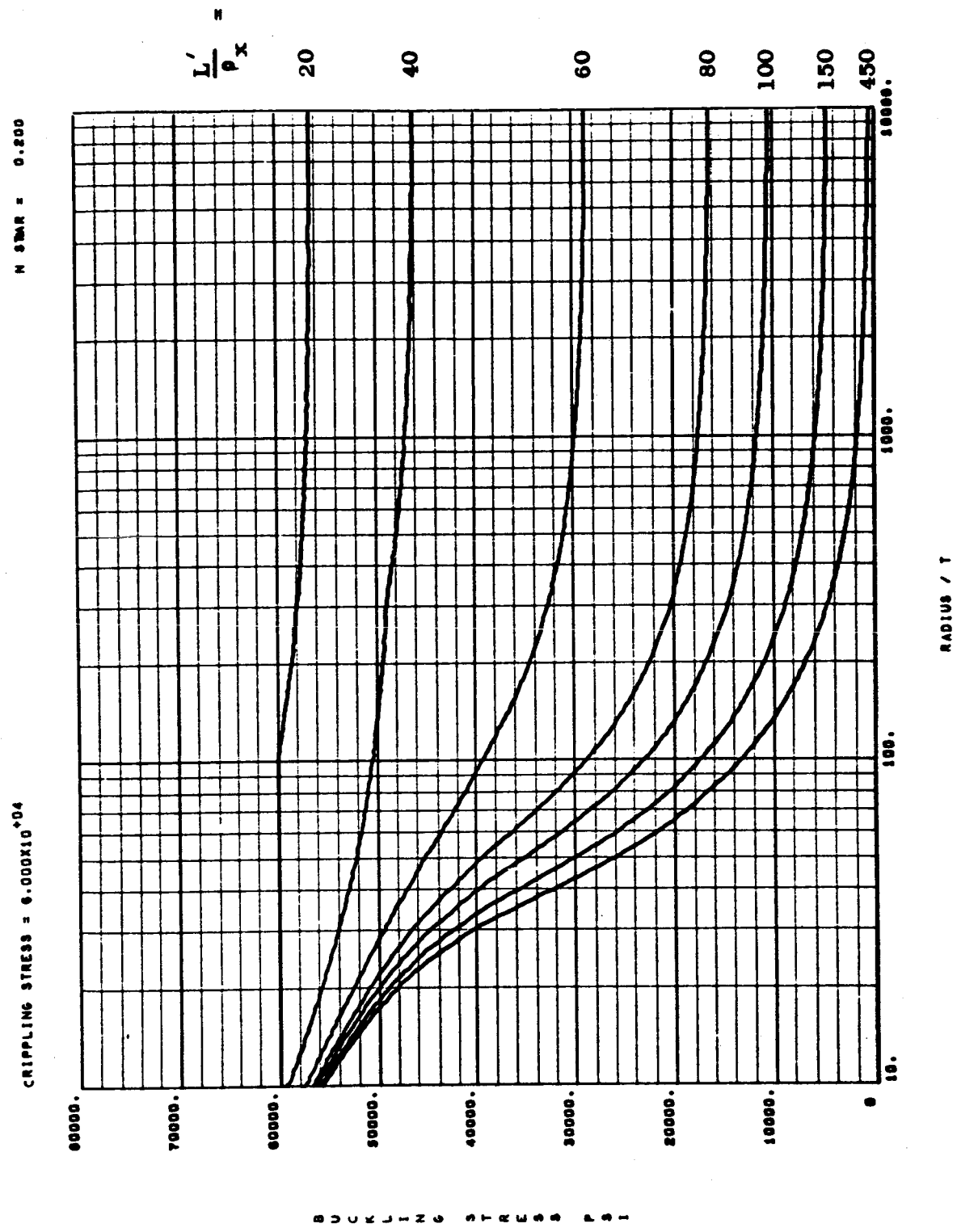
MATERIAL - 7075-T6 ALUMINUM ALLOY

Figure 16(k)

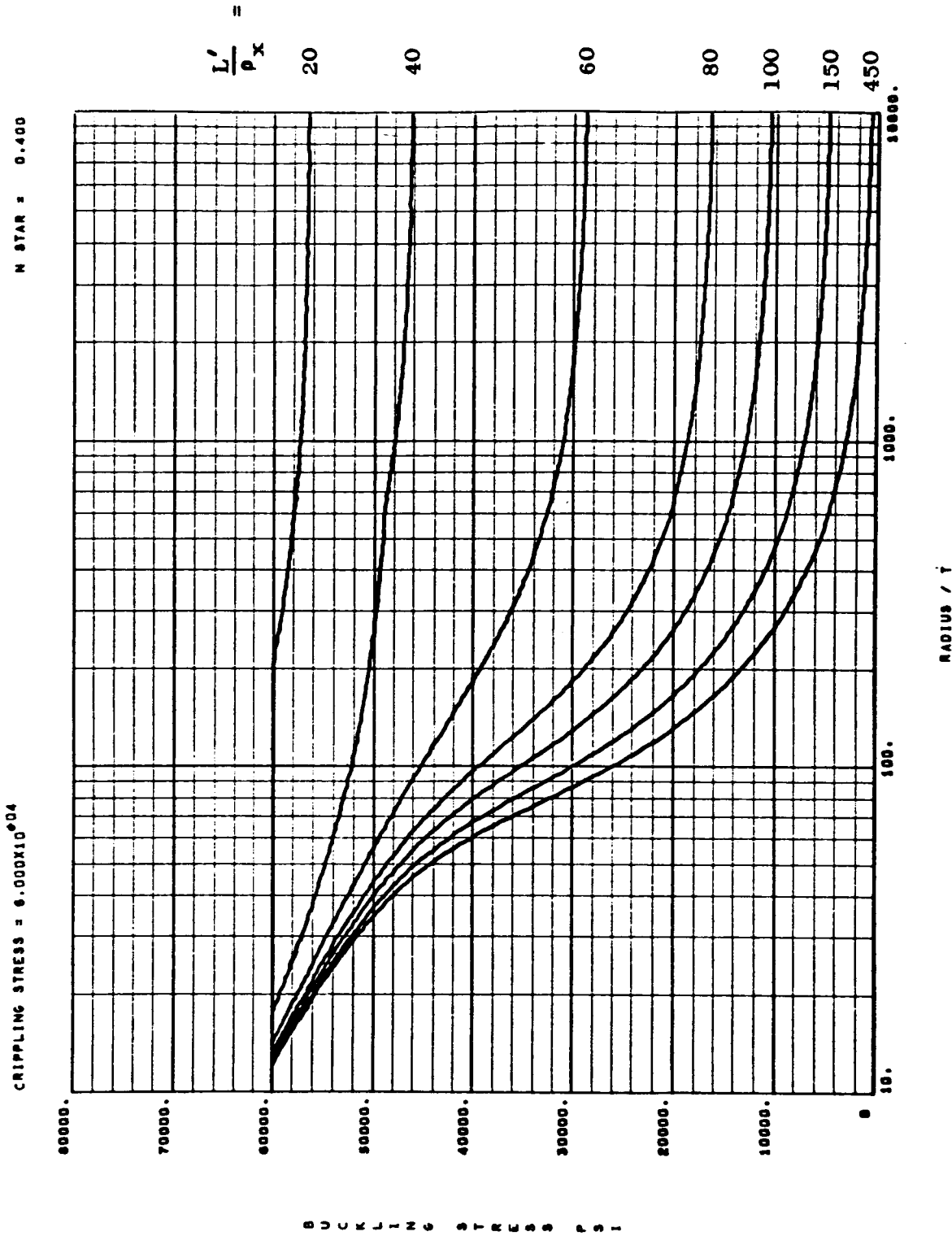


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY

Figure 17(a)

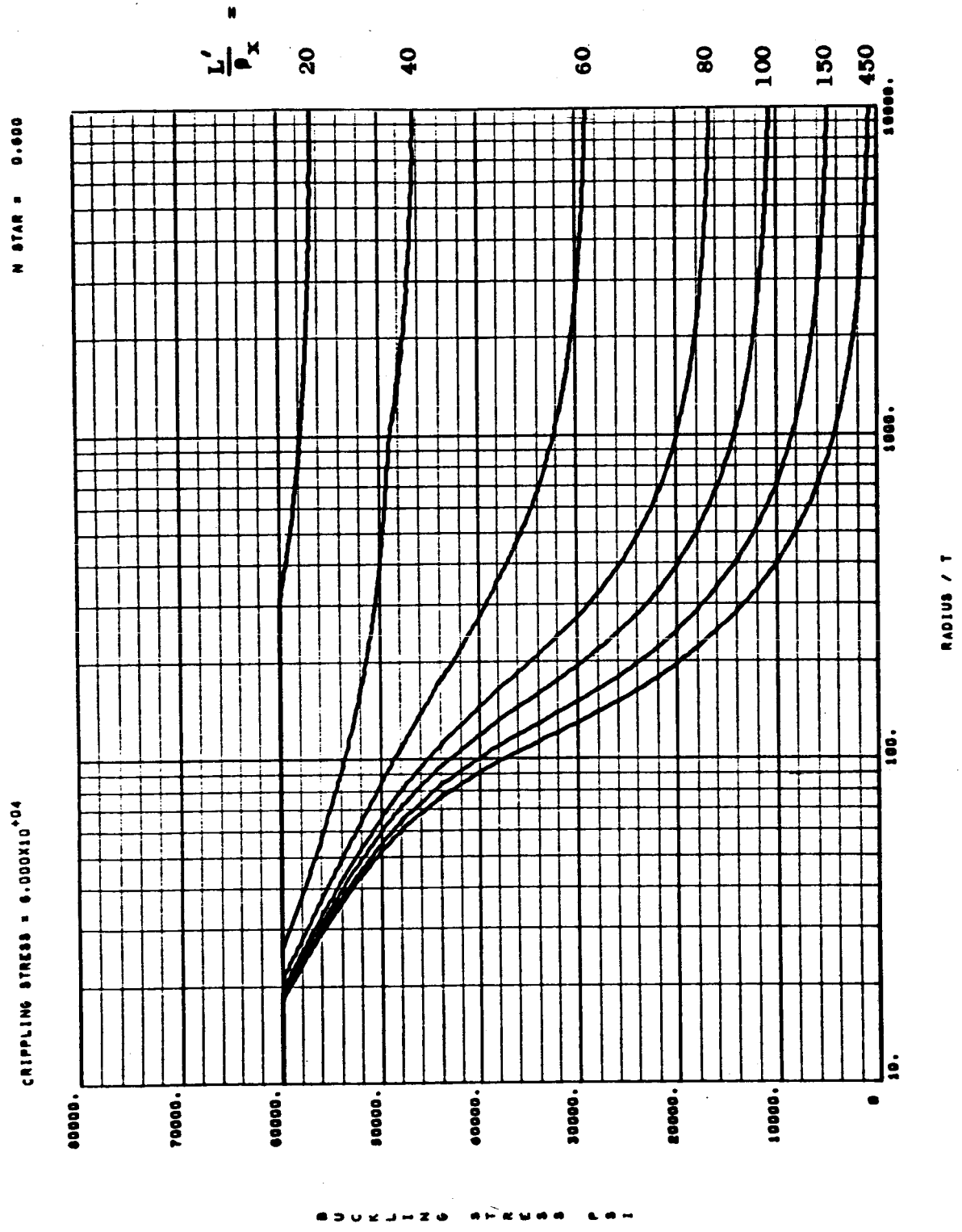


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY
Figure 17(b)

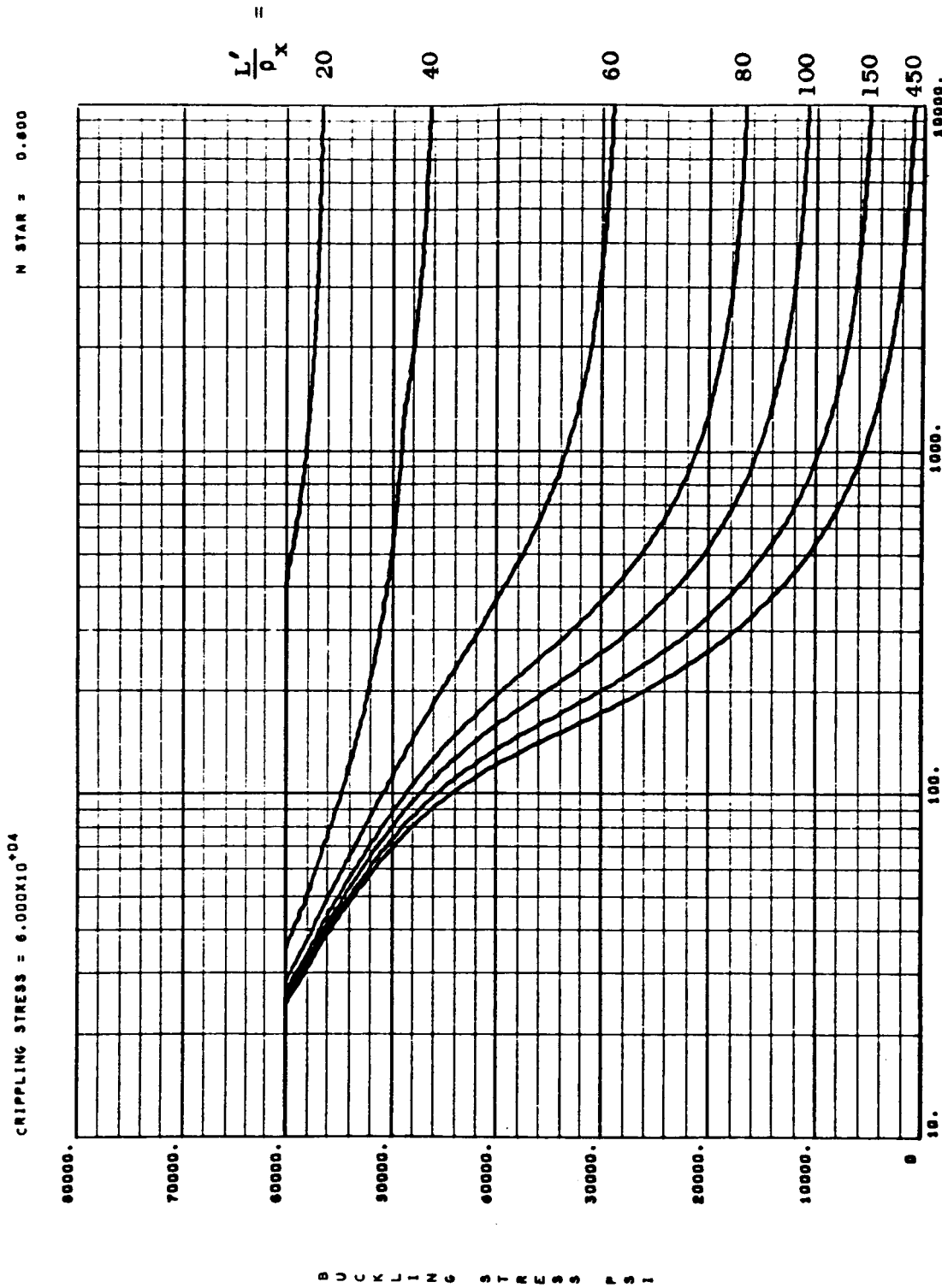


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY

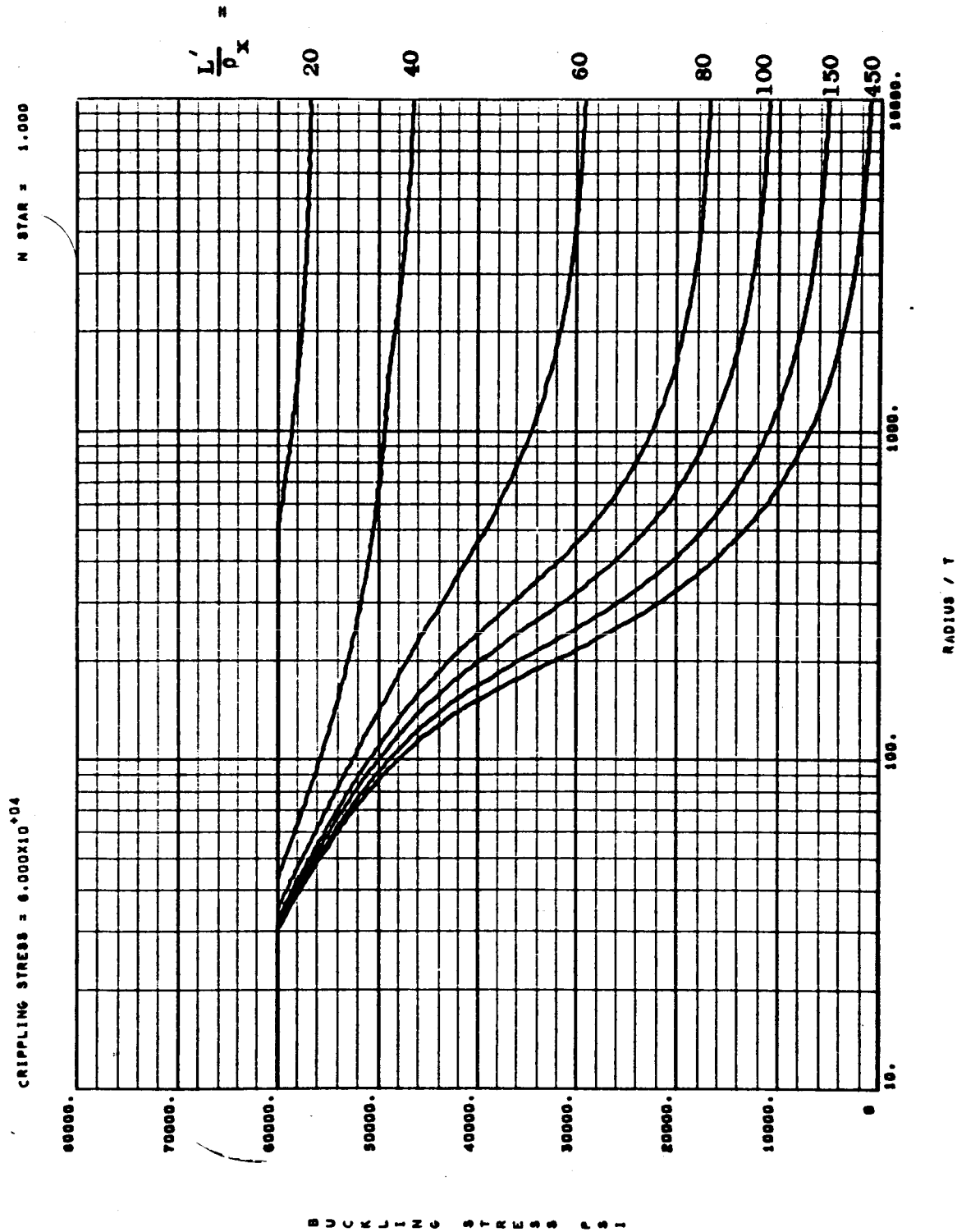
Figure 17(c)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY
Figure 17(d)

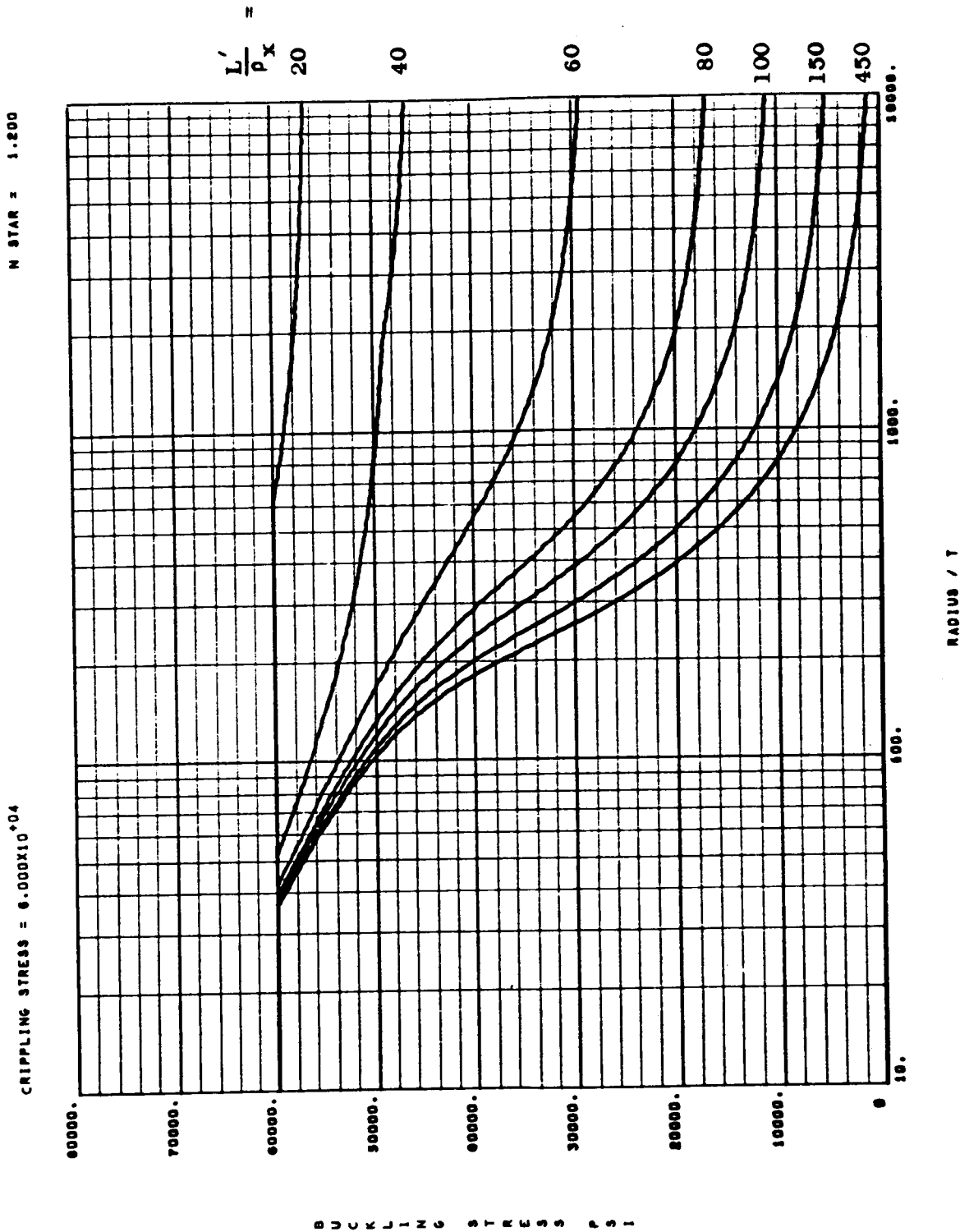


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY
Figure 17(e)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY

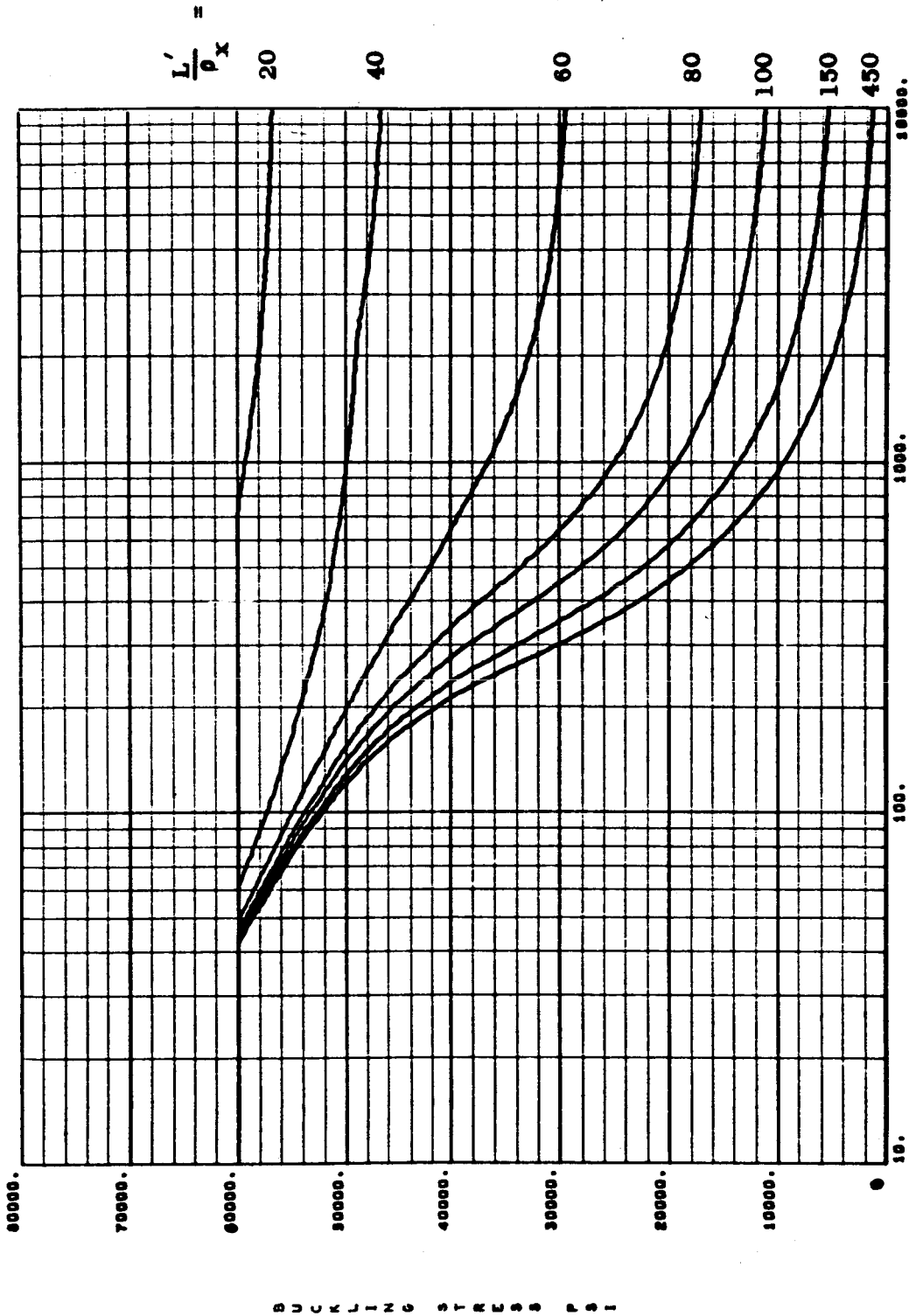
Figure 17(f)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY
Figure 17(g)

N STAR = 1.400

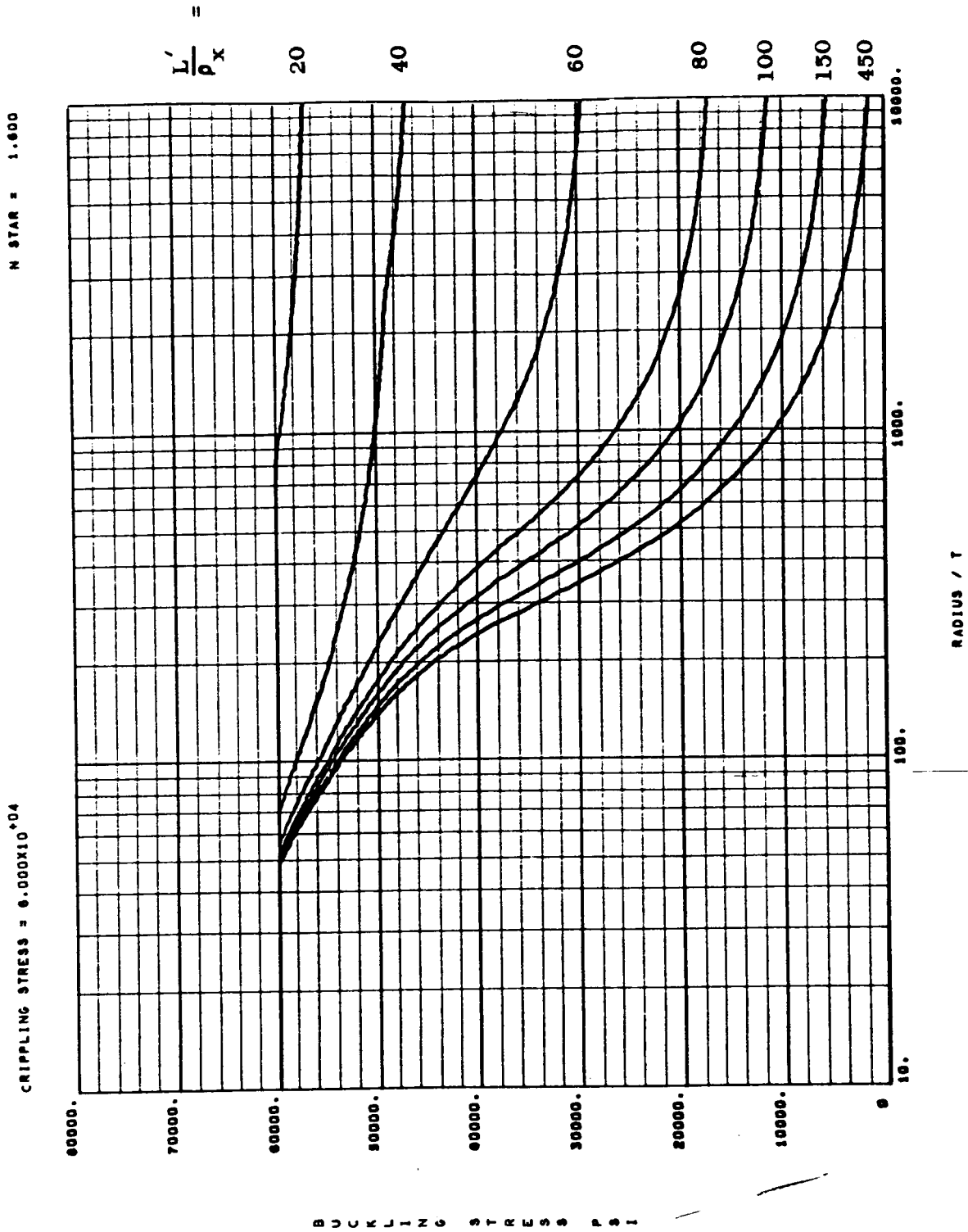
CRIPPLING STRESS = 6.000×10^4



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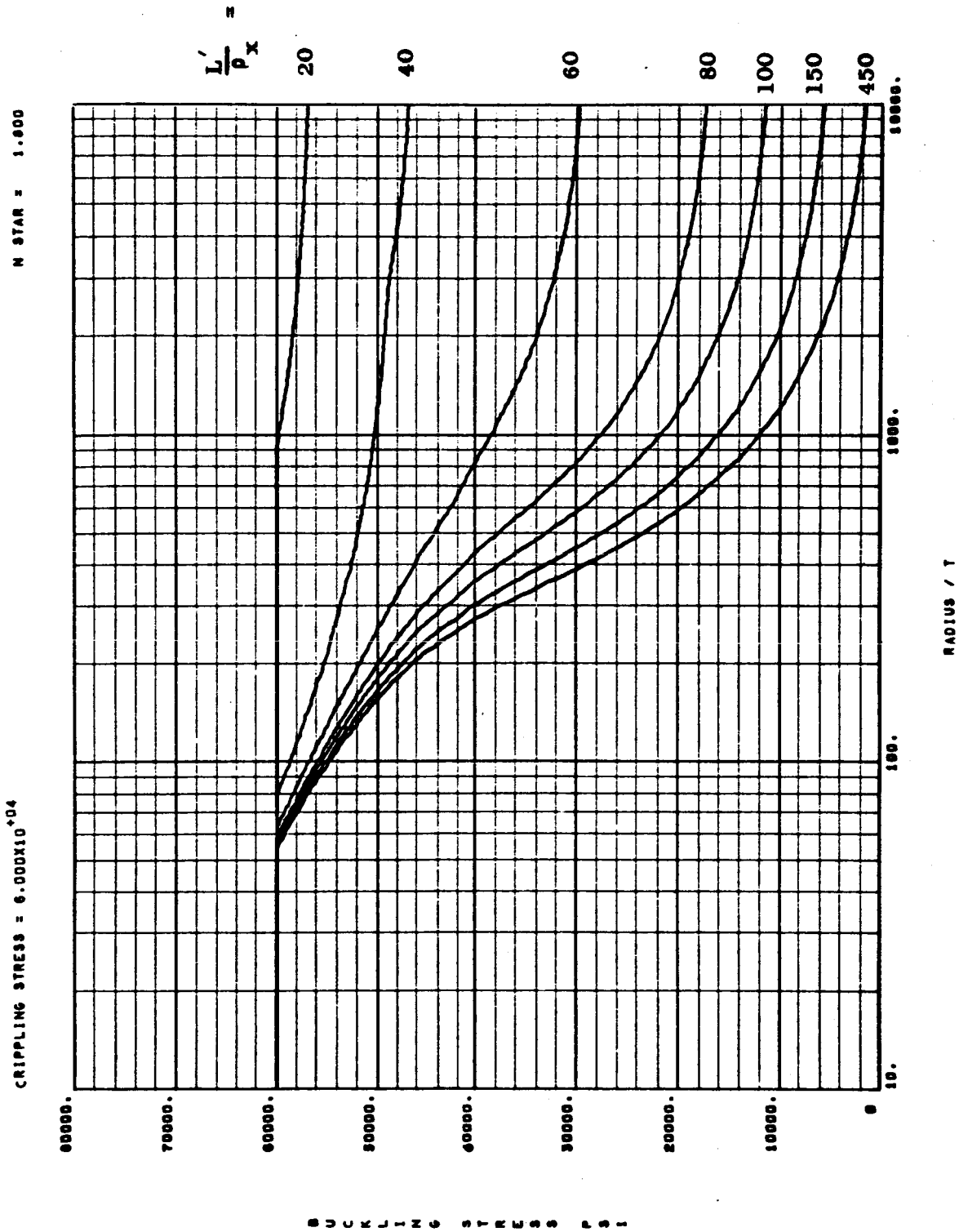
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY

Figure 17(h)



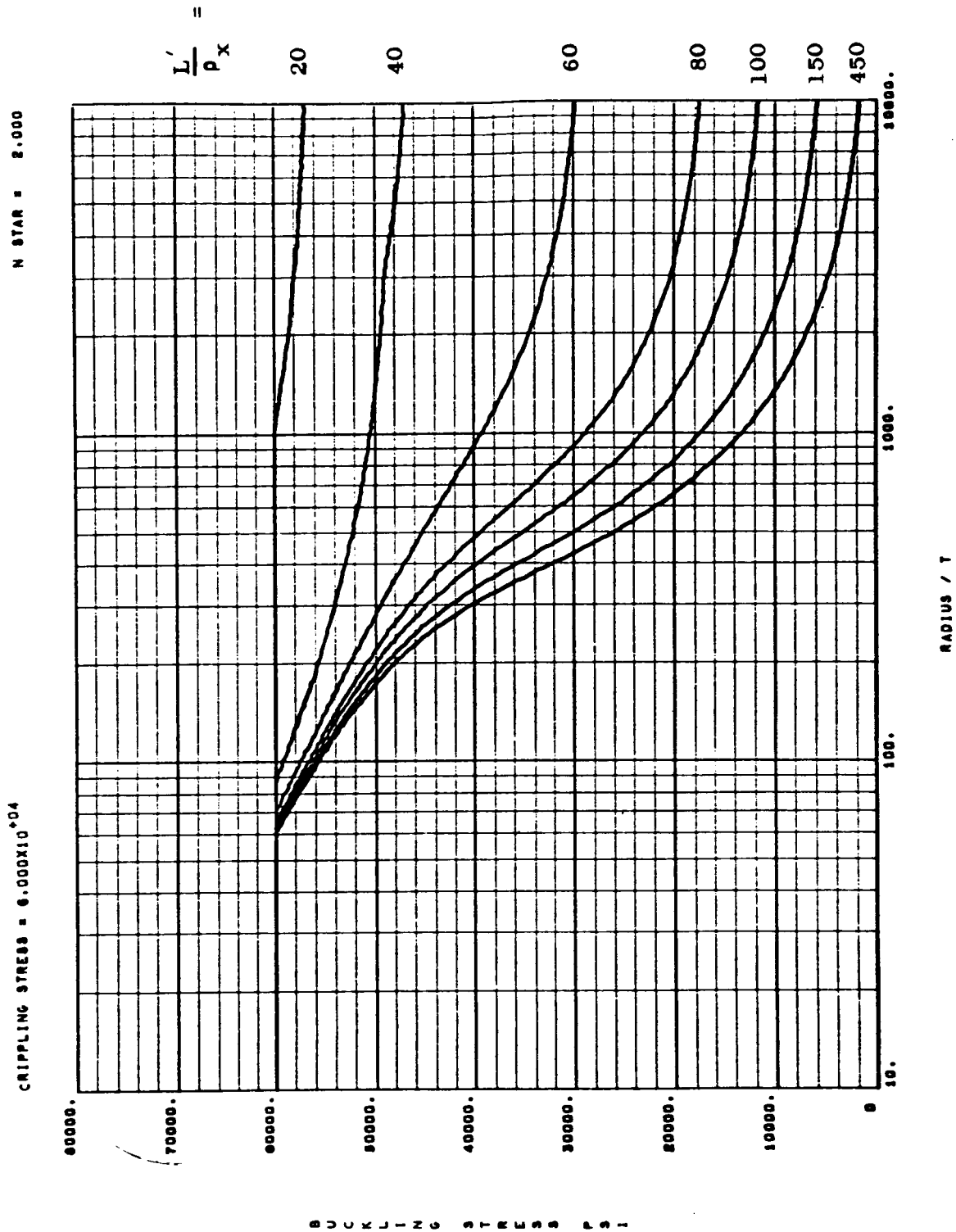
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY

Figure 17(i)



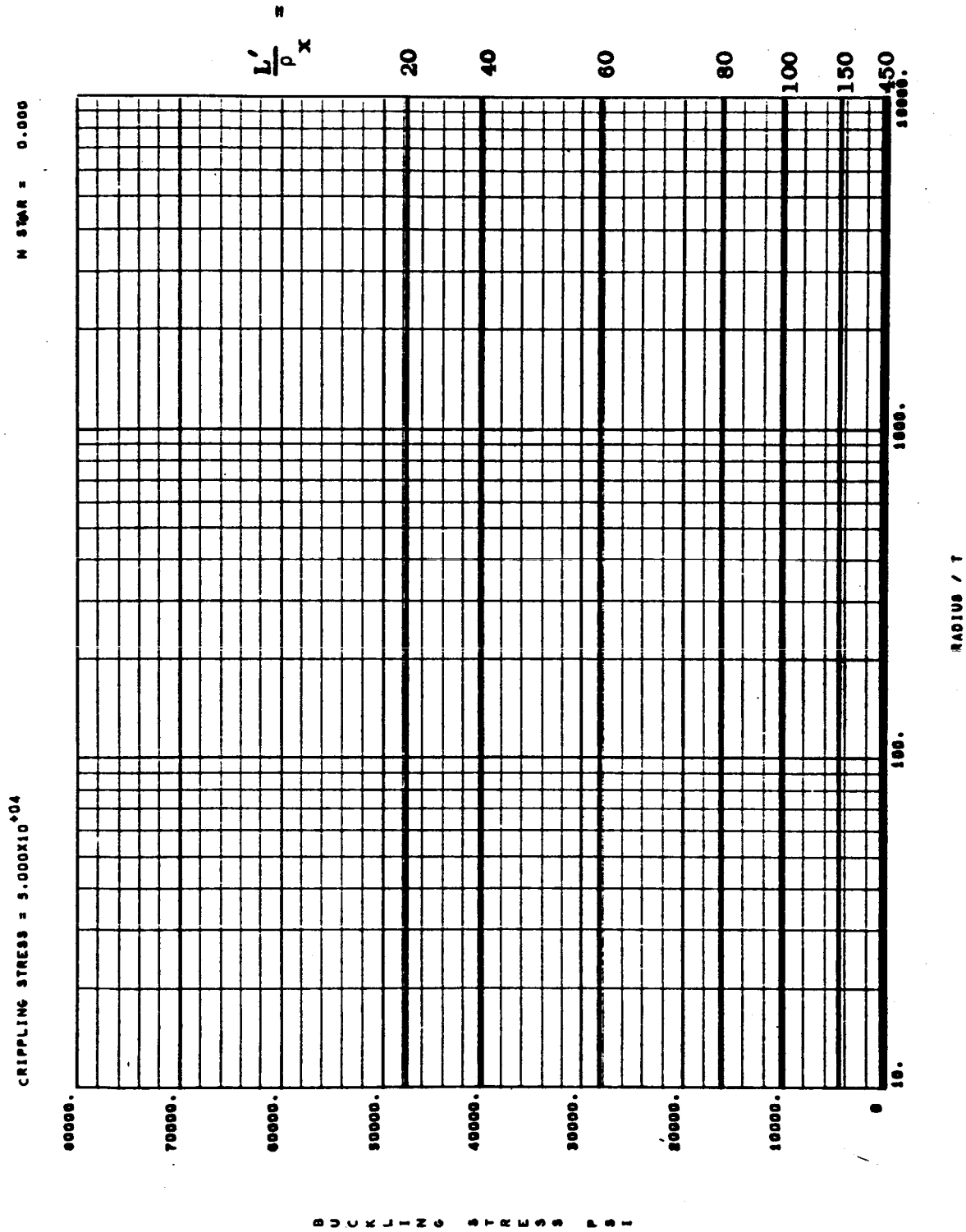
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY

Figure 17(j)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY

Figure 17(k)

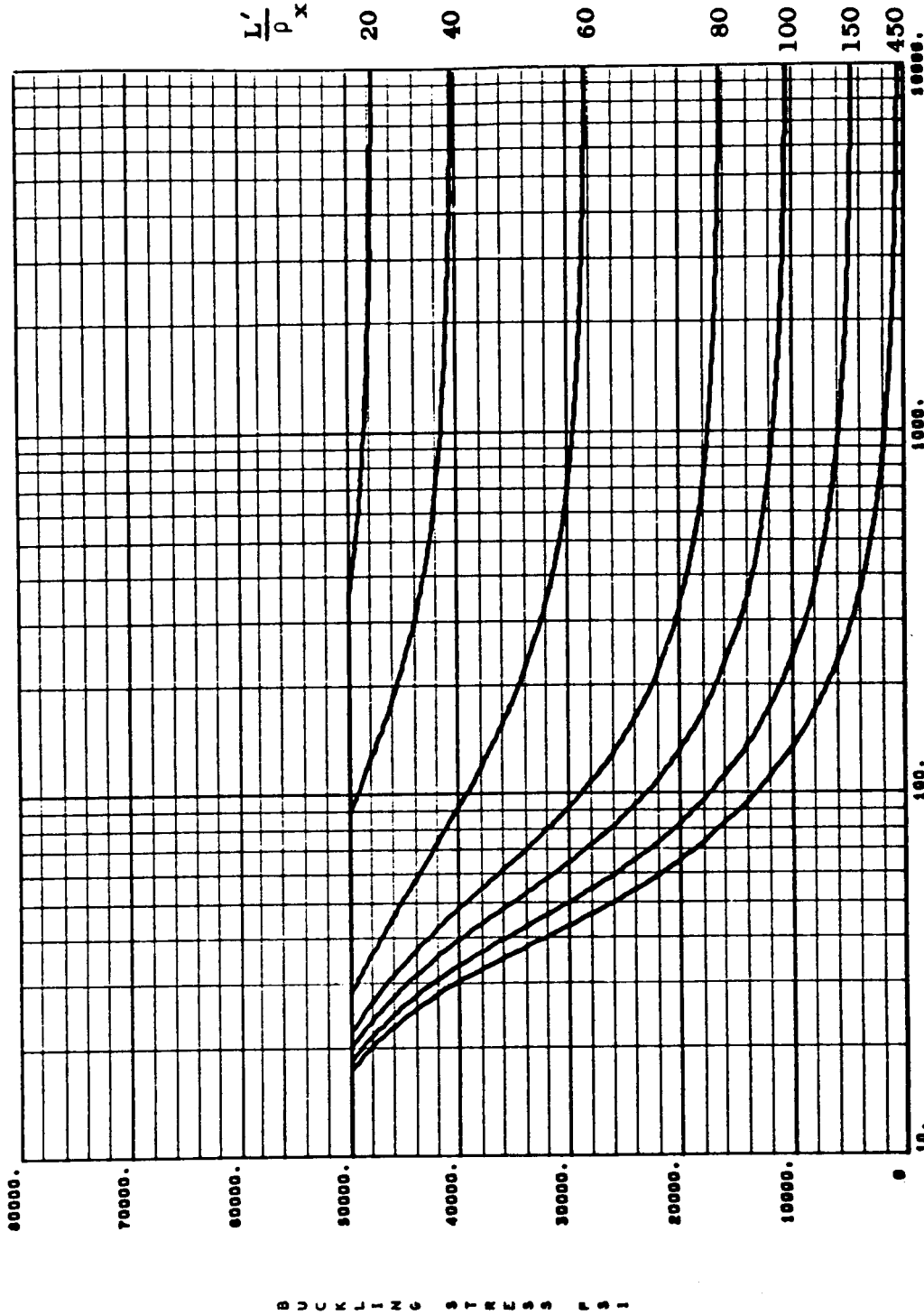


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY

Figure 18(a)

