METAL BAR GRATING

AMERICAN NATIONAL STANDARD

ANSI/NAAMM STANDARD

MBG 531-2X

ANSI/NAAMM — MBG 531-2X XXXX. X, 202X

5 GRATINGS

METAL BAR GRATING MANUAL

NINTH EDITION

- **Maximum Bearing Bar Depth . . . . 2 1/2" (63.5 mm)**
- **Maximum Bearing Bar Thickness**
  - **Steel & Stainless Steel . . . . . 3/16" (4.8 mm)**
  - **Aluminum . . . . . 1/4" (6.4 mm)**
- **Maximum Depth of I-Bar. . . . . 2 1/2" (63.5 mm)**

ANSI/NAAMM — MBG 531-2X XXXX. X, 202X

5 GRATINGS

MBG

Metal Bar Grating

Approved American National Standard

ANSI

A Division of

NAAMM

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS

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This standard was developed by representative members of the Metal Bar Grating Division (MBG) of the National Association of Architectural Metal Manufacturers (NAAMM) to provide their opinion and guidance on the design and specification of metal bar gratings. This standard contains advisory information only and is published as a public service by NAAMM. NAAMM and its Divisions disclaim all liability of any kind for the use, application, or adaptation of material published in this standard.

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METAL BAR GRATING MANUAL

For Steel, Stainless Steel, and Aluminum Gratings and Stair Treads

Ninth Edition

NAAMM MBG 531

Published and distributed by the

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS

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NAAMM'S METAL BAR GRATING DIVISION

The members of the Metal Bar Grating Division of the National Association of Architectural Metal Manufacturers have supported the preparation of this Manual. All are producers and/or suppliers of products conforming to the standards and specifications contained herein. A copy of the Membership Roster of the Metal Bar Grating Division is available from NAAMM at www.naamm.org.

FOREWORD

The NAAMM Metal Bar Grating Manual provides architects and engineers with current technical data on bar gratings and stair treads of steel, stainless steel, and aluminum. The information contained is based on sound engineering principles and reflects practices recommended by leading manufacturers in the industry.

The first seven editions of the manual have been widely used by the design professions. In preparing this eighth edition, the Metal Bar Grating Division of NAAMM has reviewed its contents in detail and has made revisions to reflect current practices.

The load tables in this edition are based on the design formulas and procedures found in ANSI/NAAMM MBG 534-14 Metal Bar Grating Engineering Design Manual, which was developed to provide a clearer understanding of the procedures used in the design of grating and treads.

Also included are metric equivalents as an aid to designers who use the metric system. The system of metric measurement used is from IEEE/ASTM SI 10-2010, “Standard for Use of the International System of Units (SI): The Modern Metric System”.

The stair treads shown in this standard have been tested and conform to the requirements of OSHA 29CFR 1910.24(c), IBC 2012.

Changes from the previous edition, ANSI/NAAMM MBG 531-09 are indicated by the placement of a vertical line next to the changed item.

VALUES EXPRESSED IN THIS MANUAL ARE IN BOTH INCH-POUND UNITS AND SI UNITS. THE VALUES STATED IN INCH-POUND UNITS ARE TO BE REGARDED AS THE STANDARD.

CONTENTS

STANDARD MARKING SYSTEM

The marking system described here is the industry standard for identifying various types of bar grating. Leading manufacturers correlate their individual marking systems with this standard.

The standard marking system for metal bar gratings, as illustrated on the facing page, identifies five characteristics of the grating in the following order:

1 TYPE OF GRATING

The type of grating is indicated by a letter, as follows:

W Welded (steel gratings only)

P Pressure-locked

R Riveted

(See Glossary for definitions of types)

2 BEARING BAR SPACING

Bearing bar spacing is designated by a number which indicates sixteenths of an inch, or mm.

For welded or pressure-locked grating this is the distance, in sixteenths of an inch, or mm, center-to-center of bars.

For riveted grating it is the distance, in sixteenths of an inch, or mm, between bearing bar faces.

3 CROSS BAR OR RIVET SPACING

Cross bar or rivet spacing is designated by a number which indicates inches, or mm.

For welded or pressure-locked grating this is the distance, in inches, or mm, center-to-center of cross bars. For riveted grating it is the distance in inches, or mm, center-to-center of rivets, measured along a single bearing bar.

4 SIZE OF BEARING BARS *

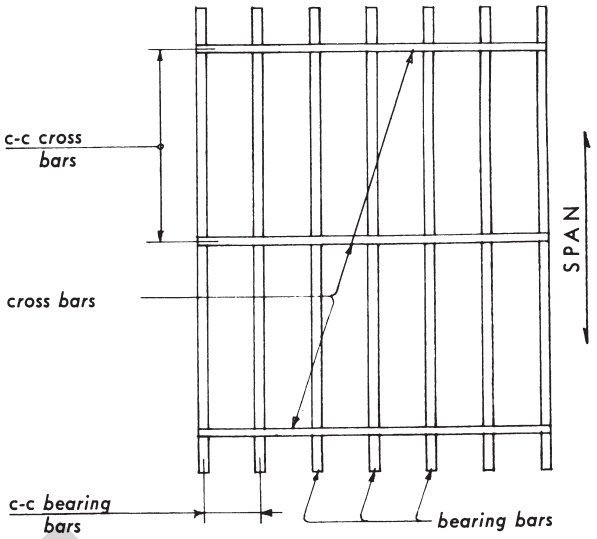
The size of bearing bars is expressed in inches of depth and thicknesses as follows:

*Equivalent bearing bar sizes in millimeters are obtained by a multiplication factor of 25.4

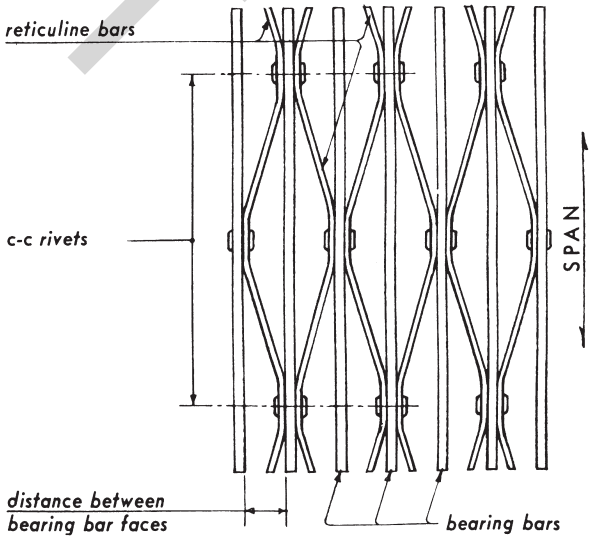
Steel / Stainless Steel		Aluminum		
¾ x ⅛	1½ x ⅛	1 x ⅛	1½ x ⅛	2 x 3/16
¾ x 3/16	1½ x 3/16	1 x 3/16	1½ x 3/16	2 x ¼
		1 x ¼	1½ x ¼	2" I Bar
1 x ⅛	1¾ x 3/16	1" I Bar	1½" I Bar	
1 x 3/16				2¼ x 3/16
	2 x 3/16	1¼ x ⅛	1¾ x 3/16	2¼ x ¼
1¼ x ⅛		1¼ x 3/16	1¾ x ¼	2¼" I Bar
1¼ x 3/16	2¼ x 3/16	1¼ x ¼	1¾" I Bar	
		1¼" I Bar		2½ x 3/16
	2½ x 3/16			2½ x ¼
				2½" I Bar

5 MATERIAL

Grating material is designated by name, such as "steel," "stainless steel" or "aluminum".



WELDED OR PRESSURE-LOCKED GRATING



RIVETED GRATING

EXAMPLES OF USE OF STANDARD MARKING SYSTEM

TYPE	DESCRIPTION OF GRATING DESIGNATED	
W-19-4 (1 x 3/16) STEEL W-30-102 (25 x 4.8)	W	welded
	19	bearing bars spaced 1 3/16 in. (30 mm) on center
	4	cross bars spaced 4 in. (102 mm) on center
	(1 x 3/16)	bearing bar size, 1 in. x 3/16 in. (25 mm x 4.8 mm)
	STEEL	material
R-18-7 (1 1/4 x 1/8) STAINLESS STEEL R-29-178 (32 x 3.2)	R	riveted
	18	bearing bars spaced 1 1/8 in. (29 mm) between faces
	7	rivets spaced 7 in. (178 mm) on center
	(1 1/4 x 1/8)	bearing bar size, 1 1/4 in. x 1/8 in. (32 mm x 3.2 mm)
	STAINLESS STEEL	material
P-15-2 (1 1/4 x 3/16) ALUMINUM P-24-51 (32 x 4.8)	P	pressure-locked
	15	bearing bars spaced 15/16 in. (24 mm) on center
	2	cross bars spaced 2 in. (51 mm) on center
	(1 1/4 x 3/16)	bearing bar size, 1 1/4 in. x 3/16 in. (32 mm x 4.8 mm)
	ALUMINUM	material
P-19-4 (1 1/2 I Bar) ALUMINUM P-30-102 (38 I Bar)	P	pressure-locked
	19	bearing bars spaced 1 3/16 in. (30 mm) on center
	4	cross bars spaced 4 in. (102 mm) on center
	(1 1/2 in. I Bar)	bearing bar size, 1 1/2 in. I Bar (38 mm I Bar)
	ALUMINUM	material

Manufacturers are equipped to produce gratings having bearing bars and cross bars of other sizes and spacings than shown in this Manual, as well as gratings of other metals, such as bronze, brass, monel, magnesium and special steel alloys. Minimum and maximum sizes and spacings are determined by equipment and/or design factors.

While gratings are normally furnished with a finish as indicated in Section V of the Standard Specifications Section, a wide variety of non-standard finishes can be applied to address specific job and/or function requirements.

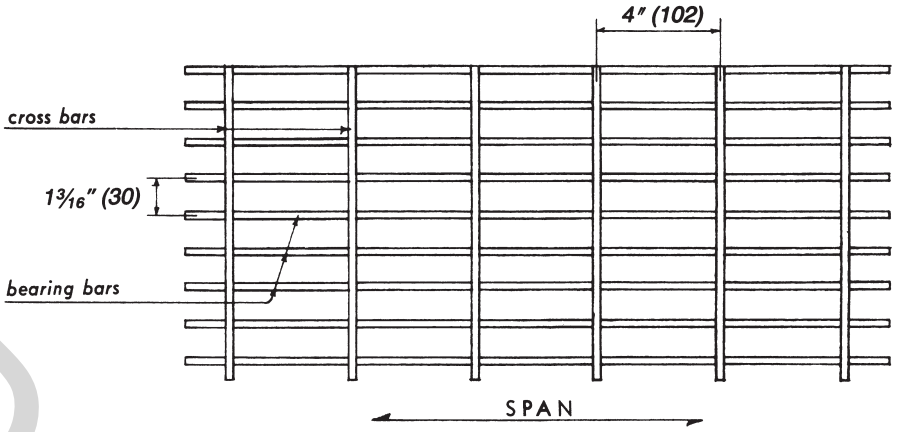
Individual manufacturers should be consulted regarding all non-standard products and/or finishes.

STANDARD
GRATINGS

See GLOSSARY OF TERMS for definitions of
Welded, Pressure-locked, and Riveted Gratings

WELDED
(Steel and Stainless Steel only)

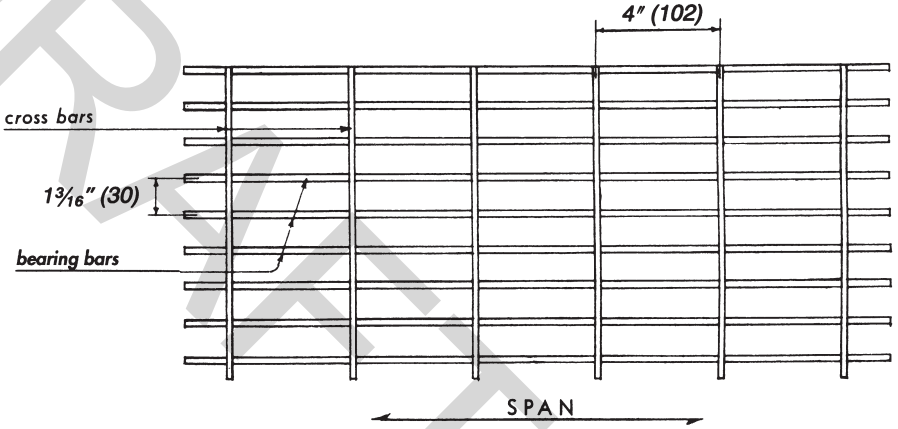
Type W-19-4
(W-30-102)



PRESSURE-LOCKED

Type P-19-4
(P-30-102)

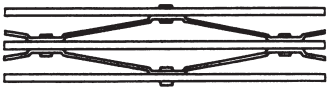
Cross bar ends are peened, bent over, welded, otherwise locked, or allowed to extend, at the manufacturer's discretion.

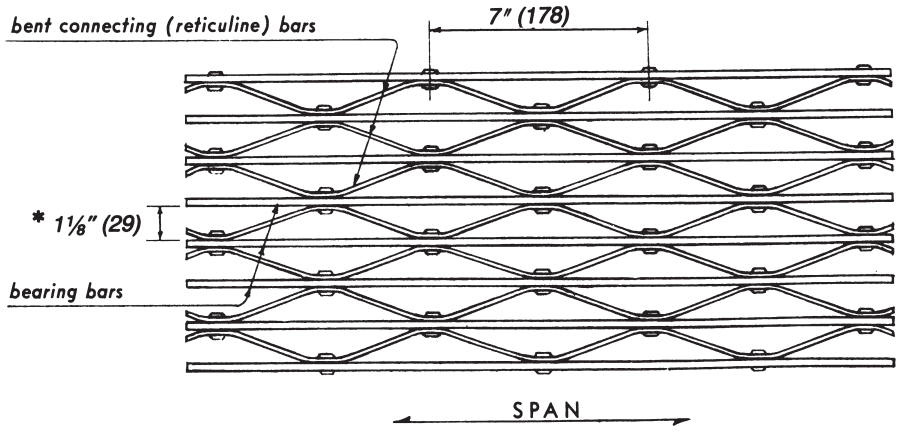


RIVETED*

Type R-18-7
(R-29-178)

Riveted grating is also available with a double crimp in the reticuline bar:





**Note that riveted grating marking indicates space between bearing bars*

MINIMUM STANDARD SIZES

CROSS BARS *and* CONNECTING BARS

STEEL / STAINLESS STEEL — WELDED*

Bearing Bars		Minimum Cross Bar Size	
Thickness in. (mm)	Depth in. (mm)	Section Area in.^{2} (mm^2)	Weight lb/ft (kg/m)
1/8 (3.2)	3/4 (19) thru 1 (25)	.031 (20)	.107 (.159)
1/8 (3.2)	1 1/4 (32) thru 1 1/2 (38)	.049 (32)	.167 (.248)
3/16 (4.8)	3/4 (19) thru 1 1/2 (38)	.049 (32)	.167 (.248)
3/16 (4.8)	1 3/4 (44) thru 2 1/2 (64)	.062 (40)	.211 (.314)

*Minimum size shown is for cross bars on 4 inch centers. When cross bars are on 2 inch centers, the minimum size may be reduced by 25%.

STEEL / STAINLESS STEEL / ALUMINUM — PRESSURE - LOCKED

Cross bars are made in a variety of solid and hollow shapes. They can be of any size and configuration which will provide structural stability under the stated design loads.