N STAR = 0.800

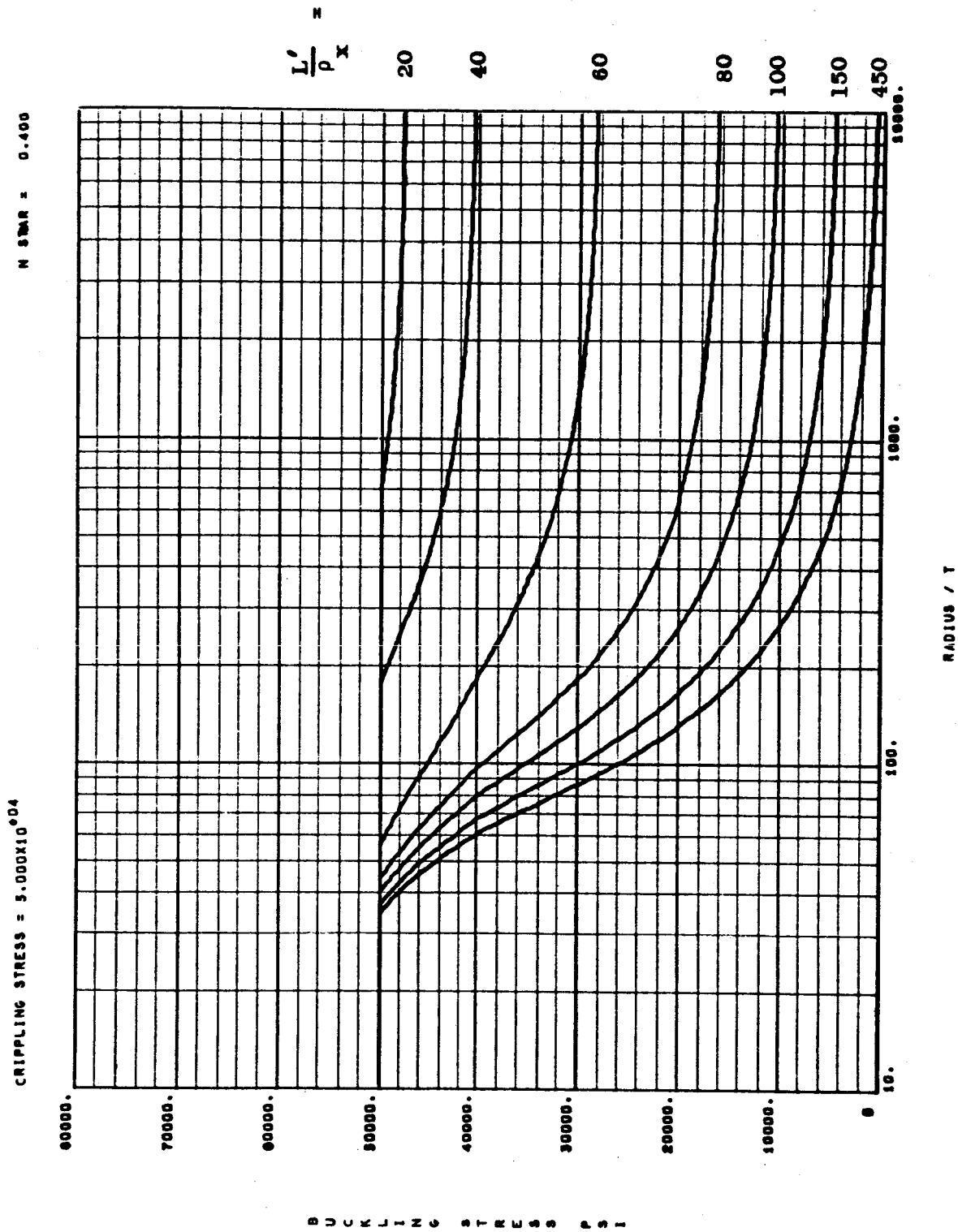
CRIPPLING STRESS = 5.000×10^4



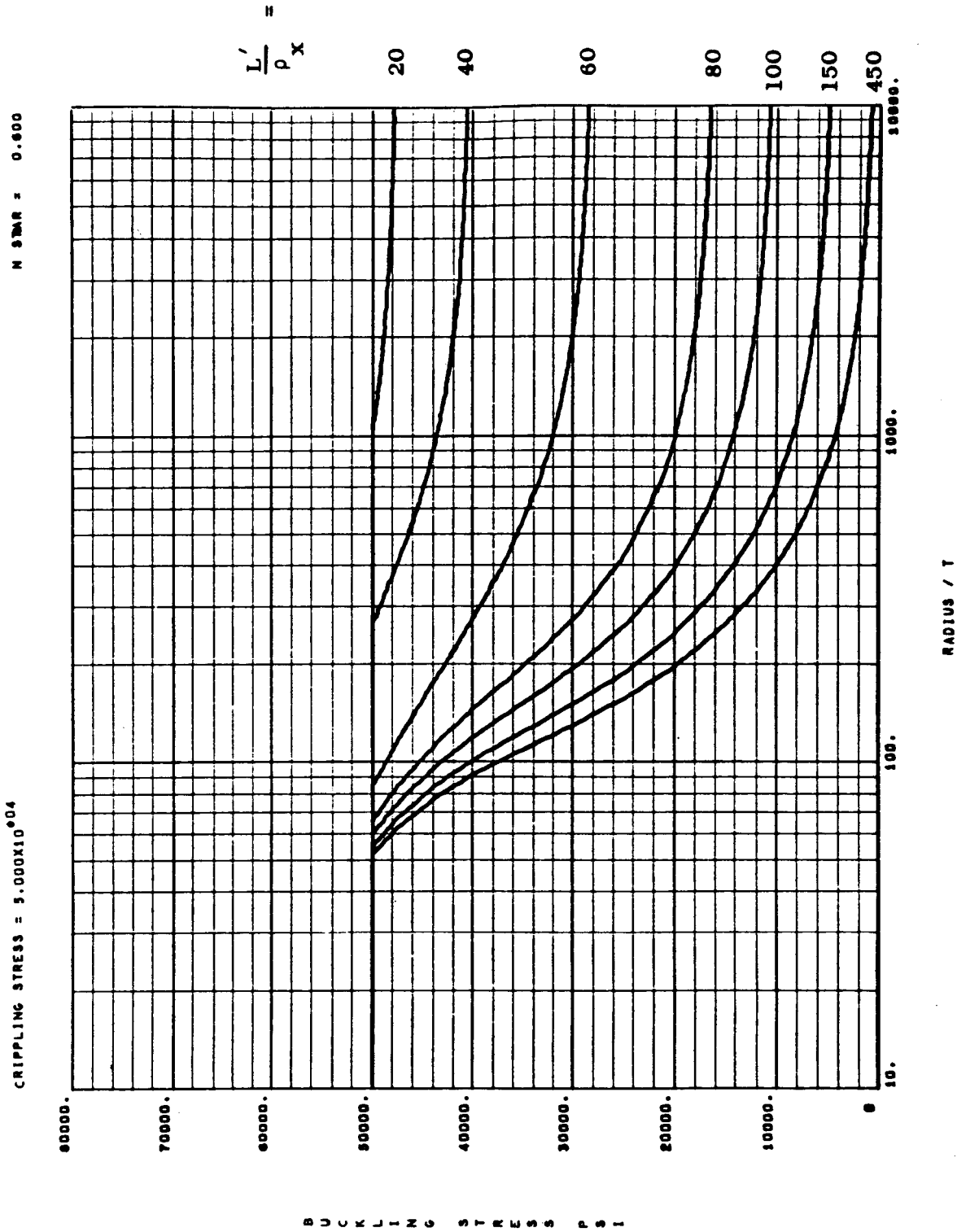
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COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY

Figure 18(b)

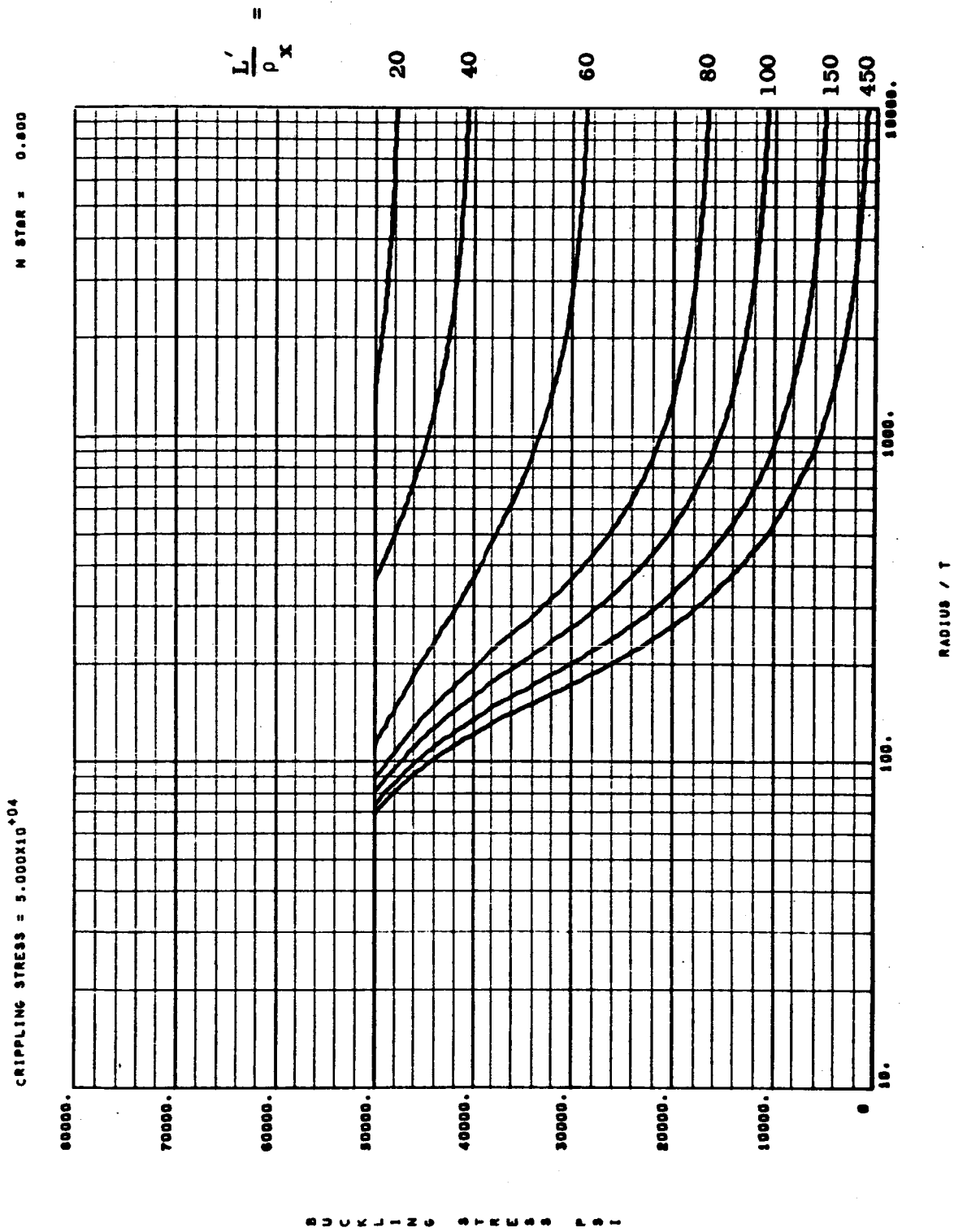


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY
Figure 18(c)



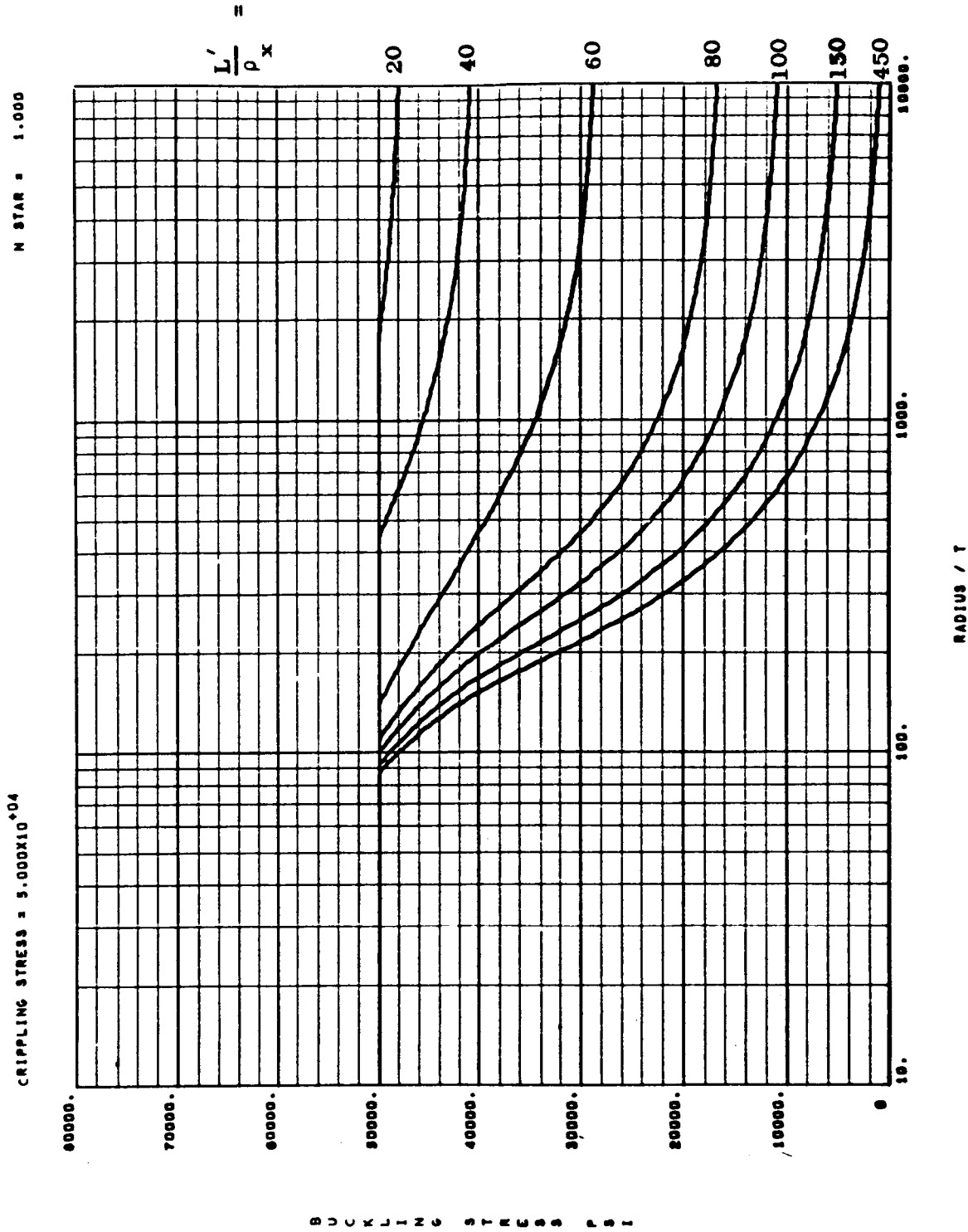
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY

Figure 18(d)



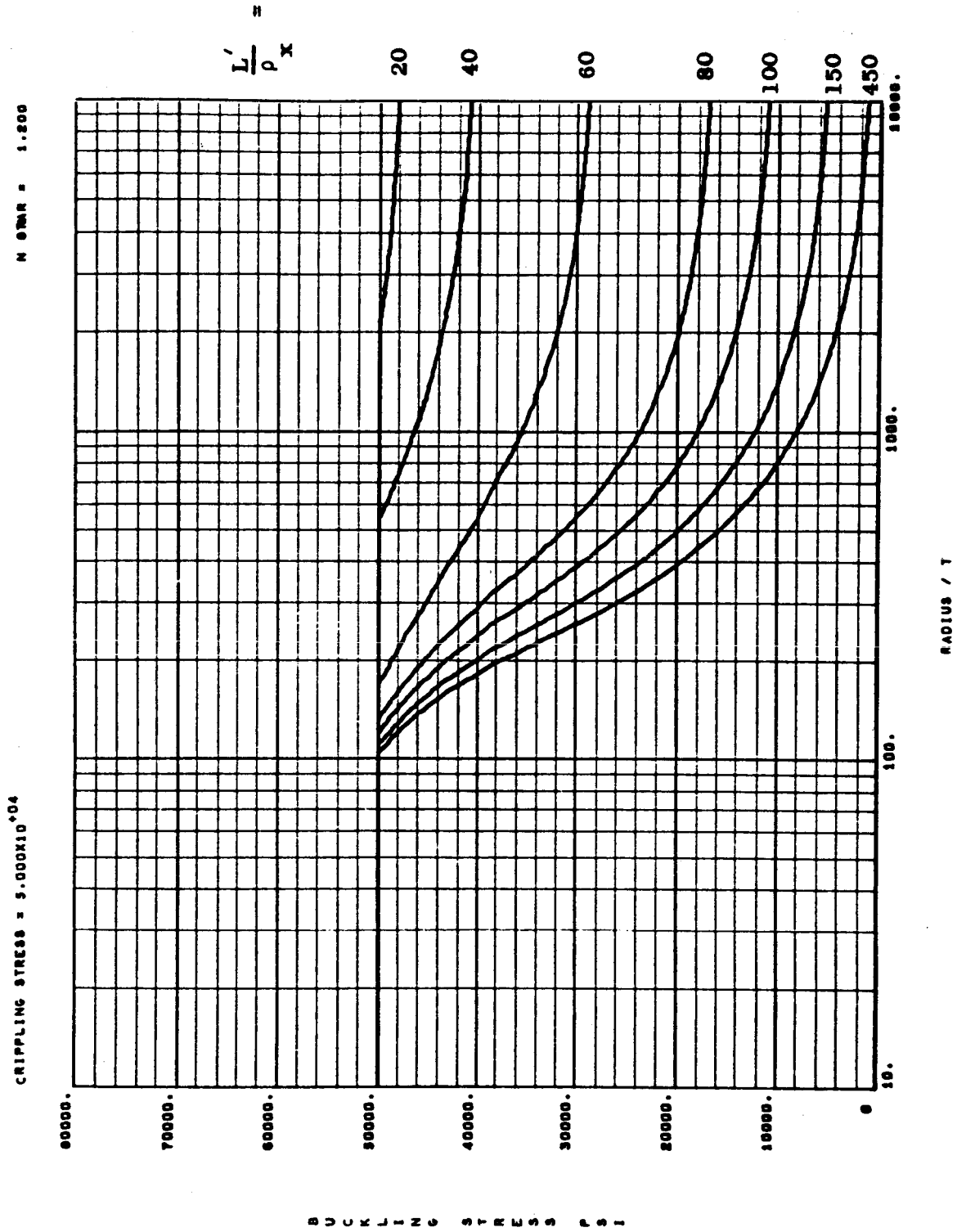
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY

Figure 18(e)



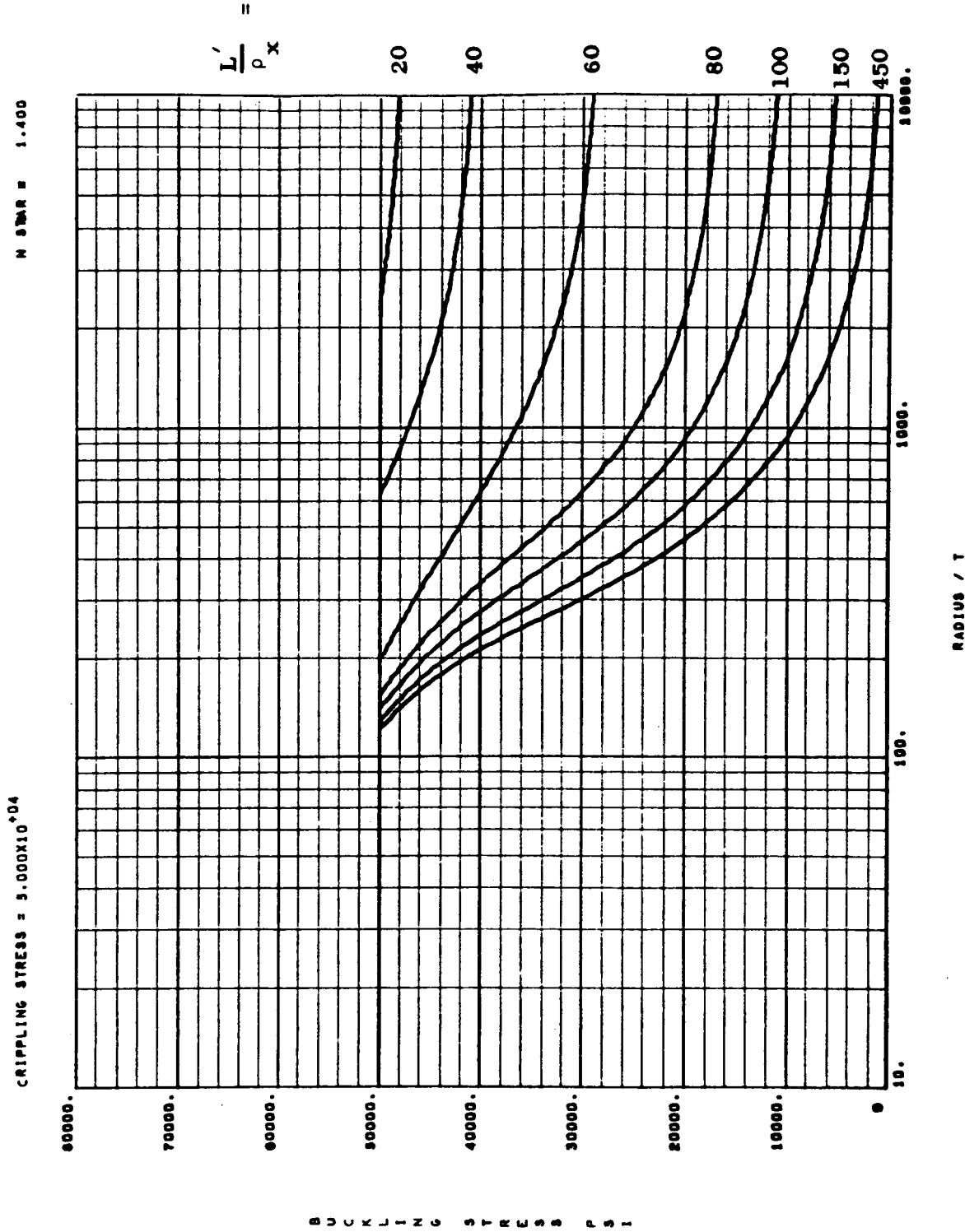
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY

Figure 18(f)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY

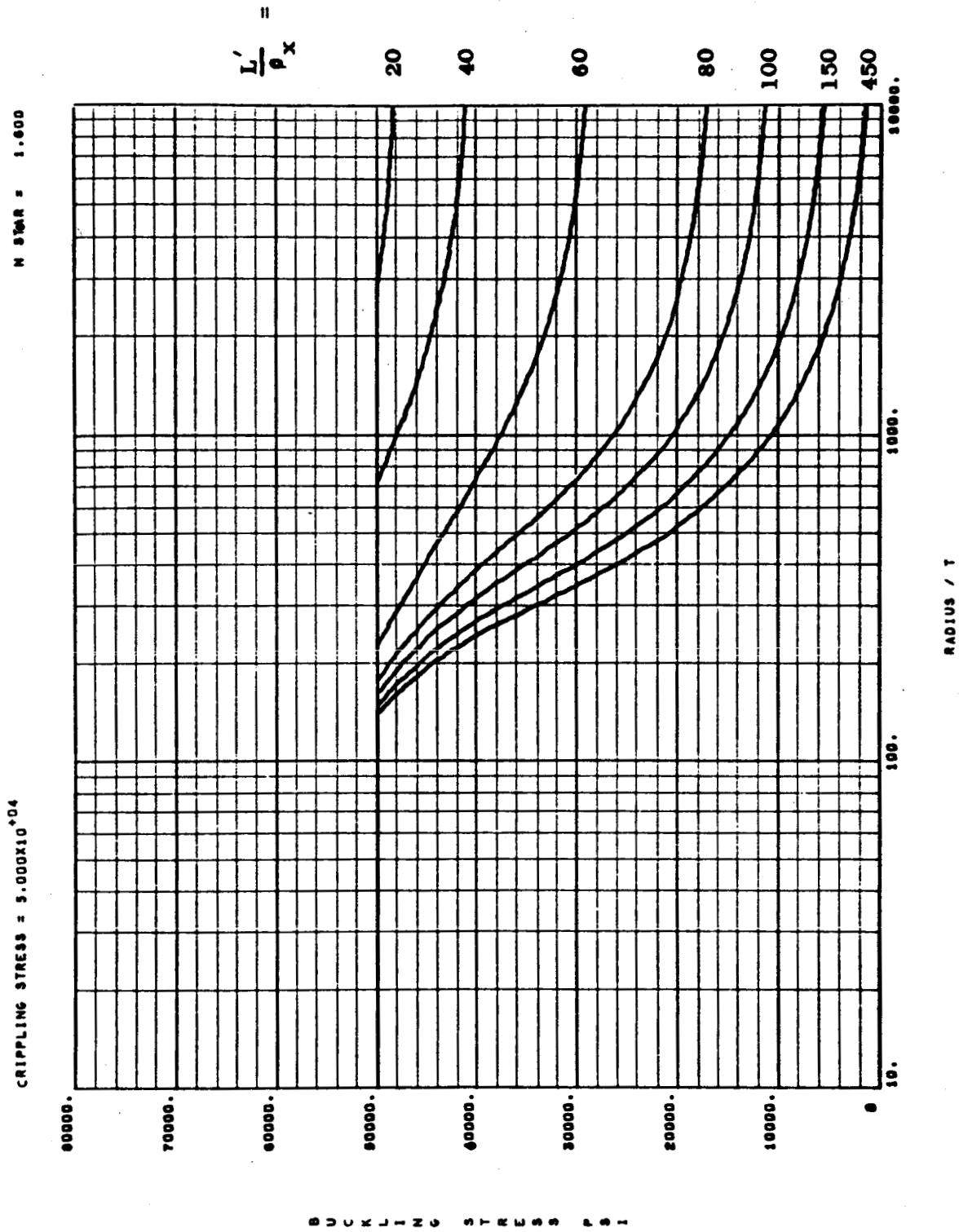
Figure 18(g)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS

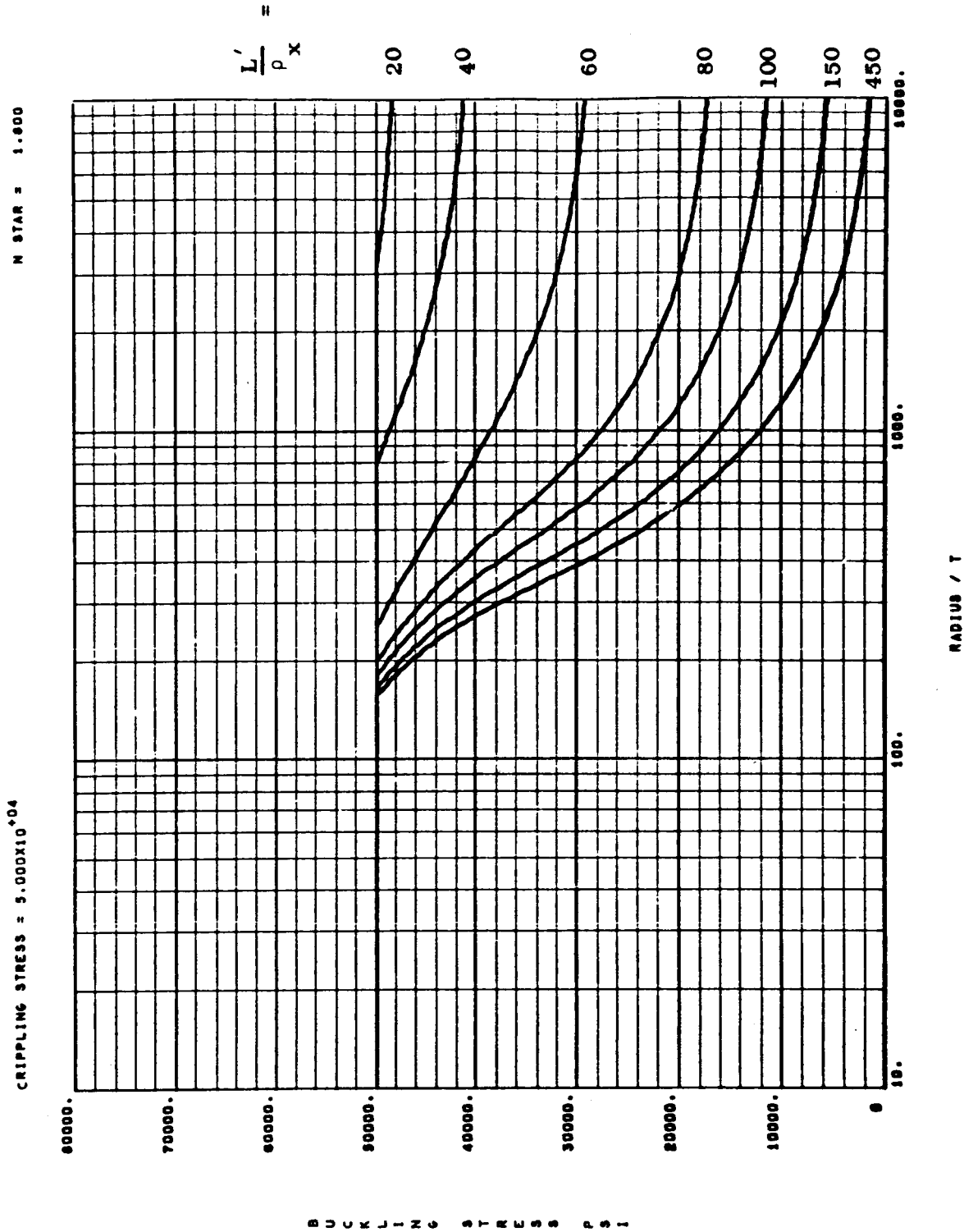
MATERIAL - 7075-T6 ALUMINUM ALLOY

Figure 18(h)



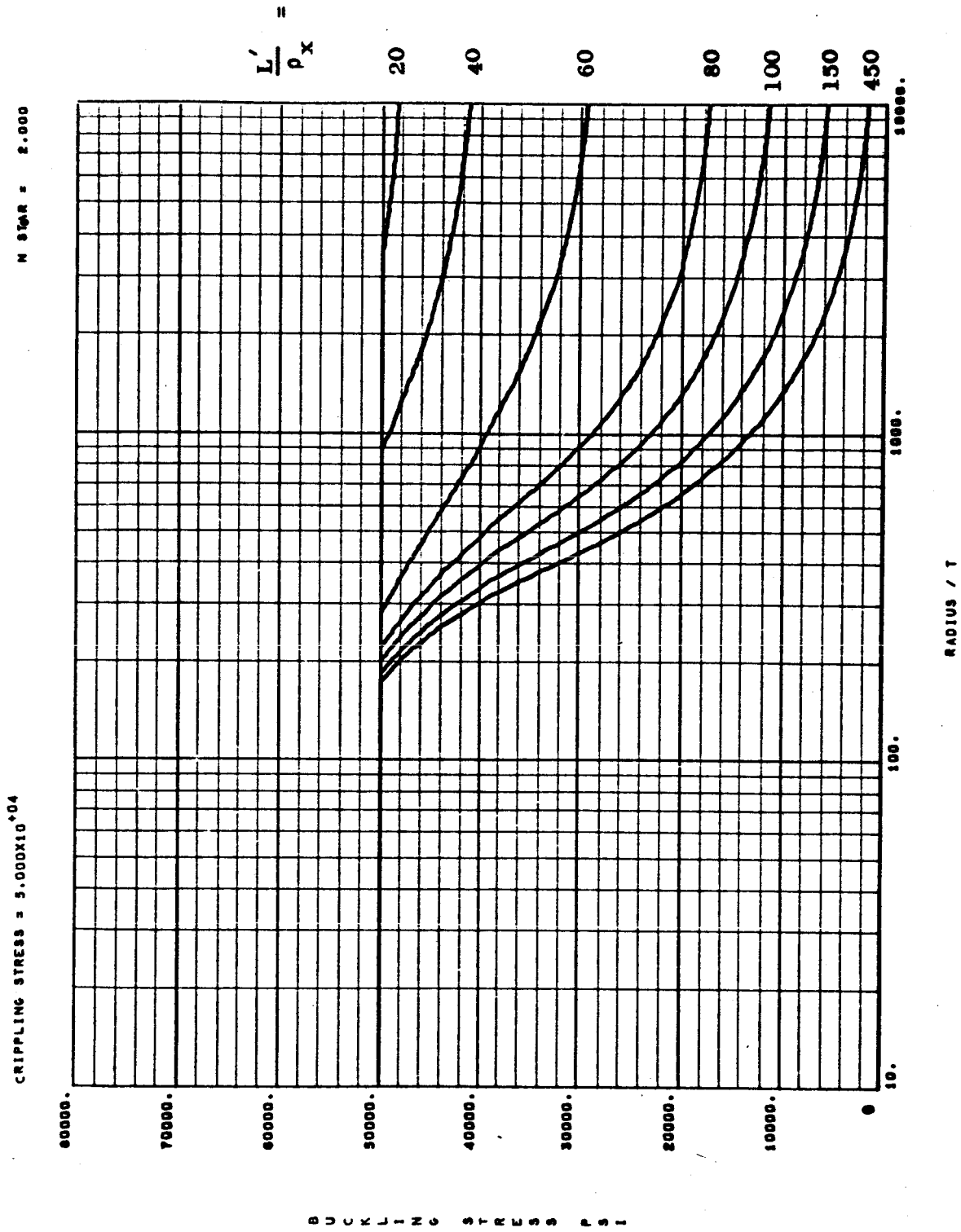
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY

Figure 18(i)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY

Figure 18(j)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 7075-T6 ALUMINUM ALLOY

Figure 18(k)

A.2.2 6Al-4V TITANIUM ALLOY (Annealed)

Table XVI lists the families provided here for longitudinally stiffened cylinders made of annealed 6Al-4V titanium alloy. These curves are based upon the following values for the indicated material properties:

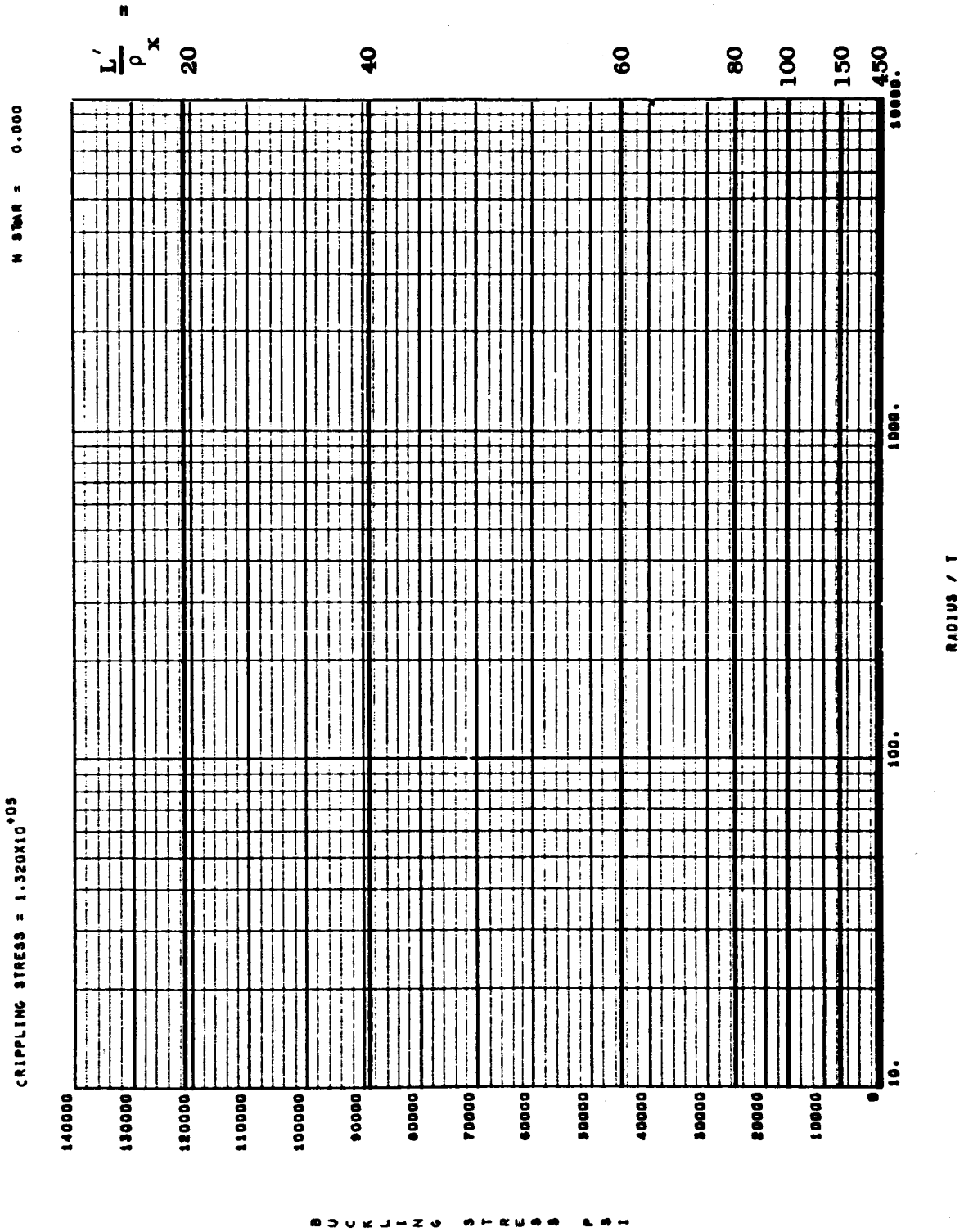
$$\begin{aligned}
 E &= 16.4 \times 10^6 \text{ psi} \\
 \nu &= .30 \\
 \sigma_{cy} &= 132,000 \text{ psi} \\
 \text{Ramberg-Osgood } n &= 35 \\
 \text{Ramberg-Osgood } \sigma_{.7} &= 133,500 \text{ psi}
 \end{aligned}$$

TABLE XVI - Table of Contents for Supplementary
Curves of Compressive Buckling Stress
for Longitudinally Stiffened Cylinders;
Material - 6Al-4V Titanium Alloy (Annealed)

<u>Figure Number</u>	<u>Crippling Stress, σ_{cc}</u>	<u>N*</u>	<u>Page</u>
19(a)	132,000	0.0	A-43
19(b)	132,000	0.2	A-44
19(c)	132,000	0.4	A-45
19(d)	132,000	0.6	A-46
19(e)	132,000	0.8	A-47
19(f)	132,000	1.0	A-48
19(g)	132,000	1.2	A-49
19(h)	132,000	1.4	A-50
19(i)	132,000	1.6	A-51
19(j)	132,000	1.8	A-52
19(k)	132,000	2.0	A-53
20(a)	110,000	0.0	A-54
20(b)	110,000	0.2	A-55
20(c)	110,000	0.4	A-56
20(d)	110,000	0.6	A-57
20(e)	110,000	0.8	A-58
20(f)	110,000	1.0	A-59
20(g)	110,000	1.2	A-60
20(h)	110,000	1.4	A-61
20(i)	110,000	1.6	A-62
20(j)	110,000	1.8	A-63
20(k)	110,000	2.0	A-64

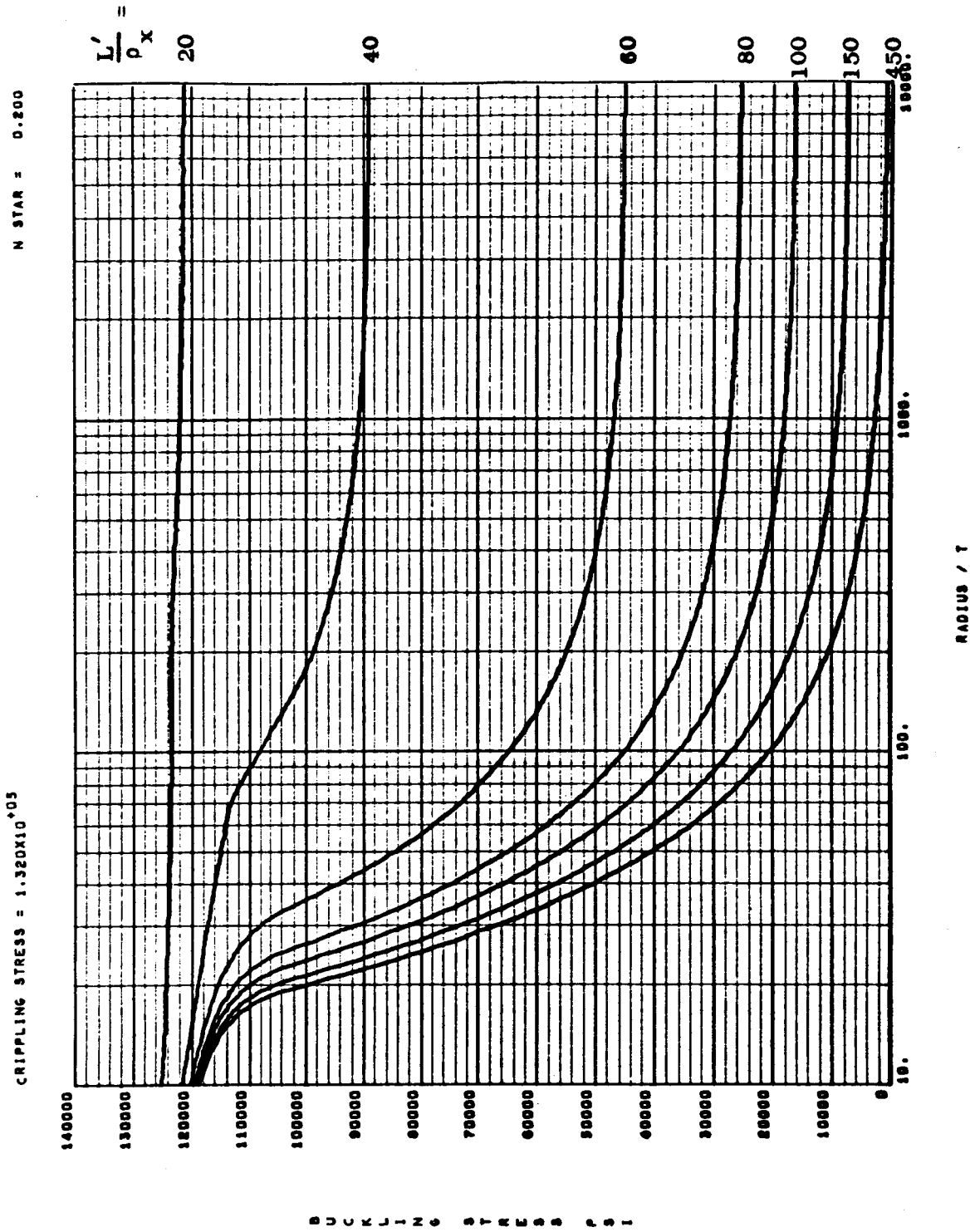
TABLE XVI - Table of Contents for Supplementary Curves
of Compressive Buckling Stress for
Longitudinally Stiffened Cylinders; Material -
6Al-4V Titanium Alloy (Annealed); (Continued)