ALUMINUM — RIVETED

Bearing Bar Depth in. (mm)	Minimum Size of Connecting (Reticuline) Bars	
	Thickness in. (mm)	Depth in. (mm)
1 (25)	1/8 (3.2)	5/8 (16)
1 1/4 (32) thru 1 3/4 (44)	1/8 (3.2)	3/4 (19)
2 (51) thru 2 1/2 (64)	1/8 (3.2)	1 (25)

STEEL / STAINLESS STEEL — RIVETED

Bearing Bar Depth in. (mm)	Minimum Size of Connecting (Reticuline) Bars	
	Thickness in. (mm)	Depth in. (mm)
3/4 (19)	1/8 (3.2)	5/8 (16)
1 (25) thru 1 3/4 (44)	1/8 (3.2)	3/4 (19)
2 (51) thru 2 1/2 (64)	1/8 (3.2)	1 (25)

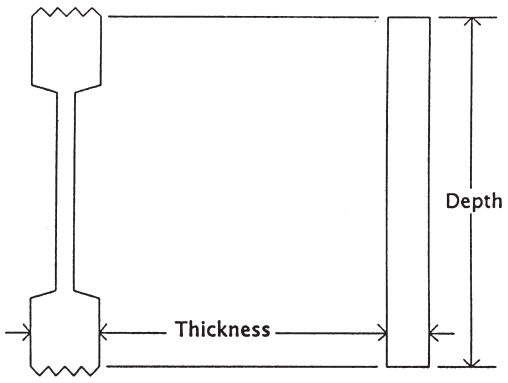
TOLERANCES - Bearing Bars

ALUMINUM

Thickness	±0.007 in. (±0.2 mm)	for 1/8" (3.2) and 3/16" (4.8)
	±0.008 in. (±0.2 mm)	for 1/4" (6.4)
Depth	±0.012 in. (±0.3 mm)	for 1"(25) and 1 1/4" (32) depths
	±0.014 in. (±0.4 mm)	for 1 1/2" (38) and 1 3/4" (44) depths
	±0.024 in. (±0.6 mm)	for 2" (51) thru 2 1/2" (63) depths

STEEL/STAINLESS STEEL

Thickness	±0.009 in. (±0.23 mm)	for all thicknesses
Depth	±0.016 in. (±0.4 mm)	for 3/4" (19) thru 1 3/4" (44) depths
	±0.024 in. (±0.6 mm)	for 2" (51) thru 2 1/2" (63) depths



NOTE: The following references were used as a guide in establishing the above bearing bar tolerances: ASTM A 1011A (1011M) Commercial Steel Type B, ASTM A 510 (A510M); ASTM B 221 (B221M), ASTM B 210 (B210M); Aluminum Association standards and data (extruded shapes).

LOAD TABLE FOR STEEL GRATING - TYPE W-19 OR P-19

ASTM A 1011 CS TYPE B
F=18,000psi, E=29,000,000psi

See Appendix A for a graphic depicting table loading

Recommended max. span (in.) for 1/4 in. deflection under uniform load of 100psf

U=uniform load, psf
D=deflection, in.
C=concentrated load at mid-span, lb per foot of grating width

All loads and deflections shown are based on engineering computations using gross sections and nominal sizes of bearing bars. The values listed are for design selection only and are not intended to be "absolute" since actual load capacity will be affected slightly by variations which can be expected due to material and manufacturing tolerances.

Note: The carrying capacity of a piece of grating subjected to a concentrated load over only a portion of its width is determined by the stiffness of both the bearing bars and the cross bars, and therefore differs with the type of grating used. To determine the carrying capacity of gratings subject to such loadings, the manufacturer's engineering department should be consulted.

Conversion Factors:
For gratings with other than 1-3/16" bearing bar spacing, or for different design stresses, proportionate conversion factors apply. Refer to the Metal Bar Grating Engineering Design Manual for the development of such factors.

Note: 1/4" is considered the maximum deflection consistent with pedestrian comfort, but can be exceeded for other loading conditions at the discretion of the engineer.

Bearing Bar Size (in) Nominal Weight (psf)**			Span in Inches 24	30	36	42	48	54	60	66	72	78	84	90	96	102	108
3/4x1/8 [4]	42	U	355	227	158	116	89	70									
		Du	0.099	0.155	0.223	0.304	0.397	0.503									
		C	355	284	237	203	178	158									
		Dc	0.079	0.124	0.179	0.243	0.318	0.402									
3/4x3/16 [6]	46	U	533	341	237	174	133	105									
		Du	0.099	0.155	0.223	0.304	0.397	0.503									
		C	533	426	355	305	266	237									
		Dc	0.079	0.124	0.179	0.243	0.318	0.402									
1x1/8 [6]	51	U	632	404	281	206	158	125	101	84	70						
		Du	0.074	0.116	0.168	0.228	0.298	0.377	0.466	0.563	0.670						
		C	632	505	421	361	316	281	253	230	211						
		Dc	0.060	0.093	0.134	0.182	0.238	0.302	0.372	0.451	0.536						
1x3/16 [8]	57	U	947	606	421	309	237	187	152	125	105						
		Du	0.074	0.116	0.168	0.228	0.298	0.377	0.466	0.563	0.670						
		C	947	758	632	541	474	421	379	344	316						
		Dc	0.060	0.093	0.134	0.182	0.238	0.302	0.372	0.451	0.536						
1-1/4x1/8 [7]	61	U	987	632	439	322	247	195	158	130	110	93	81				
		Du	0.060	0.093	0.134	0.182	0.238	0.302	0.372	0.451	0.536	0.629	0.730				
		C	987	789	658	564	493	439	395	359	329	304	282				
		Dc	0.048	0.074	0.107	0.146	0.191	0.241	0.298	0.360	0.429	0.504	0.584				
1-1/4x3/16 [9]	67	U	1480	947	658	483	370	292	237	196	164	140	121				
		Du	0.060	0.093	0.134	0.182	0.238	0.302	0.372	0.451	0.536	0.629	0.730				
		C	1480	1184	987	846	740	658	592	538	493	455	423				
		Dc	0.048	0.074	0.107	0.146	0.191	0.241	0.298	0.360	0.429	0.504	0.584				
1-1/2x1/8 [8]	70	U	1421	909	632	464	355	281	227	188	158	135	116	101	89	79	70
		Du	0.050	0.078	0.112	0.152	0.199	0.251	0.310	0.376	0.447	0.524	0.608	0.698	0.794	0.897	1.006
		C	1421	1137	947	812	711	632	568	517	474	437	406	379	355	334	316
		Dc	0.040	0.062	0.089	0.122	0.159	0.201	0.248	0.300	0.358	0.420	0.487	0.559	0.636	0.718	0.804
1-1/2x3/16 [11]	77	U	2132	1364	947	696	533	421	341	282	237	202	174	152	133	118	105
		Du	0.050	0.078	0.112	0.152	0.199	0.251	0.310	0.376	0.447	0.524	0.608	0.698	0.794	0.897	1.006
		C	2132	1705	1421	1218	1066	947	853	775	711	656	609	568	533	502	474
		Dc	0.040	0.062	0.089	0.122	0.159	0.201	0.248	0.300	0.358	0.420	0.487	0.559	0.636	0.718	0.804
1-3/4x3/16 [13]	87	U	2901	1857	1289	947	725	573	464	384	322	275	237	206	181	161	143
		Du	0.043	0.067	0.096	0.130	0.170	0.215	0.266	0.322	0.383	0.450	0.521	0.599	0.681	0.769	0.862
		C	2901	2321	1934	1658	1451	1289	1161	1055	967	893	829	774	725	683	645
		Dc	0.034	0.053	0.077	0.104	0.136	0.172	0.213	0.257	0.306	0.360	0.417	0.479	0.545	0.615	0.689
2x3/16 [14]	96	U	3789	2425	1684	1237	947	749	606	501	421	359	309	269	237	210	187
		Du	0.037	0.058	0.084	0.114	0.149	0.189	0.233	0.282	0.335	0.393	0.456	0.524	0.596	0.673	0.754
		C	3789	3032	2526	2165	1895	1684	1516	1378	1263	1166	1083	1011	947	892	842
		Dc	0.030	0.047	0.067	0.091	0.119	0.151	0.186	0.225	0.268	0.315	0.365	0.419	0.477	0.538	0.603
2-1/4x3/16 [16]	105	U	4796	3069	2132	1566	1199	947	767	634	533	454	392	341	300	266	237
		Du	0.033	0.052	0.074	0.101	0.132	0.168	0.207	0.250	0.298	0.350	0.406	0.466	0.530	0.598	0.670
		C	4796	3837	3197	2741	2398	2132	1918	1744	1599	1476	1370	1279	1199	1128	1066
		Dc	0.026	0.041	0.060	0.081	0.106	0.134	0.166	0.200	0.238	0.280	0.324	0.372	0.424	0.478	0.536
2-1/2x3/16 [18]	113	U	5921	3789	2632	1933	1480	1170	947	783	658	561	483	421	370	328	292
		Du	0.030	0.047	0.067	0.091	0.119	0.151	0.186	0.225	0.268	0.315	0.365	0.419	0.477	0.538	0.603
		C	5921	4737	3947	3383	2961	2632	2368	2153	1974	1822	1692	1579	1480	1393	1316
		Dc	0.024	0.037	0.054	0.073	0.095	0.121	0.149	0.180	0.215	0.252	0.292	0.335	0.381	0.431	0.483

NOTE: For serrated grating, the depth of grating required for a specified load is 1/4" greater than in the table.

**Weights (mass/area) shown are approximate and vary with manufacturers. They are provided for preliminary design computations only and are not intended for any other purpose.

Loads above DO NOT include the dead load of the grating.

LOAD TABLE FOR STEEL GRATING - TYPE W-19 OR P-19

ASTM A 1011 CS TYPE B
F=124MPa, E=200,000MPa

See Appendix A for a graphic depicting table loading

Recommended max. span for 6.4mm deflected under uniform load of 4.8kPa

U=uniform load, kPa
D=deflection, mm.
C=concentrated load at mid-span, kN per metre of grating width

All loads and deflections shown are based on engineering computations using gross sections and nominal sizes of bearing bars. The values listed are for design selection only and are not intended to be "absolute" since actual load capacity will be affected slightly by variations which can be expected due to material and manufacturing tolerances.

Note: The carrying capacity of a piece of grating subjected to a concentrated load over only a portion of its width is determined by the stiffness of both the bearing bars and the cross bars, and therefore differs with the type of grating used. To determine the carrying capacity of gratings subject to such loadings, the manufacturer's engineering department should be consulted.

Conversion Factors:

For gratings with other than 30mm bearing bar spacing, or for different design stresses, proportionate conversion factors apply. Refer to the Metal Bar Grating Engineering Design Manual for the development of such factors.

Note: 6.4mm is considered the maximum deflection consistent with pedestrian comfort, but can be exceeded for other loading conditions at the discretion of the engineer.

Bearing Bar Size (mm) Nominal	Weight Kg/m²**		Span in Millimeters 610	762	914	1067	1219	1372	1524	1676	1829	1981	2134	2286	2438	2591	2743
		U	17.01	10.89	7.56	5.55	4.25	3.36									
19x3	1054	Du	2.52	3.94	5.68	7.73	10.09	12.77									
		C	5.18	4.15	3.46	2.96	2.59	2.30									
[20]		Dc	2.02	3.15	4.54	6.18	8.07	10.22									
		U	25.52	16.33	11.34	8.33	6.38	5.04									
19x5	1167	Du	2.52	3.94	5.68	7.73	10.09	12.77									
		C	7.78	6.22	5.18	4.44	3.89	3.46									
[28]		Dc	2.02	3.15	4.54	6.18	8.07	10.22									
		U	30.24	19.35	13.44	9.87	7.56	5.97	4.84	4.00	3.36						
25x3	1308	Du	1.89	2.96	4.26	5.79	7.57	9.58	11.82	14.31	17.03						
		C	9.22	7.37	6.14	5.27	4.61	4.10	3.69	3.35	3.07						
[25]		Dc	1.51	2.36	3.41	4.64	6.05	7.66	9.46	11.45	13.62						
		U	45.36	29.03	20.16	14.81	11.34	8.96	7.26	6.00	5.04						
25x5	1448	Du	1.89	2.96	4.26	5.79	7.57	9.58	11.82	14.31	17.03						
		C	13.83	11.06	9.22	7.90	6.91	6.14	5.53	5.03	4.61						
[36]		Dc	1.51	2.36	3.41	4.64	6.05	7.66	9.46	11.45	13.62						
		U	47.25	30.24	21.00	15.43	11.81	9.33	7.56	6.25	5.25	4.47	3.86				
32x3	1546	Du	1.51	2.36	3.41	4.64	6.05	7.66	9.46	11.45	13.62	15.99	18.54				
		C	14.40	11.52	9.60	8.23	7.20	6.40	5.76	5.24	4.80	4.43	4.11				
[30]		Dc	1.21	1.89	2.72	3.71	4.84	6.13	7.57	9.16	10.90	12.79	14.83				
		U	70.88	45.36	31.50	23.14	17.72	14.00	11.34	9.37	7.88	6.71	5.79				
32x5	1711	Du	1.51	2.36	3.41	4.64	6.05	7.66	9.46	11.45	13.62	15.99	18.54				
		C	21.60	17.28	14.40	12.34	10.80	9.60	8.64	7.86	7.20	6.65	6.17				
[44]		Dc	1.21	1.89	2.72	3.71	4.84	6.13	7.57	9.16	10.90	12.79	14.83				
		U	68.04	43.55	30.24	22.22	17.01	13.44	10.89	9.00	7.56	6.44	5.55	4.84	4.25	3.77	3.36
38x3	1773	Du	1.26	1.97	2.84	3.86	5.04	6.39	7.88	9.54	11.35	13.32	15.45	17.74	20.18	22.78	25.54
		C	20.74	16.59	13.83	11.85	10.37	9.22	8.30	7.54	6.91	6.38	5.93	5.53	5.18	4.88	4.61
[36]		Dc	1.01	1.58	2.27	3.09	4.04	5.11	6.31	7.63	9.08	10.66	12.36	14.19	16.14	18.22	20.43
		U	102.06	65.32	45.36	33.33	25.52	20.16	16.33	13.50	11.34	9.66	8.33	7.26	6.38	5.65	5.04
38x5	1962	Du	1.26	1.97	2.84	3.86	5.04	6.39	7.88	9.54	11.35	13.32	15.45	17.74	20.18	22.78	25.54
		C	31.11	24.89	20.74	17.78	15.55	13.83	12.44	11.31	10.37	9.57	8.89	8.30	7.78	7.32	6.91
[52]		Dc	1.01	1.58	2.27	3.09	4.04	5.11	6.31	7.63	9.08	10.66	12.36	14.19	16.14	18.22	20.43
		U	138.92	88.91	61.74	45.36	34.73	27.44	22.23	18.37	15.44	13.15	11.34	9.88	8.68	7.69	6.86
44x5	2203	Du	1.08	1.69	2.43	3.31	4.32	5.47	6.76	8.18	9.73	11.42	13.24	15.20	17.30	19.53	21.89
		C	42.34	33.87	28.23	24.20	21.17	18.82	16.94	15.40	14.11	13.03	12.10	11.29	10.59	9.96	9.41
[60]		Dc	0.86	1.35	1.95	2.65	3.46	4.38	5.41	6.54	7.78	9.13	10.59	12.16	13.84	15.62	17.51
		U	181.44	116.12	80.64	59.25	45.36	35.84	29.03	23.99	20.16	17.18	14.81	12.90	11.34	10.05	8.96
51x5	2435	Du	0.95	1.48	2.13	2.90	3.78	4.79	5.91	7.15	8.51	9.99	11.59	13.30	15.13	17.09	19.16
		C	55.30	44.24	36.87	31.60	27.65	24.58	22.12	20.11	18.43	17.02	15.80	14.75	13.83	13.01	12.29
[68]		Dc	0.76	1.18	1.70	2.32	3.03	3.83	4.73	5.72	6.81	7.99	9.27	10.64	12.11	13.67	15.32
		U	229.64	146.97	102.06	74.98	57.41	45.36	36.74	30.37	25.52	21.74	18.75	16.33	14.35	12.71	11.34
57x5	2659	Du	0.84	1.31	1.89	2.58	3.36	4.26	5.26	6.36	7.57	8.88	10.30	11.82	13.45	15.19	17.03
		C	69.99	55.99	46.66	40.00	35.00	31.11	28.00	25.45	23.33	21.54	20.00	18.66	17.50	16.47	15.55
[76]		Dc	0.67	1.05	1.51	2.06	2.69	3.41	4.20	5.09	6.05	7.10	8.24	9.46	10.76	12.15	13.62
		U	283.50	181.44	126.00	92.57	70.88	56.00	45.36	37.49	31.50	26.84	23.14	20.16	17.72	15.70	14.00
64x5	2878	Du	0.76	1.18	1.70	2.32	3.03	3.83	4.73	5.72	6.81	7.99	9.27	10.64	12.11	13.67	15.32
		C	86.41	69.13	57.61	49.38	43.21	38.41	34.56	31.42	28.80	26.59	24.69	23.04	21.60	20.33	19.20
[84]		Dc	0.61	0.95	1.36	1.85	2.42	3.06	3.78	4.58	5.45	6.39	7.42	8.51	9.69	10.93	12.26

NOTE: For serrated grating, the depth of grating required for a specified load is 6mm greater than in the table.

**Weights (mass/area) shown are approximate and vary with manufacturers. They are provided for preliminary design computations only and are not intended for any other purpose.

Loads above DO NOT include the dead load of the grating.

LOAD TABLE FOR STAINLESS STEEL GRATING - TYPE W-19 OR P-19

ALLOYS 304, 316 & 304L, 316L
F=20,000psi, E=28,000,000psi

See Appendix A for a graphic depicting table loading

Recommended max. span (in.) for 1/4 in. deflection under uniform load of 100psf

U=uniform load, psf
D=deflection, in.
C=concentrated load at mid-span, lb per foot of grating width

All loads and deflections shown are based on engineering computations using gross sections and nominal sizes of bearing bars. The values listed are for design selection only and are not intended to be "absolute" since actual load capacity will be affected slightly by variations which can be expected due to material and manufacturing tolerances.

Note: The carrying capacity of a piece of grating subjected to a concentrated load over only a portion of its width is determined by the stiffness of both the bearing bars and the cross bars, and therefore differs with the type of grating used. To determine the carrying capacity of gratings subject to such loadings, the manufacturer's engineering department should be consulted.

Conversion Factors:

For gratings with other than 1-3/16" bearing bar spacing, or for different design stresses, proportionate conversion factors apply. Refer to the Metal Bar Grating Engineering Design Manual for the development of such factors.

Note: 1/4" is considered the maximum deflection consistent with pedestrian comfort, but can be exceeded for other loading conditions at the discretion of the engineer.

Bearing Bar Size (in)	Nominal Weight (psf)**		Span in Inches 24	30	36	42	48	54	60	66	72	78	84	90	96	102	108
3/4x1/8	41	U	395	253	175	129	99	78									
		Du	0.114	0.179	0.257	0.350	0.457	0.579									
		C	395	316	263	226	197	175									
[4]		Dc	0.091	0.143	0.206	0.280	0.366	0.463									
3/4x3/16	46	U	592	379	263	193	148	117									
		Du	0.114	0.179	0.257	0.350	0.457	0.579									
		C	592	474	395	338	296	263									
[6]		Dc	0.091	0.143	0.206	0.280	0.366	0.463									
1x1/8	51	U	702	449	312	229	175	139	112	93	78						
		Du	0.086	0.134	0.193	0.263	0.343	0.434	0.536	0.648	0.771						
		C	702	561	468	401	351	312	281	255	234						
[6]		Dc	0.069	0.107	0.154	0.210	0.274	0.347	0.429	0.519	0.617						
1x3/16	56	U	1053	674	468	344	263	208	168	139	117						
		Du	0.086	0.134	0.193	0.263	0.343	0.434	0.536	0.648	0.771						
		C	1053	842	702	602	526	468	421	383	351						
[8]		Dc	0.069	0.107	0.154	0.210	0.274	0.347	0.429	0.519	0.617	78	84				
1-1/4x1/8	60	U	1096	702	487	358	274	217	175	145	122	104	90				
		Du	0.069	0.107	0.154	0.210	0.274	0.347	0.429	0.519	0.617	0.724	0.840				
		C	1096	877	731	627	548	487	439	399	365	337	313				
[7]		Dc	0.055	0.086	0.123	0.168	0.219	0.278	0.343	0.415	0.494	0.579	0.672				
1-1/4x3/16	67	U	1645	1053	731	537	411	325	263	217	183	156	134				
		Du	0.069	0.107	0.154	0.210	0.274	0.347	0.429	0.519	0.617	0.724	0.840				
		C	1645	1316	1096	940	822	731	658	598	548	506	470				
[9]		Dc	0.055	0.086	0.123	0.168	0.219	0.278	0.343	0.415	0.494	0.579	0.672	90	96	102	108
1-1/2x1/8	69	U	1579	1011	702	516	395	312	253	209	175	149	129	112	99	87	78
		Du	0.057	0.089	0.129	0.175	0.229	0.289	0.357	0.432	0.514	0.604	0.700	0.804	0.914	1.032	1.157
		C	1579	1263	1053	902	789	702	632	574	526	486	451	421	395	372	351
[8]		Dc	0.046	0.071	0.103	0.140	0.183	0.231	0.286	0.346	0.411	0.483	0.560	0.643	0.731	0.826	0.926
1-1/2x3/16	77	U	2368	1516	1053	773	592	468	379	313	263	224	193	168	148	131	117
		Du	0.057	0.089	0.129	0.175	0.229	0.289	0.357	0.432	0.514	0.604	0.700	0.804	0.914	1.032	1.157
		C	2368	1895	1579	1353	1184	1053	947	861	789	729	677	632	592	557	526
[11]		Dc	0.046	0.071	0.103	0.140	0.183	0.231	0.286	0.346	0.411	0.483	0.560	0.643	0.731	0.826	0.926
1-3/4x3/16	86	U	3224	2063	1433	1053	806	637	516	426	358	305	263	229	201	178	159
		Du	0.049	0.077	0.110	0.150	0.196	0.248	0.306	0.370	0.441	0.517	0.600	0.689	0.784	0.885	0.992
		C	3224	2579	2149	1842	1612	1433	1289	1172	1075	992	921	860	806	759	716
[13]		Dc	0.039	0.061	0.088	0.120	0.157	0.198	0.245	0.296	0.353	0.414	0.480	0.551	0.627	0.708	0.793
2x3/16	95	U	4211	2695	1871	1375	1053	832	674	557	468	399	344	299	263	233	208
		Du	0.043	0.067	0.096	0.131	0.171	0.217	0.268	0.324	0.386	0.453	0.525	0.603	0.686	0.774	0.868
		C	4211	3368	2807	2406	2105	1871	1684	1531	1404	1296	1203	1123	1053	991	936
[14]		Dc	0.034	0.054	0.077	0.105	0.137	0.174	0.214	0.259	0.309	0.362	0.420	0.482	0.549	0.619	0.694
2-1/4x3/16	104	U	5329	3411	2368	1740	1332	1053	853	705	592	505	435	379	333	295	263
		Du	0.038	0.060	0.086	0.117	0.152	0.193	0.238	0.288	0.343	0.402	0.467	0.536	0.610	0.688	0.771
		C	5329	4263	3553	3045	2664	2368	2132	1938	1776	1640	1523	1421	1332	1254	1184
[16]		Dc	0.030	0.048	0.069	0.093	0.122	0.154	0.190	0.230	0.274	0.322	0.373	0.429	0.488	0.550	0.617
2-1/2x3/16	112	U	6579	4211	2924	2148	1645	1300	1053	870	731	623	537	468	411	364	325
		Du	0.034	0.054	0.077	0.105	0.137	0.174	0.214	0.259	0.309	0.362	0.420	0.482	0.549	0.619	0.694
		C	6579	5263	4386	3759	3289	2924	2632	2392	2193	2024	1880	1754	1645	1548	1462
[18]		Dc	0.027	0.043	0.062	0.084	0.110	0.139	0.171	0.207	0.247	0.290	0.336	0.386	0.439	0.495	0.555

NOTE: For serrated grating, the depth of grating required for a specified load is 1/4" greater than in the table.

**Weights (mass/area) shown are approximate and vary with manufacturers. They are provided for preliminary design computations only and are not intended for any other purpose.

Loads above DO NOT include the dead load of the grating.

LOAD TABLE FOR STAINLESS STEEL GRATING - TYPE W-19 OR P-19

ALLOYS 304, 316 & 304L, 316L
F=138MPa, E=139,000MPa

See Appendix A for a graphic depicting table loading

Recommended max. span for 6.4mm deflected under uniform load of 4.8kPa

U=uniform load, kPa
D=deflection, mm.
C=concentrated load at mid-span, kN per metre of grating width

Bearing Bar Size (mm)	Nominal Weight Kg/m²**		Span in Millimeters 610	762	914	1067	1219	1372	1524	1676	1829	1981	2134	2286	2438	2591	2743
		U	18.90	12.10	8.40	6.17	4.73	3.73									
19x3	1045	Du	2.90	4.54	6.53	8.89	11.61	14.70									
		C	5.76	4.61	3.84	3.29	2.88	2.56									
[20]		Dc	2.32	3.63	5.23	7.11	9.29	11.76									
		U	28.35	18.14	12.60	9.26	7.09	5.60									
19x5	1156	Du	2.90	4.54	6.53	8.89	11.61	14.70									
		C	8.64	6.91	5.76	4.94	4.32	3.84									
[28]		Dc	2.32	3.63	5.23	7.11	9.29	11.76									
		U	33.60	21.50	14.93	10.97	8.40	6.64	5.38	4.44	3.73						
25x3	1297	Du	2.18	3.40	4.90	6.67	8.71	11.02	13.61	16.46	19.59						
		C	10.24	8.19	6.83	5.85	5.12	4.55	4.10	3.72	3.41						
[25]		Dc	1.74	2.72	3.92	5.33	6.97	8.82	10.89	13.17	15.68						
		U	50.40	32.26	22.40	16.46	12.60	9.96	8.06	6.66	5.60						
25x5	1435	Du	2.18	3.40	4.90	6.67	8.71	11.02	13.61	16.46	19.59						
		C	15.36	12.29	10.24	8.78	7.68	6.83	6.14	5.59	5.12						
[36]		Dc	1.74	2.72	3.92	5.33	6.97	8.82	10.89	13.17	15.68						
		U	52.50	33.60	23.33	17.14	13.13	10.37	8.40	6.94	5.83	4.97	4.29				
32x3	1533	Du	1.74	2.72	3.92	5.33	6.97	8.82	10.89	13.17	15.68	18.40	21.34				
		C	16.00	12.80	10.67	9.14	8.00	7.11	6.40	5.82	5.33	4.92	4.57				
[30]		Dc	1.39	2.18	3.14	4.27	5.57	7.05	8.71	10.54	12.54	14.72	17.07				
		U	78.75	50.40	35.00	25.71	19.69	15.56	12.60	10.41	8.75	7.46	6.43				
32x5	1696	Du	1.74	2.72	3.92	5.33	6.97	8.82	10.89	13.17	15.68	18.40	21.34				
		C	24.00	19.20	16.00	13.72	12.00	10.67	9.60	8.73	8.00	7.39	6.86				
[44]		Dc	1.39	2.18	3.14	4.27	5.57	7.05	8.71	10.54	12.54	14.72	17.07				
		U	75.60	48.38	33.60	24.69	18.90	14.93	12.10	10.00	8.40	7.16	6.17	5.38	4.73	4.19	3.73
38x3	1757	Du	1.45	2.27	3.27	4.45	5.81	7.35	9.07	10.98	13.06	15.33	17.78	20.41	23.22	26.22	29.39
		C	23.04	18.43	15.36	13.17	11.52	10.24	9.22	8.38	7.68	7.09	6.58	6.14	5.76	5.42	5.12
[36]		Dc	1.16	1.81	2.61	3.56	4.64	5.88	7.26	8.78	10.45	12.26	14.22	16.33	18.58	20.97	23.51
		U	113.40	72.58	50.40	37.03	28.35	22.40	18.14	15.00	12.60	10.74	9.26	8.06	7.09	6.28	5.60
38x5	1945	Du	1.45	2.27	3.27	4.45	5.81	7.35	9.07	10.98	13.06	15.33	17.78	20.41	23.22	26.22	29.39
		C	34.56	27.65	23.04	19.75	17.28	15.36	13.83	12.57	11.52	10.64	9.88	9.22	8.64	8.13	7.68
[52]		Dc	1.16	1.81	2.61	3.56	4.64	5.88	7.26	8.78	10.45	12.26	14.22	16.33	18.58	20.97	23.51
		U	154.35	98.78	68.60	50.40	38.59	30.49	24.70	20.41	17.15	14.61	12.60	10.98	9.65	8.55	7.62
44x5	2183	Du	1.24	1.94	2.80	3.81	4.98	6.30	7.78	9.41	11.20	13.14	15.24	17.49	19.91	22.47	25.19
		C	47.05	37.64	31.36	26.88	23.52	20.91	18.82	17.11	15.68	14.48	13.44	12.55	11.76	11.07	10.45
[60]		Dc	1.00	1.56	2.24	3.05	3.98	5.04	6.22	7.53	8.96	10.51	12.19	14.00	15.92	17.98	20.15
		U	201.60	129.02	89.60	65.83	50.40	39.82	32.26	26.66	22.40	19.09	16.46	14.34	12.60	11.16	9.96
51x5	2413	Du	1.09	1.70	2.45	3.33	4.35	5.51	6.80	8.23	9.80	11.50	13.34	15.31	17.42	19.66	22.04
		C	61.45	49.16	40.97	35.11	30.72	27.31	24.58	22.34	20.48	18.91	17.56	16.39	15.36	14.46	13.66
[68]		Dc	0.87	1.36	1.96	2.67	3.48	4.41	5.44	6.59	7.84	9.20	10.67	12.25	13.93	15.73	17.63
		U	255.15	163.30	113.40	83.31	63.79	50.40	40.82	33.74	28.35	24.16	20.83	18.14	15.95	14.13	12.60
57x5	2636	Du	0.97	1.51	2.18	2.96	3.87	4.90	6.05	7.32	8.71	10.22	11.85	13.61	15.48	17.48	19.59
		C	77.77	62.22	51.85	44.44	38.89	34.56	31.11	28.28	25.92	23.93	22.22	20.74	19.44	18.30	17.28
[76]		Dc	0.77	1.21	1.74	2.37	3.10	3.92	4.84	5.85	6.97	8.18	9.48	10.89	12.39	13.98	15.68
		U	315.00	201.60	140.00	102.86	78.75	62.22	50.40	41.65	35.00	29.82	25.71	22.40	19.69	17.44	15.56
64x5	2853	Du	1	1.36	1.96	2.67	3.48	4.41	5.44	6.59	7.84	9.20	10.67	12.25	13.93	15.73	17.63
		C	96.01	76.81	64.01	54.86	48.01	42.67	38.41	34.91	32.00	29.54	27.43	25.60	24.00	22.59	21.34
[84]		Dc	0.70	1.09	1.57	2.13	2.79	3.53	4.35	5.27	6.27	7.36	8.53	9.80	11.15	12.58	14.11

All loads and deflections shown are based on engineering computations using gross sections and nominal sizes of bearing bars. The values listed are for design selection only and are not intended to be "absolute" since actual load capacity will be affected slightly by variations which can be expected due to material and manufacturing tolerances.

Note: The carrying capacity of a piece of grating subjected to a concentrated load over only a portion of its width is determined by the stiffness of both the bearing bars and the cross bars, and therefore differs with the type of grating used. To determine the carrying capacity of gratings subject to such loadings, the manufacturer's engineering department should be consulted.

Conversion Factors:

For gratings with other than 30mm bearing bar spacing, or for different design stresses, proportionate conversion factors apply. Refer to the Metal Bar Grating Engineering Design Manual for the development of such factors.

Note: 6.4mm is considered the maximum deflection consistent with pedestrian comfort, but can be exceeded for other loading conditions at the discretion of the engineer.