<u>Figure Number</u>	<u>Crippling Stress, σ_{cc}</u>	<u>N*</u>	<u>Page</u>
21(a)	90,000	0.0	A-65
21(b)	90,000	0.2	A-66
21(c)	90,000	0.4	A-67
21(d)	90,000	0.6	A-68
21(e)	90,000	0.8	A-69
21(f)	90,000	1.0	A-70
21(g)	90,000	1.2	A-71
21(h)	90,000	1.4	A-72
21(i)	90,000	1.6	A-73
21(j)	90,000	1.8	A-74
21(k)	90,000	2.0	A-75



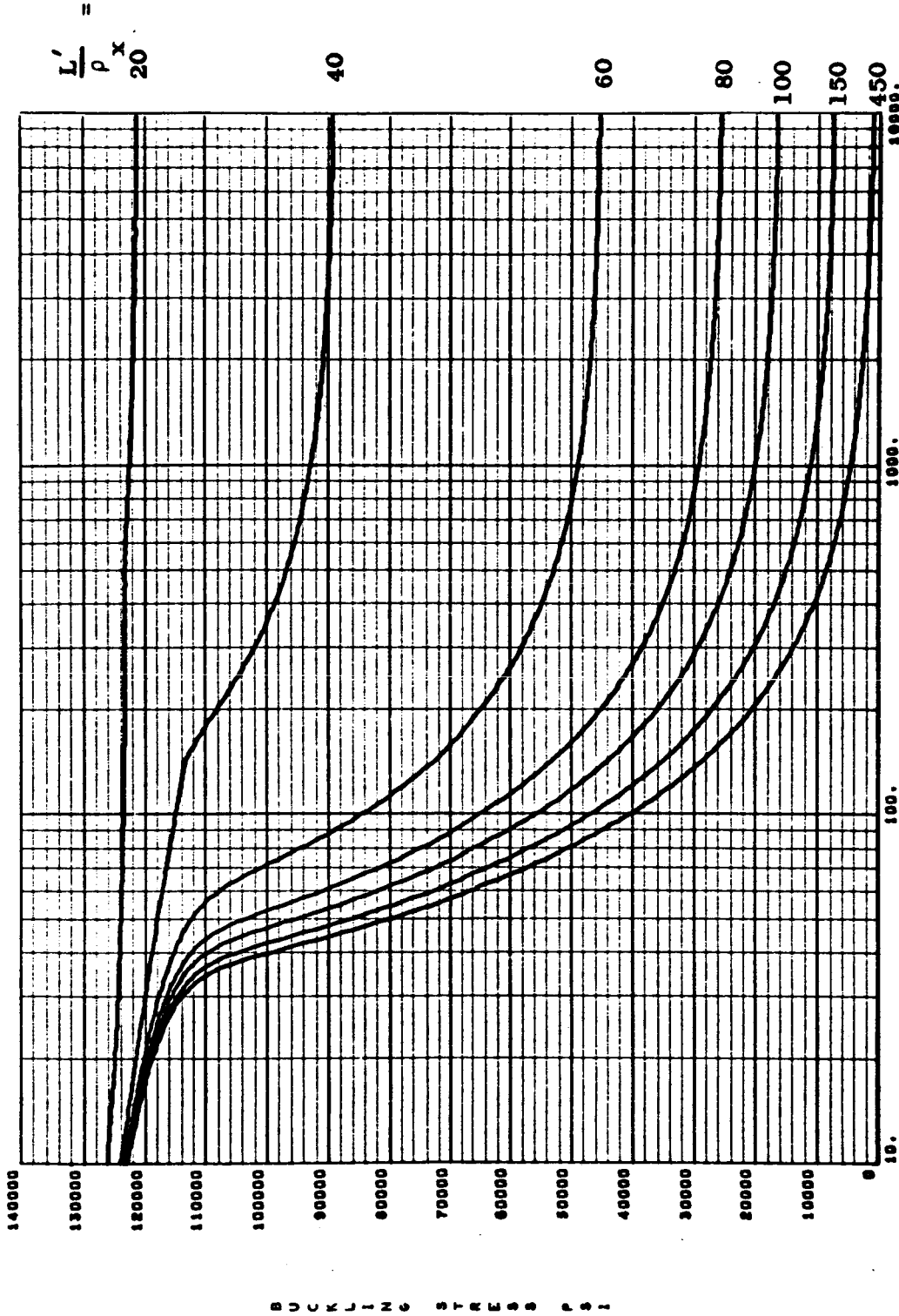
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6A1-4V TITANIUM ALLOY (ANNEALED)

Figure 19(a)



N STAR = 0.400

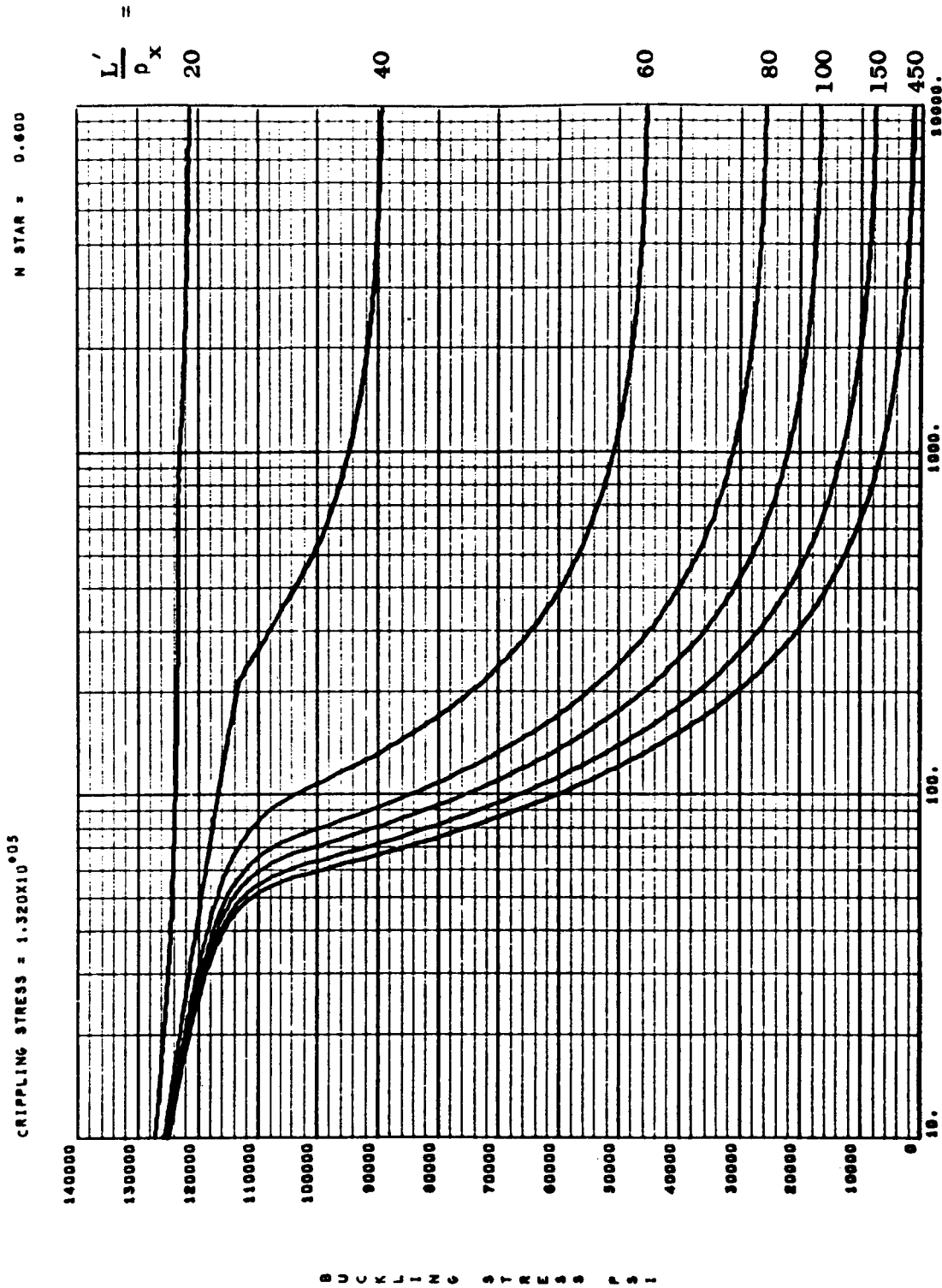
CRIPPLING STRESS = 1.32×10^5



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COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

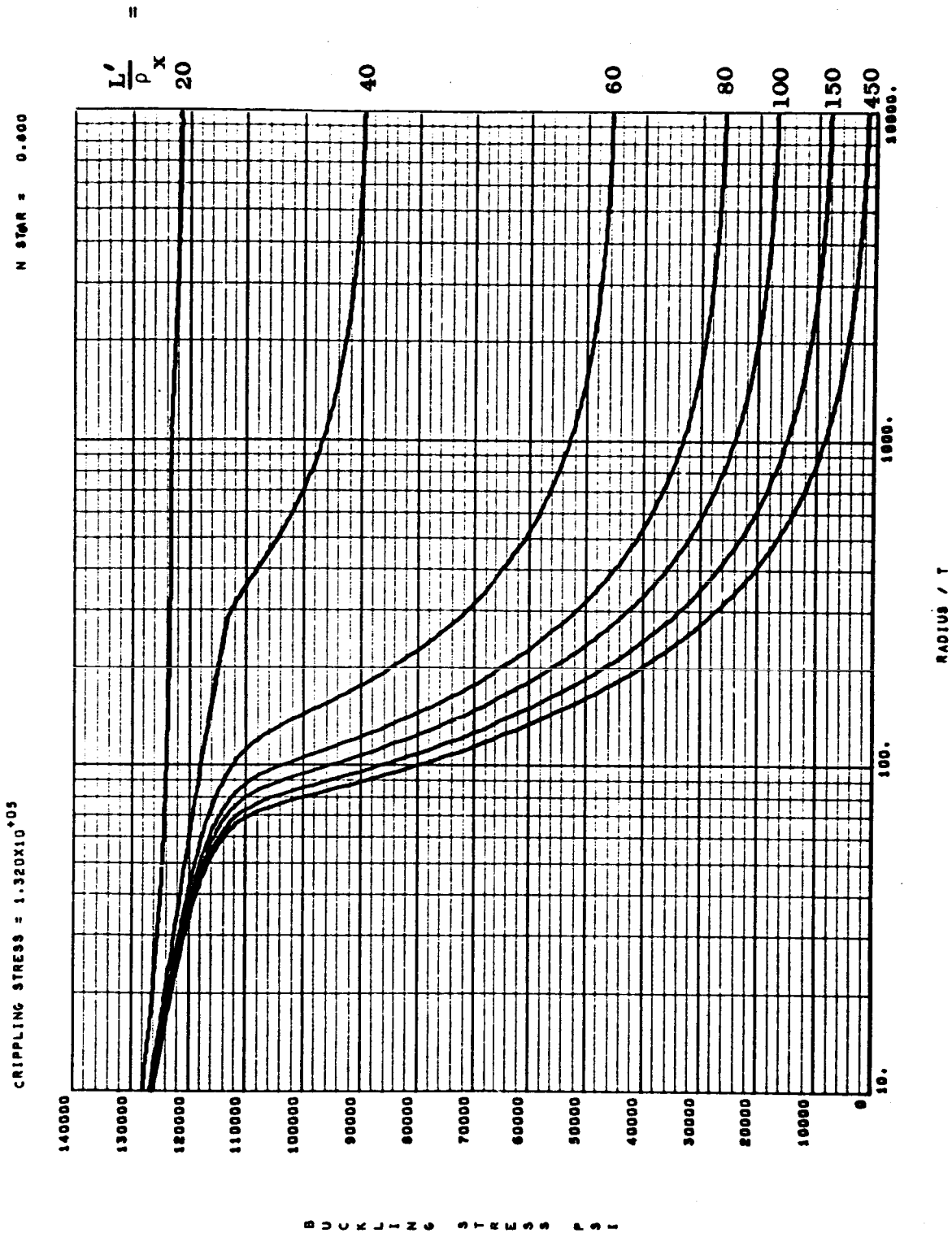
Figure 19(c)



RADIUS / T

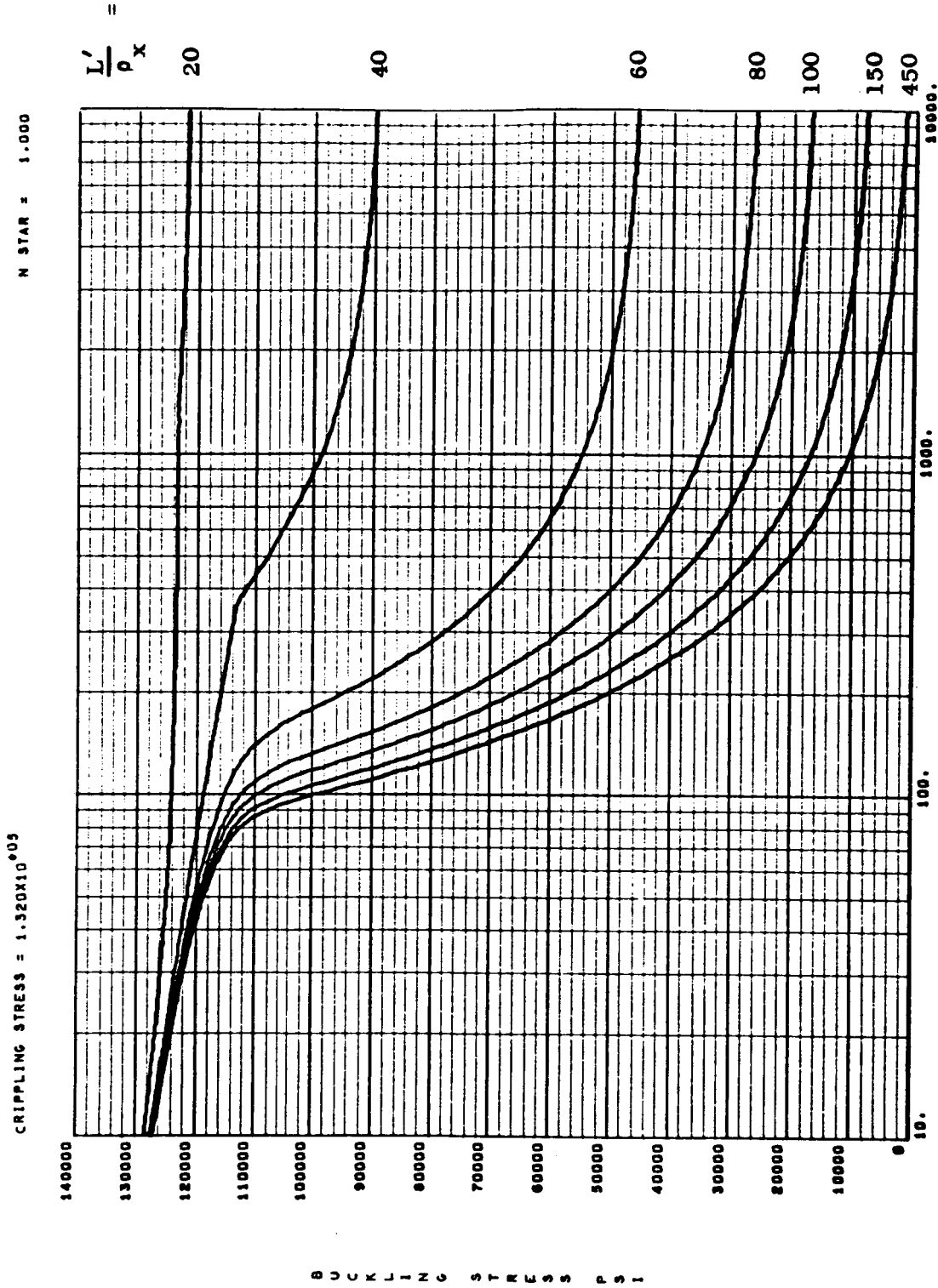
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 19(d)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL -6Al-4V TITANIUM ALLOY (ANNEALED)

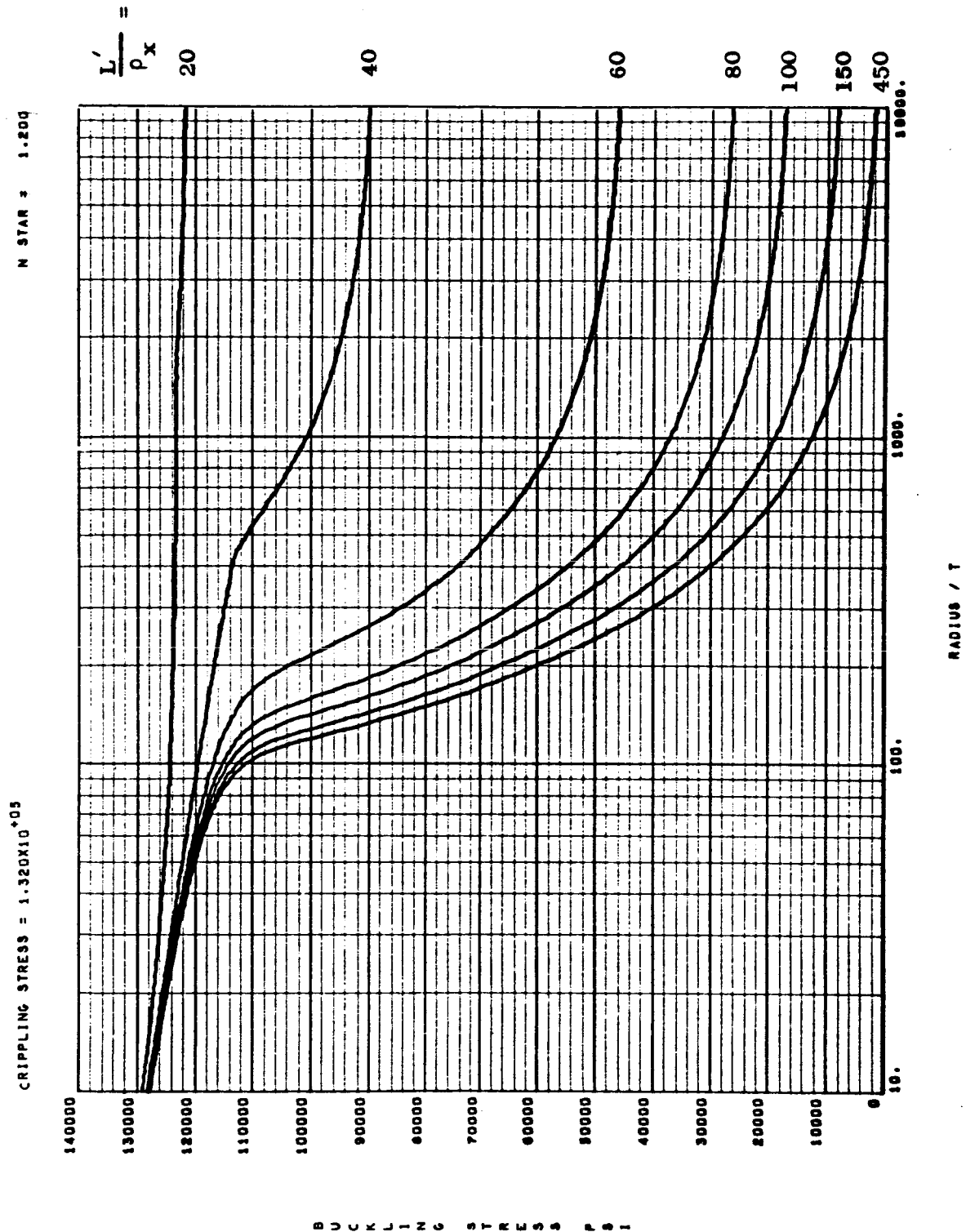
Figure 19(e)



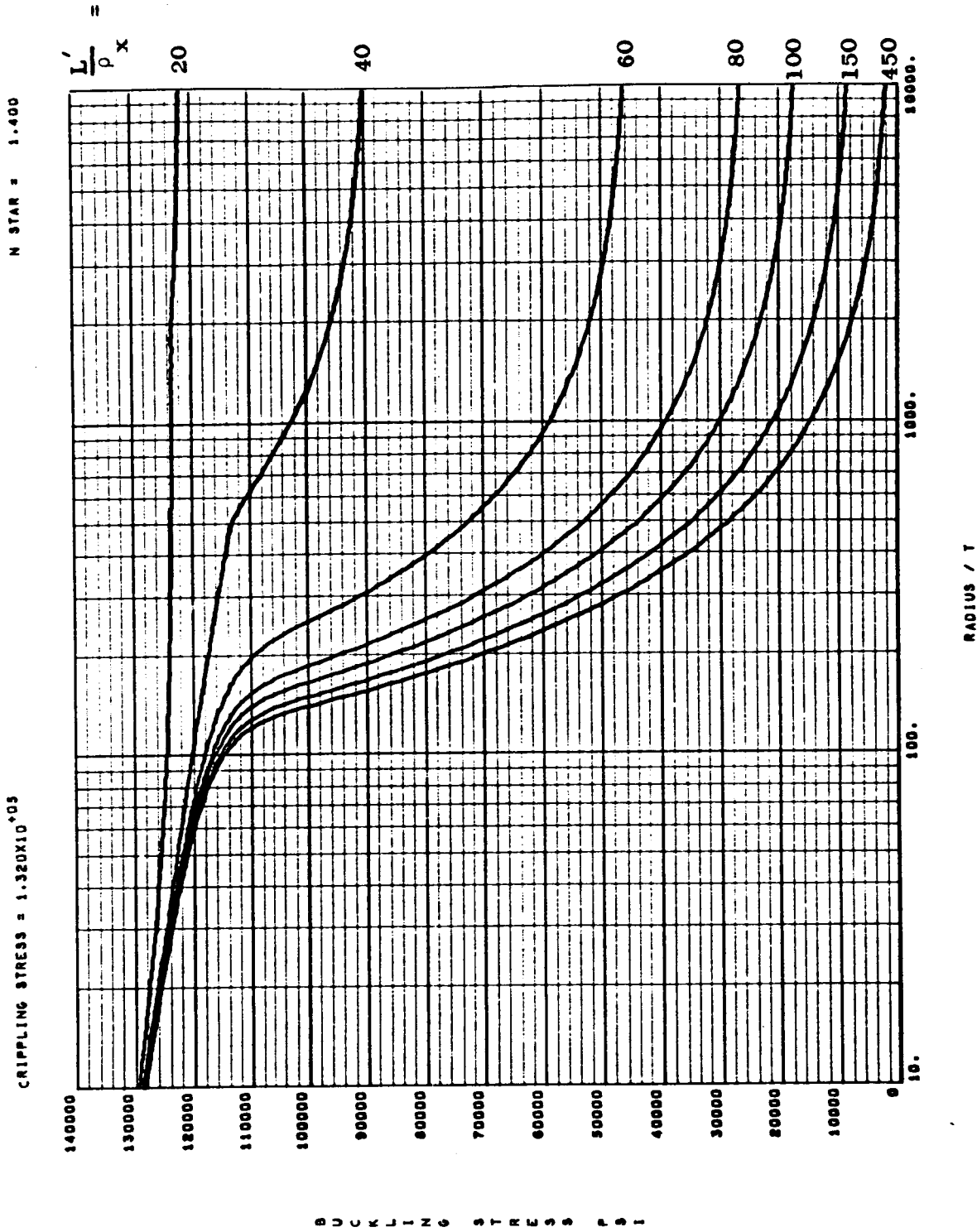
RADIUS / T

COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 19(f)

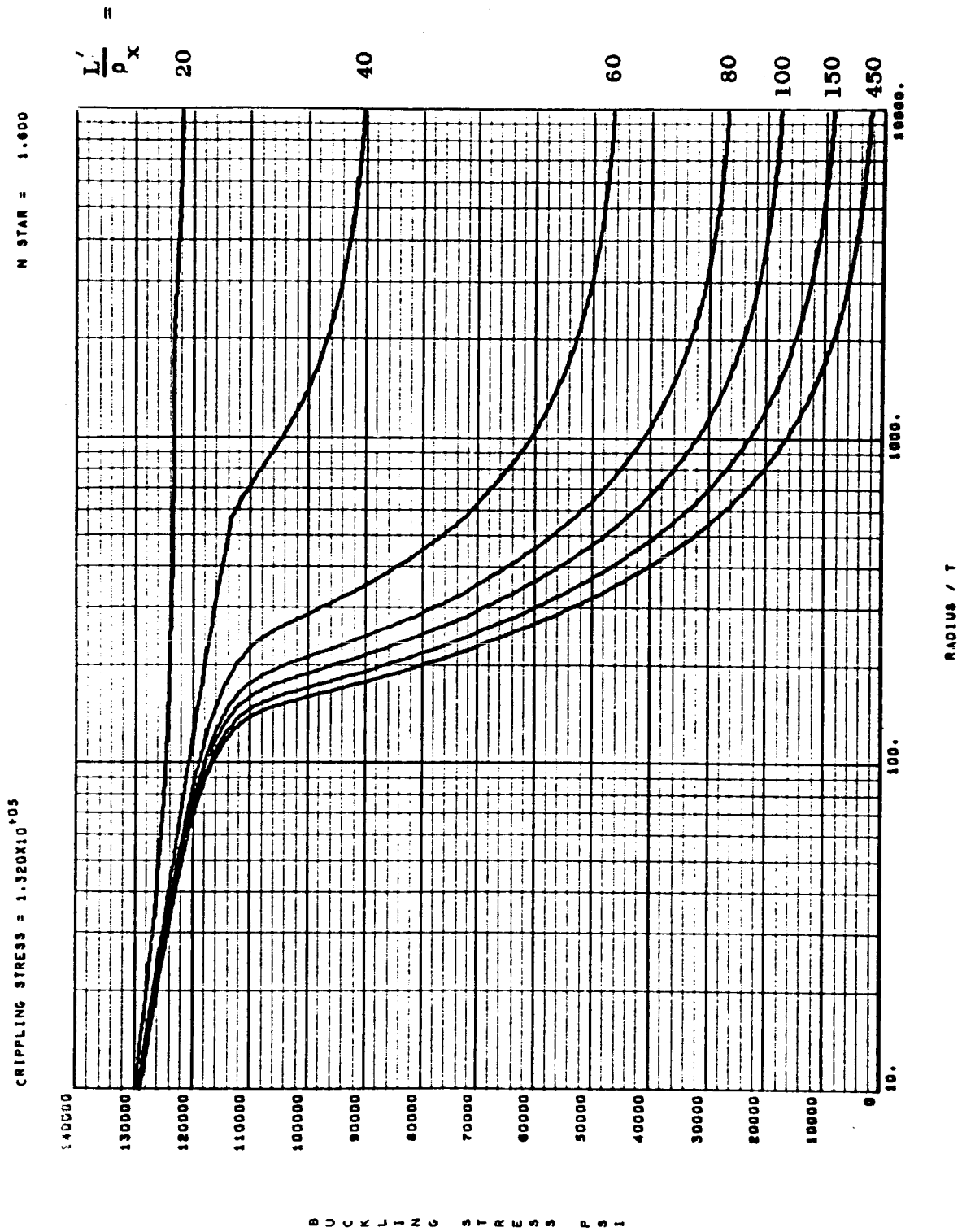


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)
Figure 19(g)



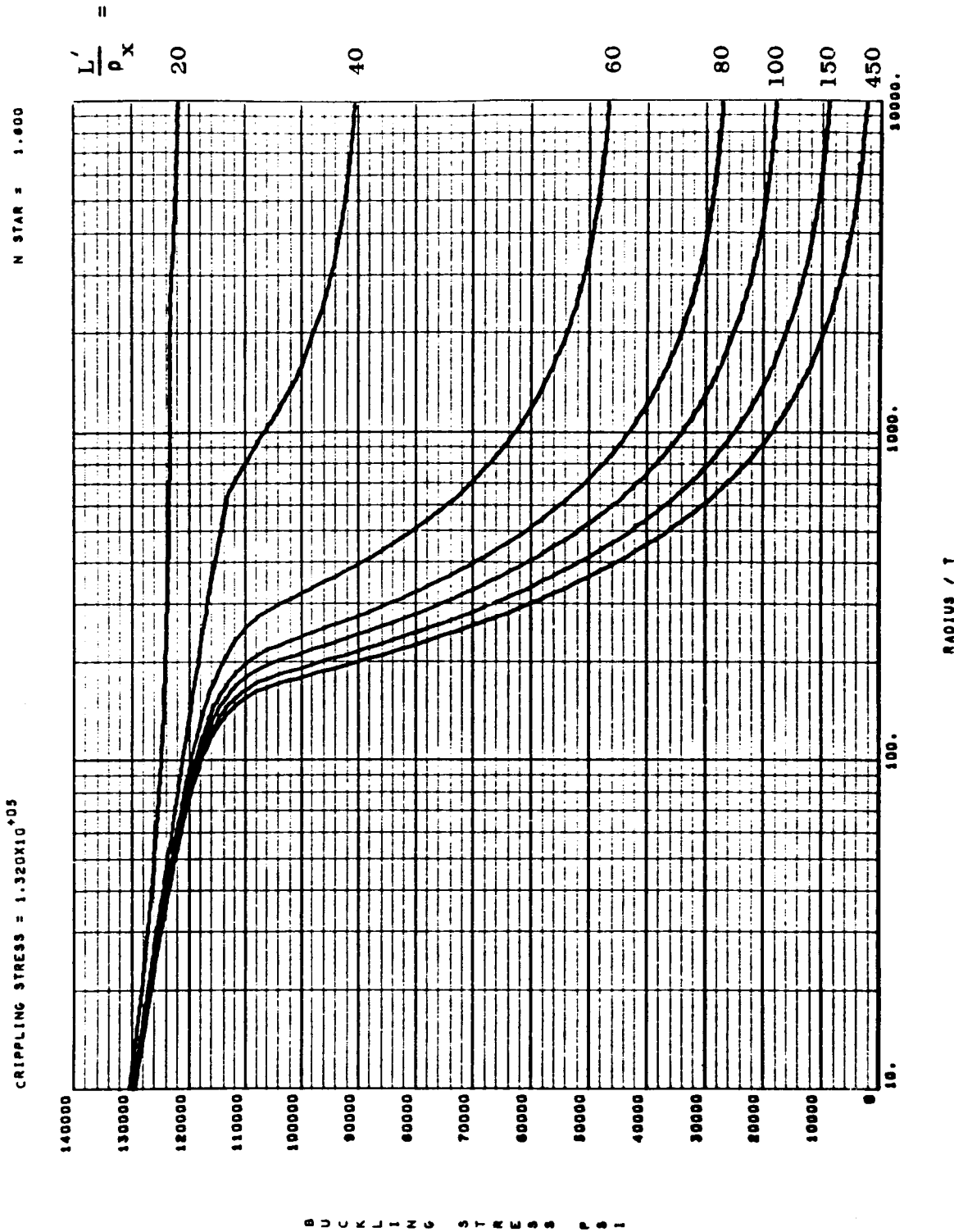
COMPRESSION BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 19(h)

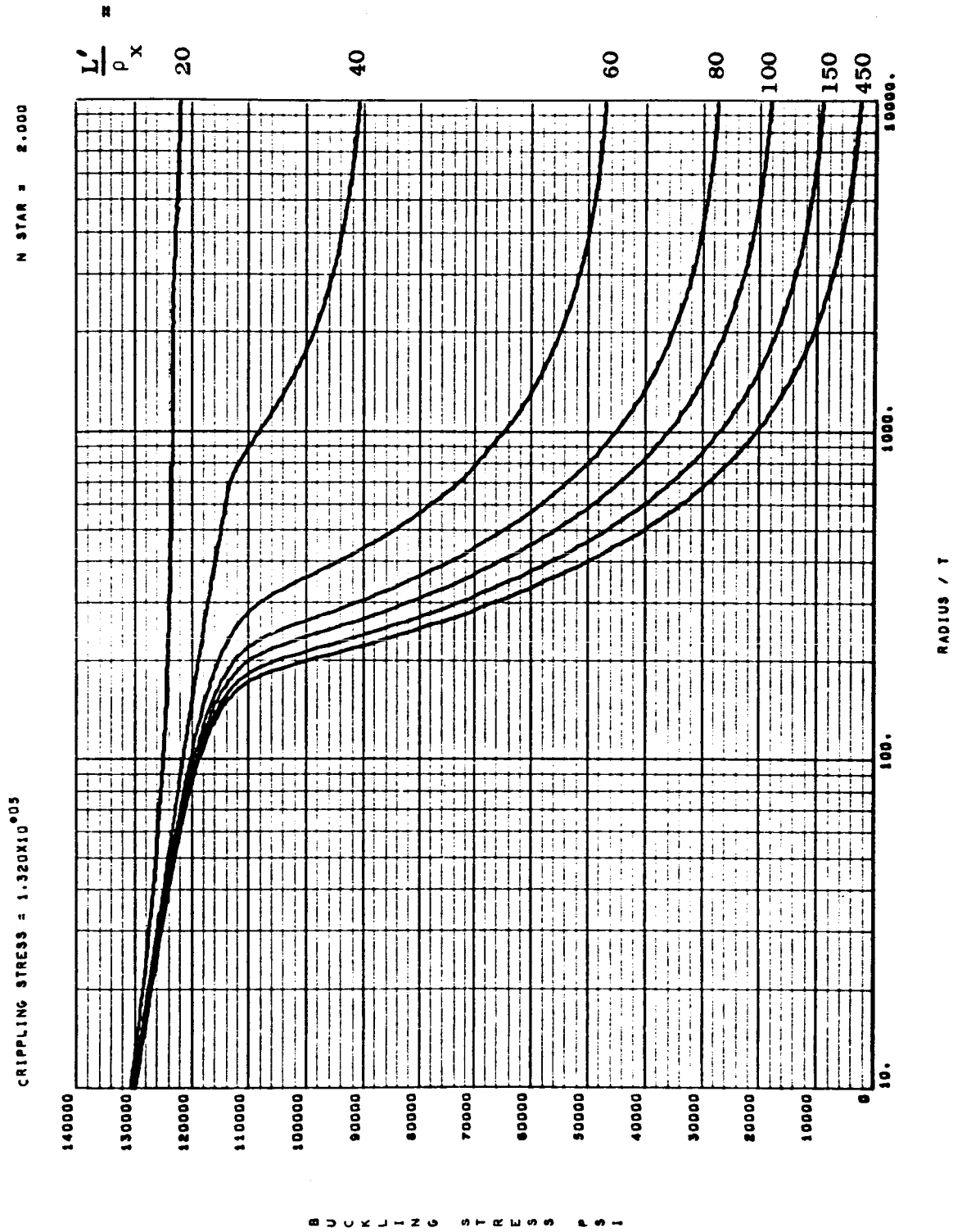


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 19(i)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)
Figure 19(j)

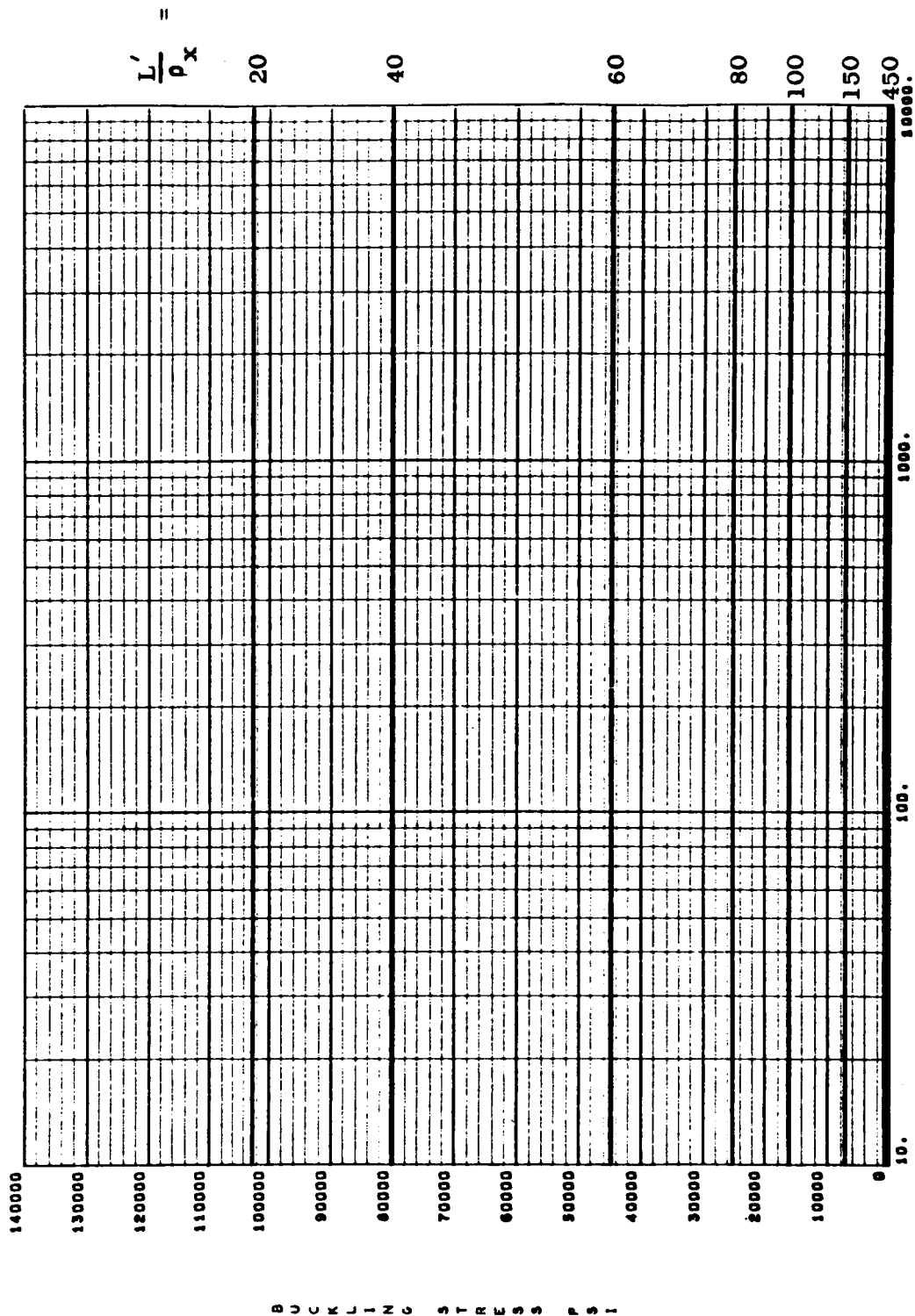


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6AL-4V TITANIUM ALLOY (ANNEALED)

Figure 19(k)