NOTE: For serrated grating, the depth of grating required for a specified load is 6mm greater than in the table.

**Weights (mass/area) shown are approximate and vary with manufacturers. They are provided for preliminary design computations only and are not intended for any other purpose.

Loads above DO NOT include the dead load of the grating.

LOAD TABLE FOR ALUMINUM GRATING - TYPE P-19

F=12,000psi, E=10,000,000psi

See Appendix A for a graphic depicting table loading

Recommended max. span (in.) for 1/4 in. deflection under uniform load of 100psf

U=uniform load, psf
D=deflection, in.
C=concentrated load at mid-span, lb per foot of grating width

All loads and deflections shown are based on engineering computations using gross sections and nominal sizes of bearing bars. The values listed are for design selection only and are not intended to be "absolute" since actual load capacity will be affected slightly by variations which can be expected due to material and manufacturing tolerances.

Note: The carrying capacity of a piece of grating subjected to a concentrated load over only a portion of its width is determined by the stiffness of both the bearing bars and the cross bars, and therefore differs with the type of grating used. To determine the carrying capacity of gratings subject to such loadings, the manufacturer's engineering department should be consulted.

Conversion Factors:

For gratings with other than 1-3/16" bearing bar spacing, or for different design stresses, proportionate conversion factors apply. Refer to the Metal Bar Grating Engineering Design Manual for the development of such factors.

Note: 1/4" is considered the maximum deflection consistent with pedestrian comfort, but can be exceeded for other loading conditions at the discretion of the engineer.

Bearing Bar Size (in)	Nominal Weight (psf)**		Span in Inches 24	30	36	42	48	54	60	66	72	78	84	90	96	102	108
1x1/8	39	U	421	269	187	137	105	83									
		Du	0.144	0.225	0.324	0.441	0.576	0.729									
		C	421	337	281	241	211	187									
[2]		Dc	0.115	0.180	0.259	0.353	0.461	0.583									
1x3/16 or 1" I Bar	44	U	632	404	281	206	158	125									
		Du	0.144	0.225	0.324	0.441	0.576	0.729									
		C	632	505	421	361	316	281									
[3]		Dc	0.115	0.180	0.259	0.353	0.461	0.583									
1x1/4	47	U	842	539	374	275	211	166	135	111	94						
		Du	0.144	0.225	0.324	0.441	0.576	0.729	0.900	1.089	1.296						
		C	842	674	561	481	421	374	337	306	281						
[4]		Dc	0.115	0.180	0.259	0.353	0.461	0.583	0.720	0.871	1.037						
1-1/4x1/8	47	U	658	421	292	215	164	130	105	87	73						
		Du	0.115	0.180	0.259	0.353	0.461	0.583	0.720	0.871	1.037						
		C	658	526	439	376	329	292	263	239	219						
[3]		Dc	0.092	0.144	0.207	0.282	0.369	0.467	0.576	0.697	0.829	78	84				
1-1/4x3/16 or 1-1/4" I Bar	52	U	987	632	439	322	247	195	158	130	110	93	81				
		Du	0.115	0.180	0.259	0.353	0.461	0.583	0.720	0.871	1.037	1.217	1.411				
		C	987	789	658	564	493	439	395	359	329	304	282				
[4]		Dc	0.092	0.144	0.207	0.282	0.369	0.467	0.576	0.697	0.829	0.973	1.129				
1-1/4x1/4	55	U	1316	842	585	430	329	260	211	174	146	125	107				
		Du	0.115	0.180	0.259	0.353	0.461	0.583	0.720	0.871	1.037	1.217	1.411				
		C	1316	1053	877	752	658	585	526	478	439	405	376				
[5]		Dc	0.092	0.144	0.207	0.282	0.369	0.467	0.576	0.697	0.829	0.973	1.129	90	96	102	108
1-1/2x1/8	53	U	947	606	421	309	237	187	152	125	105	90	77	67	59	52	47
		Du	0.096	0.150	0.216	0.294	0.384	0.486	0.600	0.726	0.864	1.014	1.176	1.350	1.536	1.734	1.944
		C	947	758	632	541	474	421	379	344	316	291	271	253	237	223	211
[3]		Dc	0.077	0.120	0.173	0.235	0.307	0.389	0.480	0.581	0.691	0.811	0.941	1.080	1.229	1.387	1.555
1-1/2x3/16 or 1-1/2" I Bar	59	U	1421	909	632	464	355	281	227	188	158	135	116	101	89	79	70
		Du	0.096	0.150	0.216	0.294	0.384	0.486	0.600	0.726	0.864	1.014	1.176	1.350	1.536	1.734	1.944
		C	1421	1137	947	812	711	632	568	517	474	437	406	379	355	334	316
[4]		Dc	0.077	0.120	0.173	0.235	0.307	0.389	0.480	0.581	0.691	0.811	0.941	1.080	1.229	1.387	1.555
1-1/2x1/4	64	U	1895	1213	842	619	474	374	303	251	211	179	155	135	118	105	94
		Du	0.096	0.150	0.216	0.294	0.384	0.486	0.600	0.726	0.864	1.014	1.176	1.350	1.536	1.734	1.944
		C	1895	1516	1263	1083	947	842	758	689	632	583	541	505	474	446	421
[5]		Dc	0.077	0.120	0.173	0.235	0.307	0.389	0.480	0.581	0.691	0.811	0.941	1.080	1.229	1.387	1.555
1-3/4x3/16 or 1-3/4" I Bar	66	U	1934	1238	860	632	484	382	309	256	215	183	158	138	121	107	96
		Du	0.082	0.129	0.185	0.252	0.329	0.417	0.514	0.622	0.741	0.869	1.008	1.157	1.317	1.486	1.666
		C	1934	1547	1289	1105	967	860	774	703	645	595	553	516	484	455	430
[5]		Dc	0.066	0.103	0.148	0.202	0.263	0.333	0.411	0.498	0.592	0.695	0.806	0.926	1.053	1.189	1.333
1-3/4x1/4	71	U	2579	1651	1146	842	645	509	413	341	287	244	211	183	161	143	127
		Du	0.082	0.129	0.185	0.252	0.329	0.417	0.514	0.622	0.741	0.869	1.008	1.157	1.317	1.486	1.666
		C	2579	2063	1719	1474	1289	1146	1032	938	860	794	737	688	645	607	573
[6]		Dc	0.066	0.103	0.148	0.202	0.263	0.333	0.411	0.498	0.592	0.695	0.806	0.926	1.053	1.189	1.333
2x3/16 or 2" I Bar	73	U	2526	1617	1123	825	632	499	404	334	281	239	206	180	158	140	125
		Du	0.072	0.113	0.162	0.221	0.288	0.365	0.450	0.545	0.648	0.761	0.882	1.013	1.152	1.301	1.458
		C	2526	2021	1684	1444	1263	1123	1011	919	842	777	722	674	632	594	561
[5]		Dc	0.058	0.090	0.130	0.176	0.230	0.292	0.360	0.436	0.518	0.608	0.706	0.810	0.922	1.040	1.166
2x1/4	79	U	3368	2156	1497	1100	842	665	539	445	374	319	275	240	211	186	166
		Du	0.072	0.113	0.162	0.221	0.288	0.365	0.450	0.545	0.648	0.761	0.882	1.013	1.152	1.301	1.458
		C	3368	2695	2246	1925	1684	1497	1347	1225	1123	1036	962	898	842	793	749
[7]		Dc	0.058	0.090	0.130	0.176	0.230	0.292	0.360	0.436	0.518	0.608	0.706	0.810	0.922	1.040	1.166
2-1/4x3/16 or 2-1/4" I Bar	80	U	3197	2046	1421	1044	799	632	512	423	355	303	261	227	200	177	158
		Du	0.064	0.100	0.144	0.196	0.256	0.324	0.400	0.484	0.576	0.676	0.784	0.900	1.024	1.156	1.296
		C	3197	2558	2132	1827	1599	1421	1279	1163	1066	984	914	853	799	752	711
[6]		Dc	0.051	0.080	0.115	0.157	0.205	0.259	0.320	0.387	0.461	0.541	0.627	0.720	0.819	0.925	1.037
2-1/4x1/4	86	U	4263	2728	1895	1392	1066	842	682	564	474	404	348	303	266	236	211
		Du	0.064	0.100	0.144	0.196	0.256	0.324	0.400	0.484	0.576	0.676	0.784	0.900	1.024	1.156	1.296
		C	4263	3411	2842	2436	2132	1895	1705	1550	1421	1312	1218	1137	1066	1003	947
[8]		Dc	0.051	0.080	0.115	0.157	0.205	0.259	0.320	0.387	0.461	0.541	0.627	0.720	0.819	0.925	1.037
2-1/2x3/16 or 2-1/2" I Bar	87	U	3947	2526	1754	1289	987	780	632	522	439	374	322	281	247	219	195
		Du	0.058	0.090	0.130	0.176	0.230	0.292	0.360	0.436	0.518	0.608	0.706	0.810	0.922	1.040	1.166
		C	3947	3158	2632	2256	1974	1754	1579	1435	1316	1215	1128	1053	987	929	877
[7]		Dc	0.046	0.072	0.104	0.141	0.184	0.233	0.288	0.348	0.415	0.487	0.564	0.648	0.737	0.832	0.933
2-1/2x1/4	93	U	5263	3368	2339	1719	1316	1040	842	696	585	498	430	374	329	291	260
		Du	0.058	0.090	0.130	0.176	0.230	0.292	0.360	0.436	0.518	0.608	0.706	0.810	0.922	1.040	1.166
		C	5263	4211	3509	3008	2632	2339	2105	1914	1754	1619	1504	1404	1316	1238	1170
[9]		Dc	0.046	0.072	0.104	0.141	0.184	0.233	0.288	0.348	0.415	0.487	0.564	0.648	0.737	0.832	0.933

NOTE: For serrated grating, the depth of grating required for a specified load is 1/4" greater than in the table.

**Weights (mass/area) shown are approximate and vary with manufacturers. They are provided for preliminary design computations only and are not intended for any other purpose.

Loads above DO NOT include the dead load of the grating.

LOAD TABLE FOR ALUMINUM GRATING - TYPE P-19

F=83MPa, E=69,000MPa

See Appendix A for a graphic depicting table loading

Recommended max. span (mm) for 6.4mm deflection under uniform load of 4.8kPa

U=uniform load, kPa
D=deflection, mm.
C=concentrated load at mid-span, kN per metre of grating width

All loads and deflections shown are based on engineering computations using gross sections and nominal sizes of bearing bars. The values listed are for design selection only and are not intended to be "absolute" since actual load capacity will be affected slightly by variations which can be expected due to material and manufacturing tolerances.

Note: The carrying capacity of a piece of grating subjected to a concentrated load over only a portion of its width is determined by the stiffness of both the bearing bars and the cross bars, and therefore differs with the type of grating used. To determine the carrying capacity of gratings subject to such loadings, the manufacturer's engineering department should be consulted.

Conversion Factors:

For gratings with other than 30mm bearing bar spacing, or for different design stresses, proportionate conversion factors apply. Refer to the Metal Bar Grating Engineering Design Manual for the development of such factors.

Note: 6.4mm is considered the maximum deflection consistent with pedestrian comfort, but can be exceeded for other loading conditions at the discretion of the engineer.

Bearing Bar Size (mm)	Nominal Weight Kg/m²**		Span in Millimeters 610	762	914	1067	1219	1372	1524	1676	1829	1981	2134	2286	2438	2591	2743
25x3	1002	U	20.16	12.90	8.96	6.58	5.04	3.98									
		Du	3.66	5.72	8.23	11.20	14.63	18.52									
		C	6.14	4.92	4.10	3.51	3.07	2.73									
[10]		Dc	2.93	4.57	6.58	8.96	11.70	14.81									
25x5 or	1109	U	30.24	19.35	13.44	9.87	7.56	5.97									
		Du	3.66	5.72	8.23	11.20	14.63	18.52									
25mm I Bar		C	9.22	7.37	6.14	5.27	4.61	4.10									
[13]		Dc	2.93	4.57	6.58	8.96	11.70	14.81									
25x6	1192	U	40.32	25.80	17.92	13.17	10.08	7.96	6.45	5.33	4.48						
		Du	3.66	5.72	8.23	11.20	14.63	18.52	22.86	27.66	32.92						
		C	12.29	9.83	8.19	7.02	6.14	5.46	4.92	4.47	4.10						
[17]		Dc	2.93	4.57	6.58	8.96	11.70	14.81	18.29	22.13	26.33						
32x3	1185	U	31.50	20.16	14.00	10.29	7.88	6.22	5.04	4.17	3.50						
		Du	2.93	4.57	6.58	8.96	11.70	14.81	18.29	22.13	26.33						
		C	9.60	7.68	6.40	5.49	4.80	4.27	3.84	3.49	3.20						
[12]		Dc	2.34	3.66	5.27	7.17	9.36	11.85	14.63	17.70	21.07	1981	2134				
32x5 or	1311	U	47.25	30.24	21.00	15.43	11.81	9.33	7.56	6.25	5.25	4.47	3.86				
		Du	2.93	4.57	6.58	8.96	11.70	14.81	18.29	22.13	26.33	30.91	35.84				
32mm I Bar		C	14.40	11.52	9.60	8.23	7.20	6.40	5.76	5.24	4.80	4.43	4.11				
[16]		Dc	2.34	3.66	5.27	7.17	9.36	11.85	14.63	17.70	21.07	24.73	28.68				
32x6	1409	U	63.00	40.32	28.00	20.57	15.75	12.44	10.08	8.33	7.00	5.96	5.14				
		Du	2.93	4.57	6.58	8.96	11.70	14.81	18.29	22.13	26.33	30.91	35.84				
		C	19.20	15.36	12.80	10.97	9.60	8.53	7.68	6.98	6.40	5.91	5.49				
[20]		Dc	2.34	3.66	5.27	7.17	9.36	11.85	14.63	17.70	21.07	24.73	28.68	2286	2438	2591	2743
38x3	1359	U	45.36	29.03	20.16	14.81	11.34	8.96	7.26	6.00	5.04	4.29	3.70	3.23	2.84	2.51	2.24
		Du	2.44	3.81	5.49	7.47	9.75	12.34	15.24	18.44	21.95	25.76	29.87	34.29	39.01	44.04	49.38
		C	13.83	11.06	9.22	7.90	6.91	6.14	5.53	5.03	4.61	4.25	3.95	3.69	3.46	3.25	3.07
[14]		Dc	1.95	3.05	4.39	5.97	7.80	9.88	12.19	14.75	17.56	20.60	23.90	27.43	31.21	35.23	39.50
38x5 or	1504	U	68.04	43.55	30.24	22.22	17.01	13.44	10.89	9.00	7.56	6.44	5.55	4.84	4.25	3.77	3.36
		Du	2.44	3.81	5.49	7.47	9.75	12.34	15.24	18.44	21.95	25.76	29.87	34.29	39.01	44.04	49.38
38mm I Bar		C	20.74	16.59	13.83	11.85	10.37	9.22	8.30	7.54	6.91	6.38	5.93	5.53	5.18	4.88	4.61
[19]		Dc	1.95	3.05	4.39	5.97	7.80	9.88	12.19	14.75	17.56	20.60	23.90	27.43	31.21	35.23	39.50
38x6	1616	U	90.72	58.06	40.32	29.62	22.68	17.92	14.52	12.00	10.08	8.59	7.41	6.45	5.67	5.02	4.48
		Du	2.44	3.81	5.49	7.47	9.75	12.34	15.24	18.44	21.95	25.76	29.87	34.29	39.01	44.04	49.38
		C	27.65	22.12	18.43	15.80	13.83	12.29	11.06	10.06	9.22	8.51	7.90	7.37	6.91	6.51	6.14
[24]		Dc	1.95	3.05	4.39	5.97	7.80	9.88	12.19	14.75	17.56	20.60	23.90	27.43	31.21	35.23	39.50
44x5 or	1688	U	92.61	59.27	41.16	30.24	23.15	18.29	14.82	12.25	10.29	8.77	7.56	6.59	5.79	5.13	4.57
		Du	2.09	3.27	4.70	6.40	8.36	10.58	13.06	15.81	18.81	22.08	25.60	29.39	33.44	37.75	42.32
44mm I Bar		C	28.23	22.58	18.82	16.13	14.11	12.55	11.29	10.26	9.41	8.69	8.07	7.53	7.06	6.64	6.27
[22]		Dc	1.67	2.61	3.76	5.12	6.69	8.46	10.45	12.64	15.05	17.66	20.48	23.51	26.75	30.20	33.86
44x6	1814	U	123.48	79.03	54.88	40.32	30.87	24.39	19.76	16.33	13.72	11.69	10.08	8.78	7.72	6.84	6.10
		Du	2.09	3.27	4.70	6.40	8.36	10.58	13.06	15.81	18.81	22.08	25.60	29.39	33.44	37.75	42.32
		C	37.64	30.11	25.09	21.51	18.82	16.73	15.05	13.69	12.55	11.58	10.75	10.04	9.41	8.86	8.36
[28]		Dc	1.67	2.61	3.76	5.12	6.69	8.46	10.45	12.64	15.05	17.66	20.48	23.51	26.75	30.20	33.86
51x5 or	1866	U	120.96	77.41	53.76	39.50	30.24	23.89	19.35	15.99	13.44	11.45	9.87	8.60	7.56	6.70	5.97
		Du	1.83	2.86	4.11	5.60	7.32	9.26	11.43	13.83	16.46	19.32	22.40	25.72	29.26	33.03	37.03
51mm I Bar		C	36.87	29.50	24.58	21.07	18.43	16.39	14.75	13.41	12.29	11.34	10.53	9.83	9.22	8.68	8.19
[25]		Dc	1.46	2.29	3.29	4.48	5.85	7.41	9.14	11.06	13.17	15.45	17.92	20.57	23.41	26.43	29.63
51x6	2005	U	161.28	103.22	71.68	52.66	40.32	31.86	25.80	21.33	17.92	15.27	13.17	11.47	10.08	8.93	7.96
		Du	1.83	2.86	4.11	5.60	7.32	9.26	11.43	13.83	16.46	19.32	22.40	25.72	29.26	33.03	37.03
		C	49.16	39.33	32.77	28.09	24.58	21.85	19.66	17.88	16.39	15.13	14.05	13.11	12.29	11.57	10.92
[32]		Dc	1.46	2.29	3.29	4.48	5.85	7.41	9.14	11.06	13.17	15.45	17.92	20.57	23.41	26.43	29.63
57x5 or	2038	U	153.09	97.98	68.04	49.99	38.27	30.24	24.49	20.24	17.01	14.49	12.50	10.89	9.57	8.48	7.56
		Du	1.63	2.54	3.66	4.98	6.50	8.23	10.16	12.29	14.63	17.17	19.91	22.86	26.01	29.36	32.92
57mm I Bar		C	46.66	37.33	31.11	26.66	23.33	20.74	18.66	16.97	15.55	14.36	13.33	12.44	11.67	10.98	10.37
[28]		Dc	1.30	2.03	2.93	3.98	5.20	6.58	8.13	9.83	11.70	13.74	15.93	18.29	20.81	23.49	26.33
57x6	2190	U	204.12	130.64	90.72	66.65	51.03	40.32	32.66	26.99	22.68	19.33	16.66	14.52	12.76	11.30	10.08
		Du	1.63	2.54	3.66	4.98	6.50	8.23	10.16	12.29	14.63	17.17	19.91	22.86	26.01	29.36	32.92
		C	62.22	49.77	41.48	35.55	31.11	27.65	24.89	22.62	20.74	19.14	17.78	16.59	15.55	14.64	13.83
[36]		Dc	1.30	2.03	2.93	3.98	5.20	6.58	8.13	9.83	11.70	13.74	15.93	18.29	20.81	23.49	26.33
64x5 or	2205	U	189.00	120.96	84.00	61.71	47.25	37.33	30.24	24.99	21.00	17.89	15.43	13.44	11.81	10.46	9.33
		Du	1.46	2.29	3.29	4.48	5.85	7.41	9.14	11.06	13.17	15.45	17.92	20.57	23.41	26.43	29.63
64mm I Bar		C	57.61	46.09	38.41	32.92	28.80	25.60	23.04	20.95	19.20	17.73	16.46	15.36	14.40	13.55	12.80
[31]		Dc	1.17	1.83	2.63	3.58	4.68	5.93	7.32	8.85	10.53	12.36	14.34	16.46	18.73	21.14	23.70
64x6	2370	U	252.00	161.28	112.00	82.29	63.00	49.78	40.32	33.32	28.00	23.86	20.57	17.92	15.75	13.95	12.44
		Du	1.46	2.29	3.29	4.48	5.85	7.41	9.14	11.06	13.17	15.45	17.92	20.57	23.41	26.43	29.63
		C	76.81	61.45	51.21	43.89	38.41	34.14	30.72	27.93	25.60	23.63	21.95	20.48	19.20	18.07	17.07
[40]		Dc	1.17	1.83	2.63	3.58	4.68	5.93	7.32	8.85	10.53	12.36	14.34	16.46	18.73	21.14	23.70

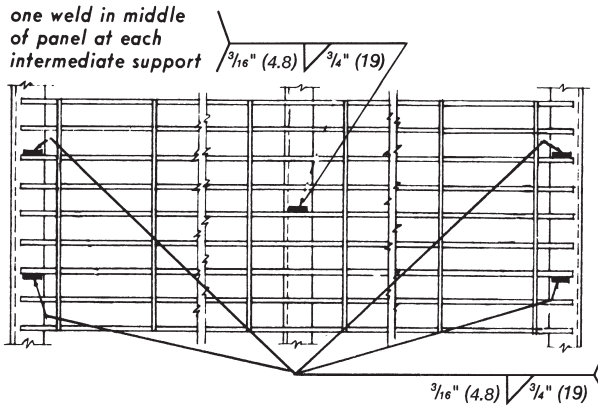
NOTE: For serrated grating, the depth of grating required for a specified load is 6mm greater than in the table.

**Weights (mass/area) shown are approximate and vary with manufacturers. They are provided for preliminary design computations only and are not intended for any other purpose.

Loads above DO NOT include the dead load of the grating.

ANCHORING DETAILS

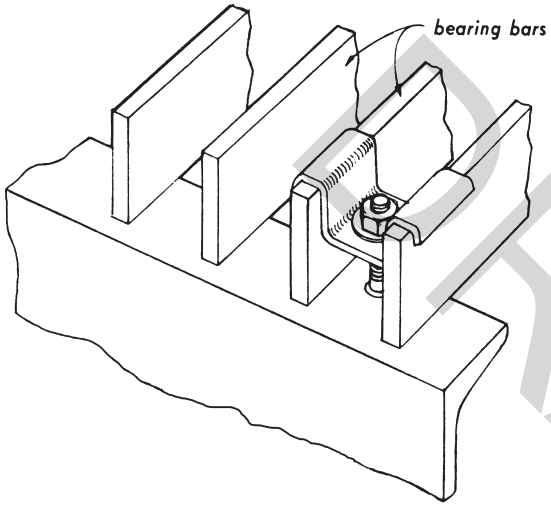
All gratings are to be firmly anchored to their supports by positive means.



1 WELDED ANCHORAGE

(in field by others)

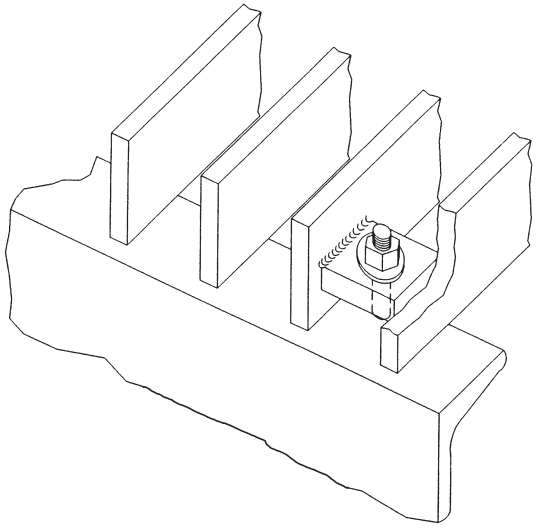
Recommended for all permanently installed gratings.



2 SADDLE CLIPS

Available in steel, stainless steel, and aluminum (it is sometimes necessary to cut cross bars during installation for fastener clearance).

Used for installations where grating is subject to removal. Will be in same location as welds in **1** unless otherwise specified. Fasteners are 1/4 in. (6.4 mm) diameter.



3 WELD LUGS

shop welded to bearing bars — must be specified when ordering

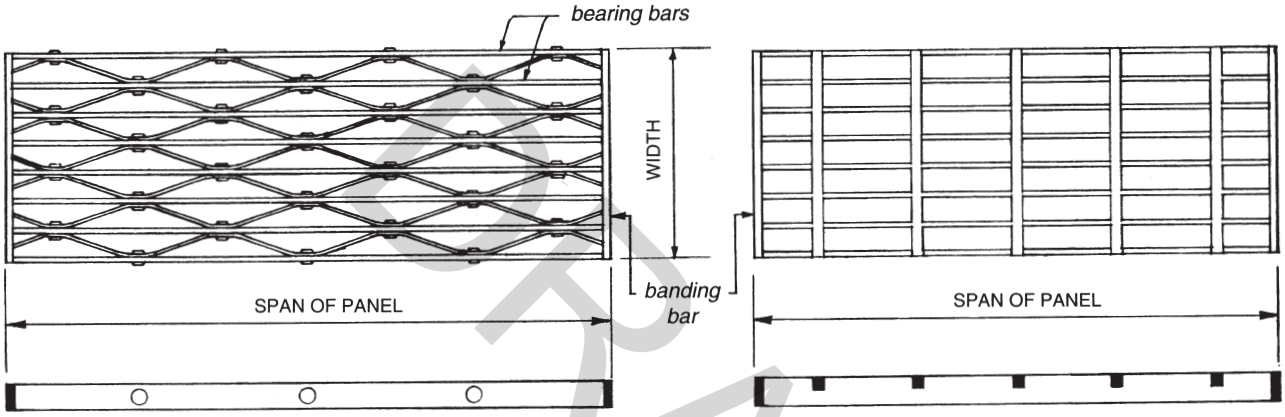
Used for installations where grating is subject to removal. Will be in same location as welds in **1** unless otherwise specified. Fasteners are 1/4 in. (6.4 mm) diameter.

4 OTHER TYPES

Other types of anchors which have been appropriately tested and have demonstrated satisfactory performance may be used also. Included in other types are top-mounting mechanical friction anchors which can be installed without requiring access to the underside of the grating and which eliminate field welding and/or drilling. These anchors are removable and may be used where gratings are subject to frequent removal.

GENERAL REQUIREMENTS FOR GRATING INSTALLATION

1. Unpack grating and inspect for damage.
2. Grating shall be installed with cross bars on top.
3. Preliminarily install all grating into area per layout drawing.
4. Adjust spacing between panels to allow for proper pack out and equal spacing between panels and between supports.
5. Verify that all grating is adequately supported. Notching bearing bars at supports or interrupting bearing bars with cutouts shall only occur when the system has been designed for such modification and is specified by the design engineer and indicated on the plans.
6. Securely fasten all grating as specified for project or per NAAMM recommendations.

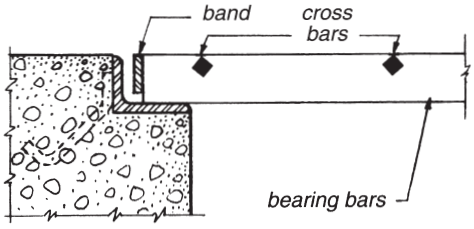


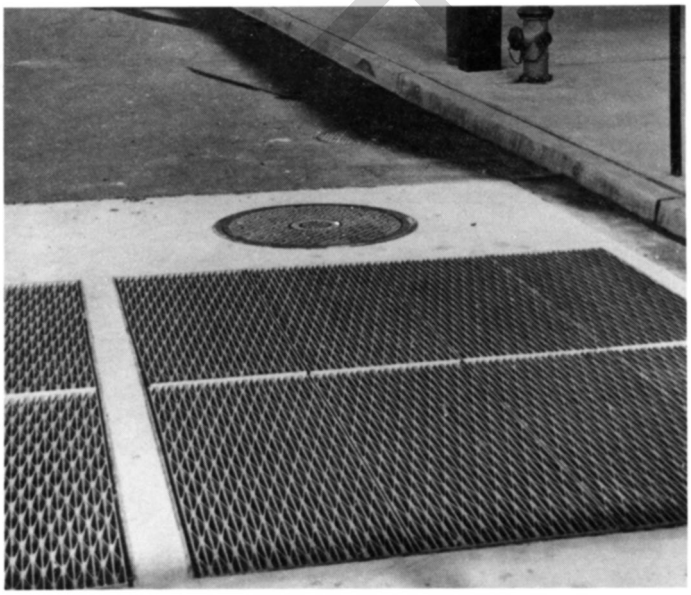
SPAN of panel is measured parallel to the bearing bars.

WIDTH of panel is measured perpendicular to the bearing bars, even if this dimension exceeds the panel span.

SUPPORT and BANDING of TRENCH GRATING

Each end of a metal bar grating panel installed in a trench shall be supported on an angle or other shape whose inside vertical dimension equals that of the bearing bar.

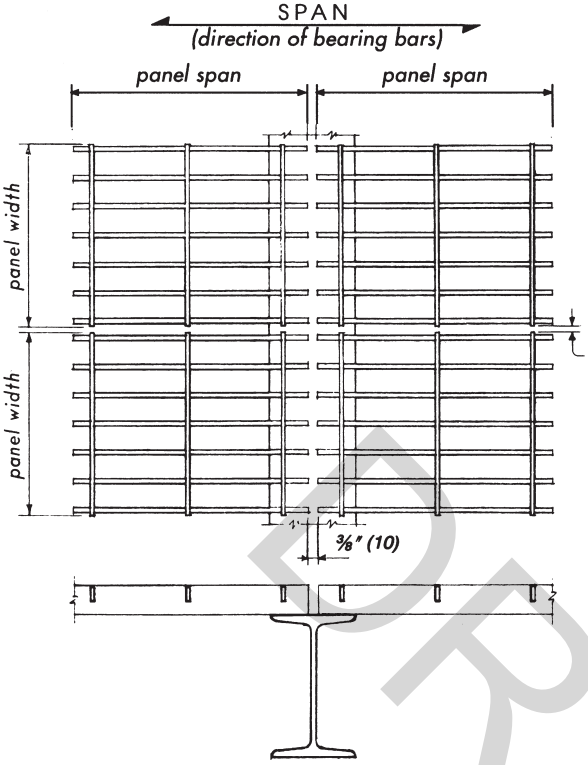




Specify banding on all gratings subject to rolling loads. Full depth band is supplied by manufacturer for all banded grating unless owner or specifier states clearly that shallow banding shall be provided.

Shallow banding bar shall be 1/4 in. (6.4 mm) to 1/2 in. (13 mm) less than depth of grating to permit drainage.

STANDARD INSTALLATION CLEARANCES

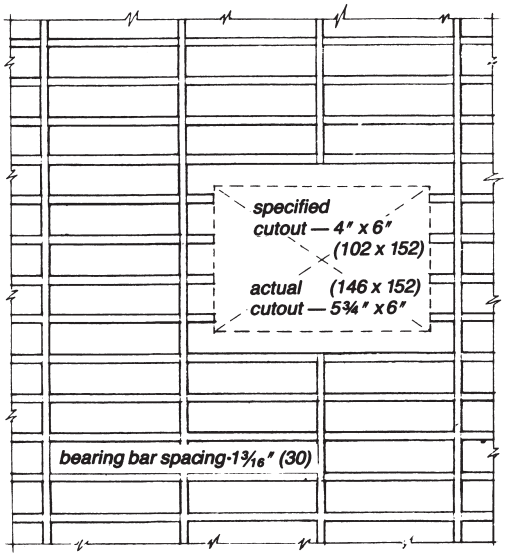


1/4" (6) nominal clearance between ends of cross bars on rectangular grating or rivet heads on riveted grating.