CRIPPLING STRESS = 1.100×10^{-05}

N STAR = 0.000



B U C C K L I N G S T R E S S P S I

$$\frac{L'}{p \times} =$$

20

40

60

80

100

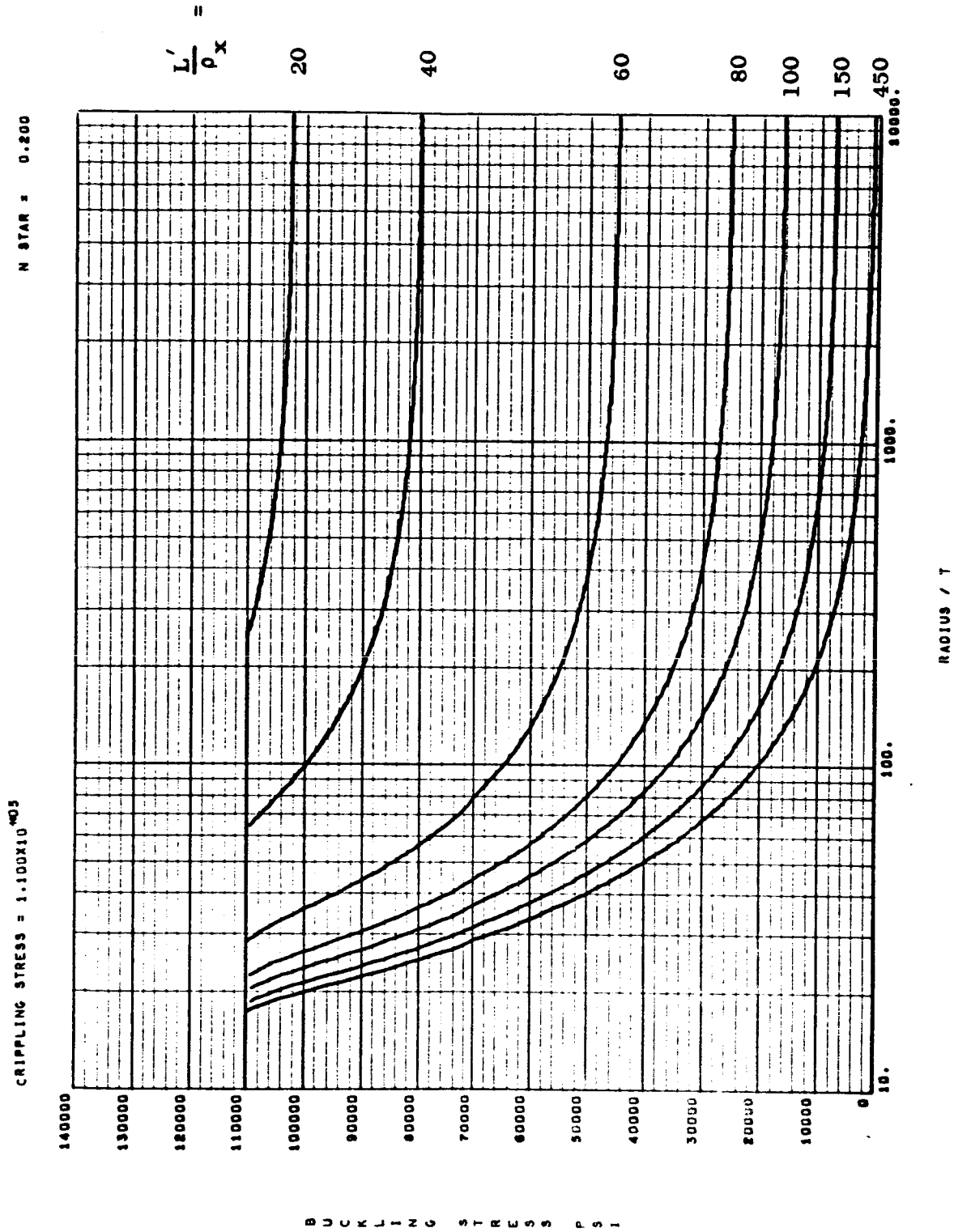
150

450

RADIUS / T

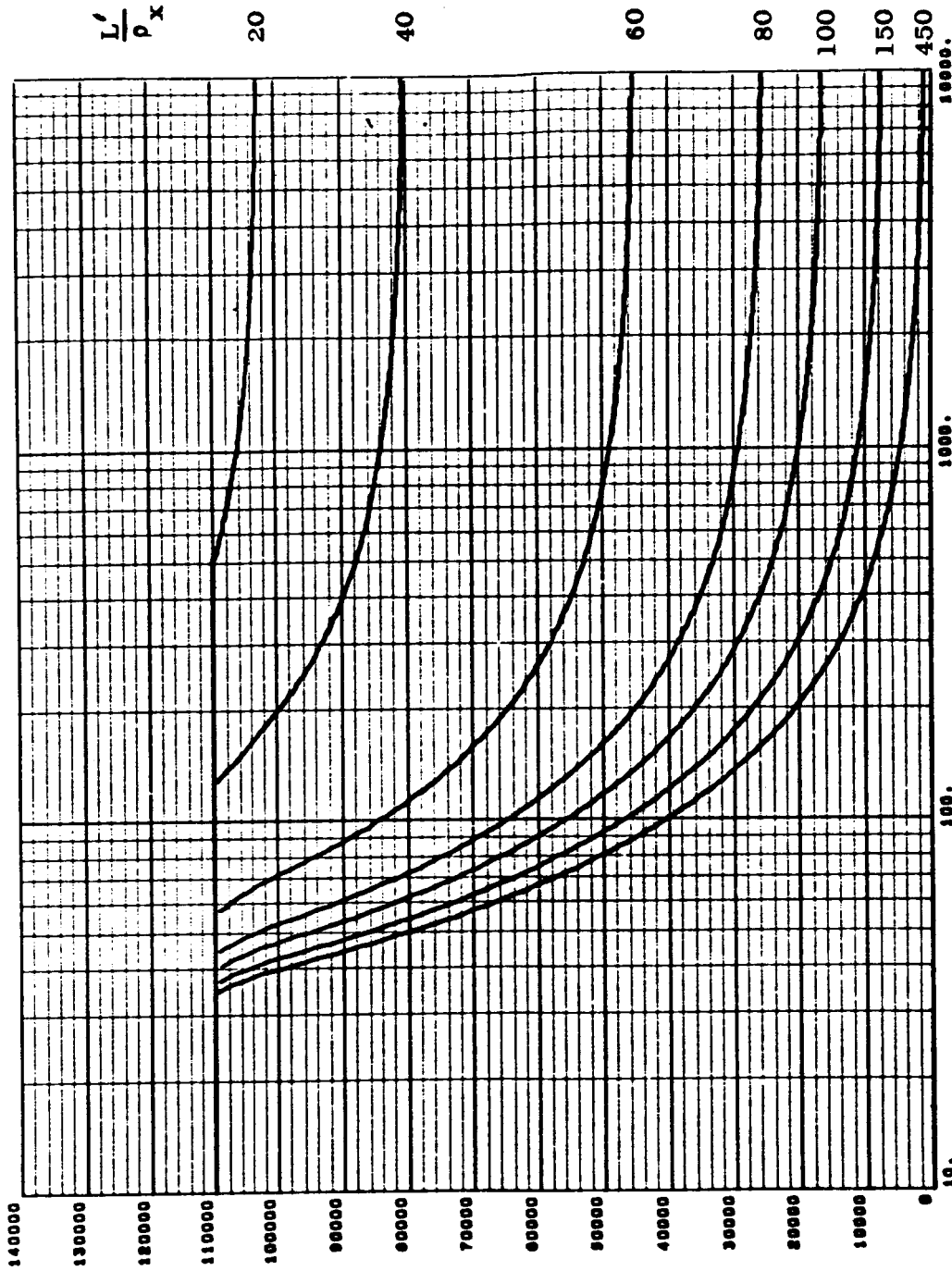
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 20 (a)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL -6AL-4V TITANIUM ALLOY (ANNEALED)
Figure 20(b)

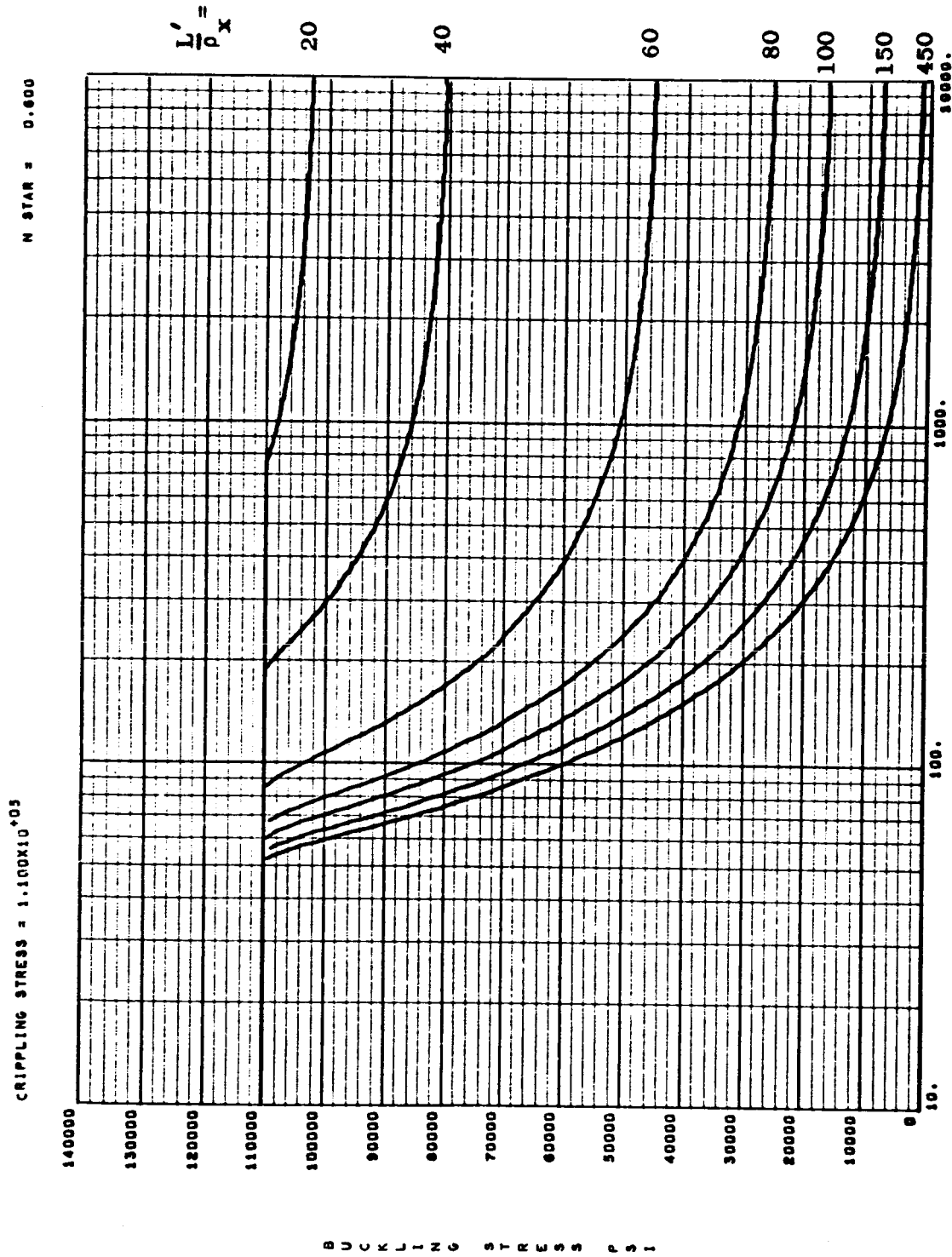
CRIPPLING STRESS = 1.100×10^4 N STAR = 0.400



RADIUS / r

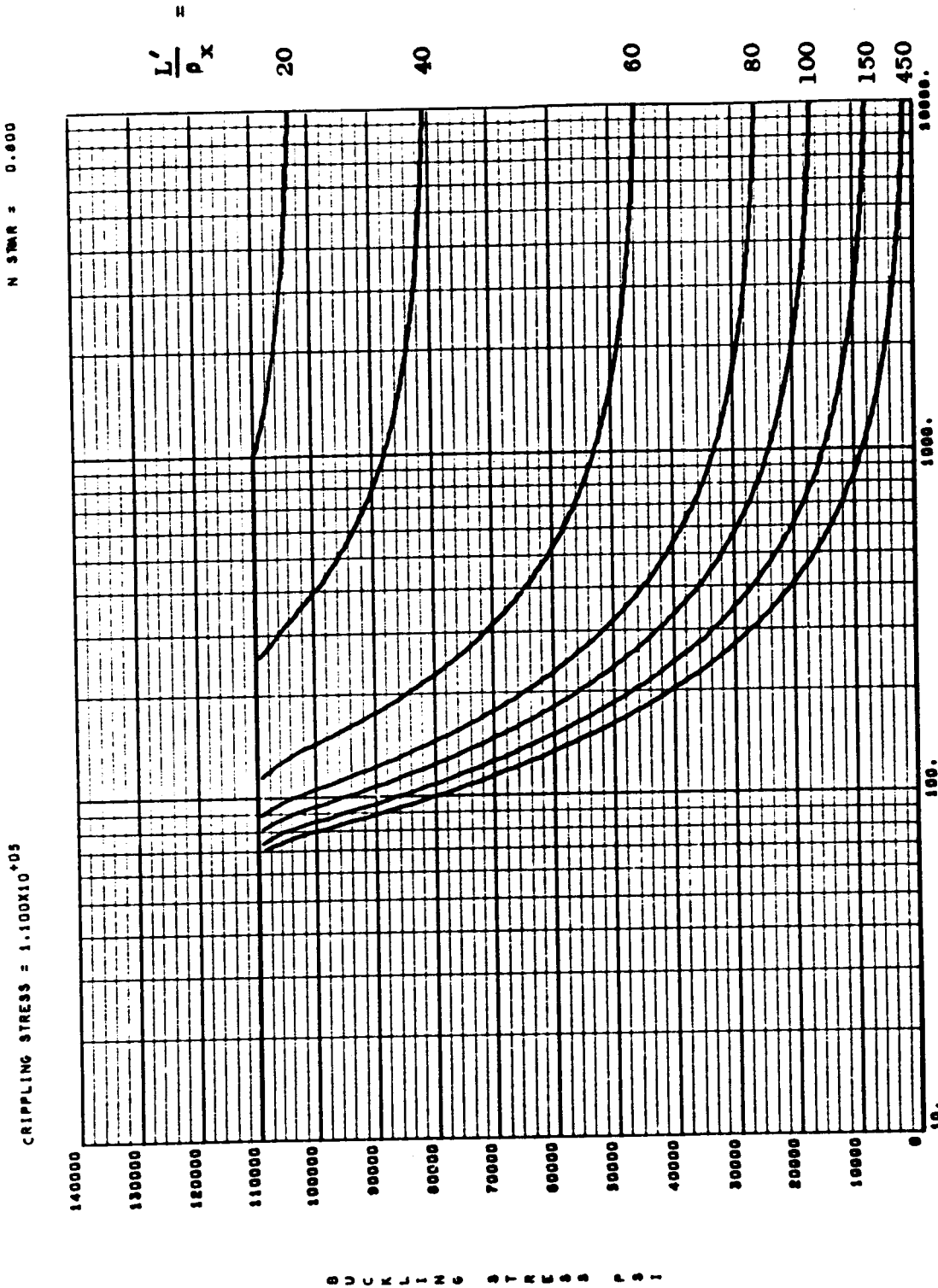
COMPRESSIVE BUCKLING STRESS FOR LONGITUDINALLY STIFFENED CYLINDERS MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 20(c)

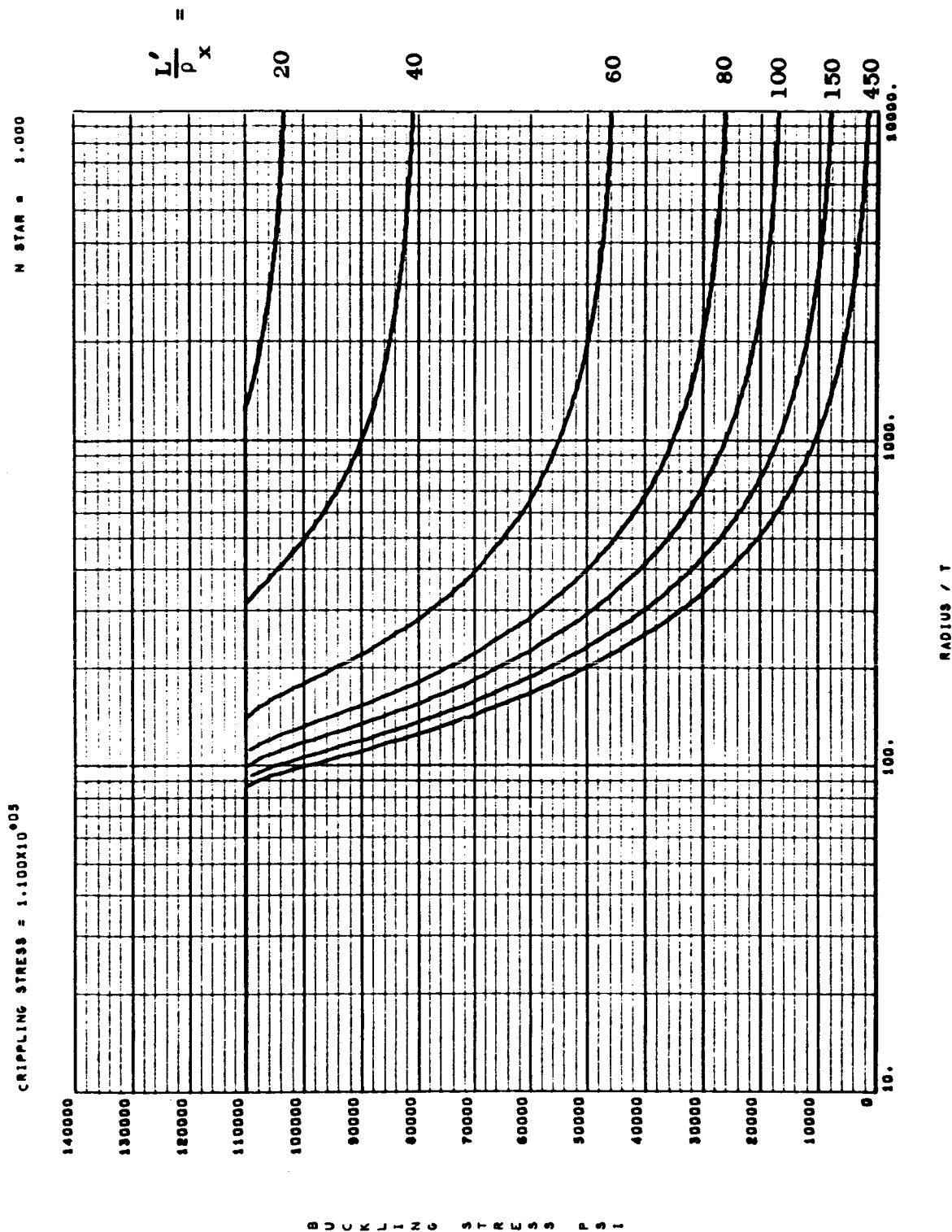


RADIUS / r

COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)
Figure 20(d)

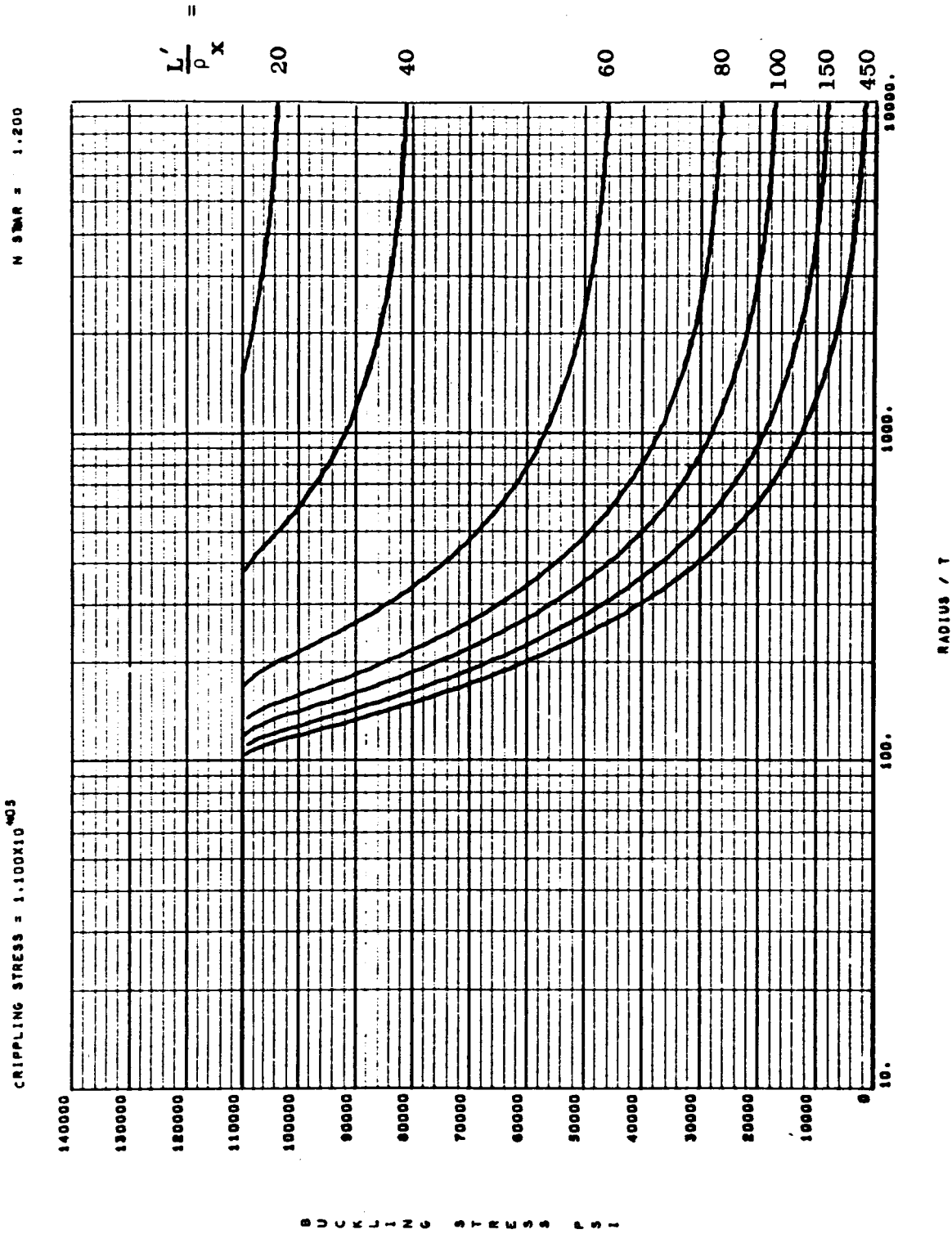


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)
Figure 20(e)



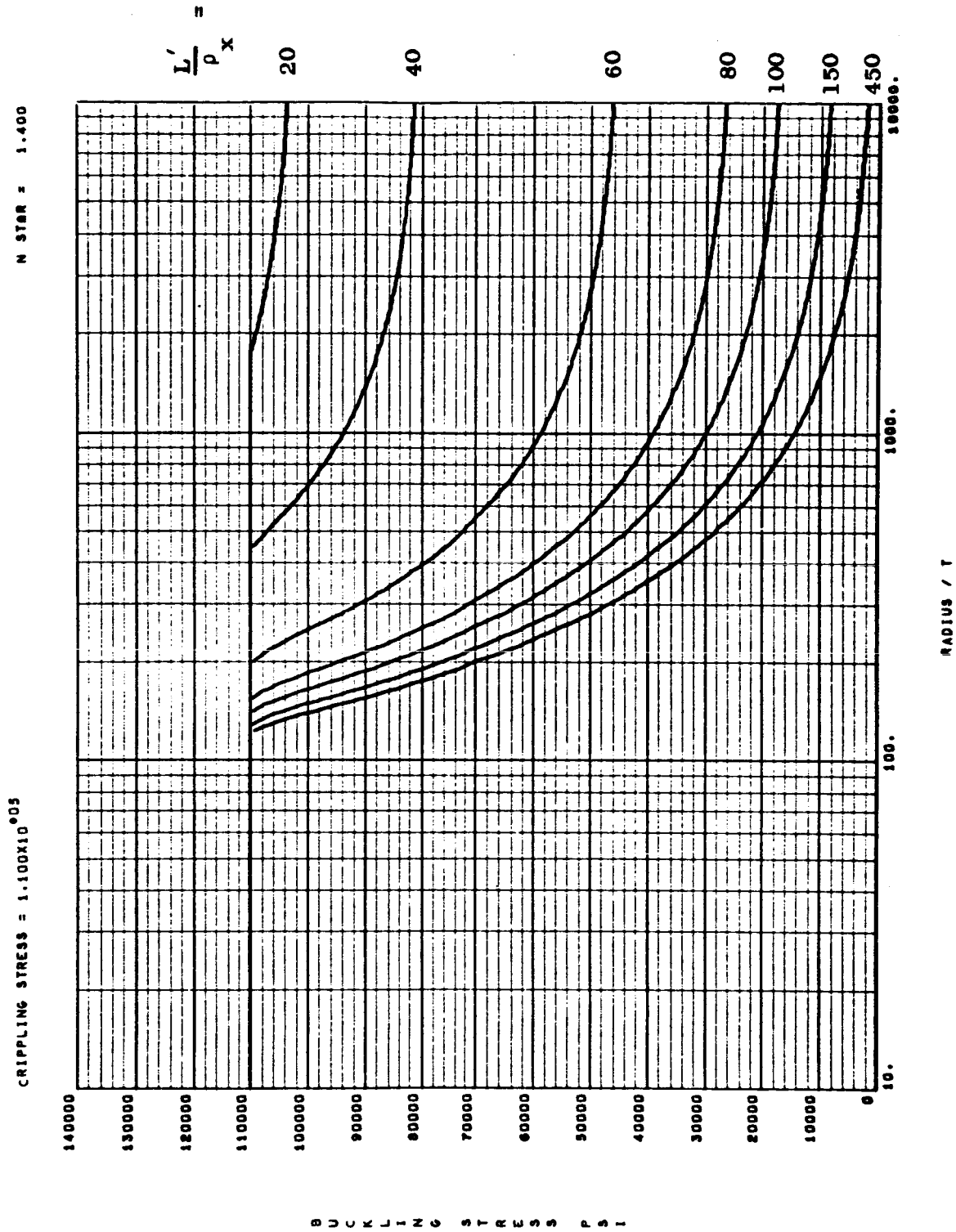
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 20(f)

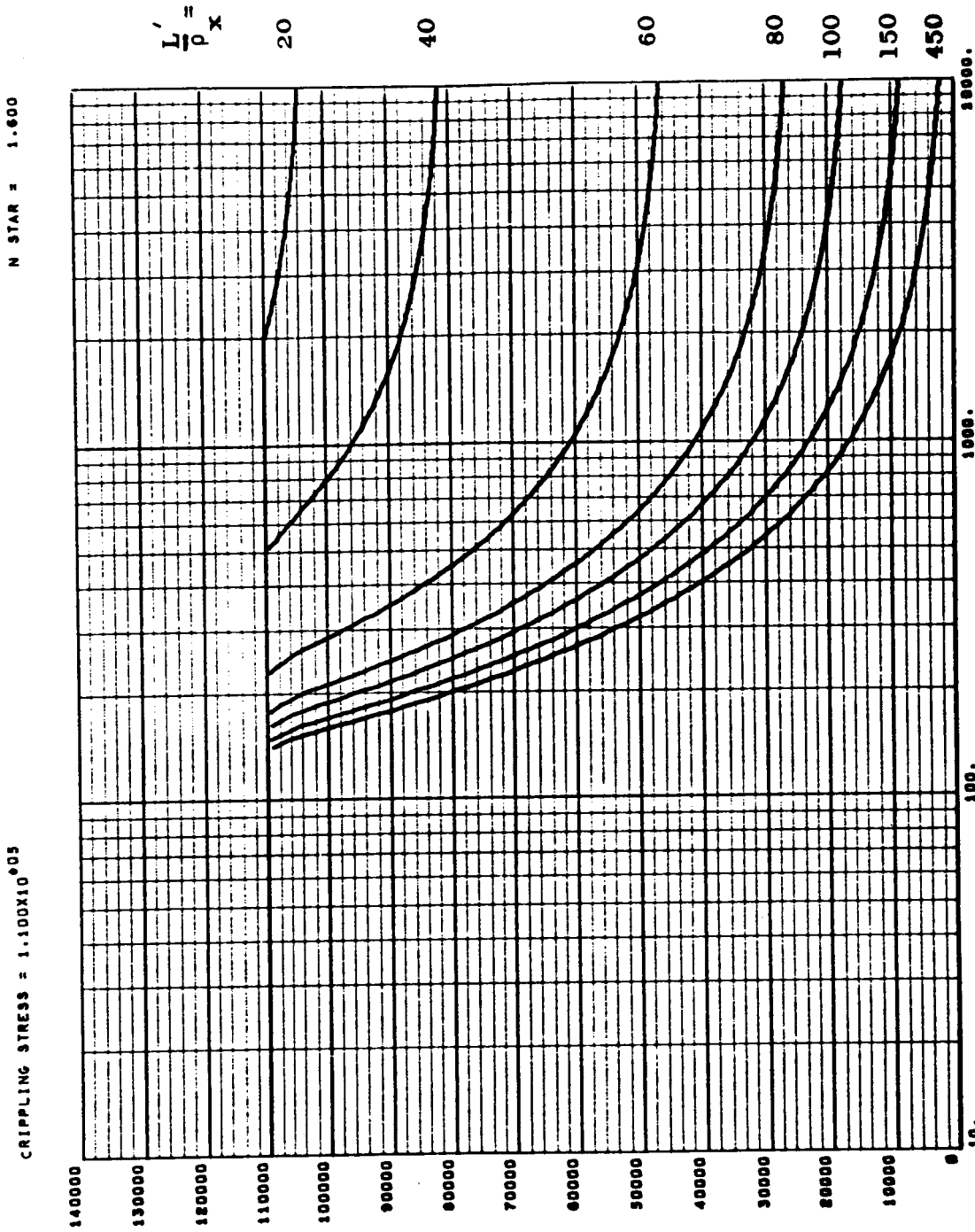


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 20(g)

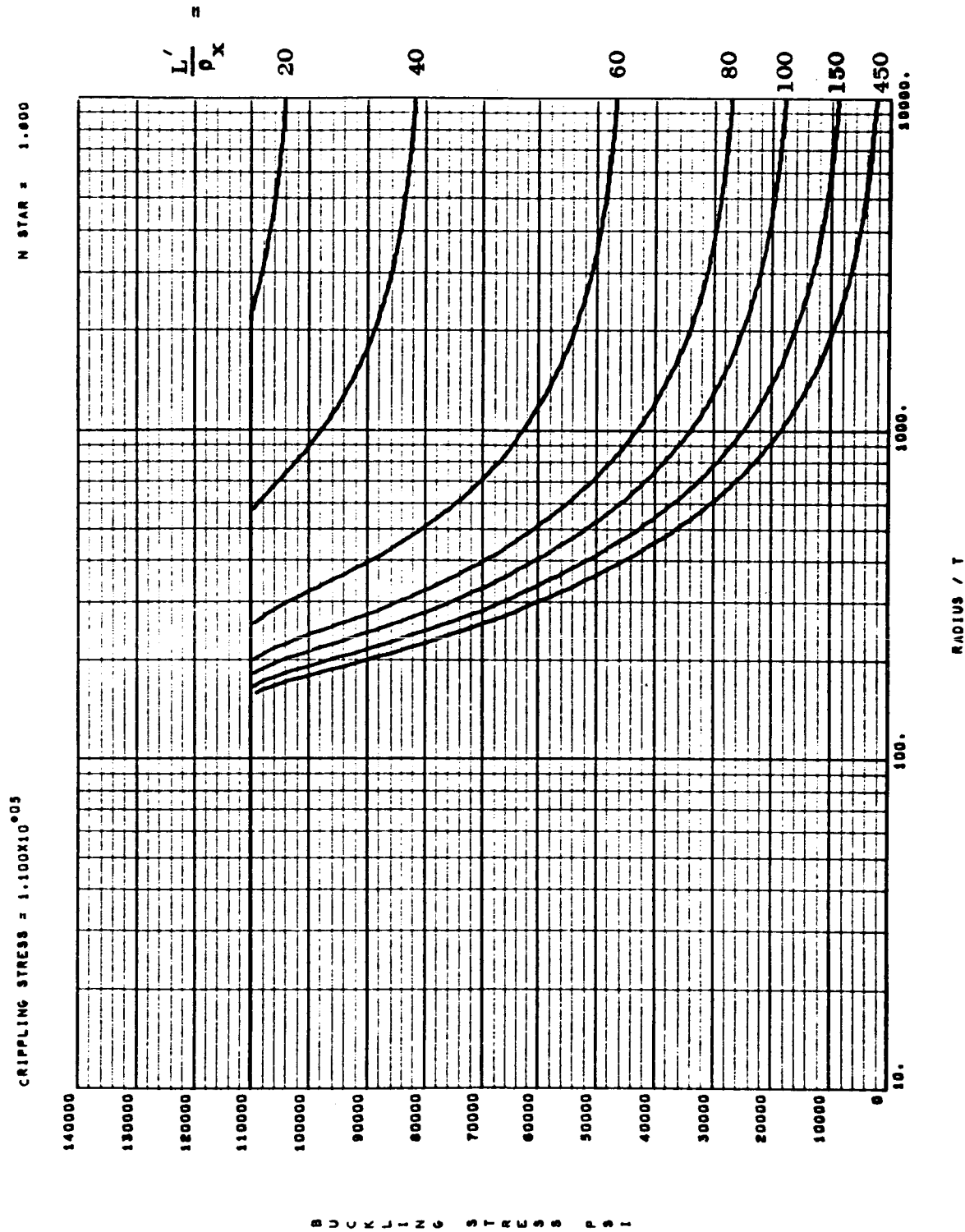


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)
Figure 20(h)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 20(i)

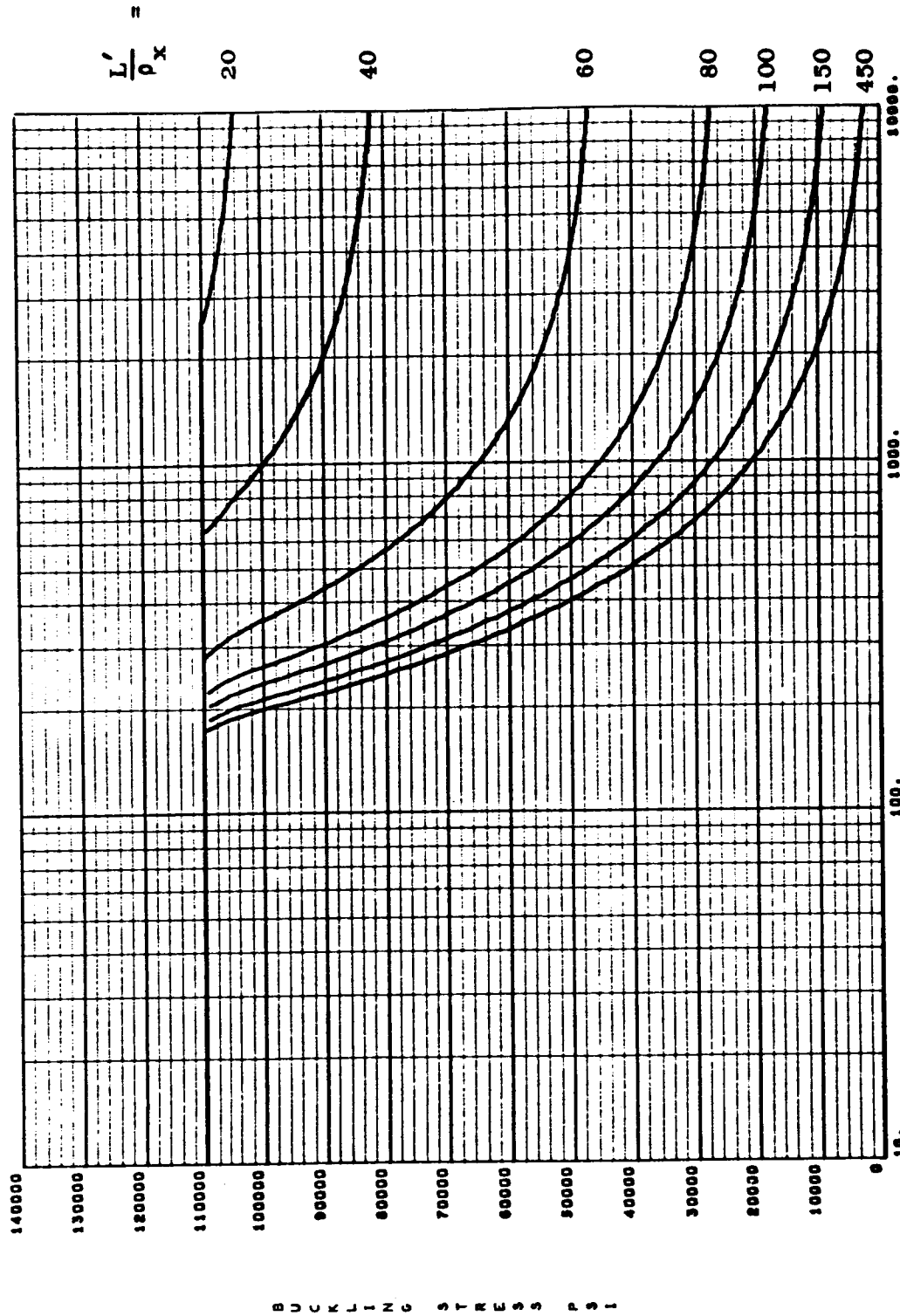


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 20(j)

N STAR = 2.000

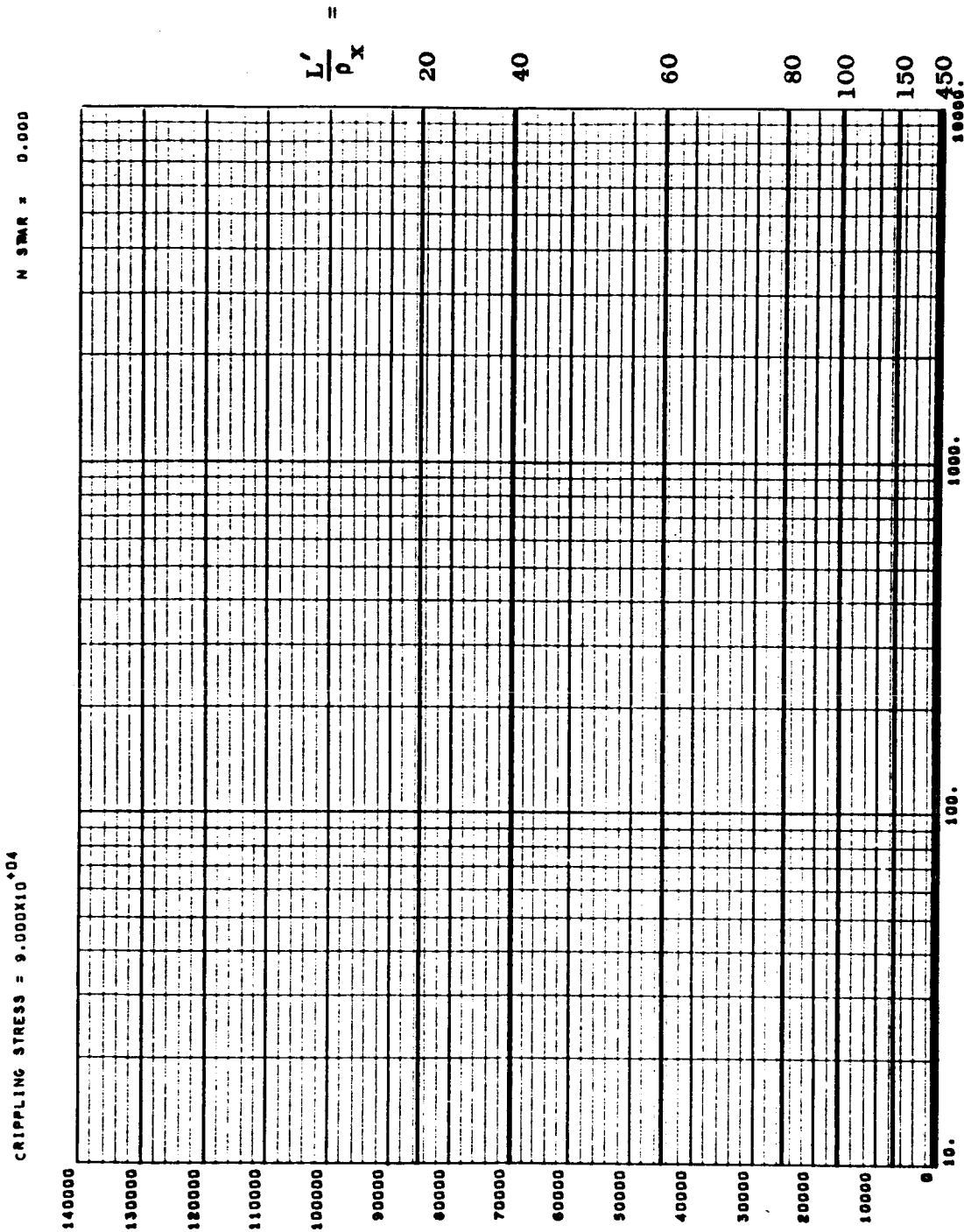
CRIPPLING STRESS = 1.100×10^{-03}



RADIUS / r

COMPRESSIVE BUCKLING STRESS FOR LONGITUDINALLY STIFFENED CYLINDERS MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

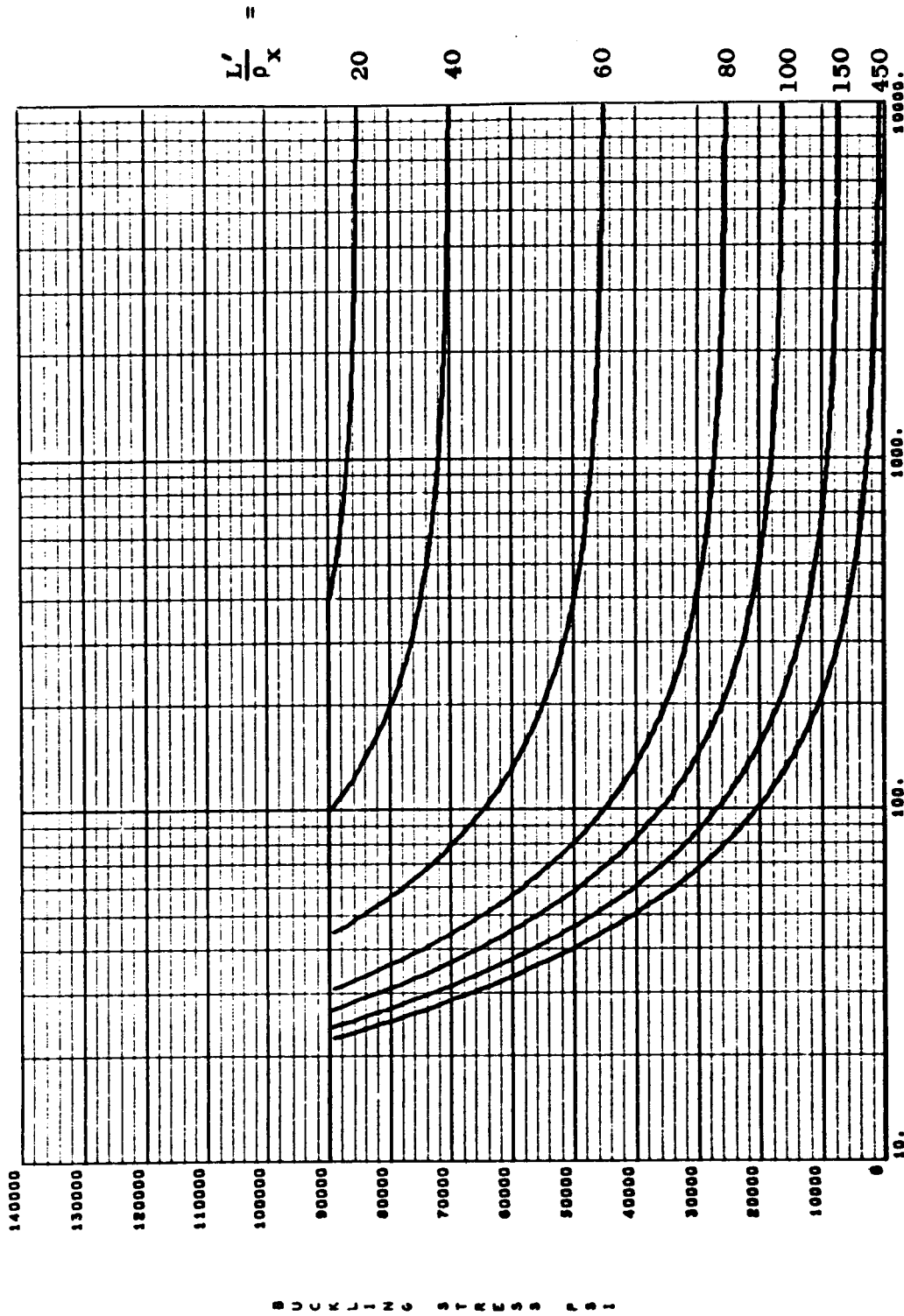
Figure 20(k)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 21(a)