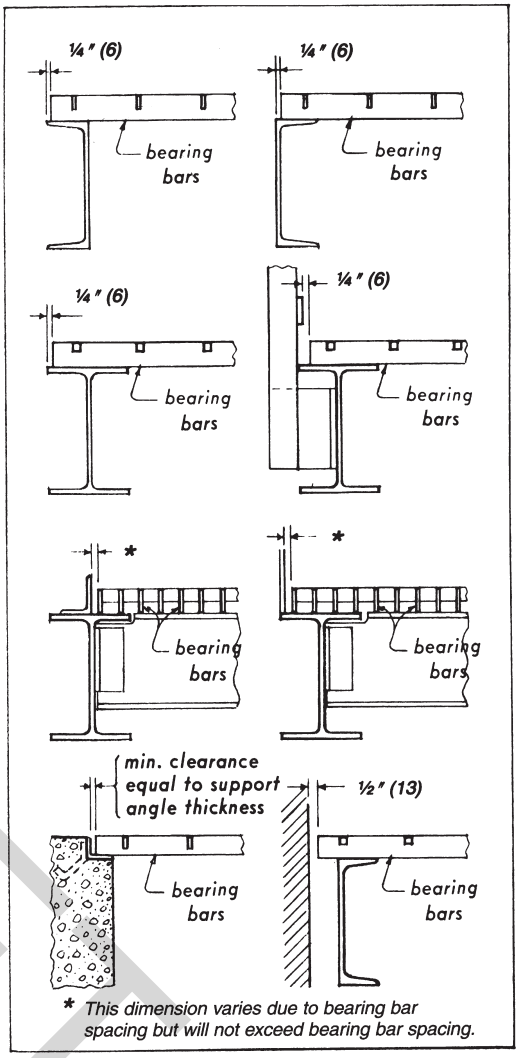
Clearances shown are recommended, but vary in accordance with dimensional tolerances shown on page 20.

Cutouts for circular obstructions are recommended to be at least 2 in. (51 mm) larger in diameter than the obstruction. It is further recommended that cutouts for all piping 4 in. (102 mm) or less in diameter be made in the field.

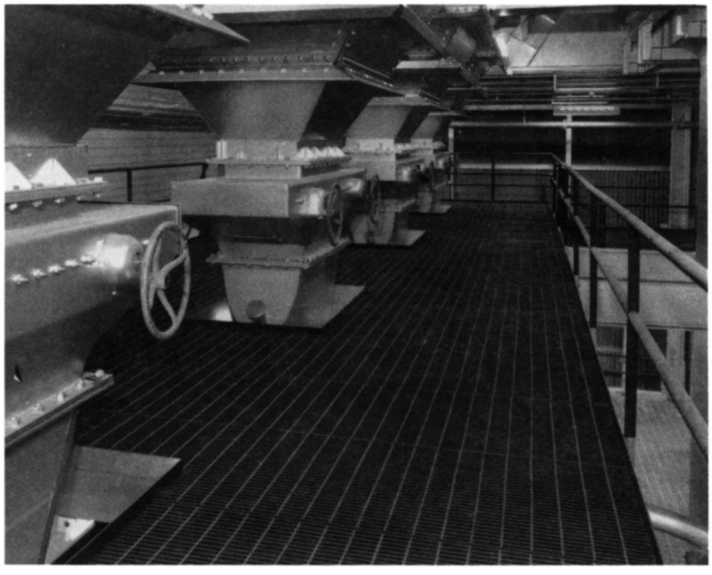
As shown in the drawing below, all rectangular cutouts are made to the next bearing bar beyond the penetration with a clearance not to exceed bearing bar spacing.



Metal shall be used for all grating supports and provide a 1 in. (25 mm) minimum bearing surface for depths up to 2 1/4 in. (57 mm), and 2 in. (51 mm) minimum bearing surface for depth 2 1/2 in. (64 mm) and over, at each end of span.



* This dimension varies due to bearing bar spacing but will not exceed bearing bar spacing.



OPERATION AND MAINTENANCE INSTRUCTIONS

1. For pedestrian load rated grating design, grating is intended for normal walking pedestrian traffic. Precautions shall be taken to prevent wheel or other loads beyond the design load rating for the application.
2. For other uniform or concentrated load rating applications, precautions shall be taken to prevent loads beyond the design load rating for the application.
3. Periodically inspect grating for damage or excessive wear, such as corrosion, damage to the finish, deformation and excessive bearing bar lean beyond the tolerances as noted on page 20. Repair or replace any areas showing damage.
4. Periodically inspect grating to be sure that all grating is securely fastened as specified for the application or as noted on page 14, if fastening method is not specified. Replace any missing attachment hardware and tighten any loose connections.

STANDARD TREAD NOSINGS

GENERAL NOTES: Nosings shall be used on treads and on grating at the head of stairs, both for visual safety and to sustain edge loads.

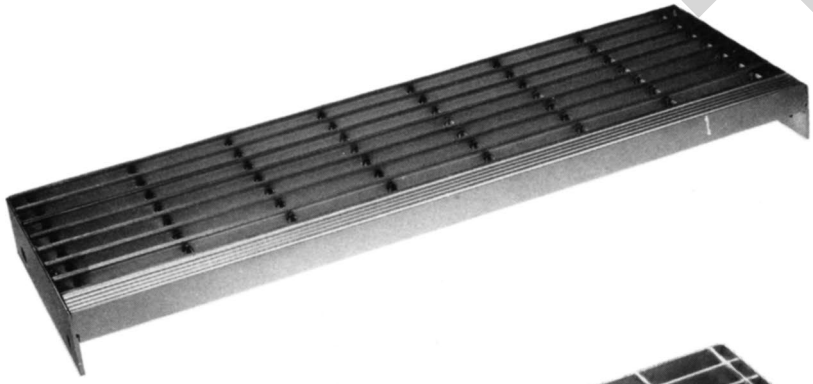
Nosing widths shall be between 1¼ in. (32 mm) and 1½ in. (36 mm). (Manufacturers' standards are within these limits.)

ROLLED FLOOR PLATE NOSING

available in carbon steel and stainless steel

DIMPLE NOSING

available in carbon steel, stainless steel, aluminum, and hot-dip zinc-coated



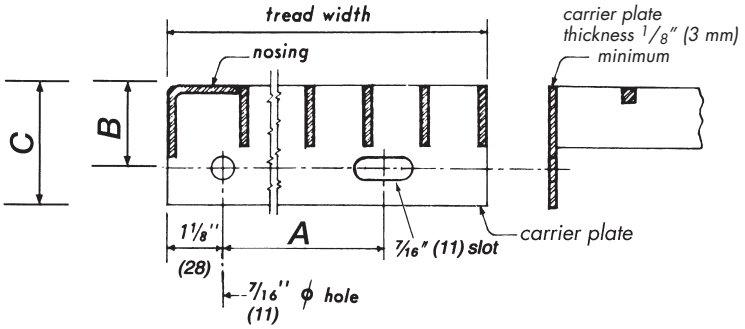
CORRUGATED NOSING

available in aluminum only

ABRASIVE NOSING

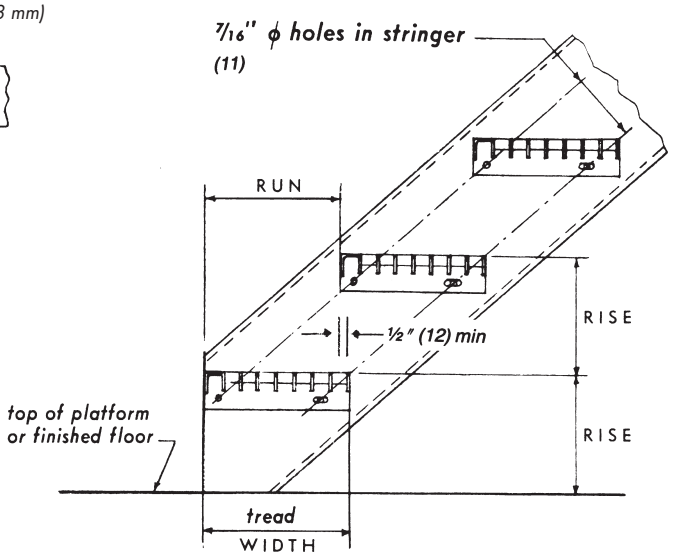
TREAD DIMENSIONS

RECOMMENDED DETAILS



TREAD with carrier plate detail

TREAD with carrier angles available, consult grating manufacturer for details



NOTE: Tread width should always be greater than tread run by 1/2 in. (12mm) minimum.

DIMENSION **A** in TREAD with carrier plate detail in. (mm)

Nominal Tread Width (approximate)** Bearing Bar Centers		Dimension A
1 3/16 (30)	15/16 (24)	
6¼ (159)	6 (152)	2½ (63)
7¼ (184)	7 (178)	4½ (114)
8½ (216)	9 (229)	4½ (114)
9¾ (248)	10 (254)	7 (178)
11 (279)	10¾ (273)	7 (178)
12 (305)	11¾ (298)	7 (178)

**Consult manufacturer for exact dimension.

DIMENSION **B & C** in TREAD with carrier plate detail in. (mm)

Grating Depth	Dimension B	Dimension C
¾ (19) to 1¼ (32)	1¾ (44)	2½ (63)
1½ (38) to 1¾ (44)	2¼ (57)	3 (76)
For aluminum and all treads over 1¾ (44) consult with manufacturer.		

RECOMMENDED BEARING BAR SIZES

STEEL TREADS

Bearing Bar Size in. (mm)	Maximum Tread Length*			
	@ 1 3/16 (30) o.c.		@ 15/16 (24) o.c.	
	Plain	Serrated	Plain	Serrated
¾ x 3/16 (19 x 5)	2′-4″ (.71m)	—	2′-8″ (.81m)	—
1 x 3/16 (25 x 5)	3′-5″ (1.04m)	2′-10″ (.86m)	4′-0″ (1.22m)	3′-4″ (1.02m)
1¼ x 3/16 (32 x 5)	4′-8″ (1.42m)	4′-2″ (1.27m)	5′-1″ (1.55m)	4′-6″ (1.37m)
1½ x 3/16 (38 x 5)	5′-6″ (1.67m)	5′-3″ (1.60m)	5′-6″ (1.67m)	5′-6″ (1.67m)

Note: When tread length exceeds 5′-6″ (1.67m), design tread for 300 lb (1.33kN) concentrated loads at one-third points.

*Maximum tread length based on 300 lb (133 kN) concentrated load on front 5 in. (127 mm) of tread at center of tread length and deflection limitation of 1/240 of length . For maximum length under other loadings, consult the manufacturer.

ALUMINUM TREADS

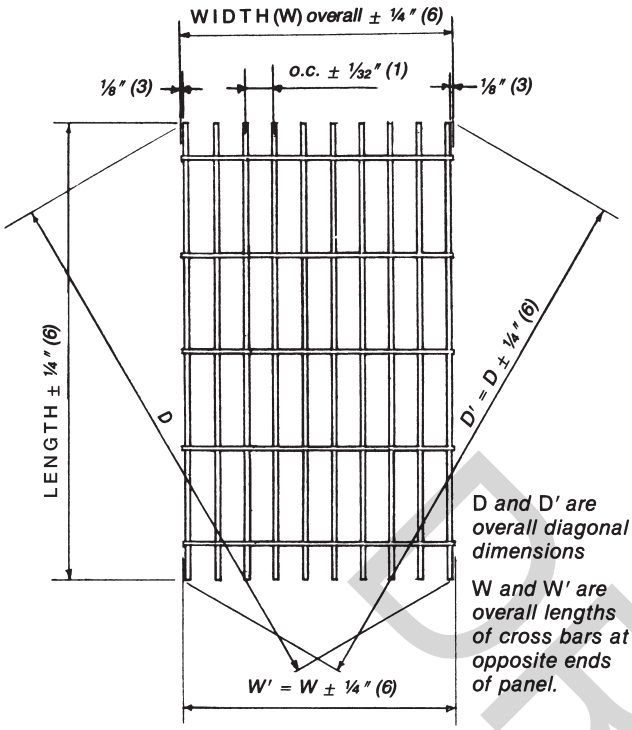
Rectangular Bars

Bearing Bar Size in. (mm)	Maximum Tread Length*			
	@ 1 3/16 (30) o.c.		@ 15/16 (24) o.c.	
	Plain	Serrated	Plain	Serrated
1 x 3/16 (25 x 5)	2′-4″ (.71m)	—	2′-6″ (.76m)	—
1¼ x 3/16 (32 x 5)	2′-10″ (.86m)	2′-7″ (.79m)	3′-1″ (.94m)	2′-9″ (.84m)
1½ x 3/16 (38 x 5)	3′-6″ (1.07m)	3′-2″ (.97m)	3′-10″ (1.17m)	3′-6″ (1.07m)
1¾ x 3/16 (44 x 5)	4′-3″ (1.30m)	3′-10″ (1.17m)	4′-8″ (1.42m)	4′-3″ (1.30m)

I Bars

Bearing Bar Size in. (mm)	Maximum Tread Length*	
	@ 1 3/16 (30) o.c.	@ 15/16 (24) o.c.
1 (25) I	2′-4″ (.71m)	2′-6″ (.76m)
1¼ (32) I	2′-10″ (.86m)	3′-1″ (.94m)
1½ (38) I	3′-6″ (1.07m)	3′-10″ (1.17m)
1¾ (44) I	4′-3″ (1.30m)	4′-8″ (1.42m)

All dimensions given are maximum permissible tolerances.

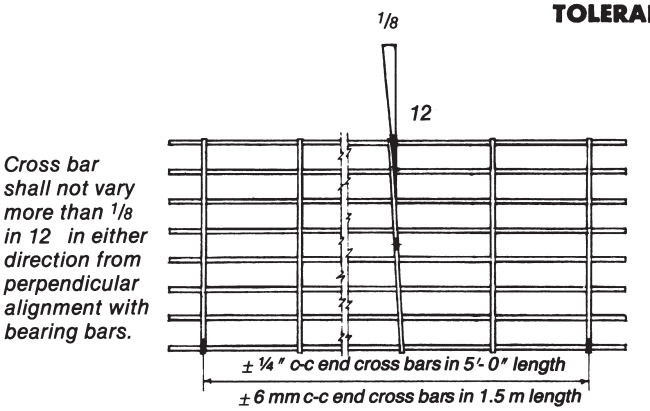


D and D' are overall diagonal dimensions

W and W' are overall lengths of cross bars at opposite ends of panel.

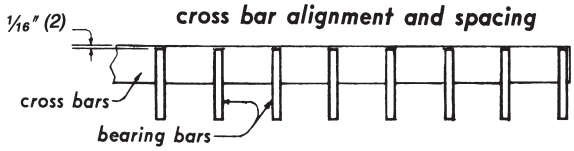
overall dimensions and squareness

Sweep 1/200 of Span

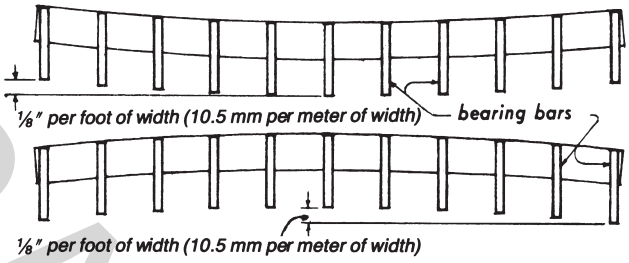


Cross bar shall not vary more than 1/8 in 12 in either direction from perpendicular alignment with bearing bars.

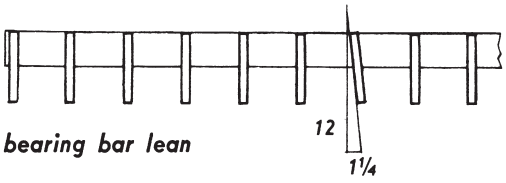
cross bar alignment and spacing



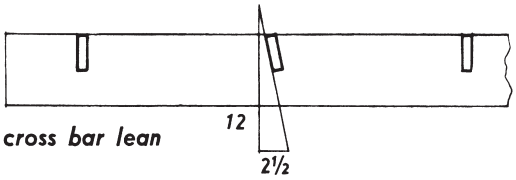
cross bar location



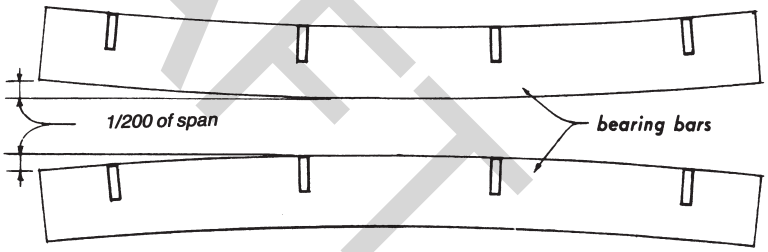
transverse bow (before fastening to supports)



bearing bar lean

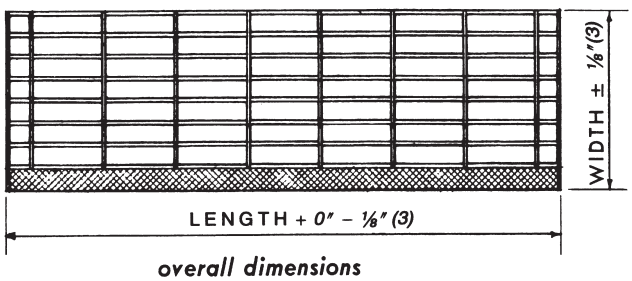


cross bar lean

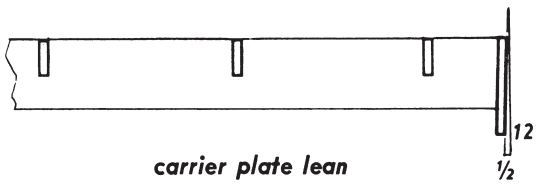


longitudinal bow

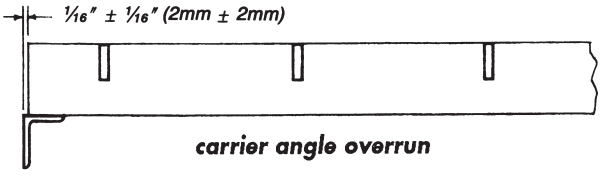
STAIR TREAD TOLERANCES



overall dimensions



carrier plate lean



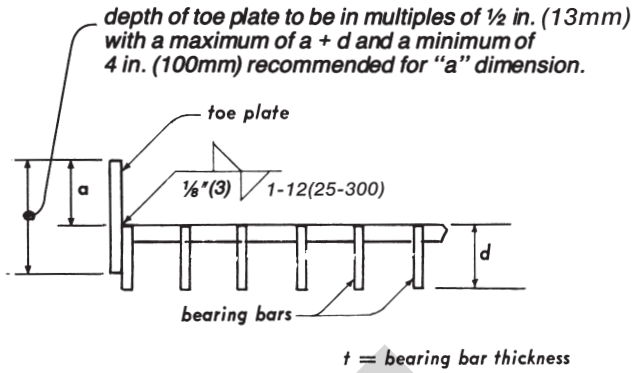
carrier angle overrun

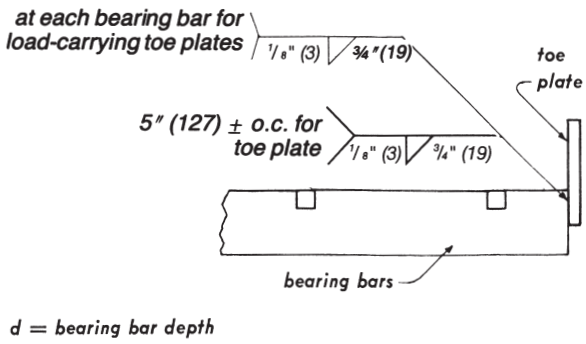
NOTE: *Length of tread is distance between outer faces of carrier plates or back to back of carrier angles.*

WELDING STANDARDS

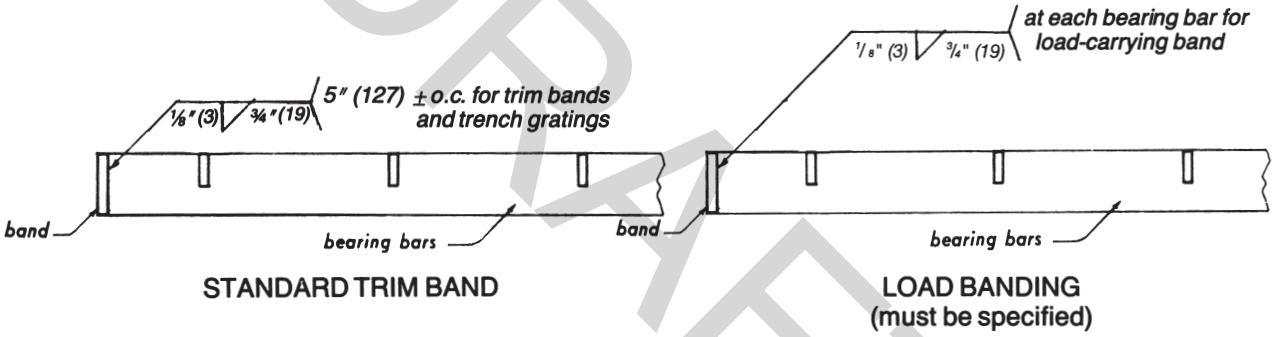
The welding standards shown here apply to those gratings and treads having a clear opening of not less than ⅝ in. (16 mm) between bearing bars and those galvanized as per Specifications, page 24. See NAAMM STANDARD MBG 533 "Welding Specifications for Fabrication of Steel, Aluminum and Stainless Steel Bar Grating" for welding specifications and certification of welders.

TOE PLATES



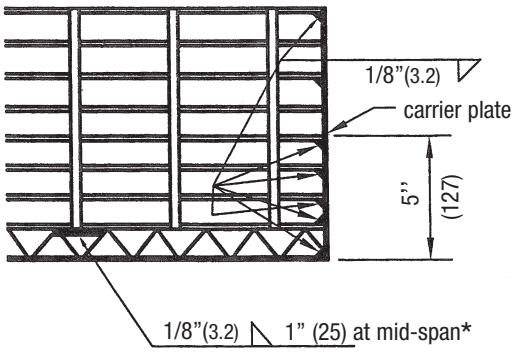


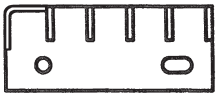
BANDING



STANDARD STAIR TREADS

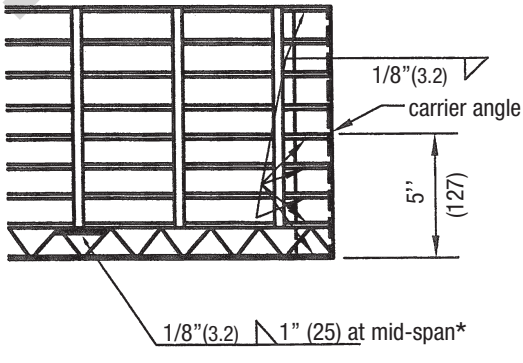
(bearing bar thickness less than 1/4"(6.4mm) and bearing bar clear opening greater than or equal to 5/8" (16mm))

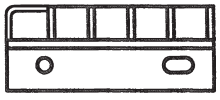




for stair treads
3' - 0 and greater
(914mm)

when carrier plates and carrier angles are used, the bearing bars in the front five inches, the back bearing bar, and the nosing shall be welded to the carrier plate or carrier angle as shown.



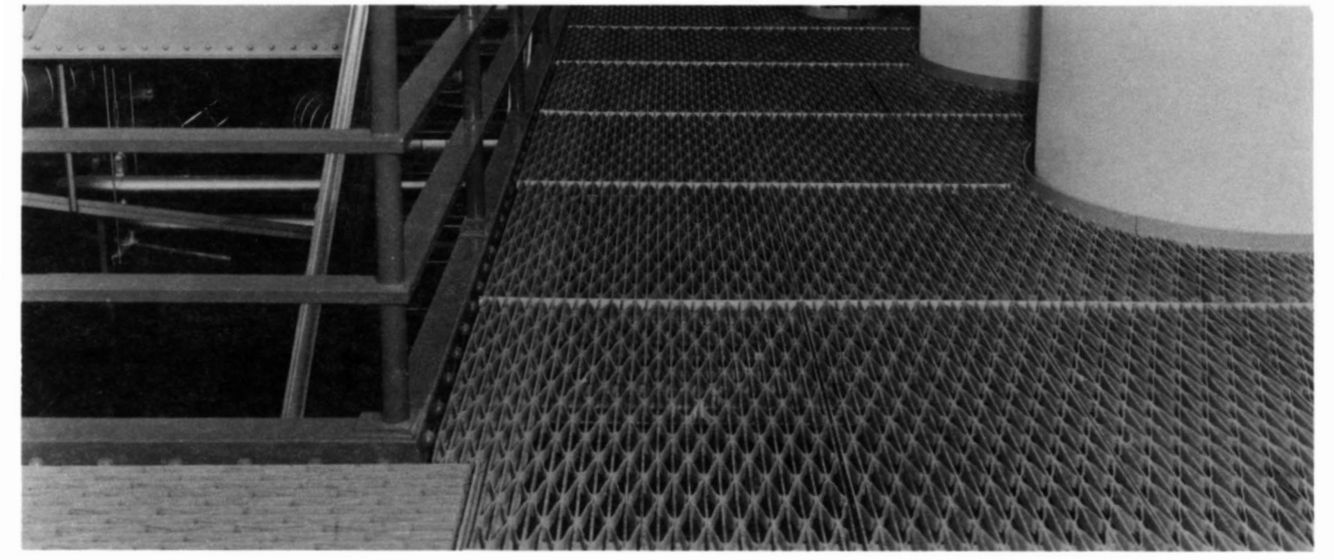


for stair treads
3' - 0 and greater
(914mm)

On treads over 9-3/4 in. (248) wide weld end of center bar also.
* Treads spanning 4 ft. (1.2m) or more shall have welds located at the third points.

USES FOR GRATINGS

Airplane Landing Mats
Airplane Unloading Ramps
Airport Light Guards
Areaways
Boat Landing Ramps
Bridge Centerline Markers
Bridge Flooring
Bridge Sidewalks
Catwalks
Concrete Armoring
Concrete Reinforcement
Cracking Plant Trays
Crating
Crow's Nests
Deflecting Fenders
Dipping Trays
Drainage Pit Covers
Fencing
Fire Escapes
Floor Boards
Flooring
Foot Scrapers
Freight Car Flooring
Freight Car Top Walkways
Ladder Treads
Machine and Motor Bases
Machinery Safety Guards
Material Screens
Mezzanine Floors
Mooring Docks
Ornamental Grills
Overhead Sign Platforms
Paint Booths
Parapet Screens
Partitions
Platforms
Racks and Shelving
Railway Crossings
Ramps
Refrigerator Car Trays
Running Boards
Scaffolding
Security Screens
Snow Fences
Solar Screens
Stage Flooring
Stairs
Stiles
Strainers
Temporary Wing Walls
Tote Trays and Boxes
Trap Doors
Tree and Pole Guards
Trench Covers
Truck Beds
Truck Radiator Grills
Vault Covers
Ventilated Bin Floors
Ventilating Screens
Vestibule Grates
Walkways
Wash Racks
Window Guards



INFORMATION TO BE PROVIDED

when specifying or purchasing METAL BAR GRATING:

Description of grating (see standard marking system, page 4 of this Manual)

A drawing, showing: area to be covered (including all cutouts)
span (direction of bearing bars)
method of support
all critical dimensions
(indicate whether clearances are taken into account)

Type of anchorage: (see page 14 of this Manual)

Finish: Steel gratings — mill finish, manufacturer's standard paint, or galvanized as specified

Aluminum gratings — mill as fabricated

Stainless steel gratings — mill as fabricated

Shipping instructions

INFORMATION TO BE PROVIDED

when specifying or purchasing METAL BAR GRATING TREADS:

Description of grating (see standard marking system, page 4 of this Manual)

Type of nosing: (see page 18 of this Manual)

Dimensions: width and length of tread

Number of treads

Finish: Steel treads — mill finish, manufacturer's standard paint, or galvanized as specified

Aluminum treads — mill as fabricated

Stainless steel treads — mill as fabricated

Shipping instructions

STANDARD SPECIFICATIONS

for Metal Bar Gratings and Treads

A Mediumscope Section under Division 5, Uniform System

I. SCOPE

These specifications apply to metal bar grating and/or metal bar grating treads as hereinafter defined and described.

II. DEFINITIONS

a) Metal bar grating is an open grid of metal bars. The bearing bars, which have a cross-sectional depth much greater than width, are held at regular spacing, usually parallel, either by:

1. Straight, sinuous or corrugated cross bars having their longitudinal axis perpendicular to the bearing bars and being connected to them by welding, forging or mechanical locking, or by

2. Bent connecting bars alternately contacting adjacent bearing bars and riveted to them at regular intervals.

b) A metal bar grating tread is a stair tread consisting of a panel of metal bar grating having a metal nosing section extending along one of its long edges and a carrier angle or plate at each end for connection to a stringer.

c) Definitions of other terms shall conform to those given in the Glossary of Terms in the Metal Bar Grating Manual.

III. MATERIALS

a) Steel gratings:
Steel used in bearing bars, cross bars and connecting bars of rectangular section shall have mechanical properties equal to, or greater than the performance of ASTM A 1011/A 1011M Commercial Steel (Type B) for hot rolled carbon steel sheet and strip. Cross bars made of wire rod shall conform to ASTM A 510/A 510M for carbon steel wire rods and coarse round wire, except that permissible tolerance on diameter of coarse round wire shall be ± 0.005 in. (± 0.13 mm). Combinations of these steels are permitted to be welded together.

Rivets shall be of steel prescribed in ASTM A 575, 1/4 in. (6.4 mm) minimum diameter, flat head type.

b) Aluminum gratings:
Bearing bars shall be either alloy 6005A-T61, 6061-T6, 6105-T5, or alloy 6063-T6, conforming to ASTM B 221 (B 221M). Cross bars and bent connecting bars shall be of alloy 6061 or 6063 conforming to ASTM B 221 (B 221M), or alloy 3003 conforming to ASTM B 210 (B 210M).

Rivets shall be made of aluminum wire of alloy 6053-T61 conforming to ASTM B 316/B 316M.

c) Stainless steel gratings:
Bearing bars, cross bars, and connecting bars shall be Type 304, 304L, 316, or 316L alloy conforming to ASTM A 666.

Rivets shall be of a Type 300 series alloy as prescribed in ASTM A 493.

IV. MINIMUM SIZE OF MEMBERS

a) Size of bearing bars shall conform to the tolerances shown in the Minimum Standard Section, page 7, of the Metal Bar Grating Manual.

b) Minimum dimensions of cross bars shall be as shown on page 7 of the Metal Bar Grating Manual.

c) Banding bars shall have the following minimum thicknesses:

with rectangular bearing bars, the thickness of the bearing bars to which they are attached:

with I-bar section bearing bars, 1/8 in. (3mm).