CRIPPLING STRESS = 9.000×10^{-4} N STAR = 0.200



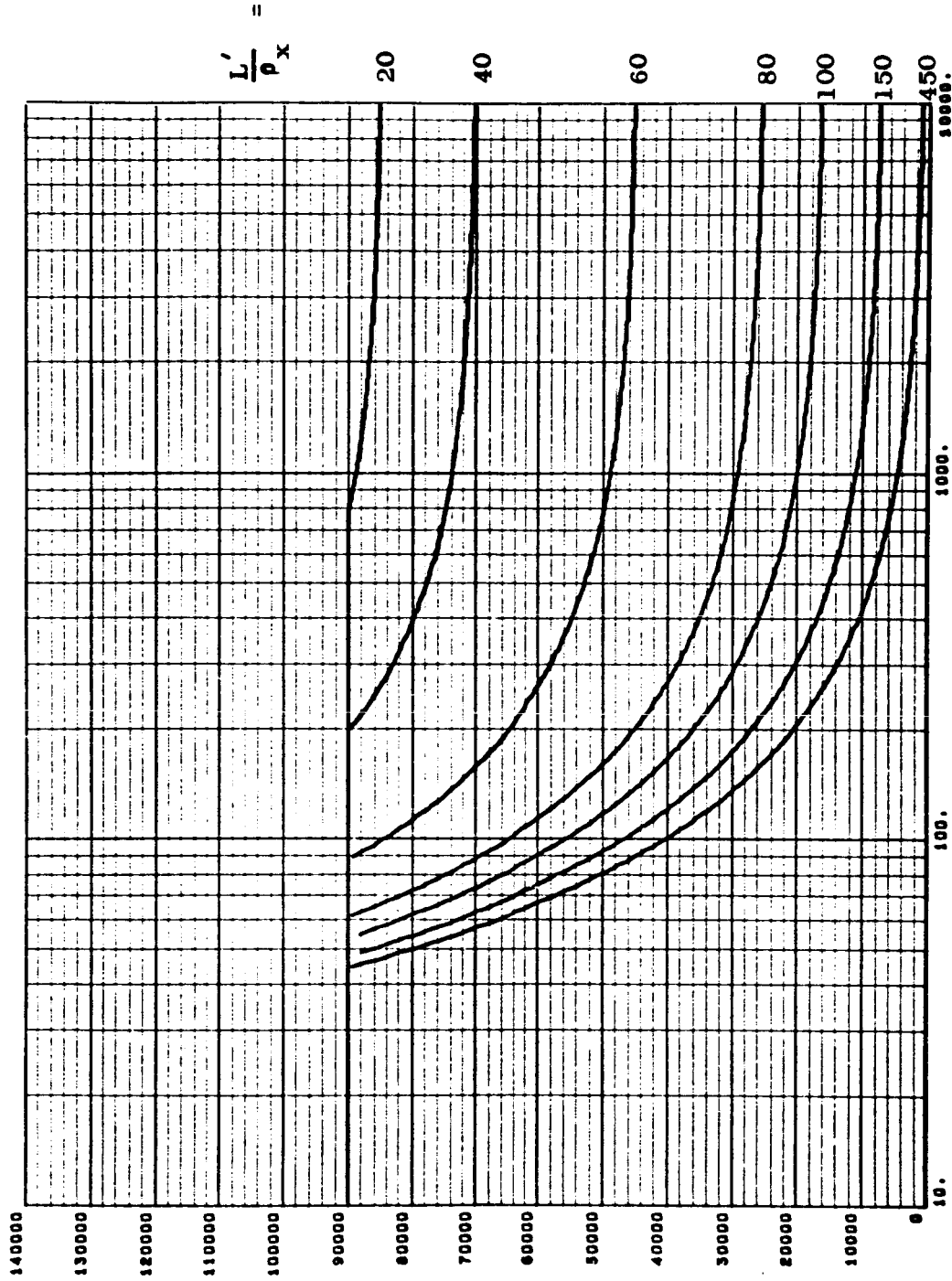
RADIUS / r

COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 21(b)

CRIPPLING STRESS = 9.000×10^{-4}

N STAR = 0.400

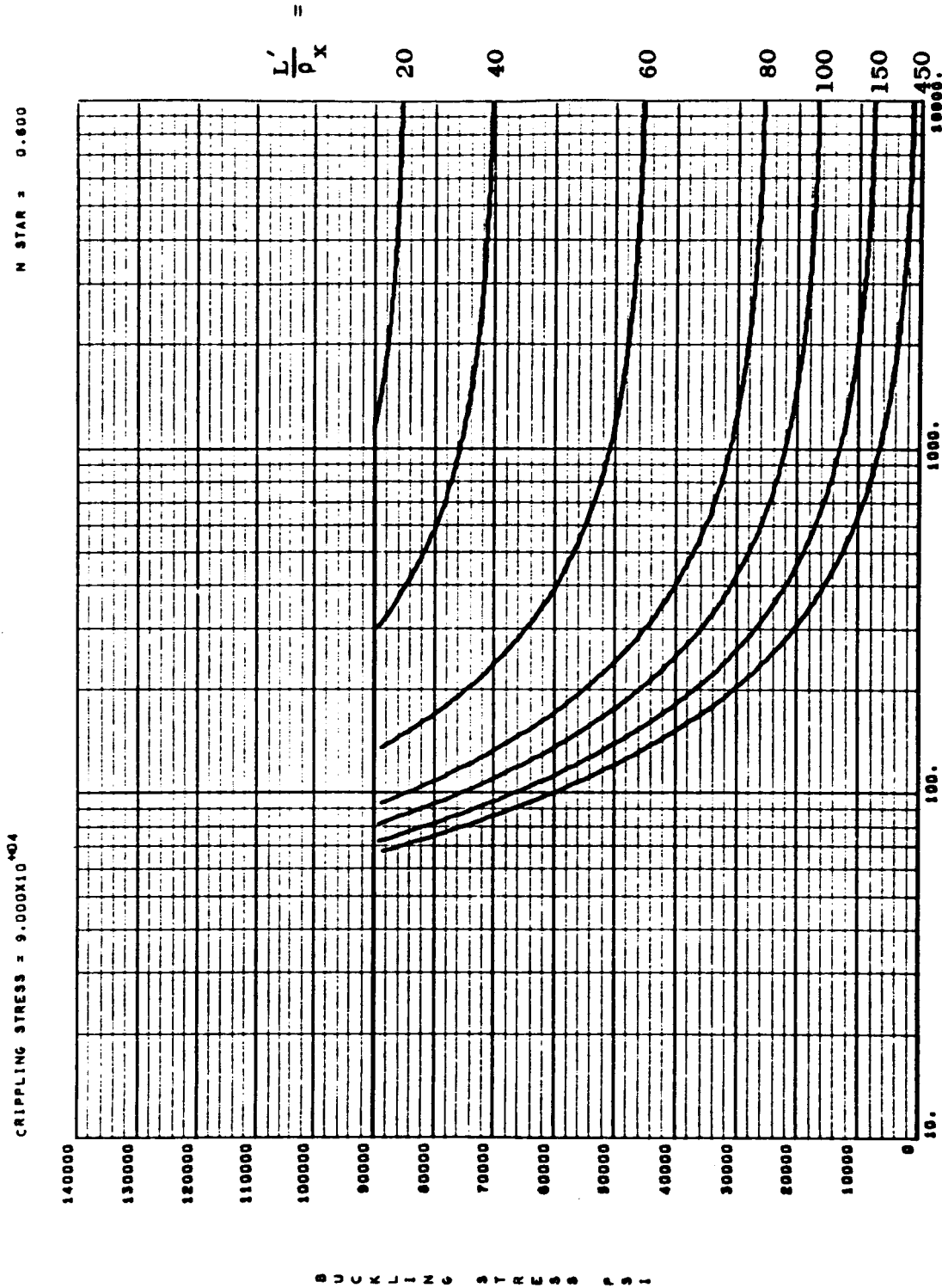


B U C K L I N G S T R E S S

RADIUS / T

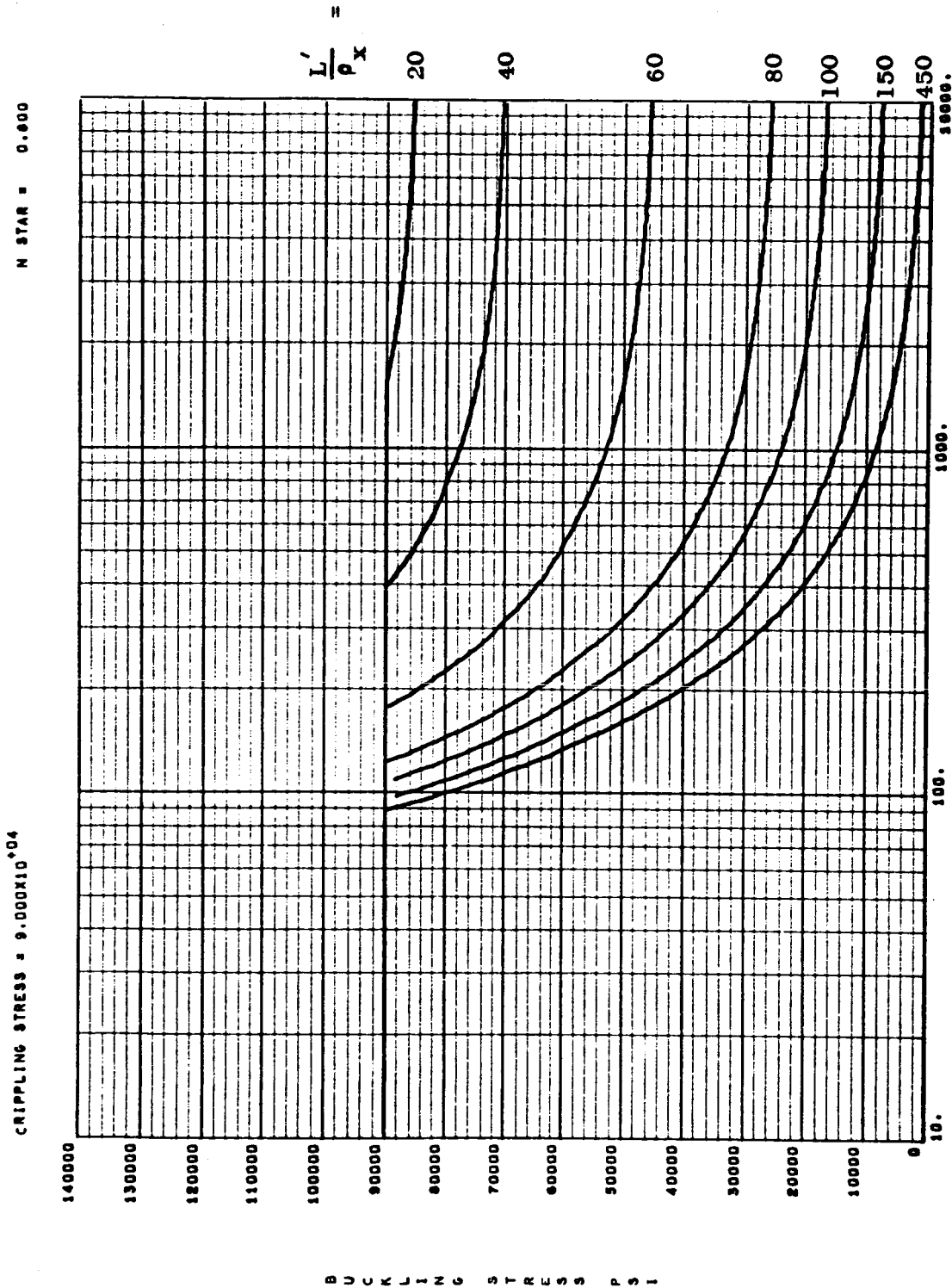
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 21(c)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

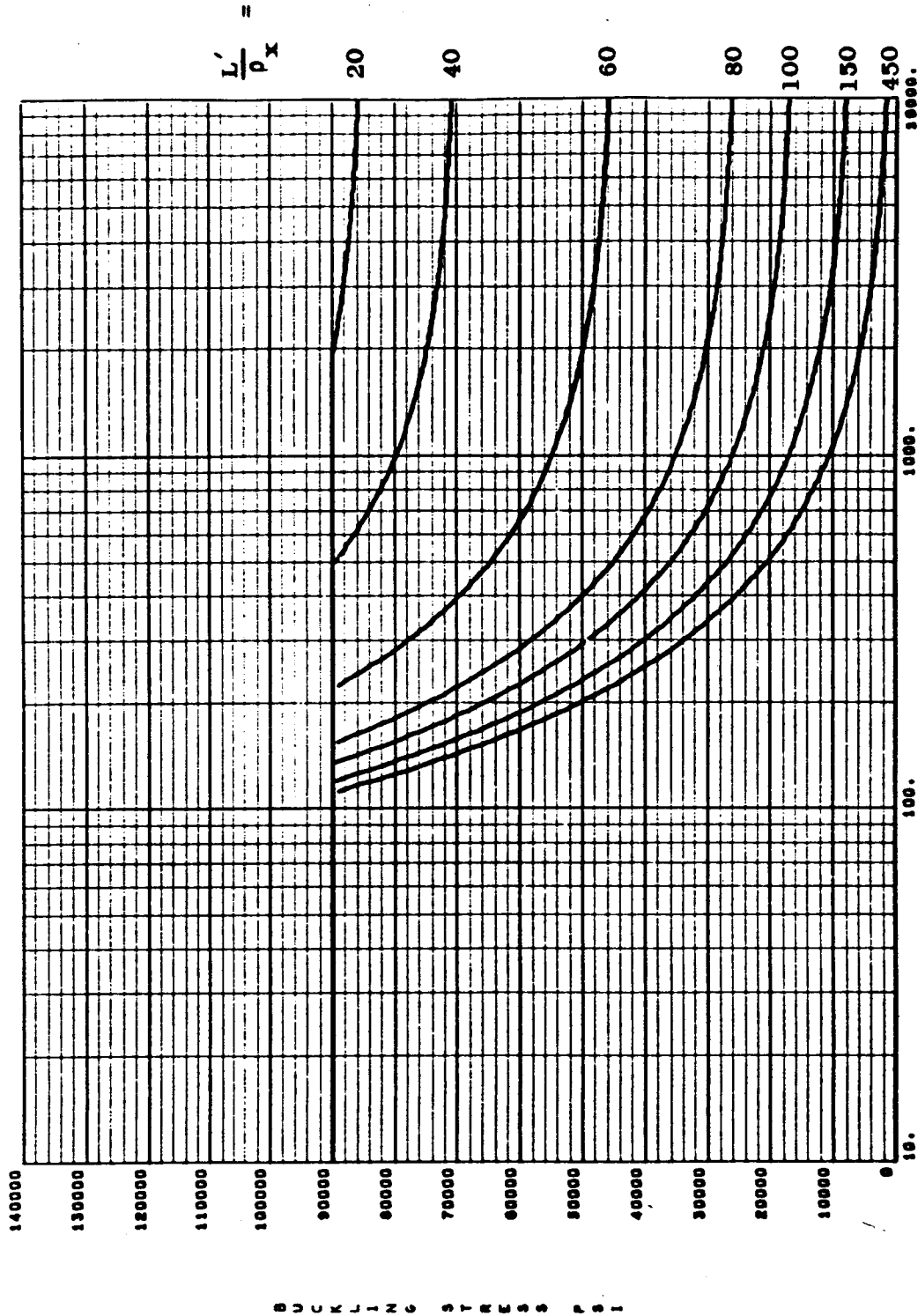
Figure 21(d)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)
Figure 21(e)

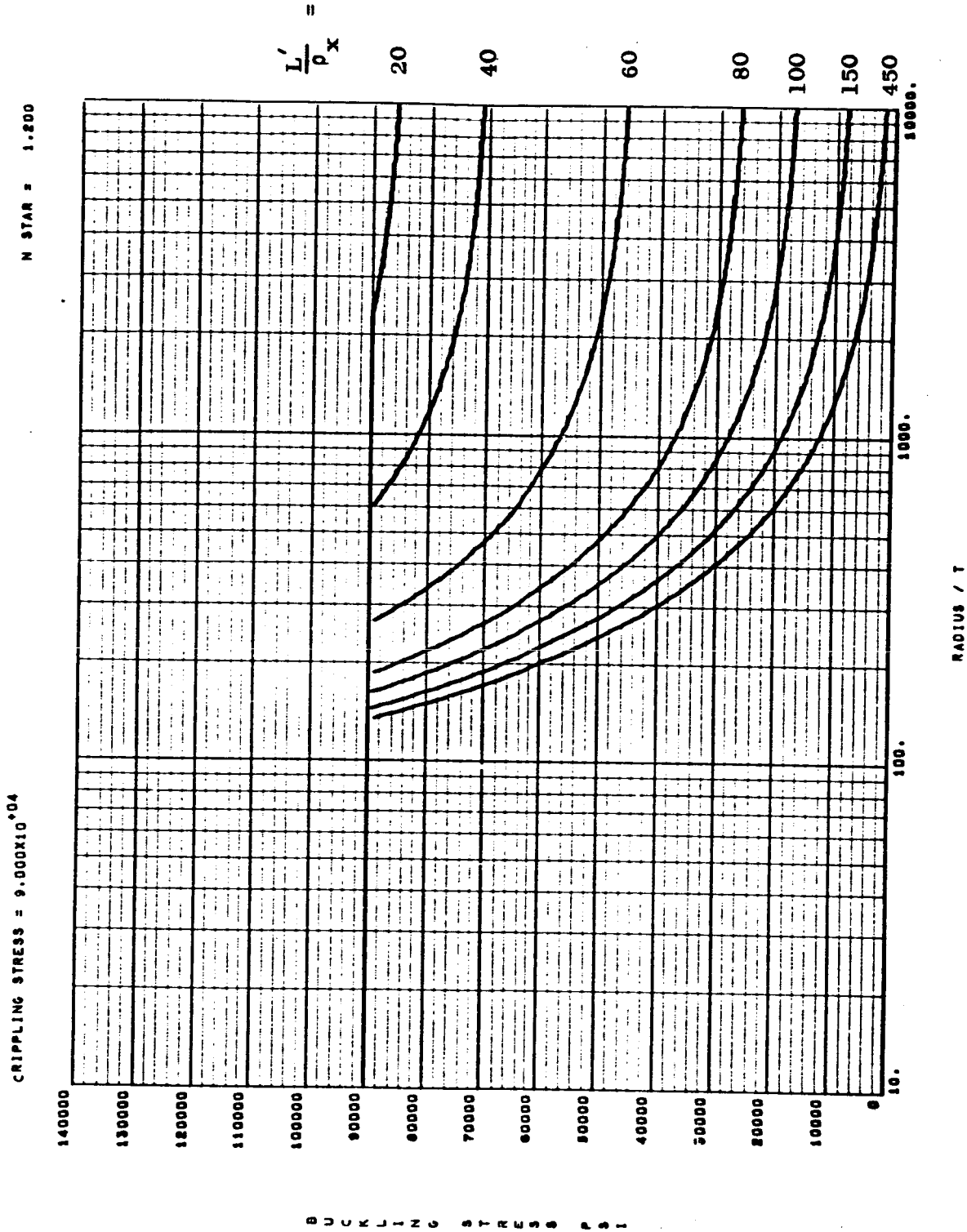
N 3MAR = 1.000

CRIPPLING STRESS = $9.000 \times 10^{+04}$



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 21(f)

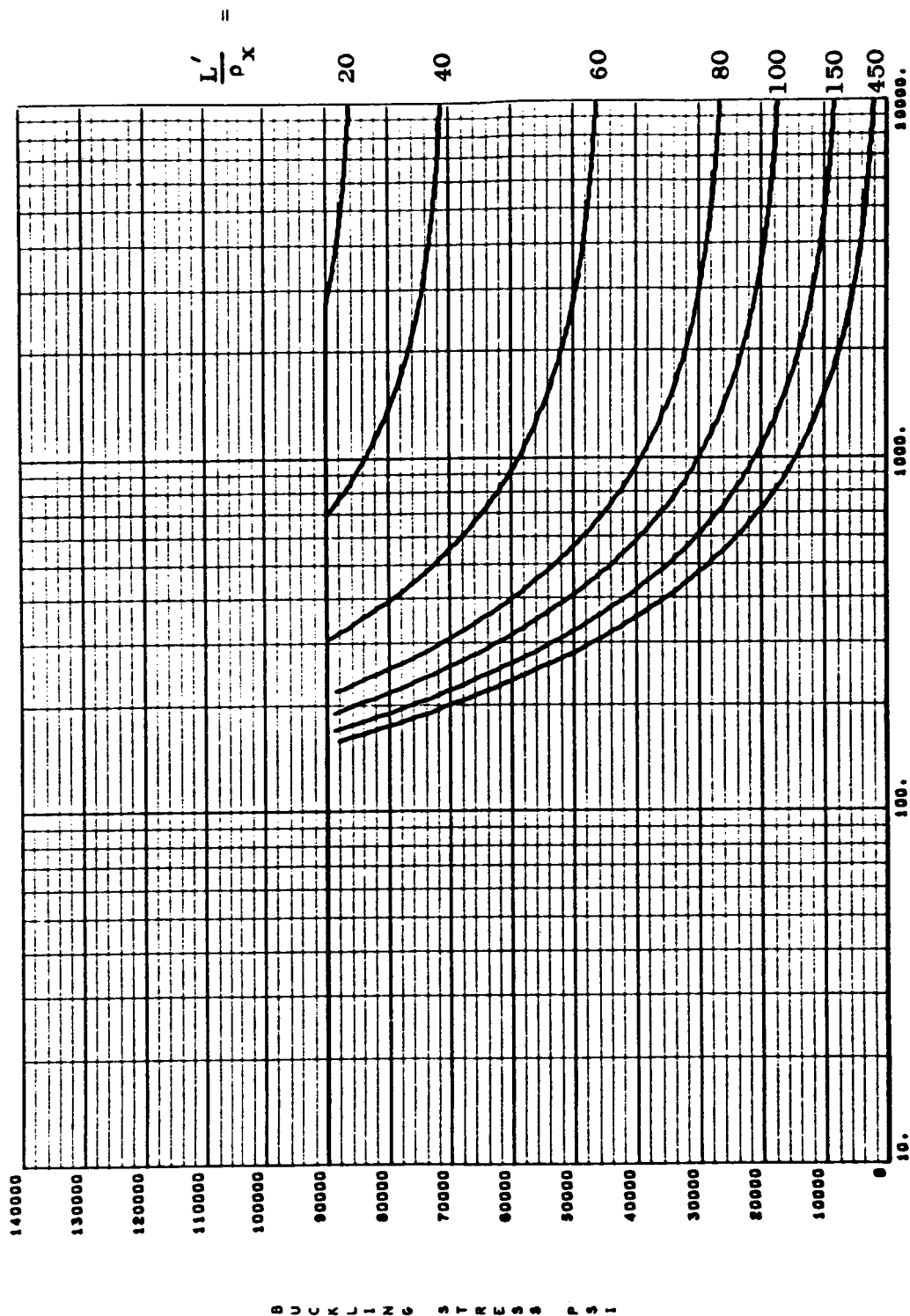


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 21(g)

N STAR = 1.400

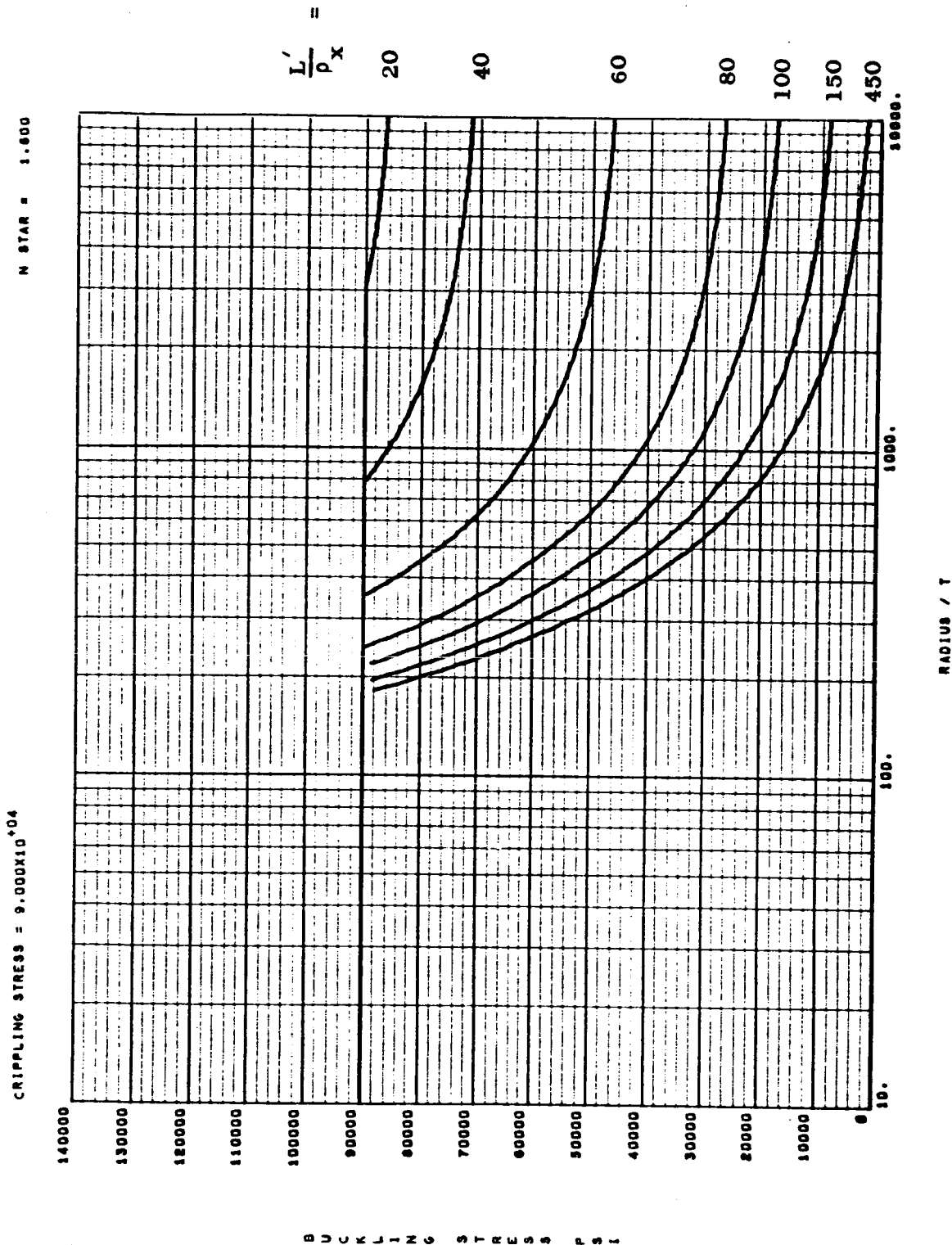
CRIPPLING STRESS = $9.000 \times 10^{+04}$



RADIUS / T

COMPRESSIVE BUCKLING STRESS FOR LONGITUDINALLY STIFFENED CYLINDERS MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

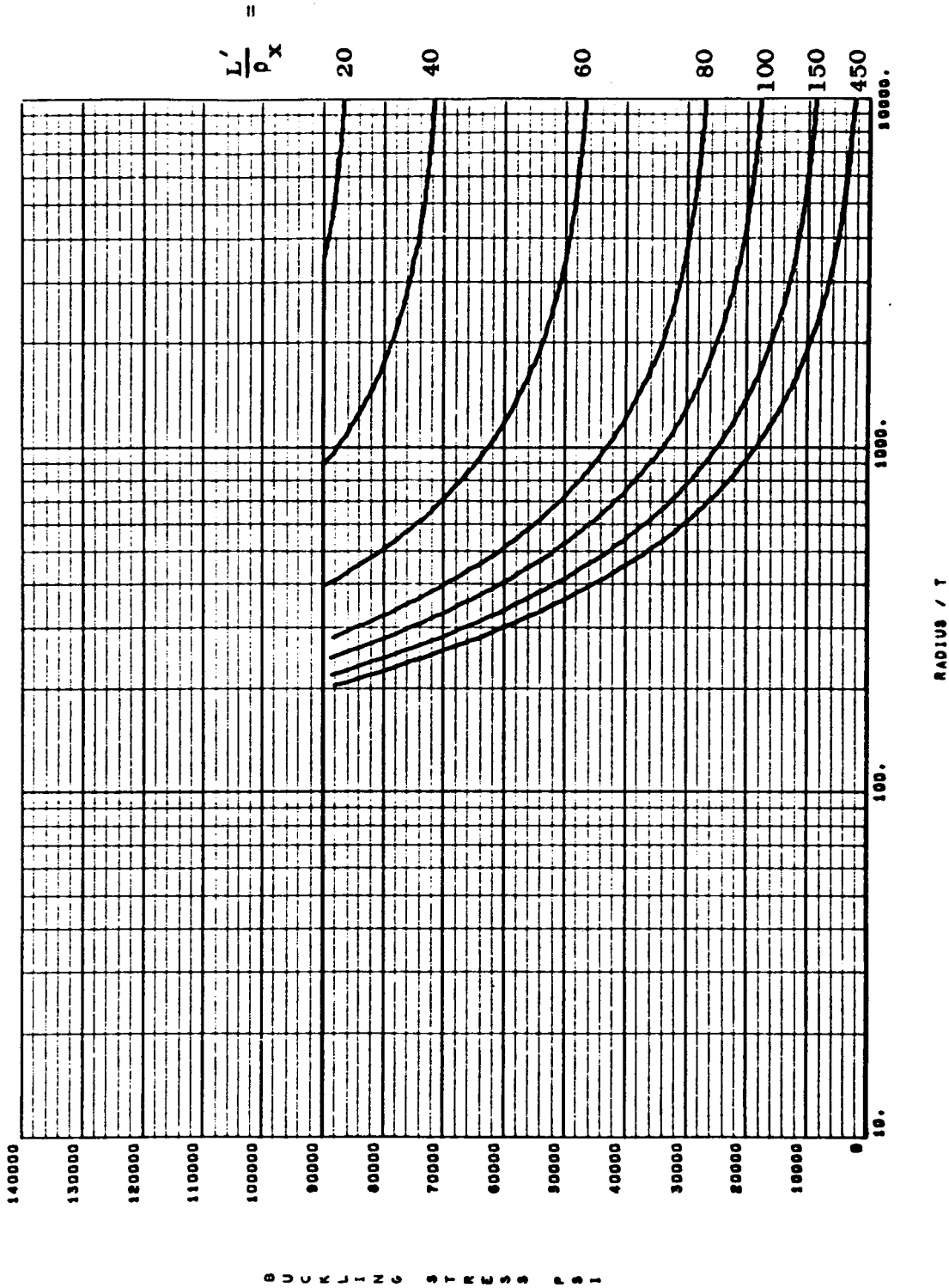
Figure 21(h)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 21(i)

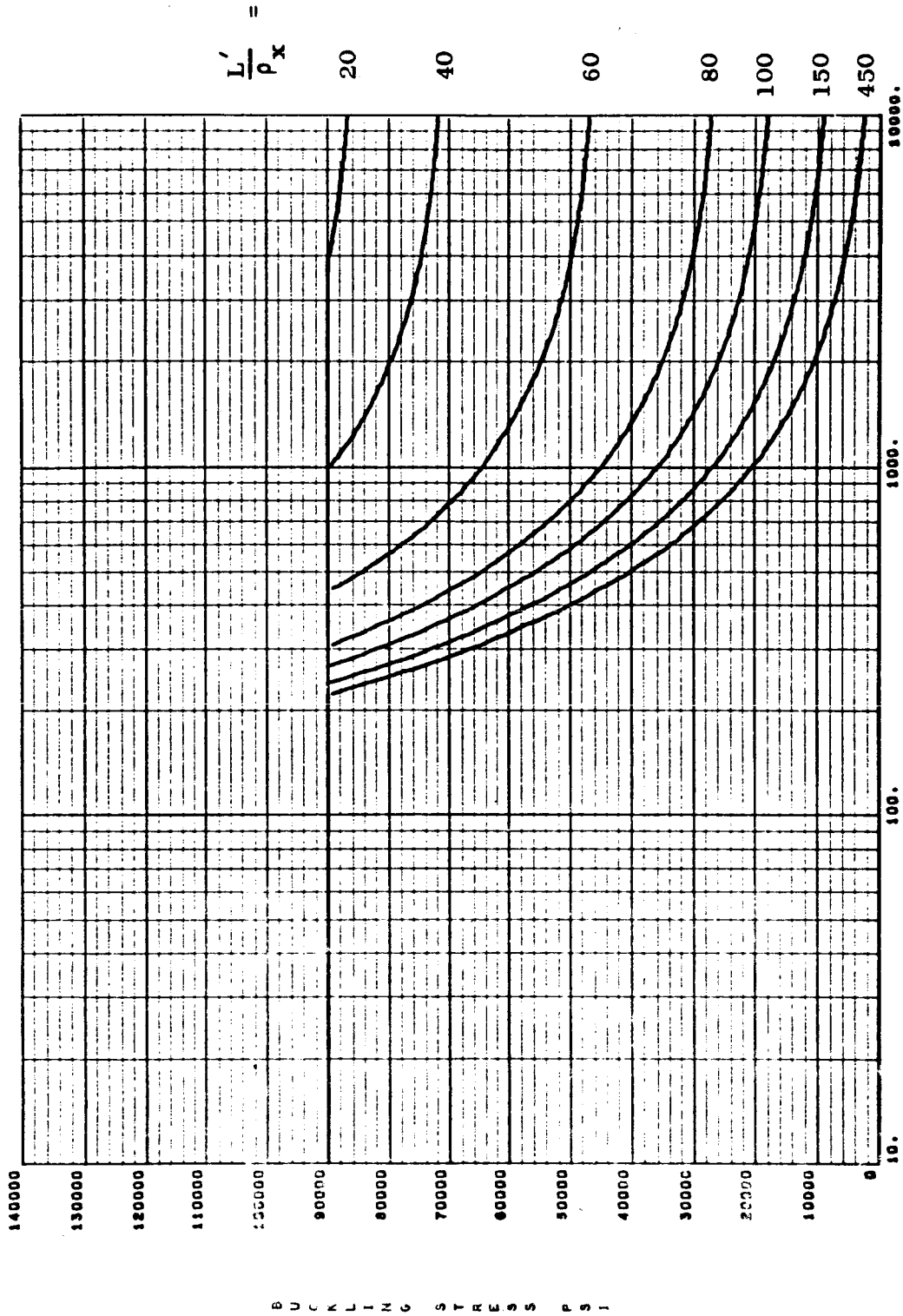
CRIPPLING STRESS = $9.000 \times 10^{+04}$ N STAR = 1.000



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL -6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 21(j)

CRIPPLING STRESS = 9.000×10^{-4} N STAR = 2.000



RADIUS / T

COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 6Al-4V TITANIUM ALLOY (ANNEALED)

Figure 21(k)

A.2.3 718 NICKEL ALLOY (Annealed + Double Aged)

Table XVII lists the families provided here for longitudinally stiffened cylinders made of 718 nickel alloy (annealed + double aged). These curves are based upon the following values for the indicated material properties:

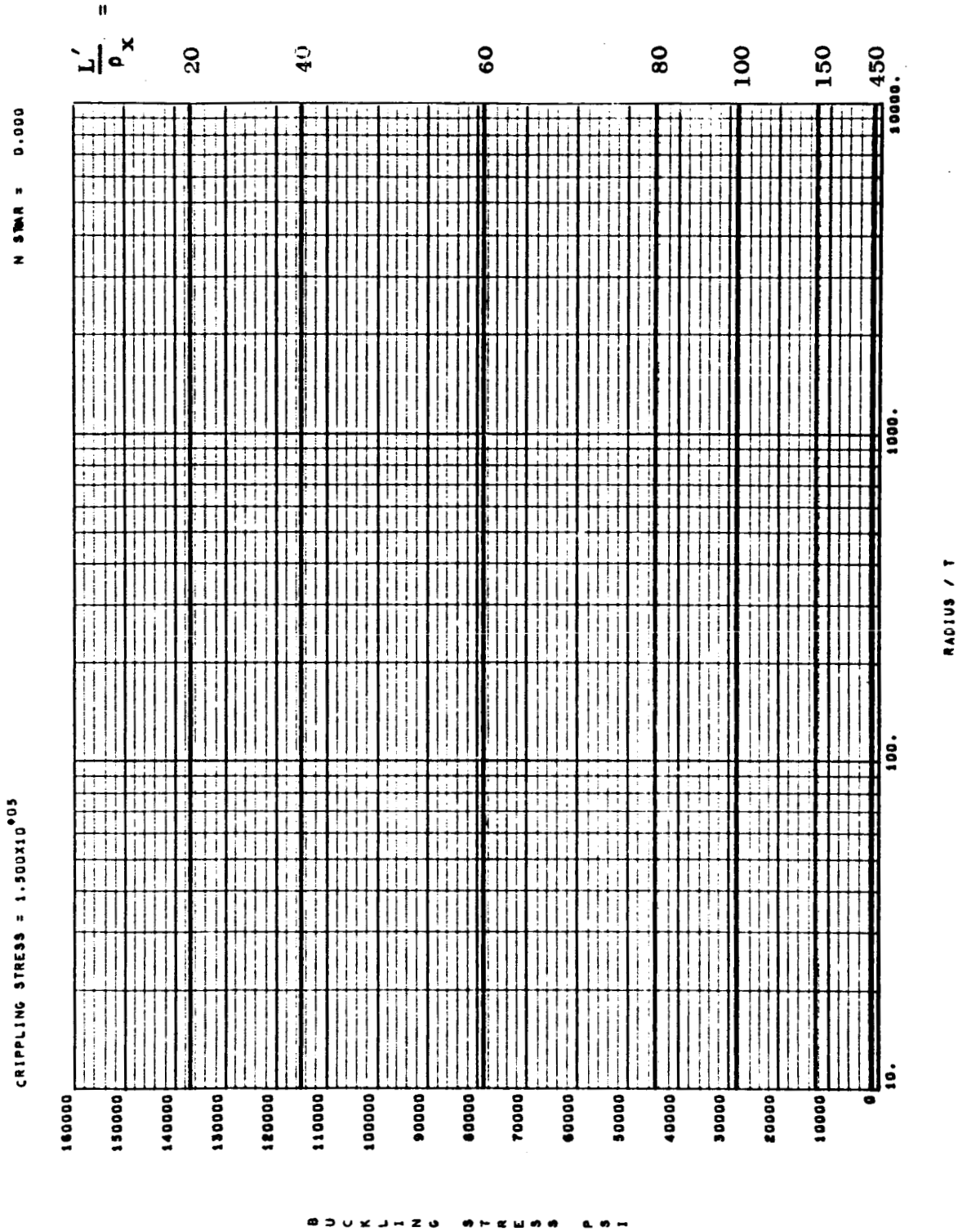
$$\begin{aligned}
 E &= 29.0 \times 10^6 \text{ psi} \\
 \nu &= .30 \\
 \sigma_{cy} &= 150,000 \text{ psi} \\
 \text{Ramberg-Osgood } n &= 12.7 \\
 \text{Ramberg-Osgood } \sigma_{.7} &= 150,500 \text{ psi}
 \end{aligned}$$

TABLE XVII - Table of Contents for Supplementary
Curves of Compressive Buckling Stress
for Longitudinally Stiffened Cylinders;
Material - 718 Nickel Alloy (Annealed
+ Double Aged)

<u>Figure Number</u>	<u>Crippling Stress, σ_{cc}</u>	<u>N*</u>	<u>Page</u>
22(a)	150,000	0.0	A-81
22(b)	150,000	0.2	A-82
22(c)	150,000	0.4	A-83
22(d)	150,000	0.6	A-84
22(e)	150,000	0.8	A-85
22(f)	150,000	1.0	A-86
22(g)	150,000	1.2	A-87
22(h)	150,000	1.4	A-88
22(i)	150,000	1.6	A-89
22(j)	150,000	1.8	A-90
22(k)	150,000	2.0	A-91
23(a)	130,000	0.0	A-92
23(b)	130,000	0.2	A-93
23(c)	130,000	0.4	A-94
23(d)	130,000	0.6	A-95

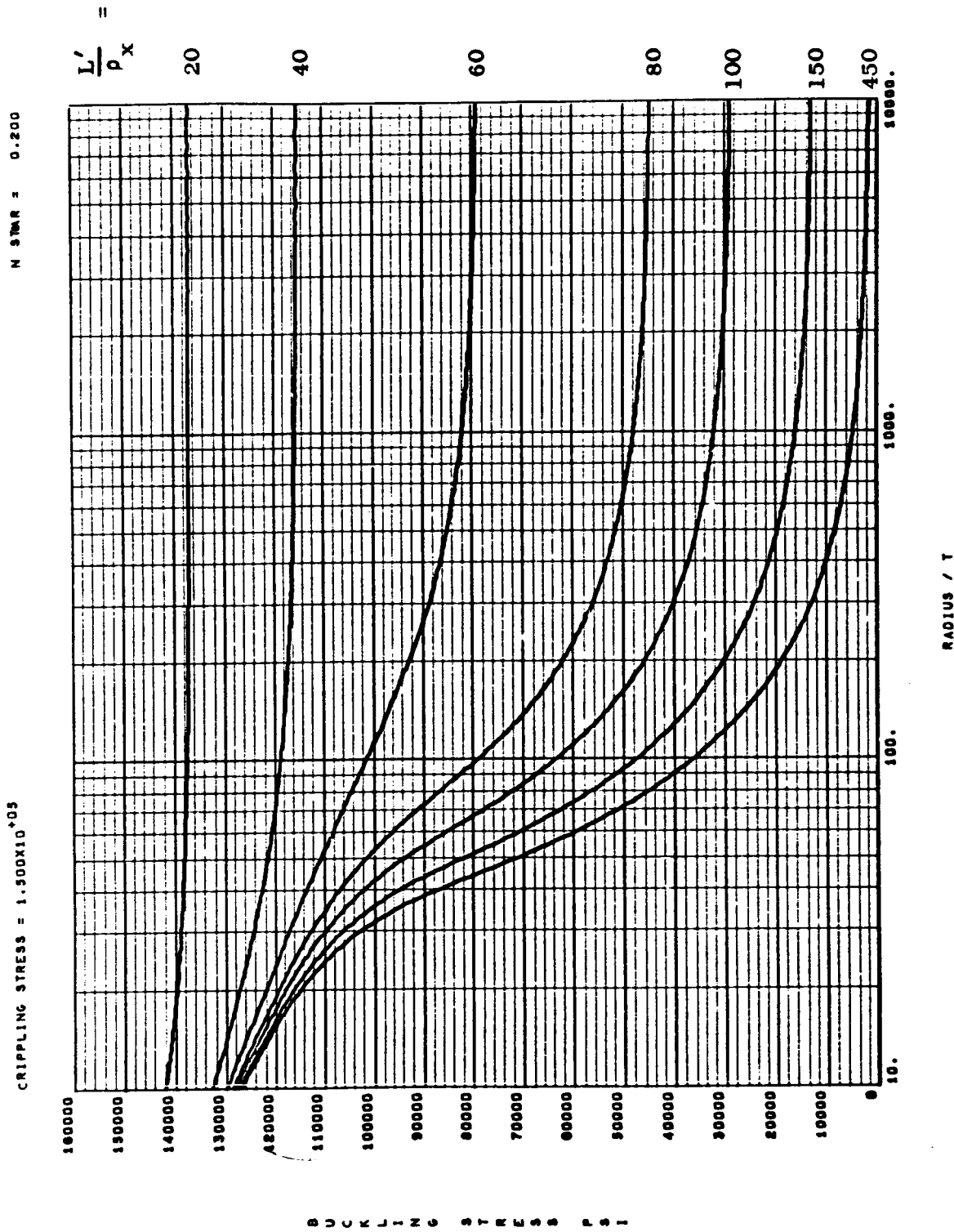
TABLE XVII - Table of Contents for Supplementary
Curves of Compressive Buckling Stress
for Longitudinally Stiffened Cylinders;
Material - 718 Nickel Alloy (Annealed
+ Double Aged) ; (Continued)