V. FABRICATION

Basic fabrication of welded, riveted and pressure-locked grating shall be as defined in the Glossary of Terms.

a) All tolerances shall be within the limits shown on page 20 of the Metal Bar Grating Manual.

b) Bandings, nosings, carriers and toe plates, when specified, shall be attached by welding as shown on page 21 of the Metal Bar Grating Manual.

c) All cutouts where more than one bearing bar is cut and bearing bars are not supported shall be load banded.

d) Unless specifically ordered otherwise, no welds anywhere on the grating will be ground.

e) Finishes: Carbon steel gratings shall be specified unfinished, galvanized, or painted one coat of manufacturer's standard paint applied in accordance with the manufacturer's standard practice. One coat of manufacturer's standard paint is designed as an economical solution for many applications. Gratings specified to be galvanized shall have their exposed surfaces zinc-coated by the hot dip process per ASTM A 123 after fabrication. Gratings and/or treads stored at the jobsite shall be covered or under roof. **Required covering is not the responsibility of the grating and/or tread supplier.**

Unless otherwise specified, abrasive nosings will have the manufacturer's standard finish.

Aluminum and stainless steel gratings shall have a mill (as fabricated) finish, unless otherwise specified.

VI. ANCHORS

Grating anchors shall be supplied by the manufacturer only when specified.

CODE OF STANDARD PRACTICE

The following Code represents generally accepted standard practice in the metal bar grating industry. In order to avoid misunderstanding, these practices will apply only to manufacturers individually adopting them, and then, only to the extent each manufacturer has not made unilateral modifications. Each manufacturer is free to modify the Code generally or as it specifically agrees with any Buyer.

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1. GENERAL

1.1 Scope and Application

The rules and practices contained in this Code were developed by the NAAMM Metal Bar Grating Division as standard for the industry. Unless specifically stated otherwise, they shall be considered applicable to, and a part of, all contracts relating to the purchase and supply of metal bar gratings and/or treads.

No provisions herein contained, however, shall be construed as denying the right of any company to set its own prices and terms of sale, or restricting any Buyer or Seller from voiding, by mutual agreement, any part of this Code.

1.2 Definitions

As used in this Code, the term "product" or "products" refers to metal bar gratings or metal bar grating treads and their accessories; the term "Buyer" to the party, or authorized representative of the party, who contracts to purchase such products, and the term "Seller" to the manufacturer who contracts to supply them.

1.3 Designs and Materials

Unless otherwise specified, all designs and materials shall be in accord with the Standard Specifications for Metal Bar Gratings and Treads as published in the NAAMM Metal Bar Grating Manual, latest edition, and the NAAMM Metal Bar Grating Engineering Design Manual, latest edition.

2. QUOTATIONS

2.1 Bidding Plans

Plans intended to serve as the basis for bidding shall provide complete information as to the description of the product, the limits of areas to be covered, the direction of span of grating panels, all supporting members, all cutouts to be provided in the grating area, anchors if required, and finishes desired.

2.2 Basis of Unit Price Quotations

Quotations shall preferably be on the basis of unit price per square foot (square meter) of grating and per tread. The quoted grating price shall be for grating furnished in rectangular sections.

2.3 Extras:

The following are examples of items not included in unit price quotations, and shall be considered as extras in quotations:

Cutting
Banding
Toe plates
Support plates or angles
Hinges
Locking devices
Forming, undercutting or notching
Special drilling, punching or tapping
Anchors
Bolts for stair treads
Degreasing or sandblasting
Special bundling or strapping other than steel strapping
Field measurements
Installation
Any materials, practices or finishes not called for in the Standard Specifications for Metal Bar Gratings and Treads, including special welding if galvanized in accord with ASTM A 385.

Research of structural steel detail drawings to determine the layout dimensions for vertical bracing and moment connections when such details are not furnished prior to start of preparation of grating drawings.

3. DRAWINGS AND SPECIFICATIONS

3.1 Construction Drawings and Specifications

The Buyer shall be expected to furnish to the Seller an electronic file of construction drawings and specifications of current issue showing the layout of supports and floor openings correctly dimensioned, together with the sizes and types of grating and treads desired. Should cutouts for vertical bracing or moment connections be required for shop fabrication, the structural steel detail drawings shall be furnished prior to the preparation of the grating drawings.

If construction drawings and specifications are not available, the Buyer shall provide complete information regarding all items listed in “Information to be Provided” as shown on page 23 of the NAAMM Metal Bar Grating Manual.

3.2 Limit of Seller’s Responsibility

In the absence of written notice to the contrary, the Buyer’s construction plans and specifications will be assumed by the Seller to be correct in all details, and the Seller’s responsibility shall be limited to furnishing the products in accord with these documents.

3.3 Approval Drawings

If required by the Buyer, the Seller shall submit to the Buyer one electronic copy of detailed drawings in outline form for the latter’s review. The Buyer shall return one copy marked with his approval or desired changes. Should changes be required which involve work not called for in the original construction plans and specifications, the Seller shall have the right to charge extra for the engineering work required to make such changes. After all necessary corrections and/or changes are made, the drawings shall be re-submitted to the Buyer for his final review. The Seller shall not proceed with any shop work until drawings are approved for fabrication.

3.4 Installation Drawings

If requested, the Seller shall furnish to the Buyer an electronic copy of all installation drawings.

4. GRATING MISCELLANEOUS SUPPORTS

4.1 When construction drawings are furnished to the Seller as per item 3.1, drawings shall show and locate all main and miscellaneous structural members intended to support the grating.

4.2 To facilitate installation, it may be required to cut the grating panels around penetrations, equipment supports, or other obstructions common to the grating supports. Buyer shall properly review and correct any support deficiencies when such conditions occur.

4.3 Seller will not accept any type of backcharges for support deficiencies as insufficient support is considered an omission at time of design.

5. QUANTITY MEASUREMENTS

5.1 Quantity measurements for gratings ordered to specific dimensions without drawings, shall be based on span times width of each panel, with no deduction made for cutouts.

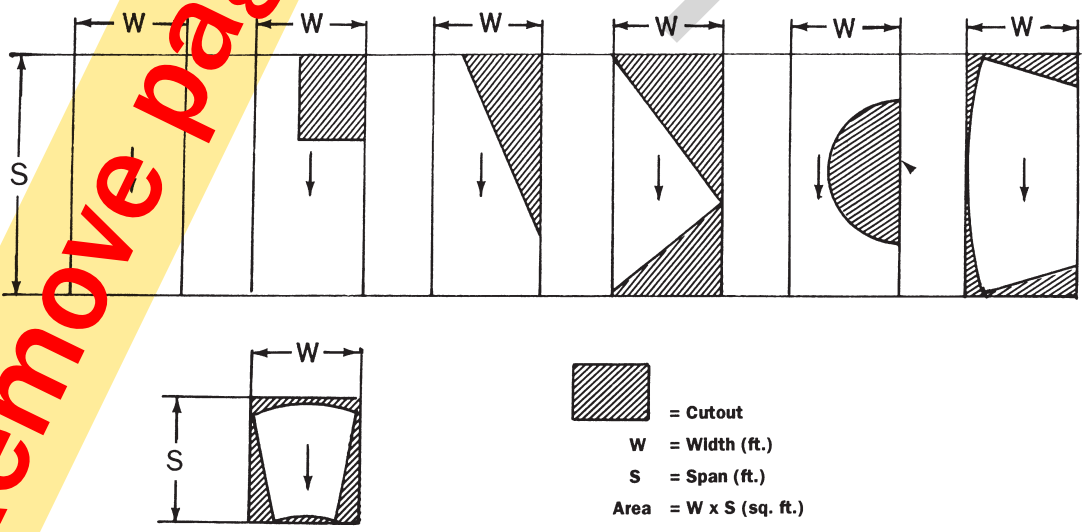
5.2 Final calculated grating quantities supplied from drawings shall be on the basis of gross area measured center-to-center of supports, or back to back of supporting angles or channels, or overall dimensions of grating, whichever is larger, with no deduction for clearances. Allowances for cutouts shall be determined as follows:

a) Deductions in area for circular cutouts will be allowed only when the diameter of the cutout exceeds 3' 6" (1.07 m). The deduction allowance will be equal to one-half the square of the diameter of the cutout.

b) Deductions in area for cutouts other than circular will be allowed only when the cutout area exceeds nine (9) square feet (0.84 square meter).

c) No deductions will be allowed for any triangular segment or corners of gratings wasted in skew cuts.

d) For special applications, such as (but not limited to) containment areas in nuclear power plants, the final grating quantities shall be the total gross area of all the pieces furnished with no allowance for cutouts. See the following sketches.



5.3 Measurement of cuts shall be on the basis of a minimum of one (1) lineal foot (0.30 m) per panel. Any cut in excess of one (1) lineal foot (0.3 m) shall be measured to the next higher lineal foot (0.3 m). (See diagram at the right.)

5.4 Measurement of bandings, toe plates and nosings shall be on the same basis as that of cuts, as defined in 5.3.

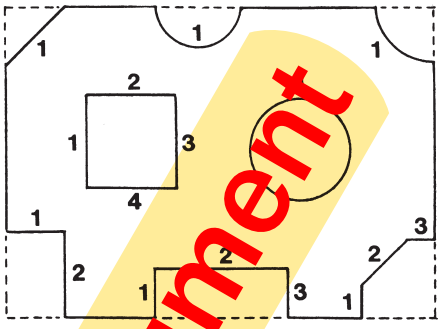


Diagram showing number of cuts required

6. CHANGES IN SCOPE OF CONTRACT

6.1 If at any time during the course of the work, the Buyer orders changes made which require materials and/or labor not called for in the original bidding plans, the cost of making such changes shall be paid by the Buyer at a price to be agreed upon.

7. FIELD WORK

7.1 The Seller shall not be responsible for taking actual measurements of construction work in the field.

7.2 Backcharges for field work of any kind are not acceptable without prior written authorization by the grating supplier.

8. BACKCHARGES

8.1 Upon discovery of unsatisfactory material, the Buyer shall immediately notify the Seller.

8.2 The Seller shall acknowledge receipt of the Buyer's complaint and initiate an investigation.

8.3 The Seller shall be given the opportunity to inspect the material PRIOR TO ANY CORRECTIVE WORK BEING DONE.

8.4 Seller is responsible for providing grating in accordance with approved drawings and specifications. Seller is not responsible for field changes, drawing changes not received and approved by Seller prior to grating fabrication, improper fabrication and/or erection of supporting members.

8.5 If the investigation and inspection confirm errors in Seller fabrication, the Seller agrees to repair and/or replace defective material at no charge to the Buyer.

GLOSSARY OF TERMS

Commonly used in the Industry

ANCHOR — A device by which grating is attached to its supports.

BAND — A flat welded to a side or end of a grating panel, or along the line of a cutout, and extending neither above nor below the bearing bars.

Load-carrying Band: A band used to transfer the load between bearing bars.

Trim Band: A band which carries no load, but is used chiefly to improve appearance.

BEARING BARS — Load-carrying bars made from steel strip or slit sheet or from rolled or extruded aluminum and extending in the direction of the grating span.

BEARING BAR CENTERS — The distance center-to-center of the bearing bars.

CARRIERS — Flats or angles which are welded to the grating panel and nosing of a stair tread and are bolted to a stair stringer to support the tread.

CLEAR OPENING — The distance between faces of bearing bars in a rectangular grating, or between a bent connecting bar and a bearing bar in a riveted grating.

CROSS BARS — The connecting bars, made from steel strip, slit sheet, or rolled bars, or from rolled or extruded aluminum, which extend across the bearing bars, usually perpendicular to them. They may be bent into a corrugated or sinuous pattern and, where they intersect the bearing bars, are welded, forged or mechanically locked to them.

CROSS BAR CENTERS — The distance center-to-center of the cross bars.

CURVED CUT — A cutout following a curved pattern.

CUTOUT — An area of grating removed to clear an obstruction or to permit pipes, ducts, columns, etc. to pass through the grating.

FINISH — The coating, usually paint or galvanizing, which is applied to the grating.

GRATING — An open grid assembly of metal bars, in which the bearing bars, running in one direction, are spaced by rigid attachment to cross bars running perpendicular to them or by bent connecting bars extending between them.

HINGED PANELS — Grating panels which are hinged to their supports or to other grating parts.

I-BAR — An extruded aluminum bearing bar having a cross sectional shape resembling the letter "I".

LENGTH — Refer to *Span of Grating.*

LOAD-CARRYING BAND — see Band

METRIC — **The system of metric measurement used is from IEEE/ASTM SI 10-2010, "Standard for Use of the International System of Units (SI): The Modern Metric System".**

NOSING — A special L-section member serving as the front or leading edge of a stair tread, or of grating at the head of a stair.

PRESSURE-LOCKED GRATING — Pressure-locked means bearing bars are locked in position by cross bar deformation instead of riveting or welding.

Several proven methods are:

- Expansion of an extruded or drawn tubular cross bar;
- Extruded cross bar deformed or swaged between bearing bars;
- Press assembly of rectangular cross bars into slotted bearing bars.

RADIALLY CUT GRATING — Rectangular grating which is cut into panels shaped as angular segments, for use in circular or angular areas.

RETICULINE BAR — A sinuously bent connecting bar extending between two adjacent bearing bars, alternately contacting and being riveted to each.

REVERSIBLE GRATING — Grating so constructed that it may be installed either side up, with no difference in appearance or carrying capacity.

RIVET CENTERS — The distance center to center of rivets along one bearing bar.

RIVETED GRATING — Grating composed of straight bearing bars and bent connecting bars, which are joined, at their contact points, by riveting.

SERRATED GRATING — Grating which has the top surfaces of the bearing bars or cross bars, or both, notched.

SPAN OF GRATING — The distance between points of grating support, or the dimension of the bearing bars in this direction.

STRAIGHT CUT — That portion of the cut edge or cutout of a grating which follows a straight line.

SWAGING — A method of altering the cross-sectional shape of a metal bar by pressure applied through dies.

TOEPLATE — A flat bar attached flat against the outer edge of a grating or rear edge of a tread, and projecting above the top surface of grating or tread to form a lip or curb.

TREAD — A panel of grating having carriers and nosing attached by welding, and designed specifically to serve as a stair tread.

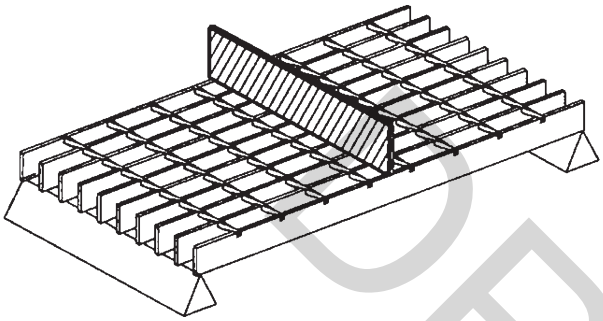
TRIM BAND — see Band

WELDED GRATING — Grating in which the bearing bars and the cross bars are joined at all of their intersections by either a resistance weld or conventional hand welding.
A resistance weld is obtained by the heat produced by the resistance of the material to the flow of electric current causing the material to become plastic. At this point, the pressure on the cross bar is rapidly increased causing the cross bar to penetrate the bearing bar so that they are fused together.

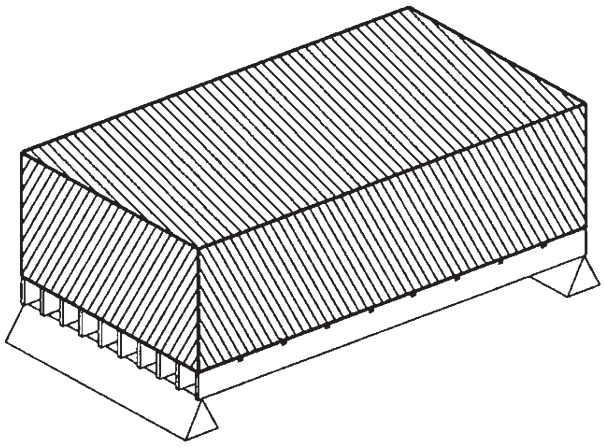
WIDTH — The overall dimension of a grating panel, measured normal to the bearing bars.

APPENDIX A

Graphic Depicting the Loadings in Tables



Concentrated Mid Span Load per foot of width



Uniform Load per square foot