<u>Figure Number</u>	<u>Crippling Stress, σ_{cc}</u>	<u>N*</u>	<u>Page</u>
23(e)	130,000	0.8	A-96
23(f)	130,000	1.0	A-97
23(g)	130,000	1.2	A-98
23(h)	130,000	1.4	A-99
23(i)	130,000	1.6	A-100
23(j)	130,000	1.8	A-101
23(k)	130,000	2.0	A-102
24(a)	110,000	0.0	A-103
24(b)	110,000	0.2	A-104
24(c)	110,000	0.4	A-105
24(d)	110,000	0.6	A-106
24(e)	110,000	0.8	A-107
24(f)	110,000	1.0	A-108
24(g)	110,000	1.2	A-109
24(h)	110,000	1.4	A-110
24(i)	110,000	1.6	A-111
24(j)	110,000	1.8	A-112
24(k)	110,000	2.0	A-113



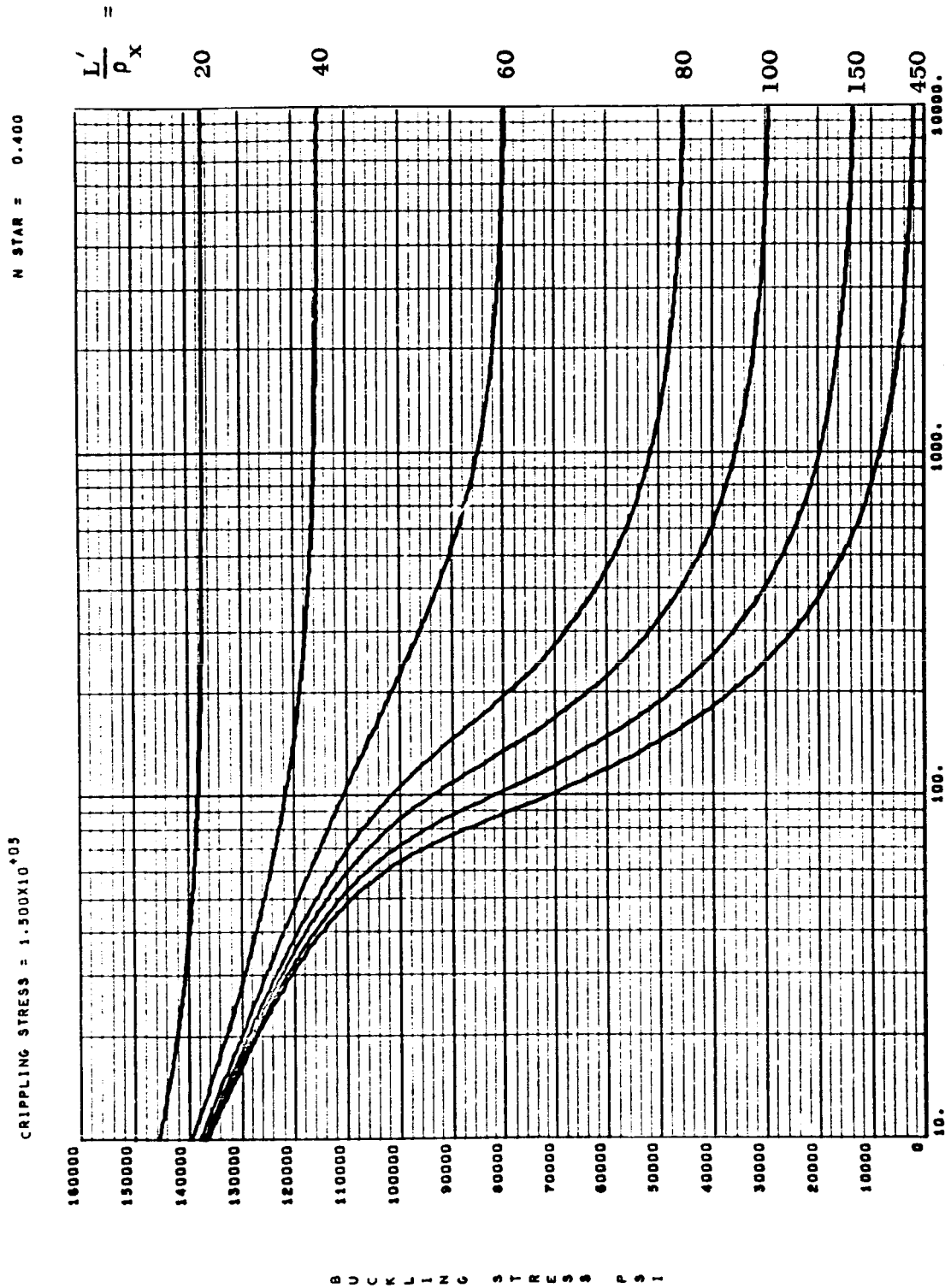
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 22(a)



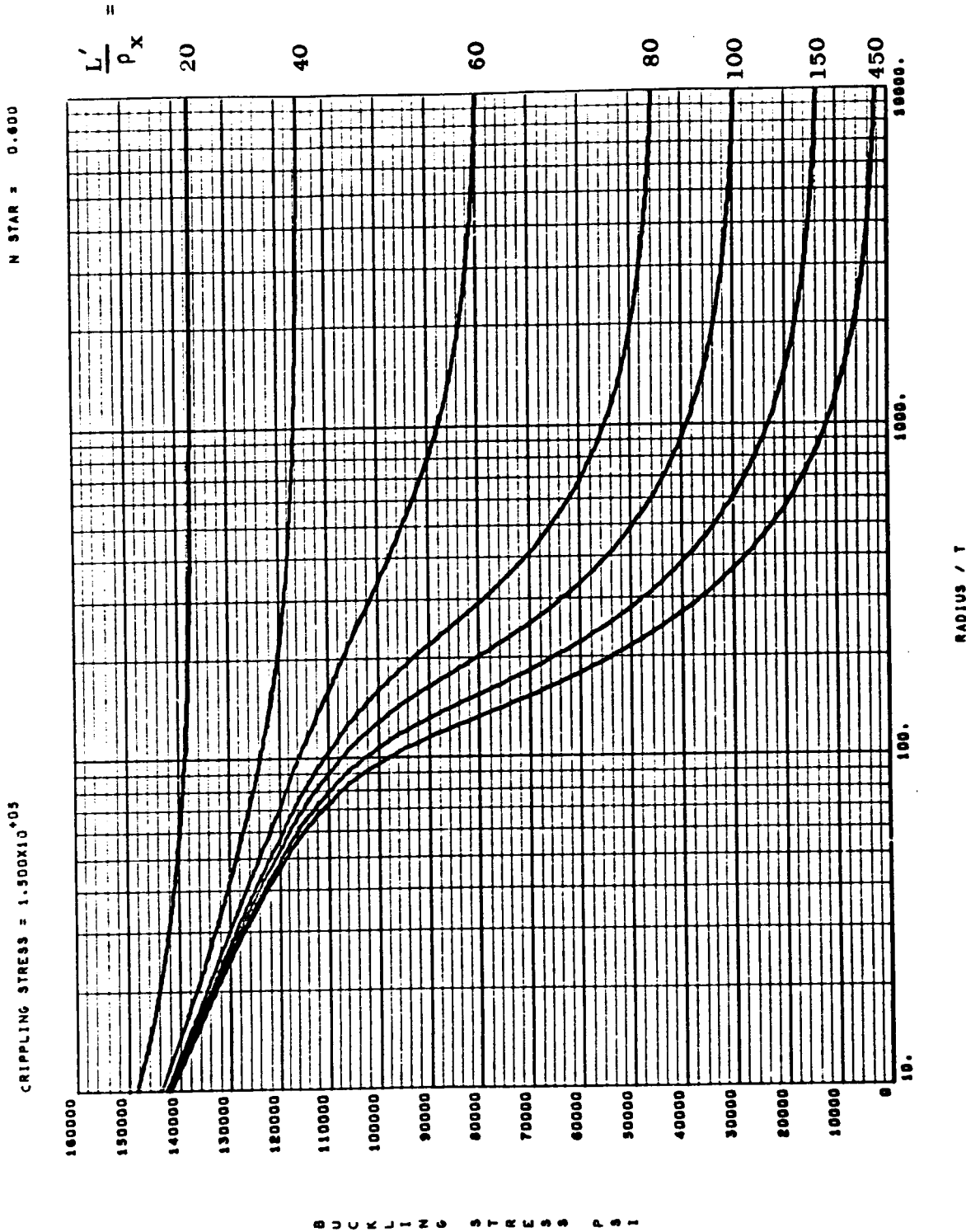
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 22(b)



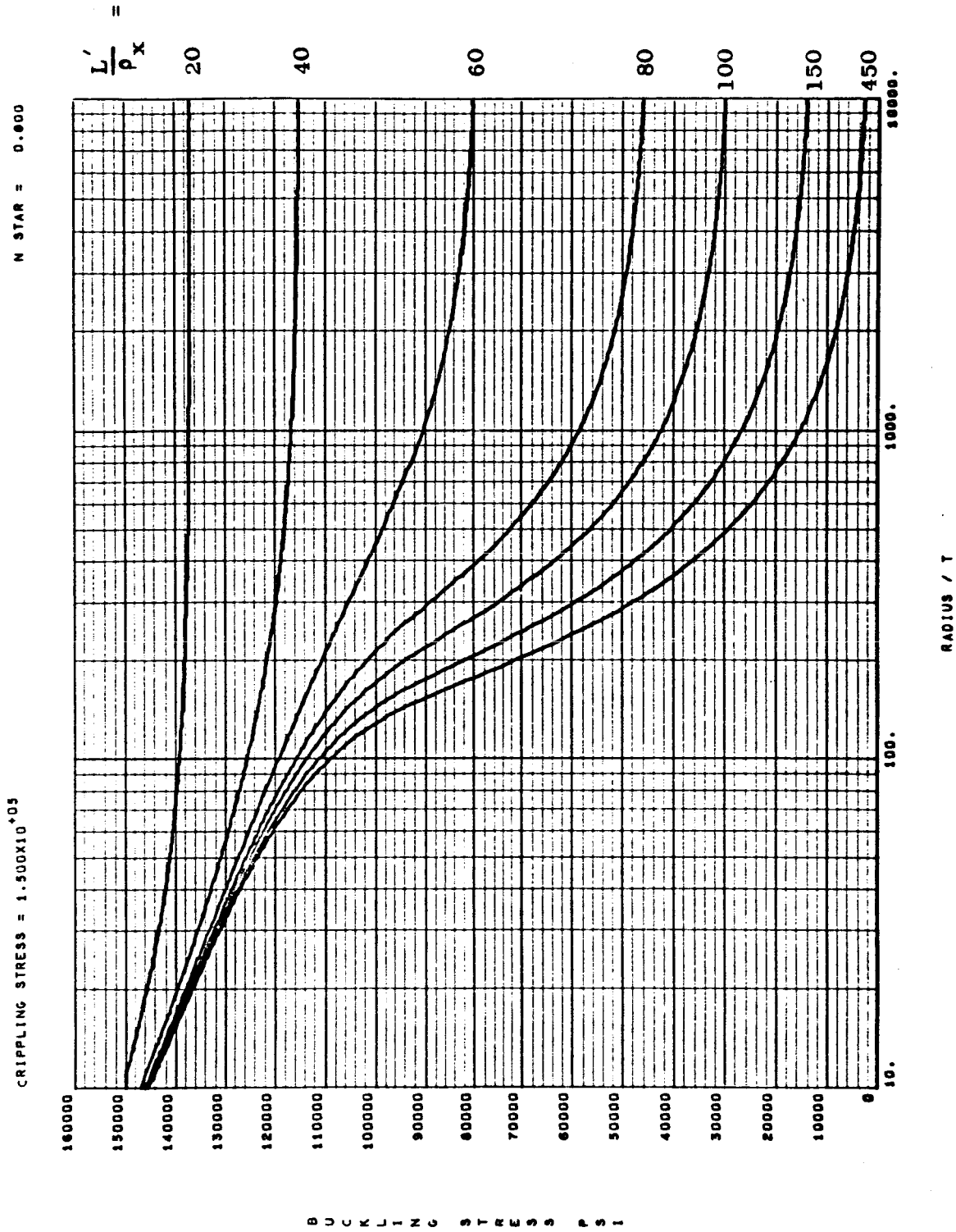
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 22(c)



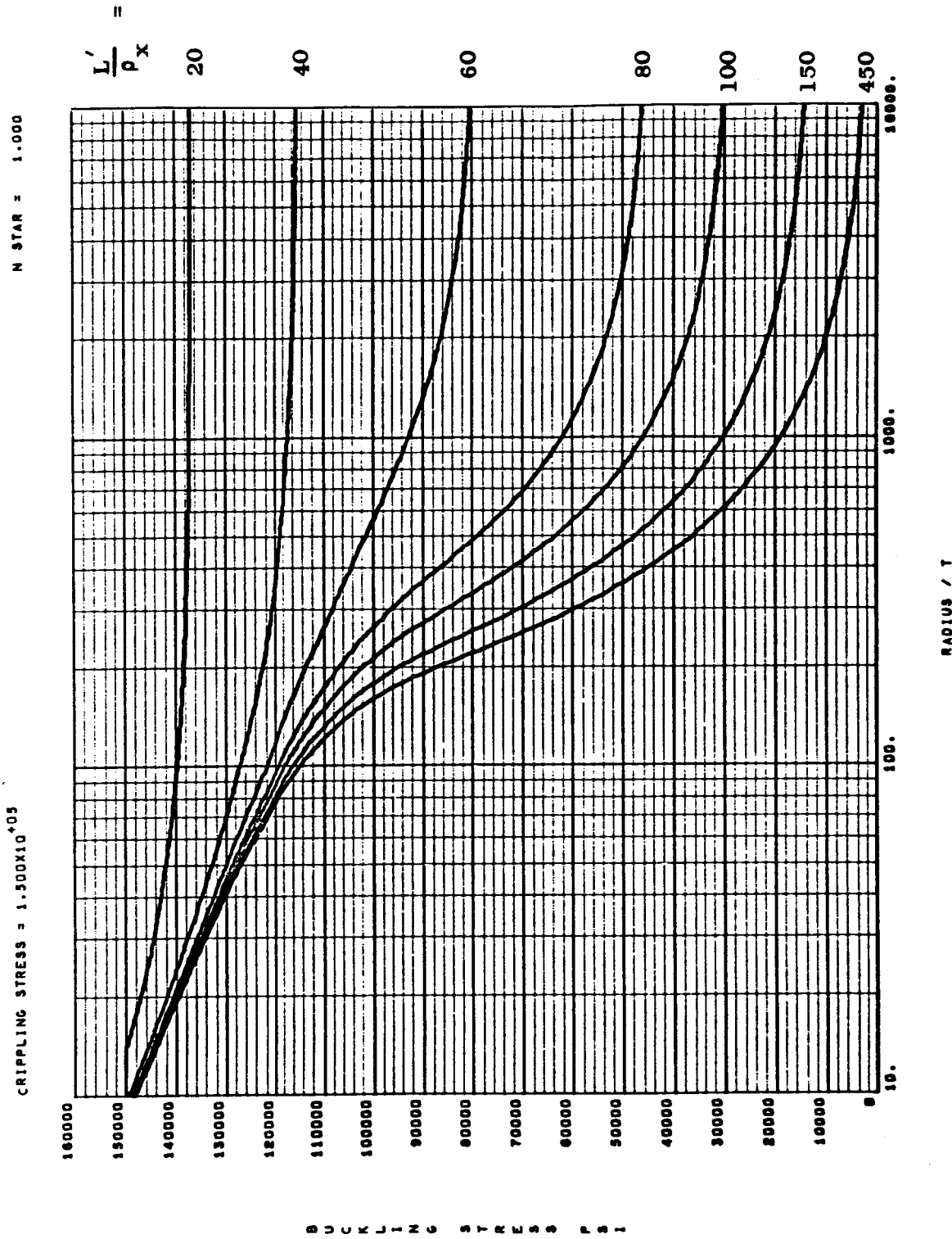
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 22(d)



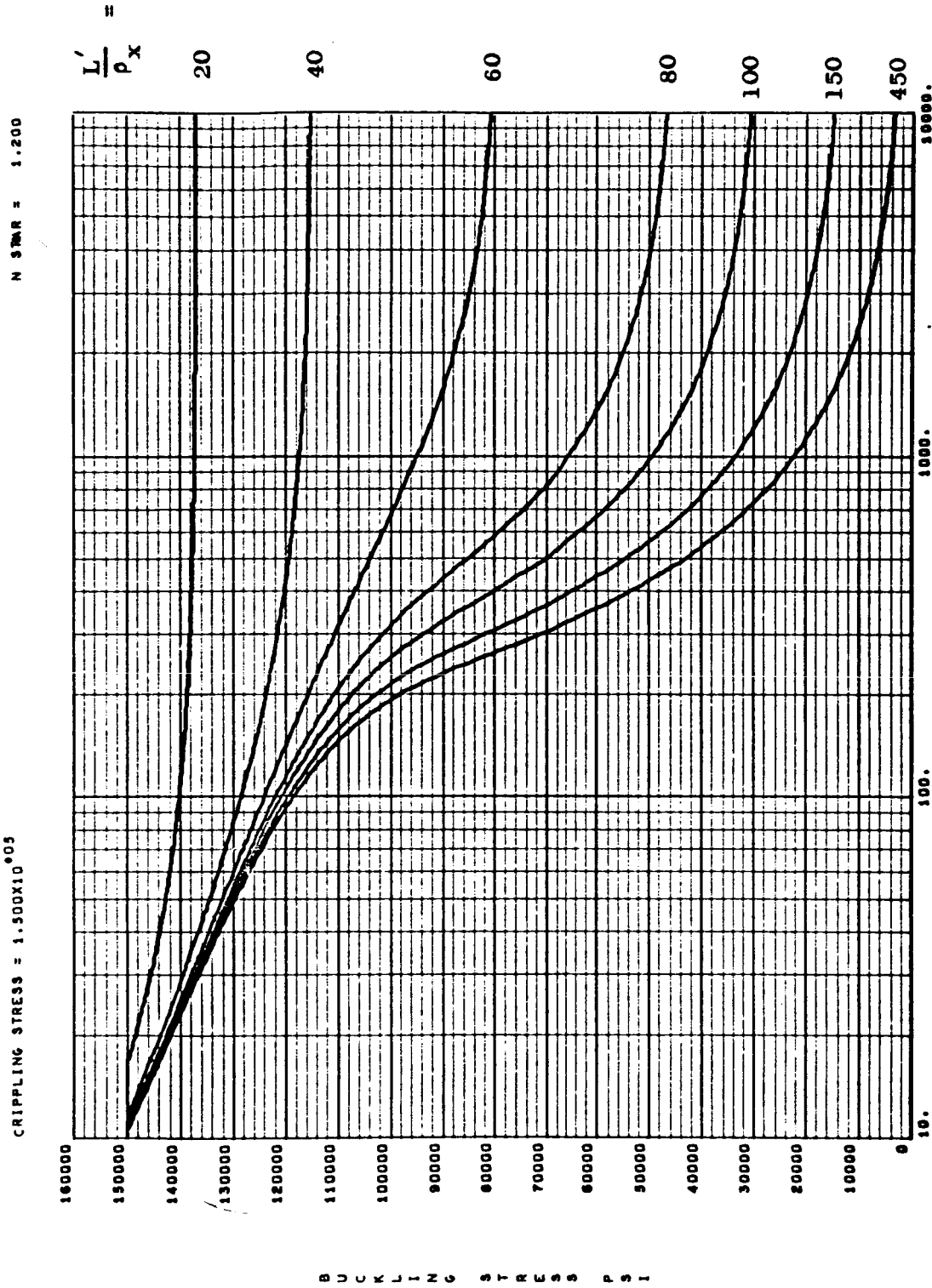
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 22(e)



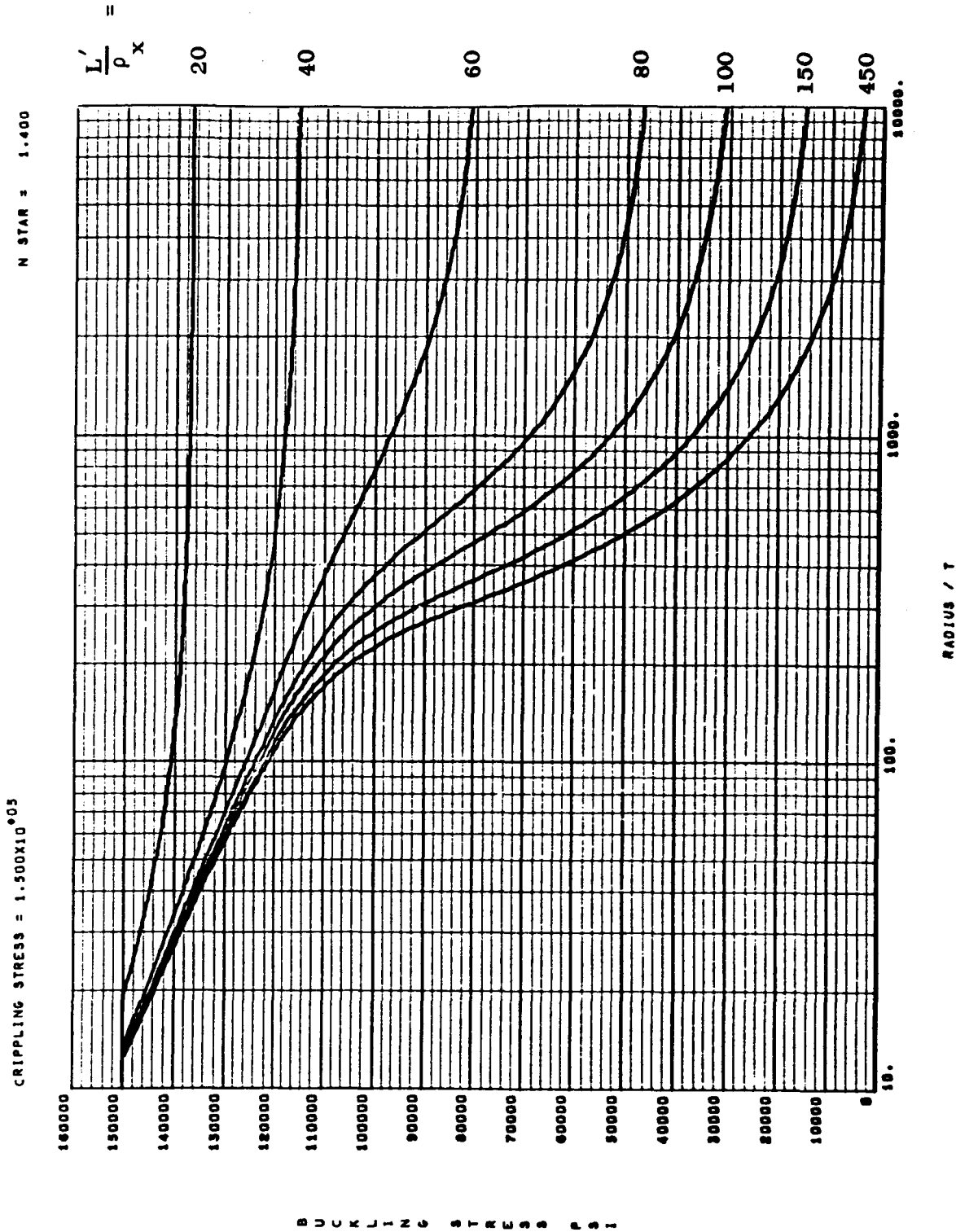
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 22(f)



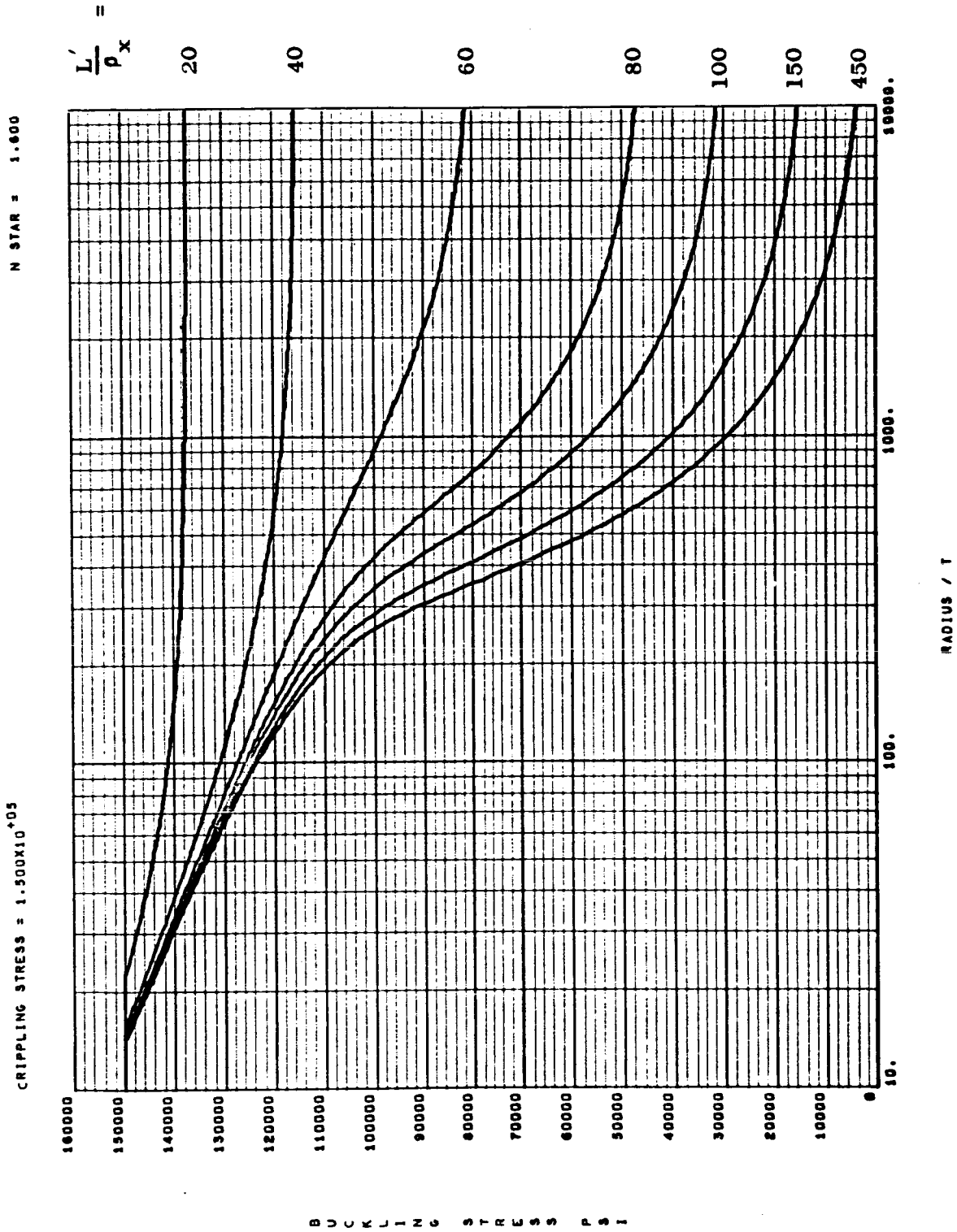
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 22(g)

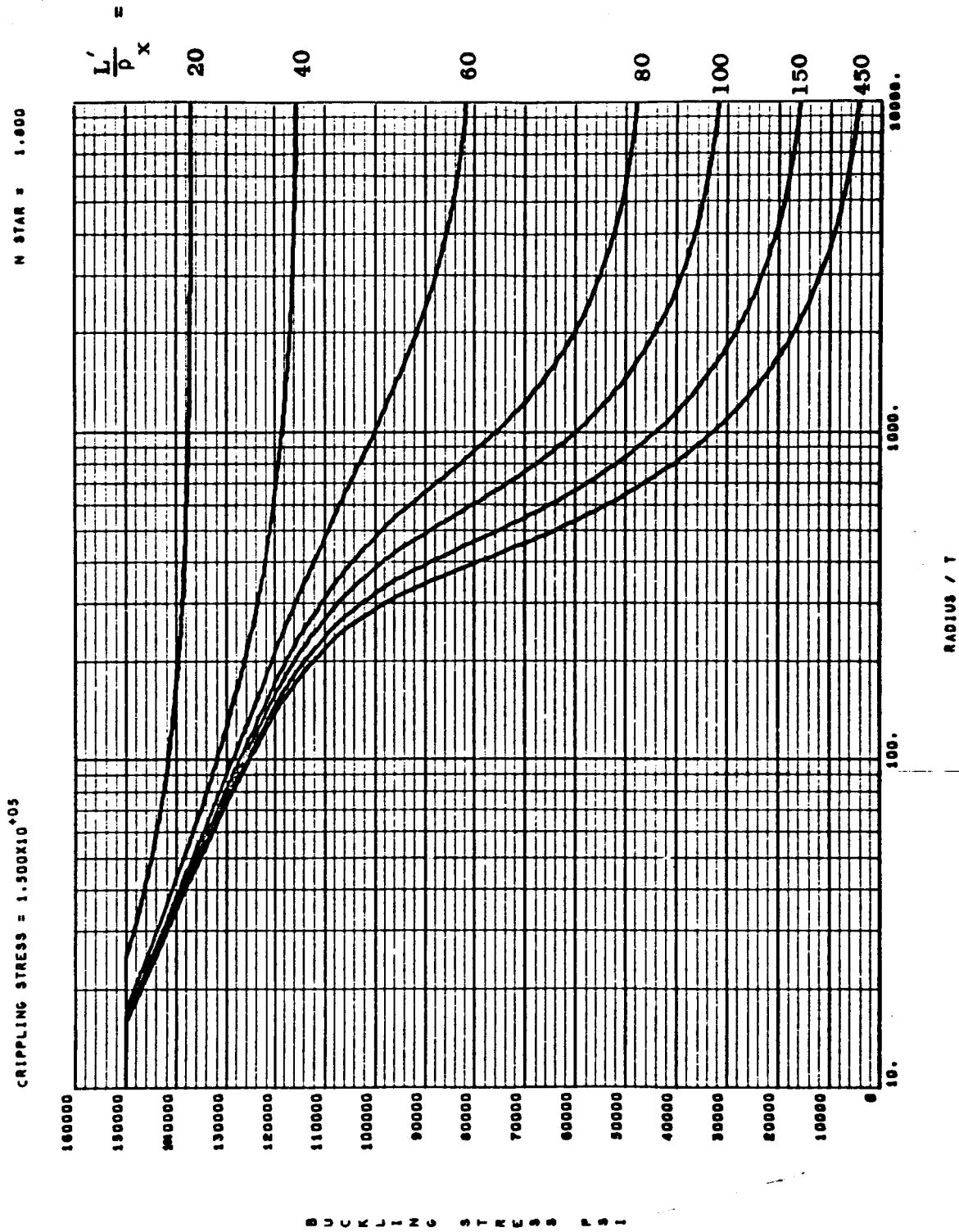


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 22(h)

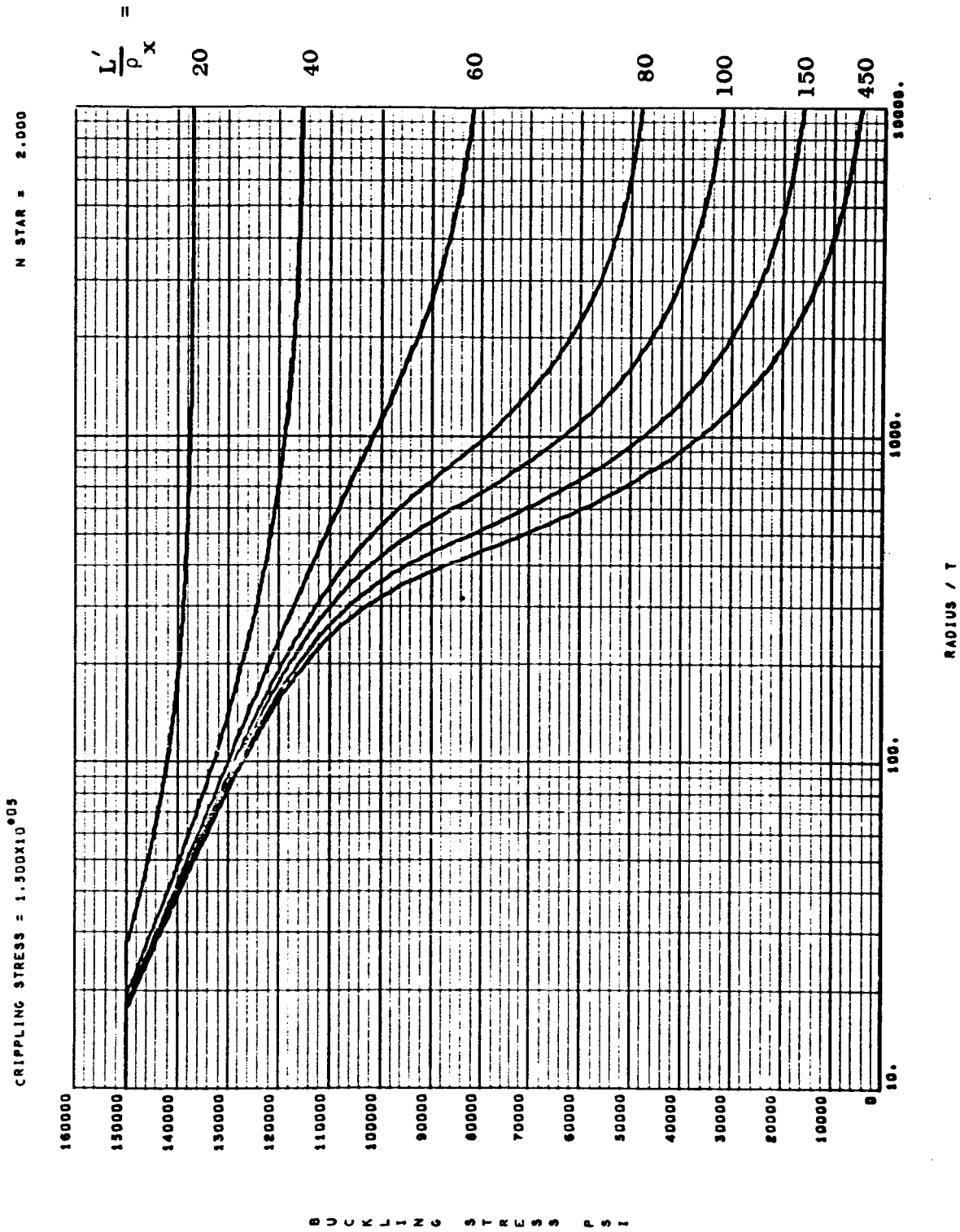


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)
Figure 22(i)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 22(j)

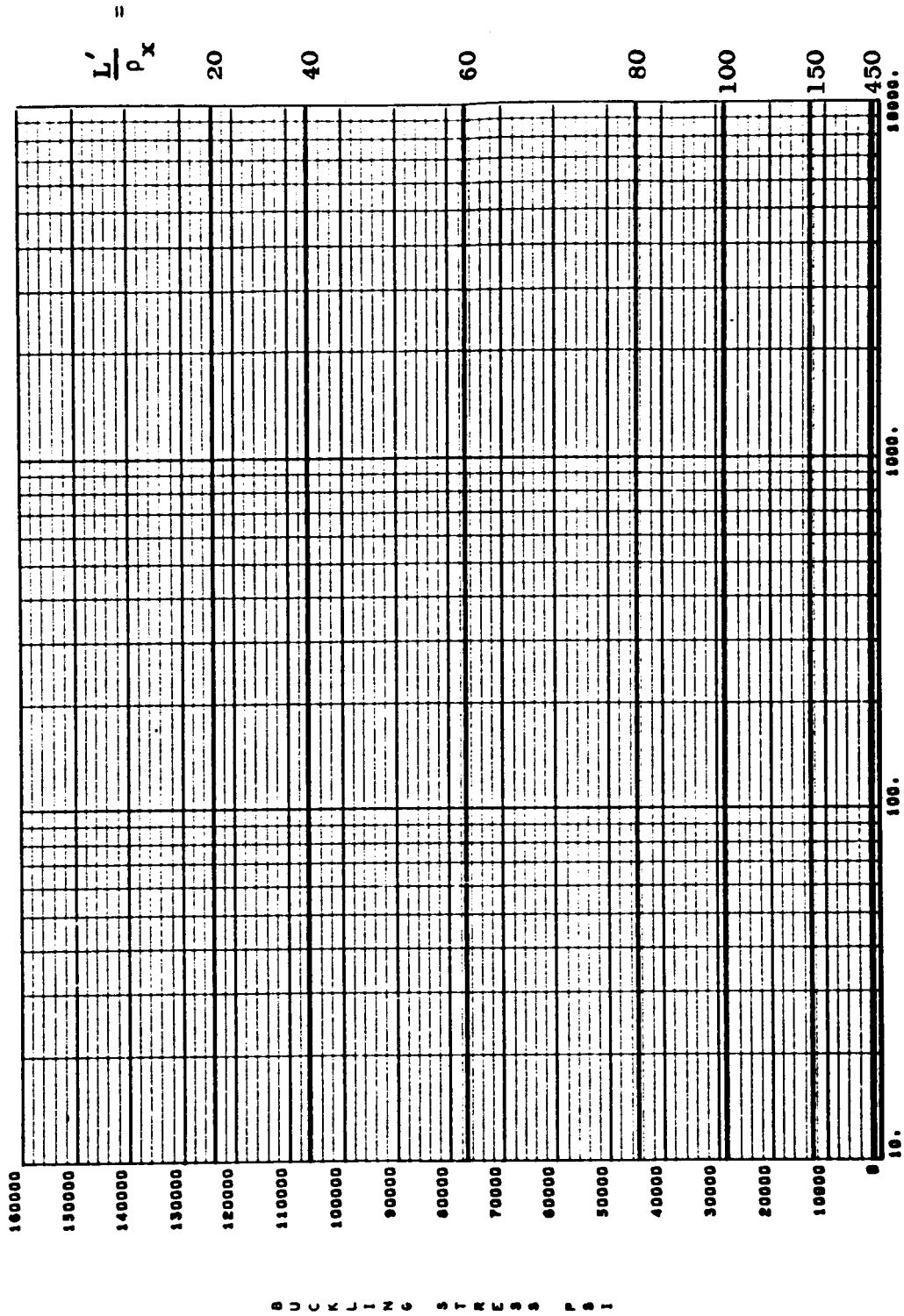


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 22(k)

N STAR = 0.000

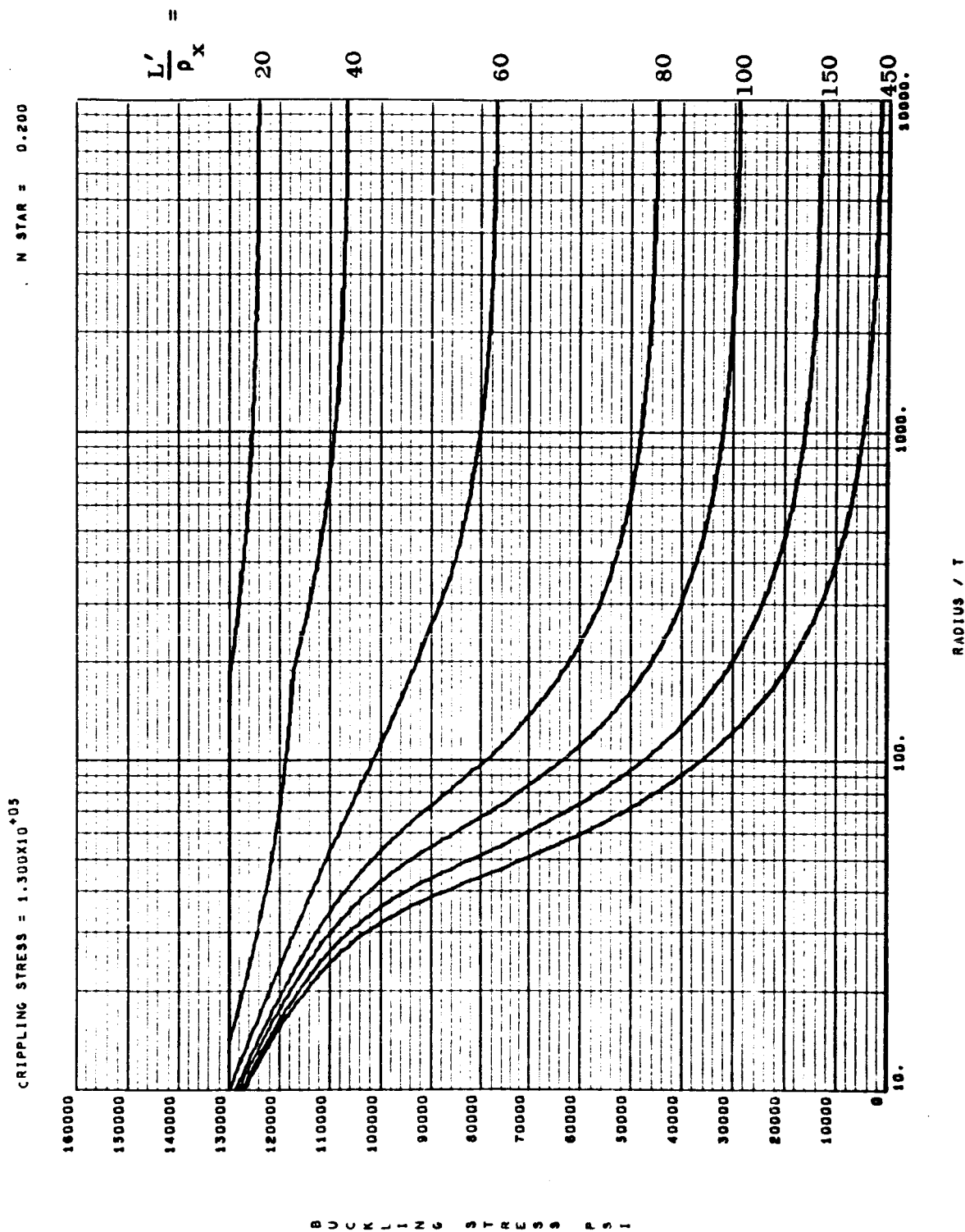
CRIPPLING STRESS = $1.300 \times 10^{+05}$



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS

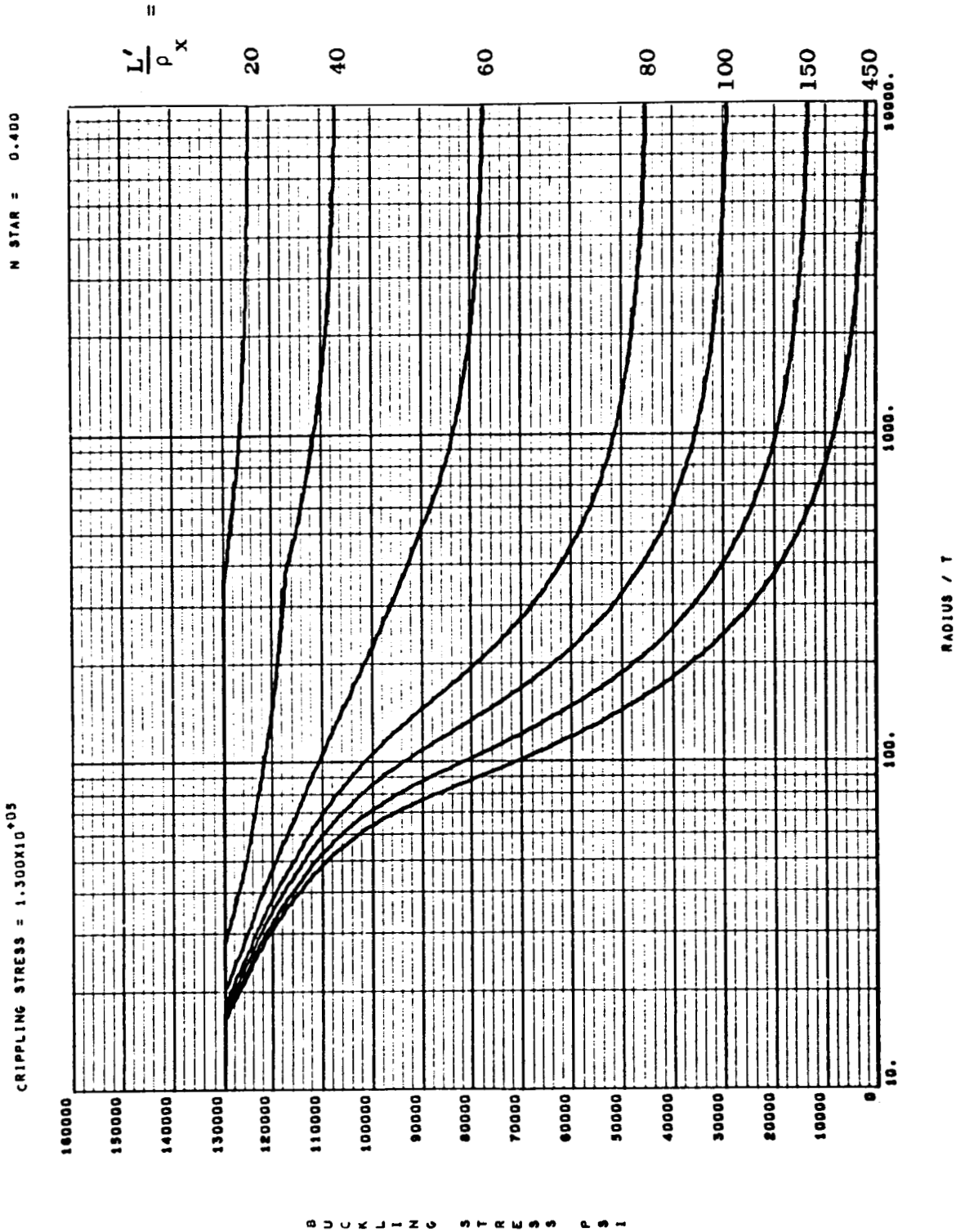
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 23(a)



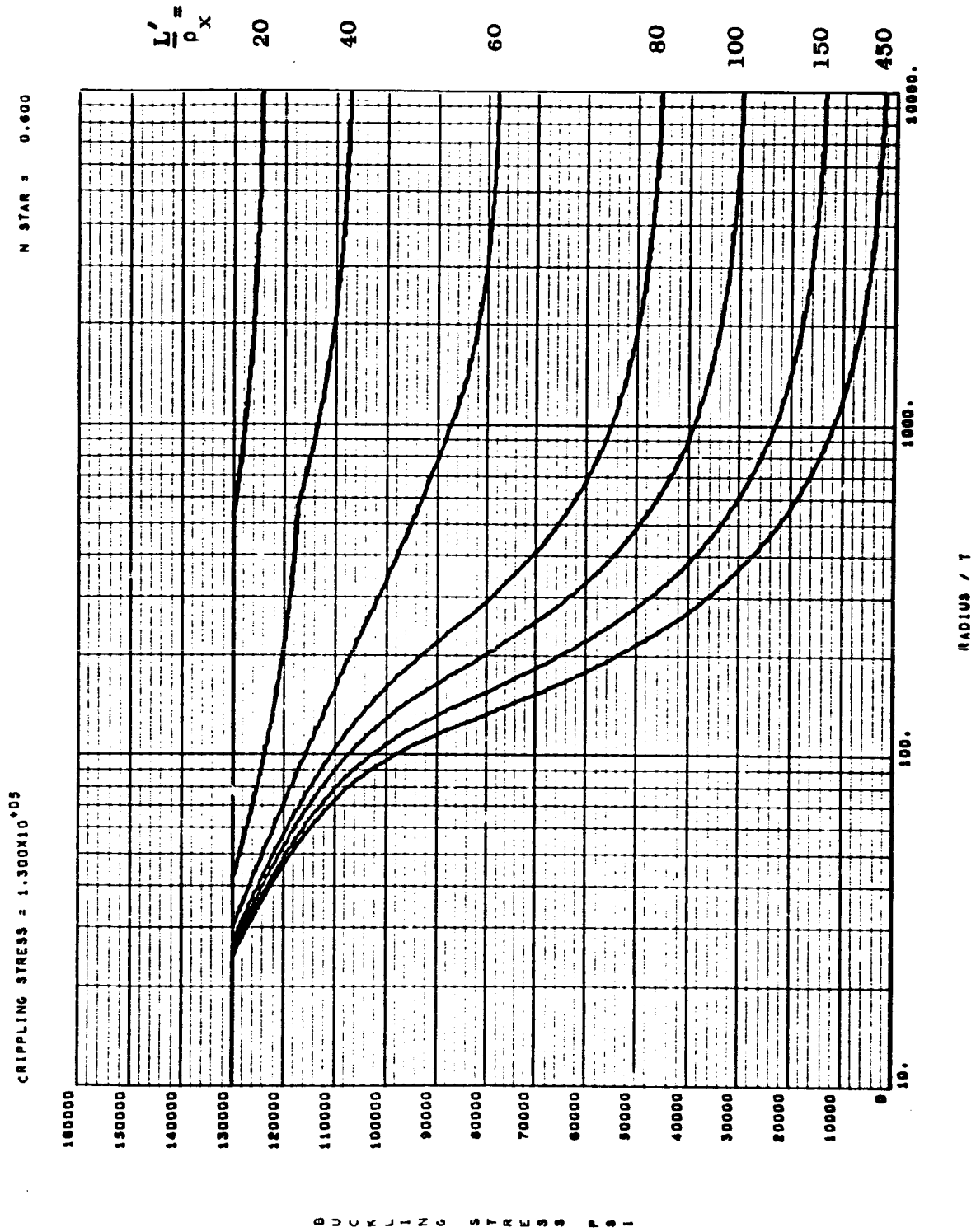
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 23(b)



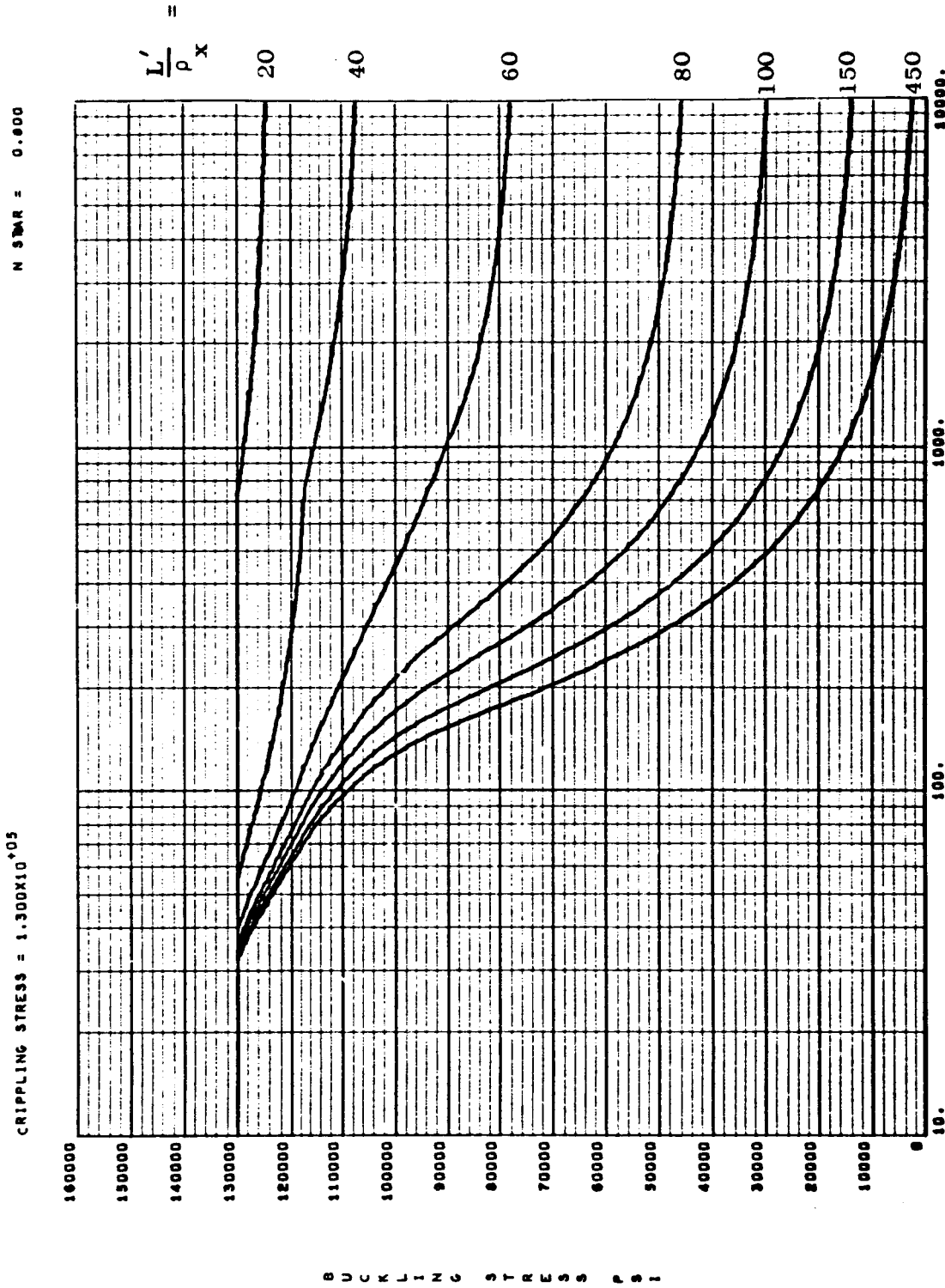
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 23(c)



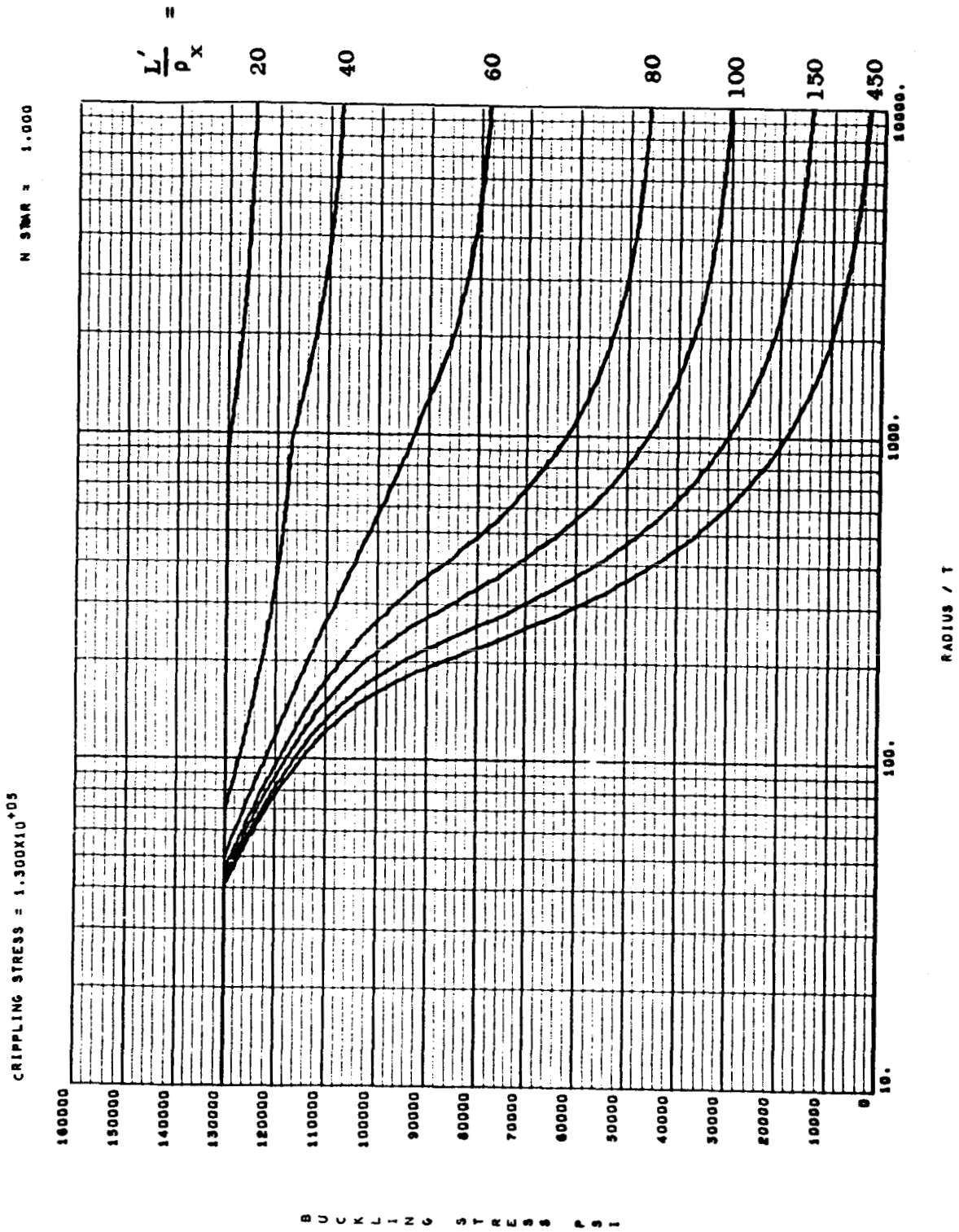
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 23(d)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 23(e)

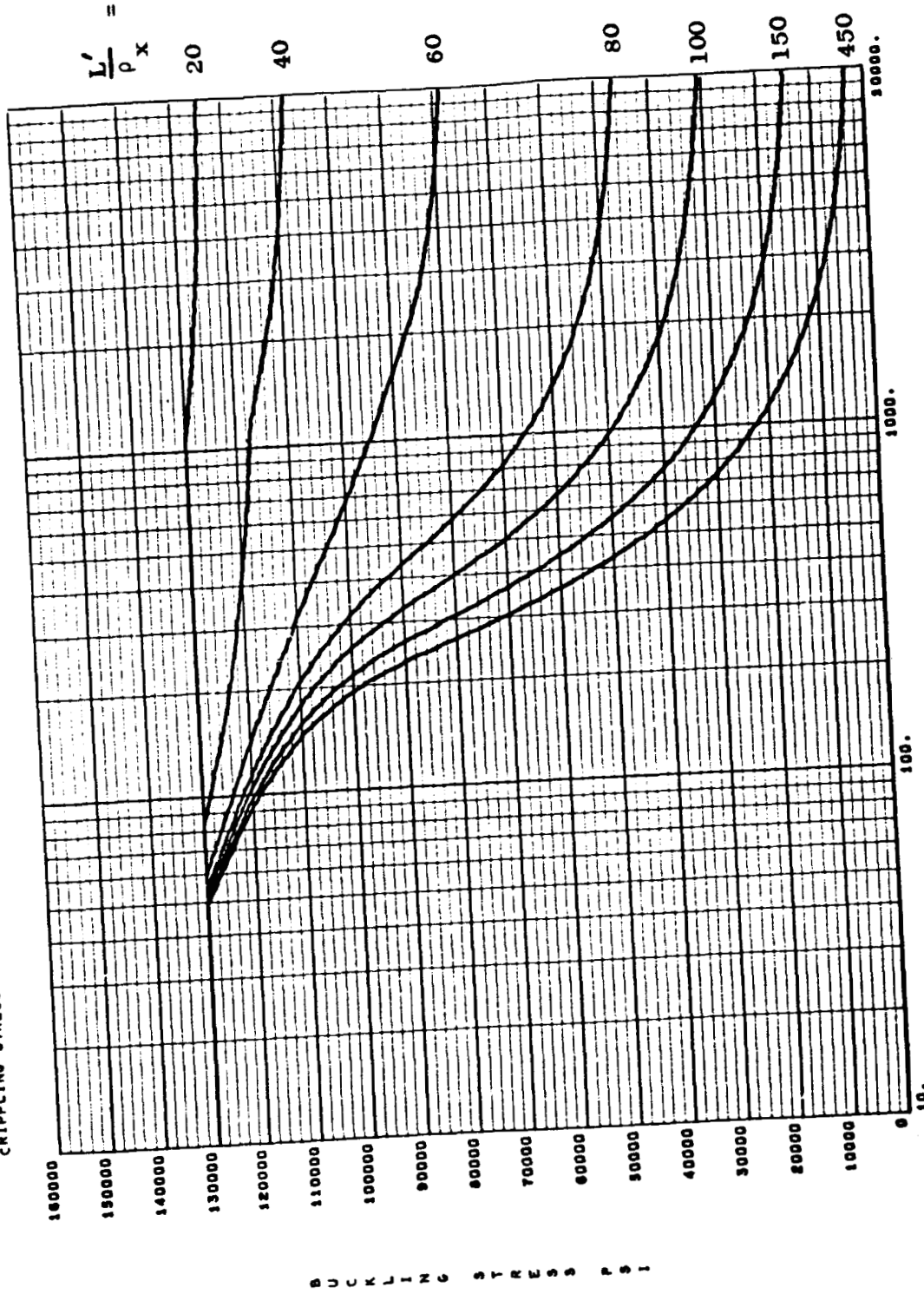


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 23(f)

N STAR = 1.200

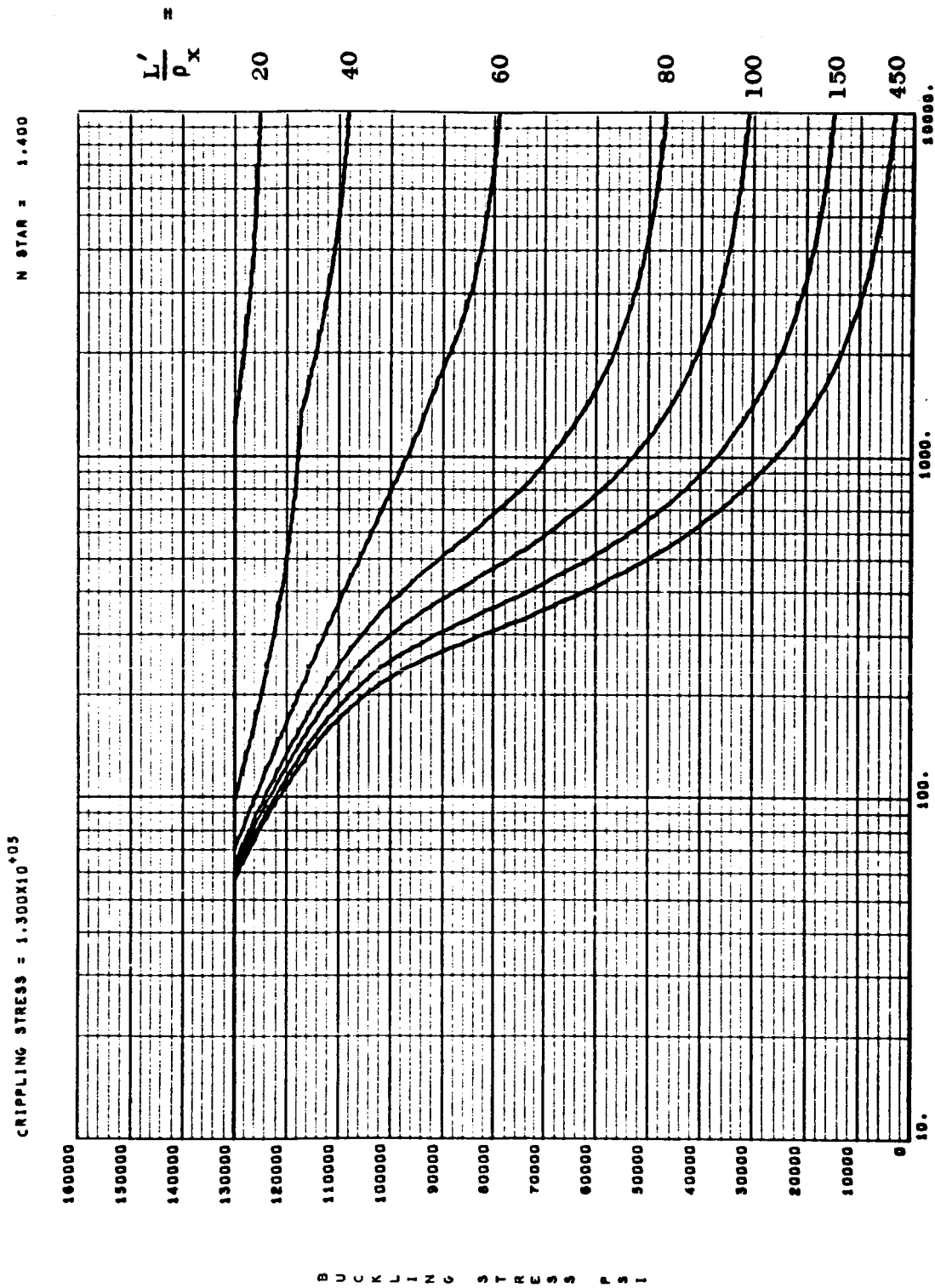
CRIPPLING STRESS = 1.300×10^{-5}



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COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 23(g)

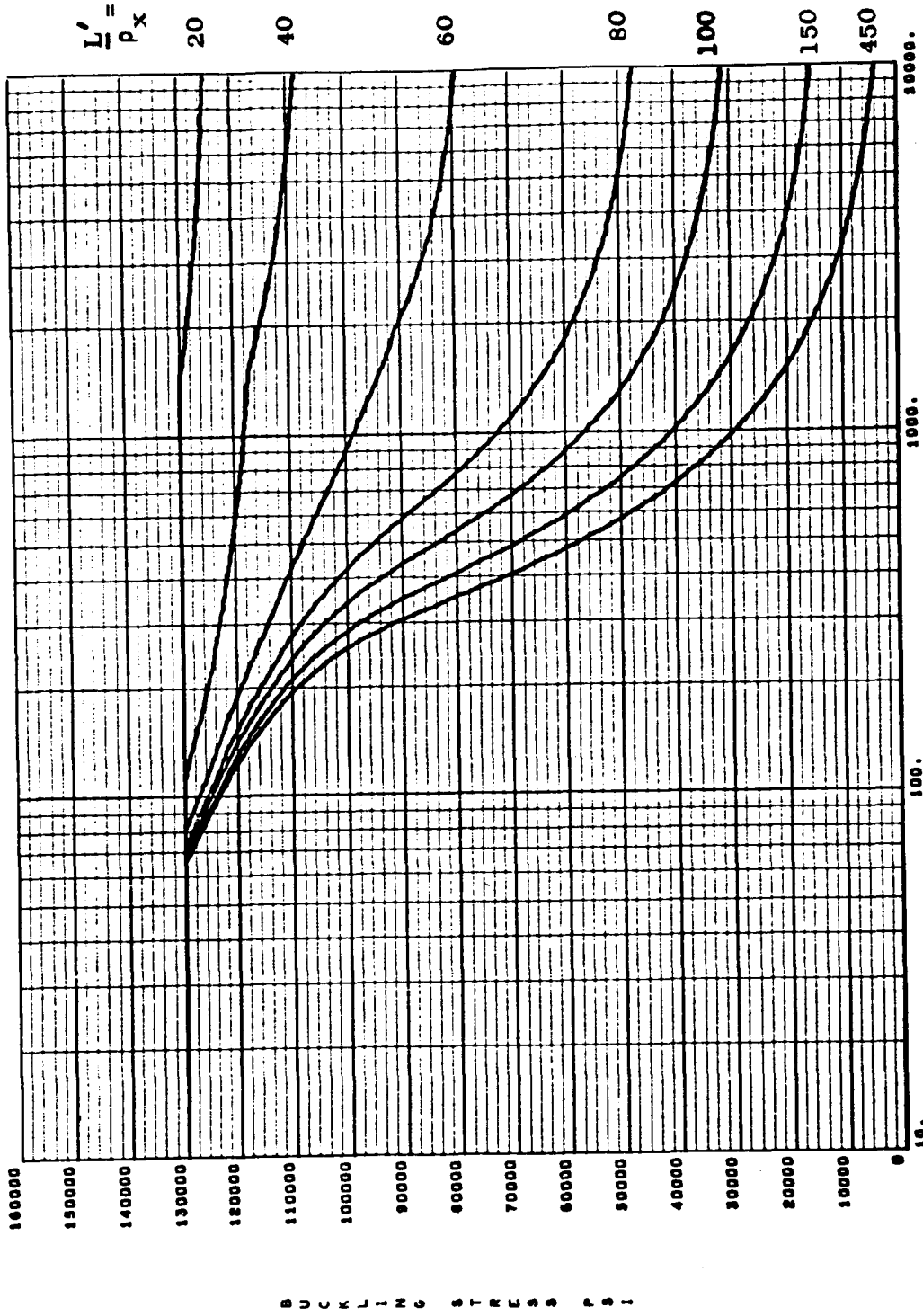


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 23(h)

N STAR = 1.600

CRIPPLING STRESS = 1.300×10^4 PSI

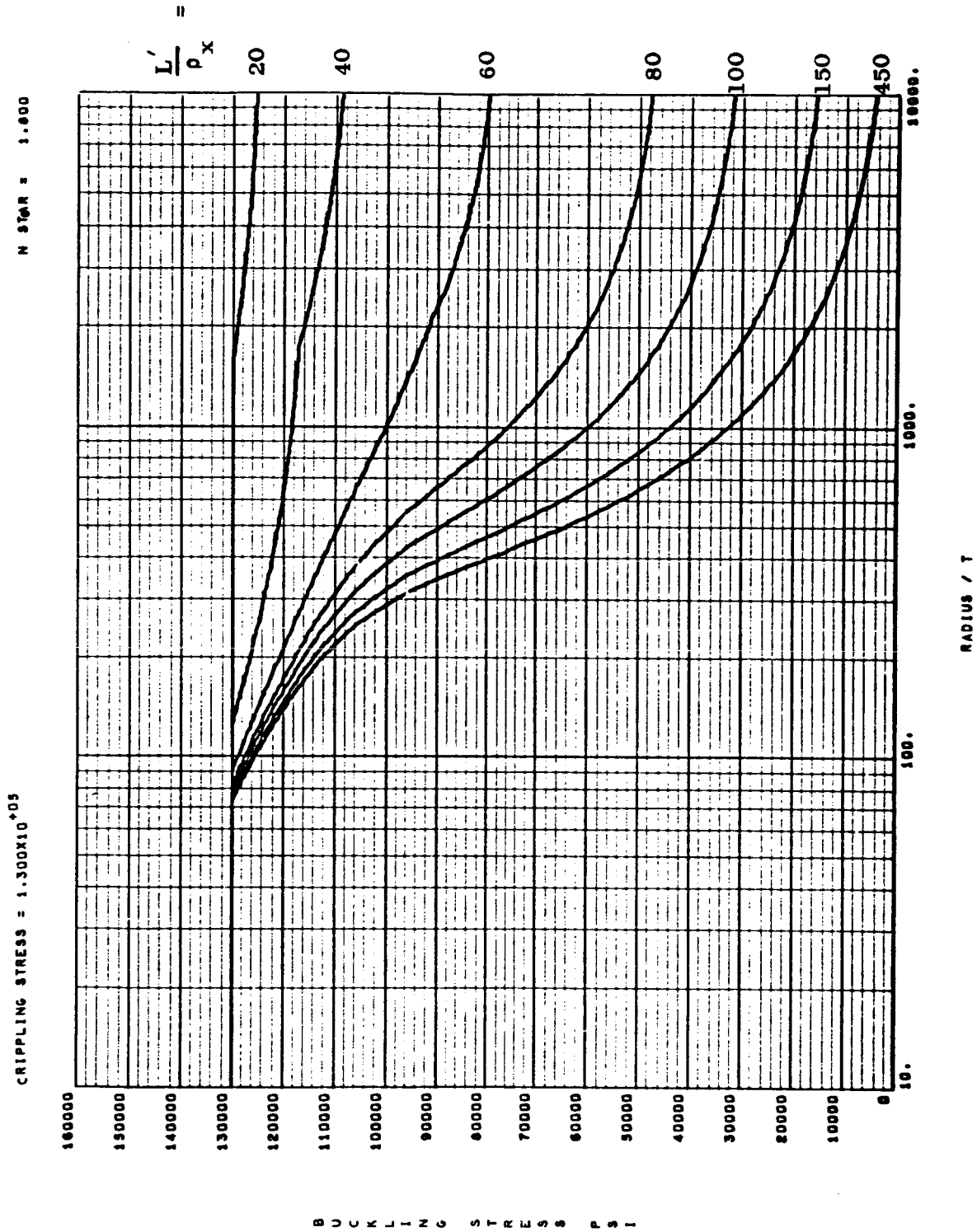


RADIUS / IN

COMPRESSIVE BUCKLING STRESS FOR LONGITUDINALLY STIFFENED CYLINDERS

MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 23(i)

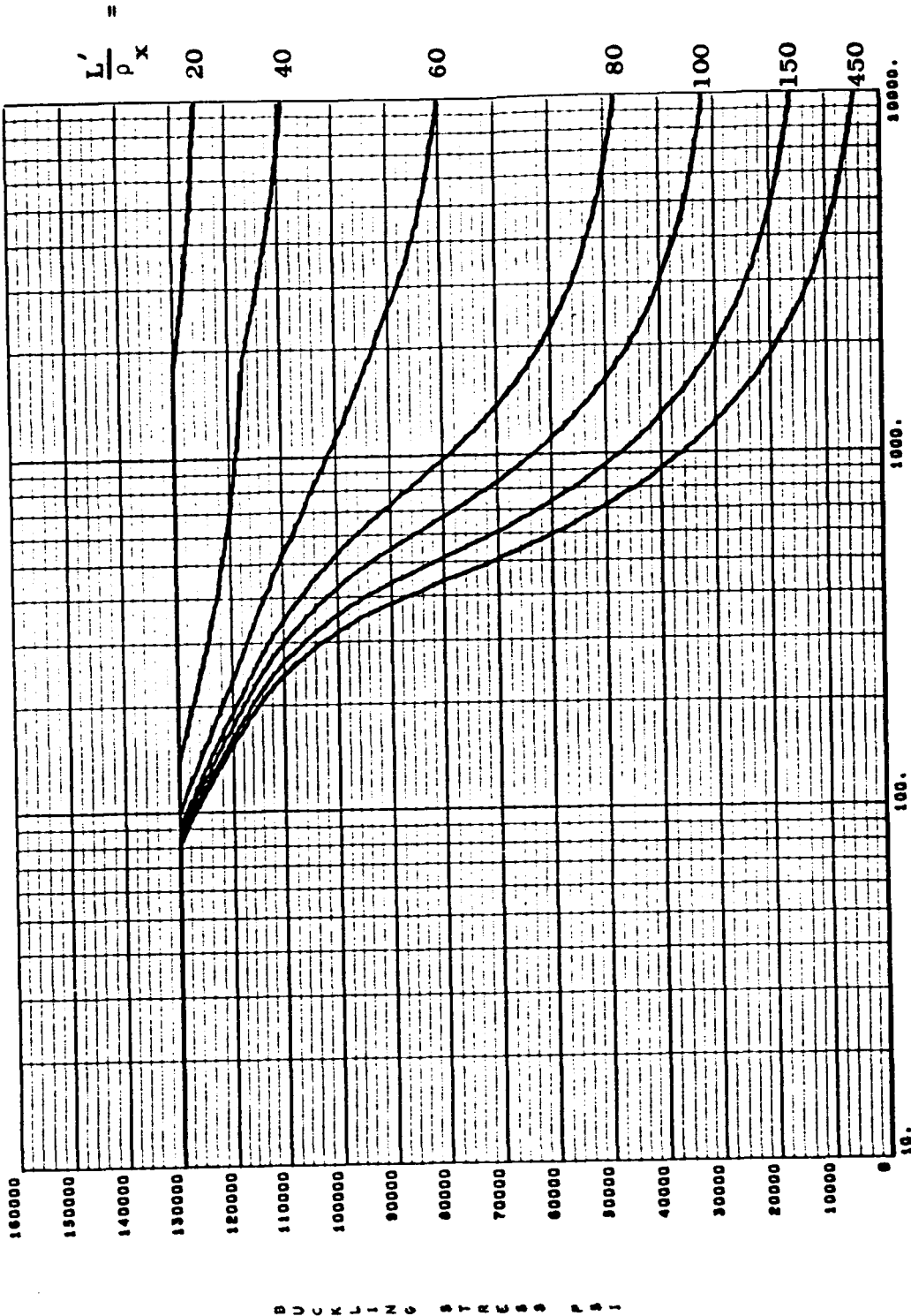


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 23(j)

N STAR = 2.000

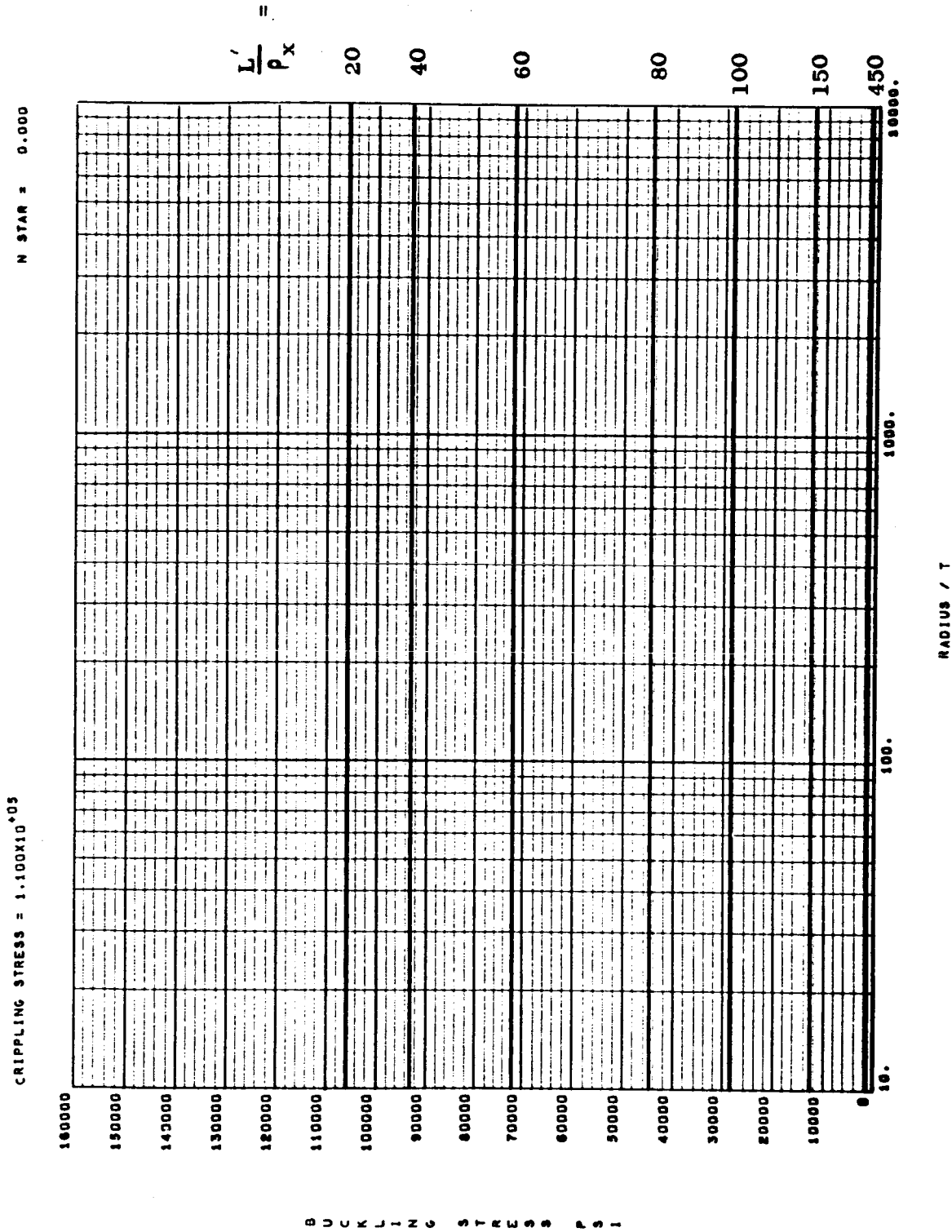
CRIPPLING STRESS = 1.300×10^5



RADIUS / T

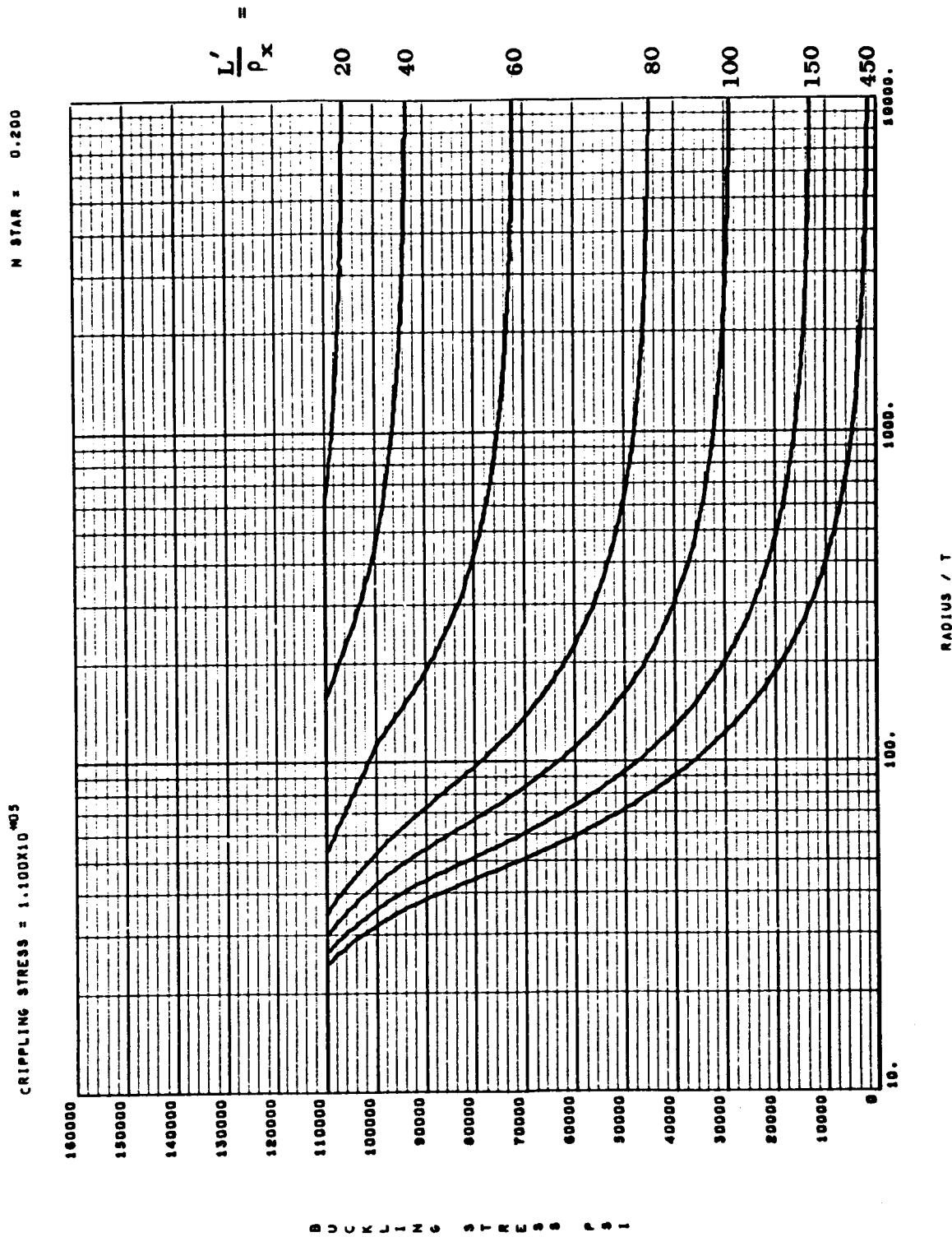
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 25(k)



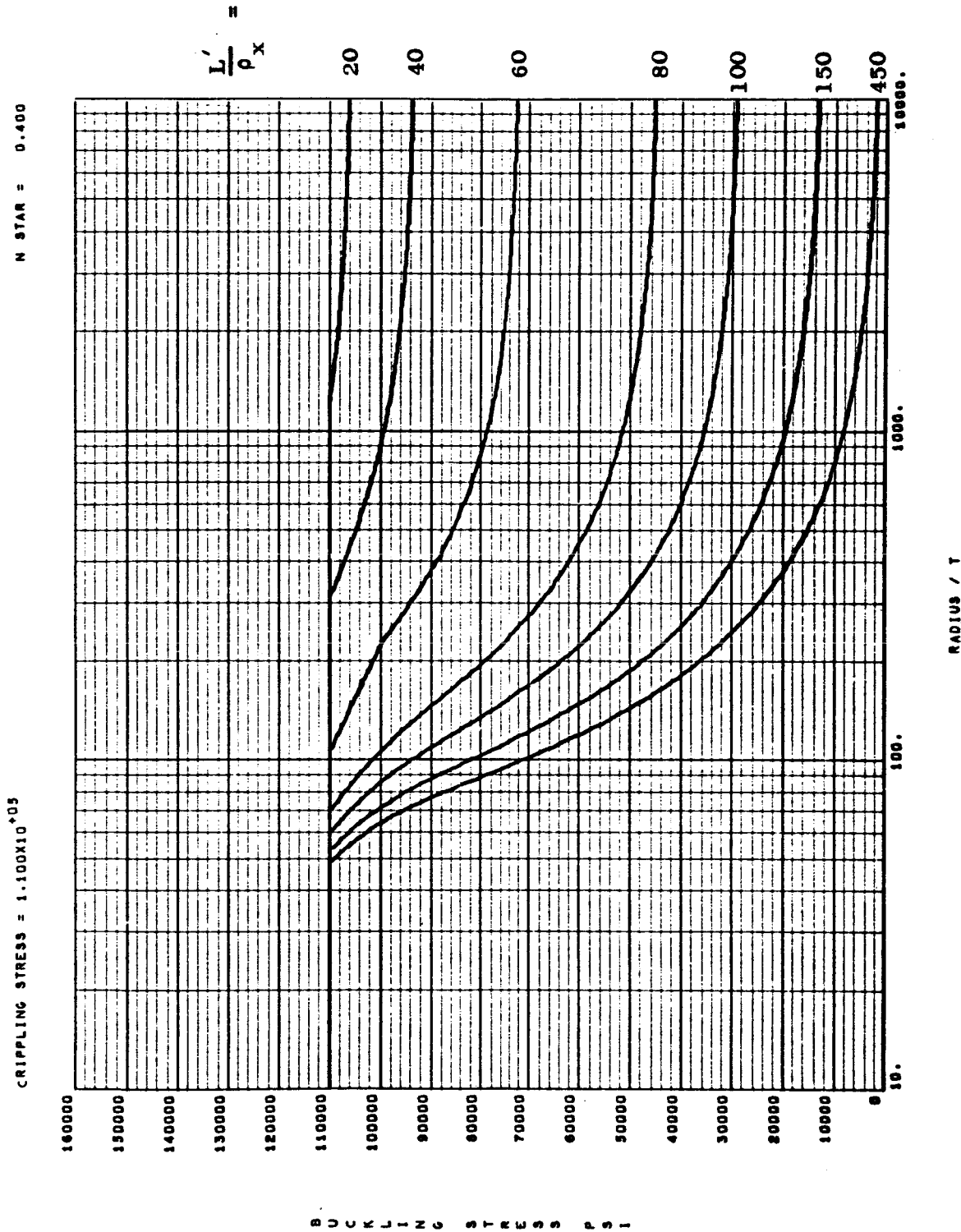
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 24(a)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 24(b)

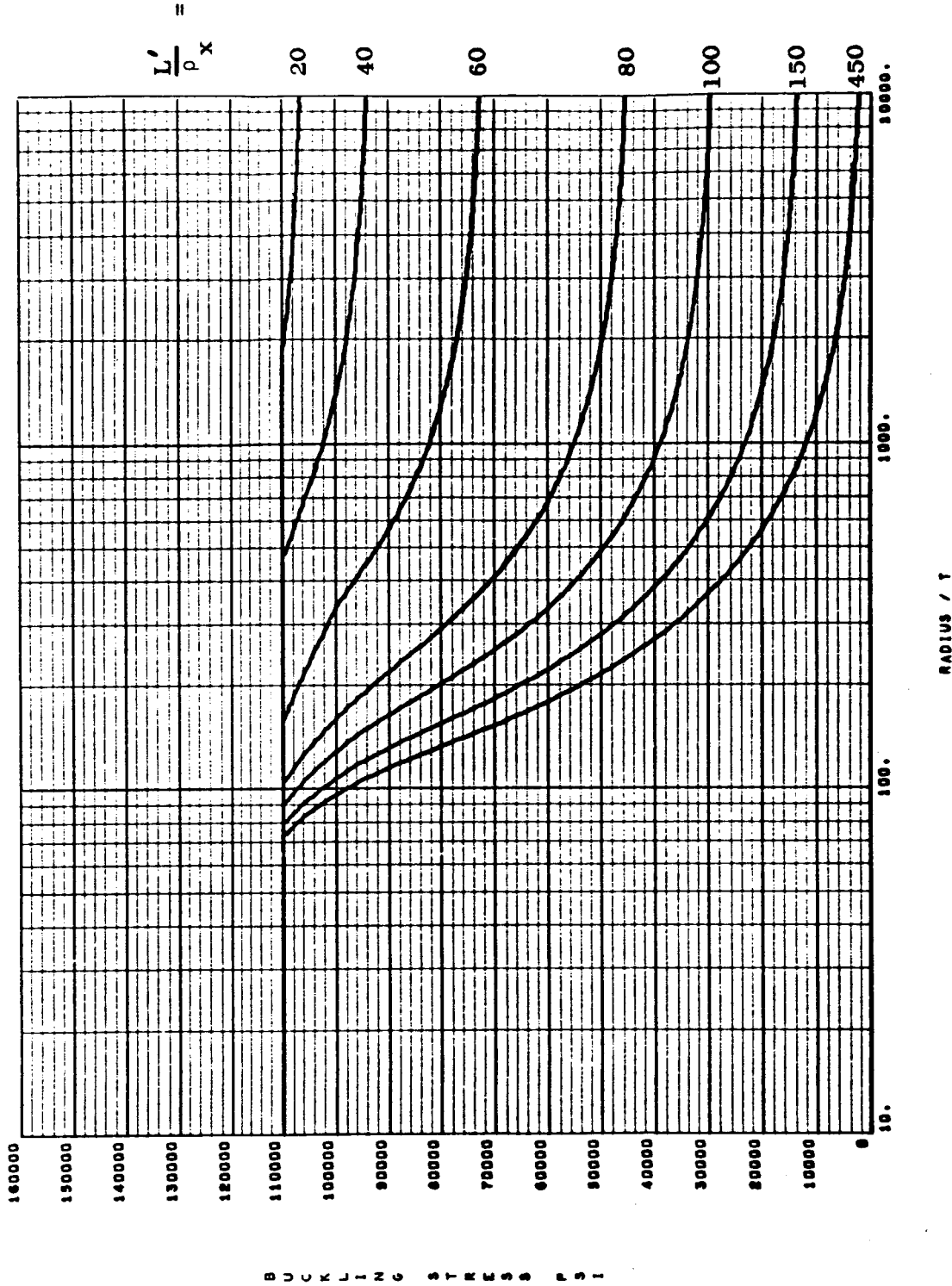


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 24(c)

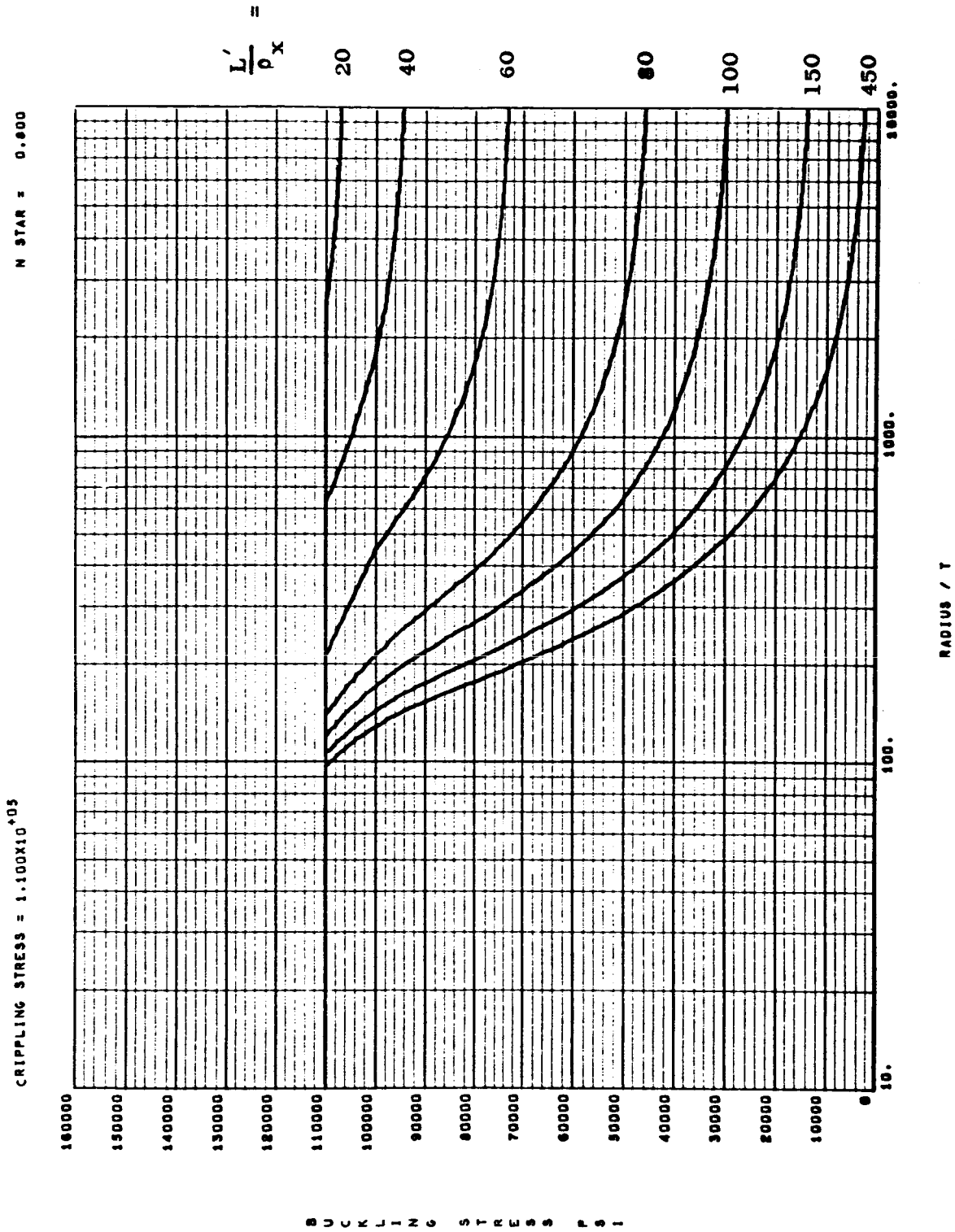
N STAR = 0.600

CRIPPLING STRESS = 1.100×10^{10}



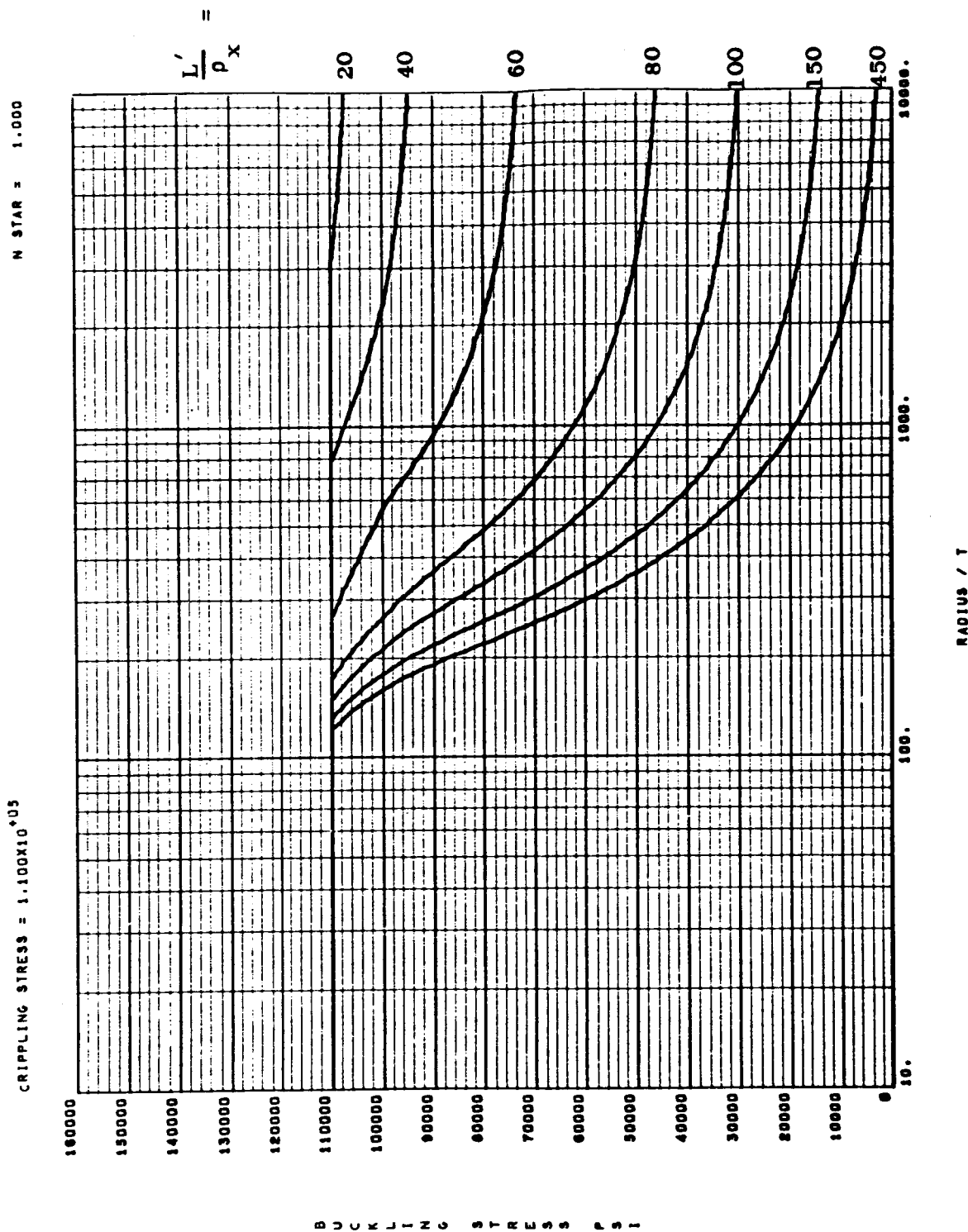
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 24(d)



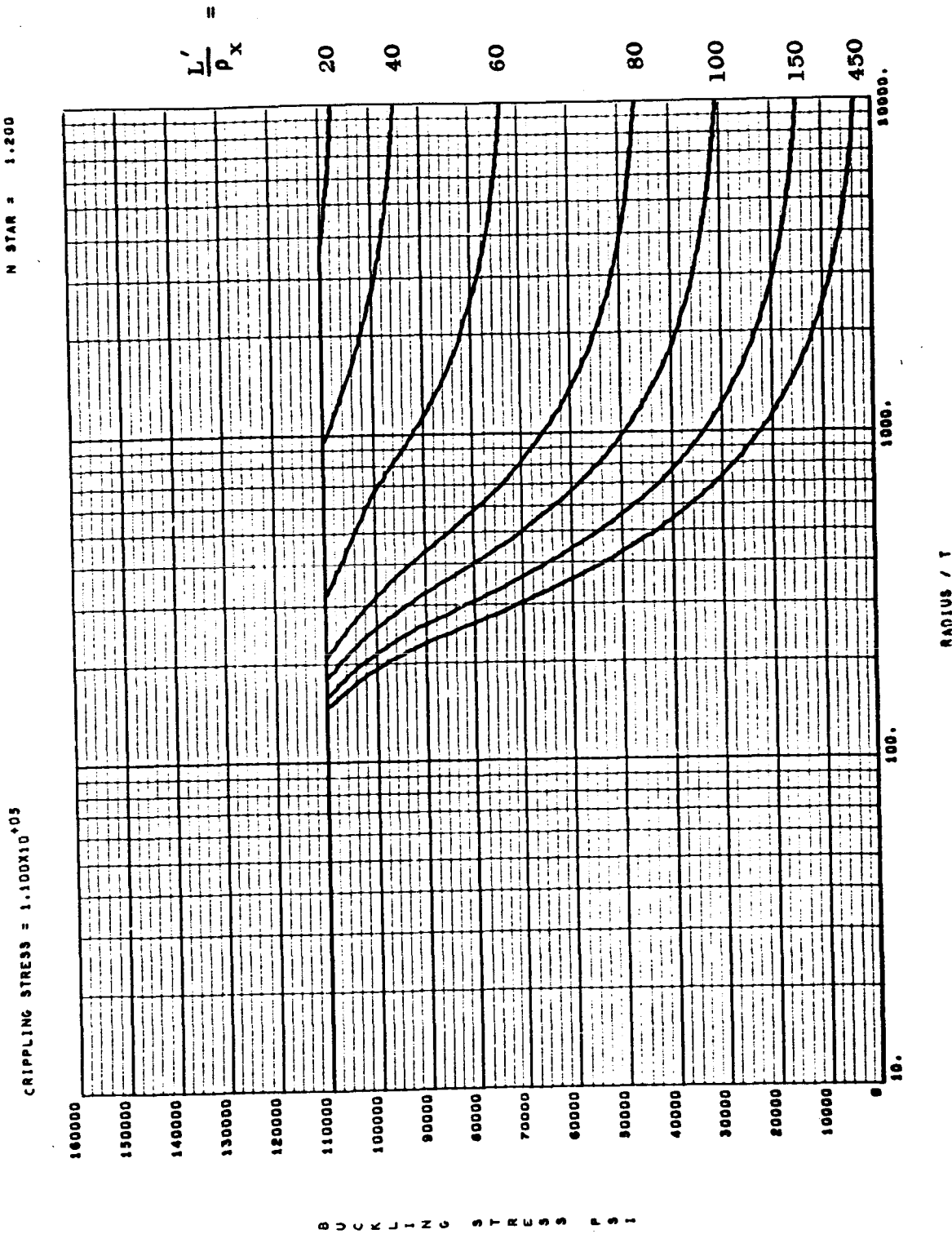
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 24(e)



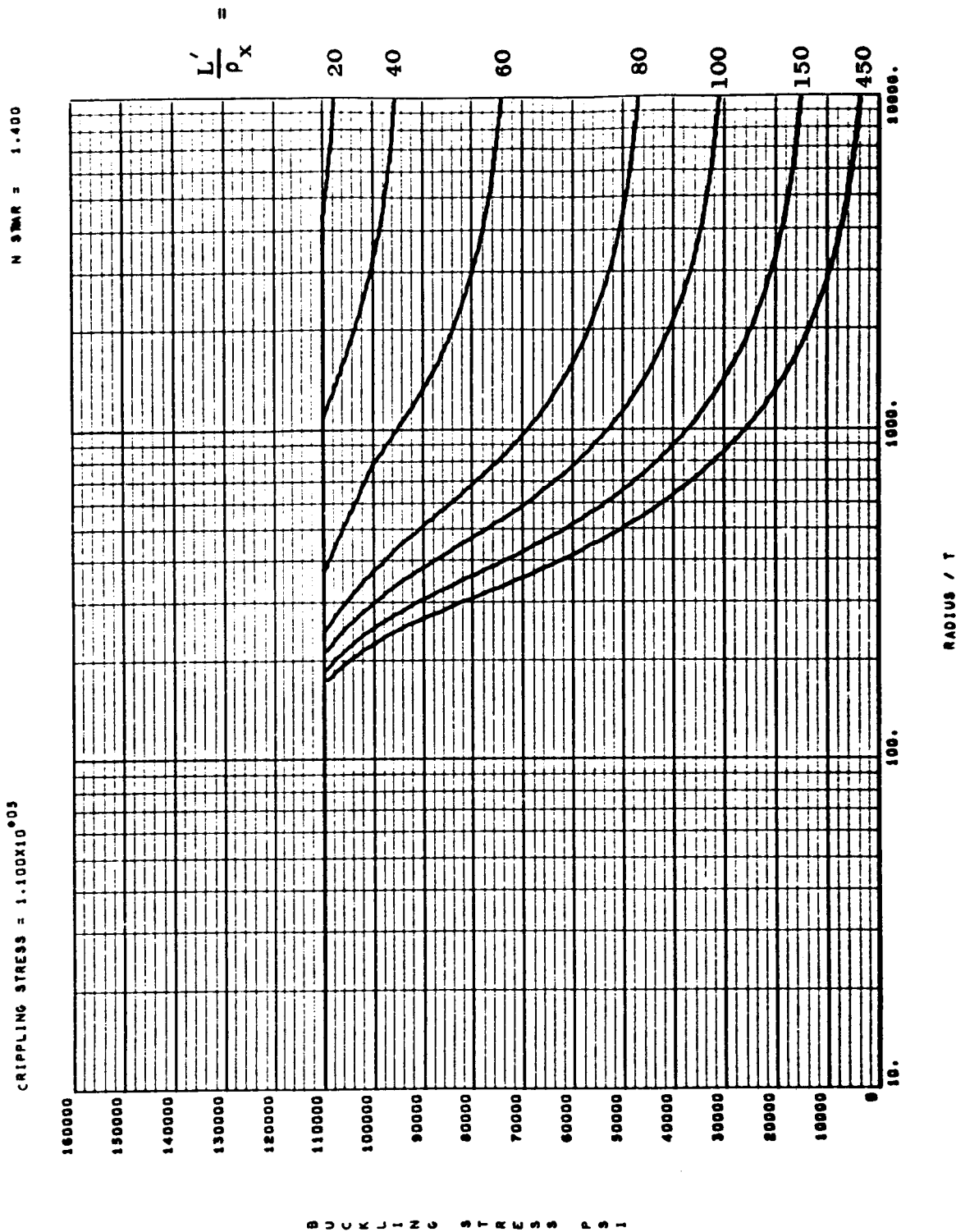
COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL -718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 24(f)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL -718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

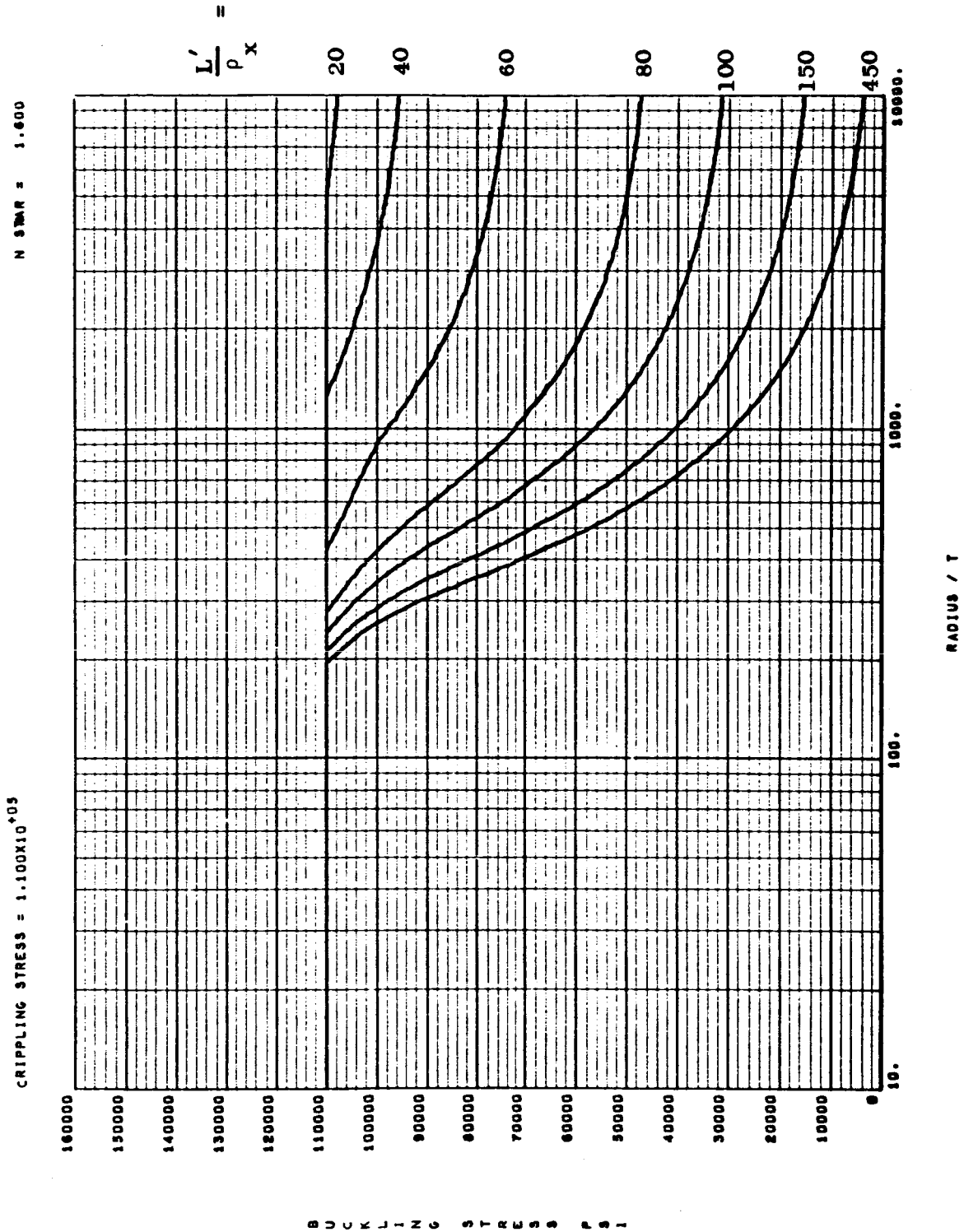
Figure 24(g)



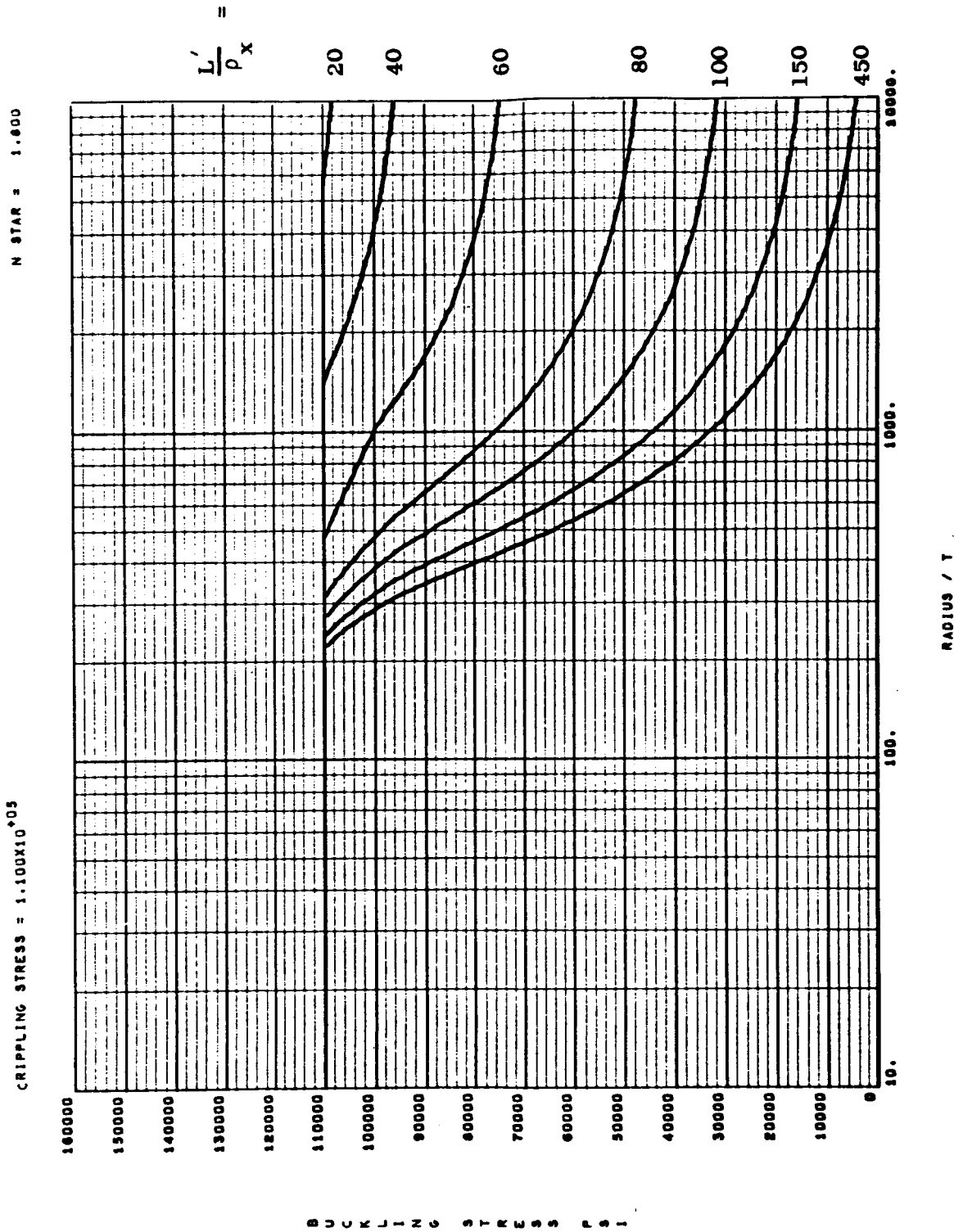
RADIUS / T

COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 24(h)

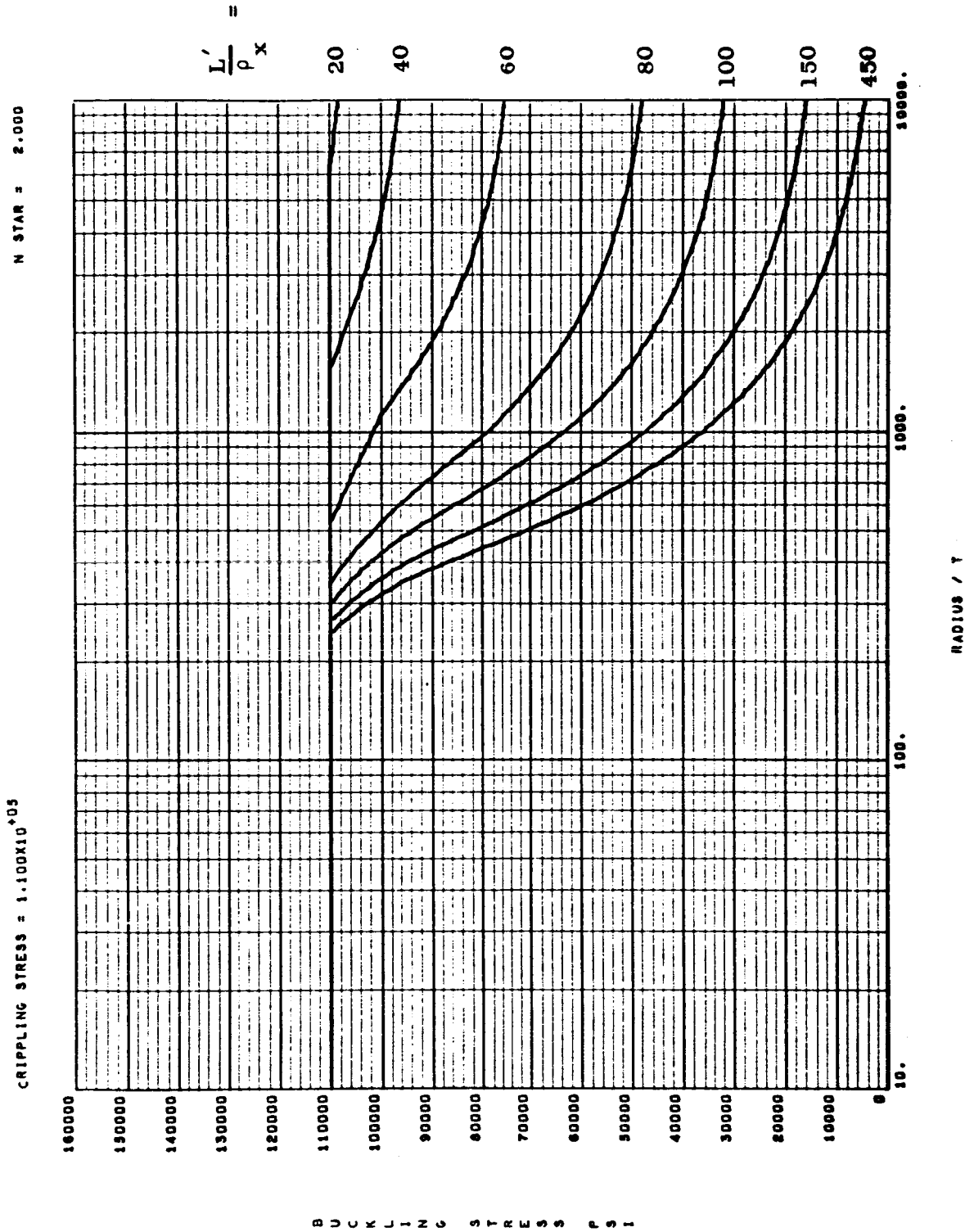


COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)
Figure 24(i)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 24(j)



COMPRESSIVE BUCKLING STRESS FOR
LONGITUDINALLY STIFFENED CYLINDERS
MATERIAL - 718 NICKEL ALLOY (ANNEALED + DOUBLE AGED)

Figure 24(k)

APPENDIX B

NONDIMENSIONAL CURVES WHICH ARE NOT
RESTRICTED TO SINGLE MATERIAL

For skin-stringer combinations having slenderness ratios which satisfy the inequality

$$\frac{L'}{\rho_x} \geq (\sqrt{2})(\pi) \left(\sqrt{\frac{E}{\sigma_{cc}}} \right) \quad (B-1)$$

the many material-dependent buckling curves of SECTION 5.1 and APPENDIX A can be replaced by the single nondimensional family of Figure 25. These latter curves are of a widely-known basic form which emerges from application of the Ramberg-Osgood [9] nondimensional stress-strain curves given in Figure 26. It appears that the information embodied in Figures 25 and 26 can be judiciously manipulated to permit similar application for cases where the inequality (B-1) is not satisfied. However, further development is required to establish the exact procedures by which this can be accomplished.

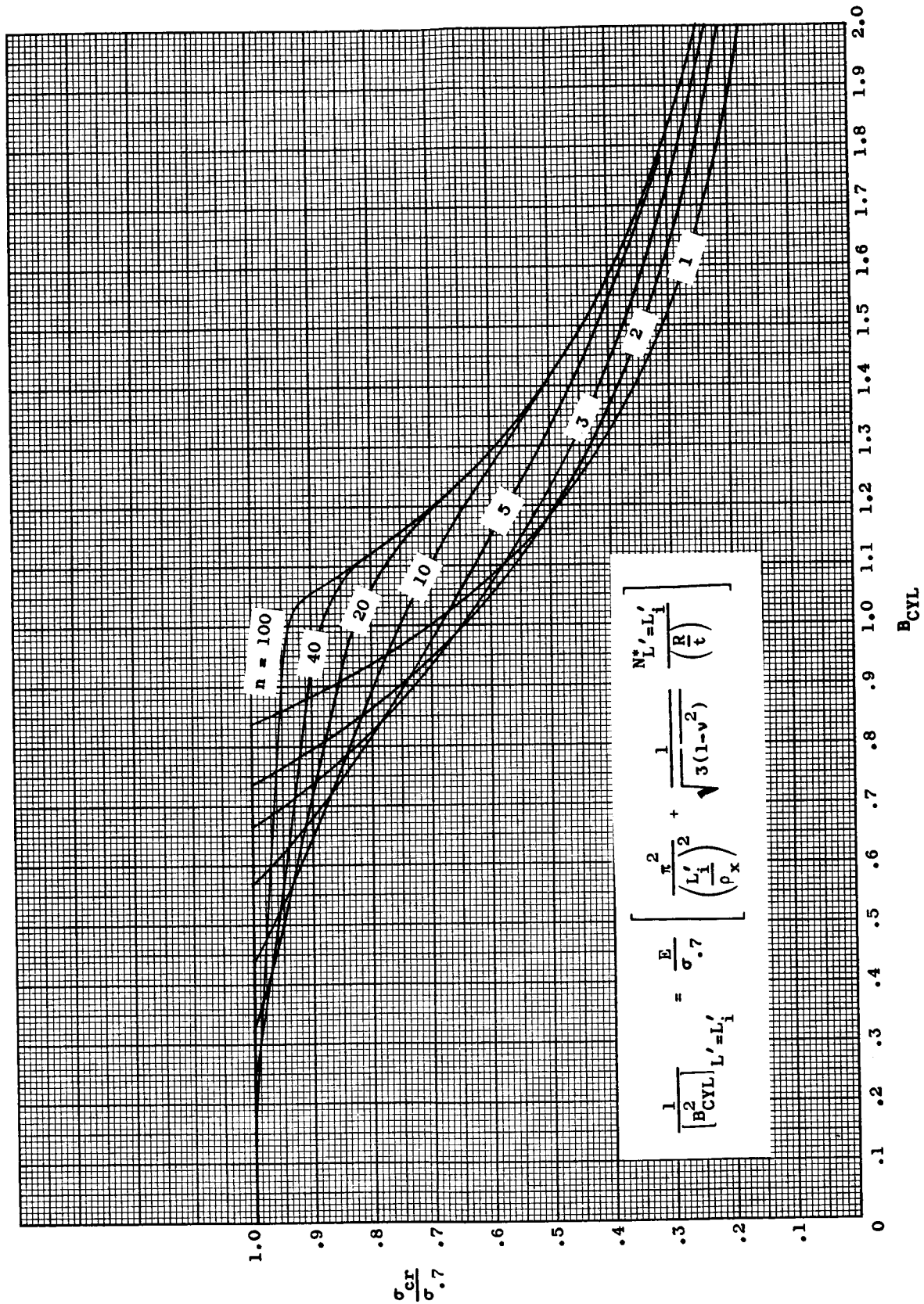


Figure 25(a) - Nondimensional Buckling Curves

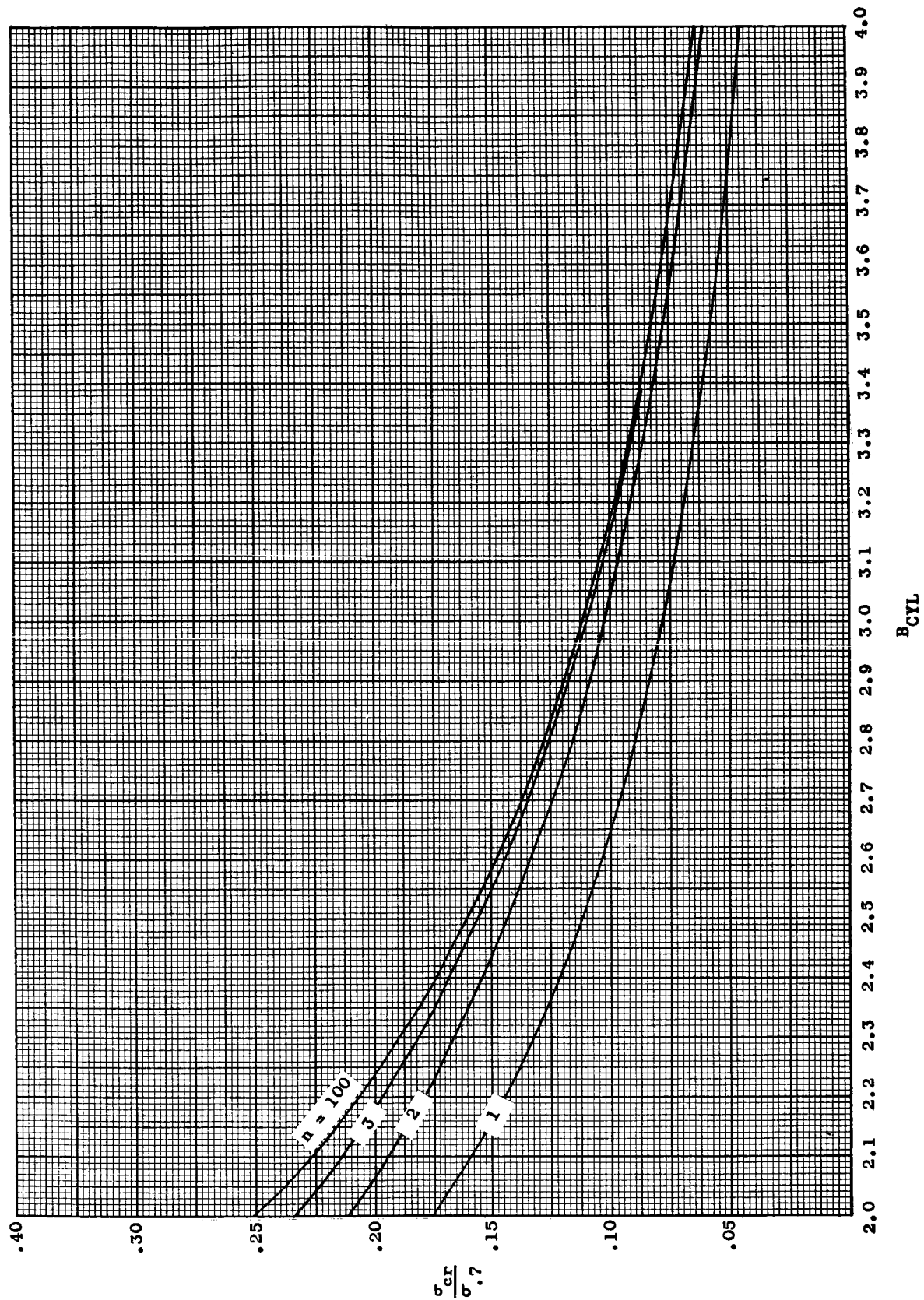


Figure 25(b) - Nondimensional Buckling Curves

B-3

GENERAL DYNAMICS CONVAIR DIVISION

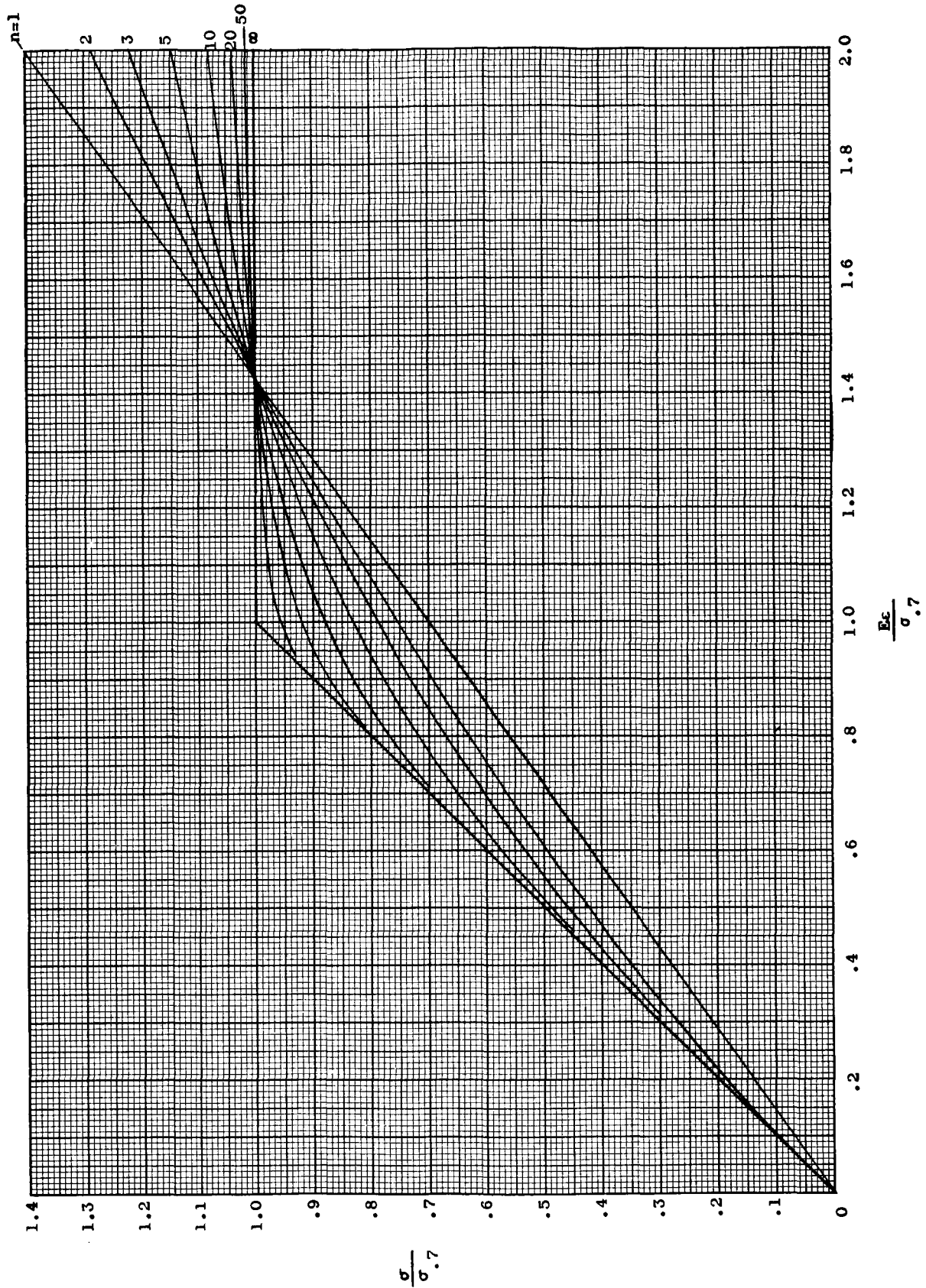


Figure 26 - Nondimensional Stress-Strain Curves