

# International Conference of Building Officials

## RESEARCH COMMITTEE REPORT

Report No. 1388  
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Filing Category: ROOF, WALL AND FLOOR PANELS—Steel

**ROBERTSON STEEL FLOOR AND STEEL ROOF DECK**  
**H. H. ROBERTSON COMPANY**  
**TWO GATEWAY CENTER**  
**PITTSBURGH, PENNSYLVANIA 15222**

I. Subject: Robertson Steel Floor and Steel Roof Deck.

II. Description: A. General: The roof and floor panels are cold-rolled from galvanized steel sheet conforming to U.B.C. Standard No. 27-1 (ASTM A446-76, Grade A, minimum). The panels are of three basic types consisting of a single ribbed sheet, a ribbed sheet resistance welded in the shop to a flat sheet or a ribbed sheet resistance welded to a ribbed sheet in the shop. See profile drawings for different sections. Diaphragm shear values in pounds per linear foot are set forth in tables included in this report. Vertical loads for deck composite actions are included.

B. Welding: For all decking described above, the welding shall be made with E60 or E70 rods having a minimum size of  $\frac{1}{8}$  inch. Prior to proceeding with the welding, the welder shall demonstrate his ability to produce the prescribed weld satisfactorily to the welding inspector.

C. Fire-resistive Floor or Roof Construction: Fire-resistive ratings for unprotected steel deck are as set forth below.

RESTRAINED FIRE-RESISTIVE RATINGS

DECK SECTIONS	TYPE OF CONCRETE	MINIMUM CONCRETE THICKNESS ABOVE TOP FLUTE (In Inches)	CLEAR SPAN MAXIMUM (In Feet)	FIRE-RESISTIVE TIME PERIOD (In Hours)
QL-3, QL-UKX, QL-21, QL-NKX, Keystone Composite, Inverted QL-3 and QL-21	3000 PSI—Lightweight <sup>1</sup>	3 $\frac{1}{4}$	12	2
QL-3, QL-UKX, QL-21, QL-NKX, QL-NKC, Keystone Composite, Inverted QL-3 and QL-21	3000 PSI Stone Aggregate <sup>2</sup>	4 $\frac{1}{2}$	12	2
Sec. 3, QL-3, Sec. 21 QL-21 and Keystone 69	See Research Report No. 2434—Zonolite 3536—Permalite	2 $\frac{1}{4}$	8	2
		2	8	1
DC or ADC	3000 PSI—Lightweight <sup>1</sup>	2 $\frac{1}{2}$	See Note Below	1
DC or ADC with #5		2 $\frac{3}{4}$		1
DC		3		2
DC with ADC		3 $\frac{1}{4}$		2
DC or ADC with #5		3 $\frac{1}{2}$		2
DC or ADC or #5	3000 PSI—Stone Aggregate <sup>2</sup>	3		1
DC or ADC		4		2
DC or ADC with #5		4 $\frac{1}{2}$		2

NOTE: SPAN LIMITATIONS (CLEAR)  
ALL 7  $\frac{1}{2}$ " deep decks 18' 10"  
ALL 6" deep decks 15' 3"  
ALL 4  $\frac{1}{2}$ " deep decks 14' 0"  
ALL 3" deep decks 13' 2"

All depths refer to total depth of bare deck.

<sup>1</sup>110 pcf  $\pm$  3 pounds air dry weight.

<sup>2</sup>145 pcf  $\pm$  3 pounds air dry weight.

D. Identification: Each bundle of deck is identified by a label bearing the job and work order that indicates the type and gauge of the decks.

III. Evidence Submitted: 1. Report and analysis of tests on full scale diaphragms are submitted.

2. Fire tests in accordance with U.B.C. Standard No. 43-1.
3. Load tests establish criteria for composite action.

### Findings

IV. Findings: That the Robertson Steel Floor and Steel Roof Decks are satisfactory alternate types of construction to those specified in the 1979 Uniform Building Code for use as floor or roof systems to resist vertical or horizontal forces, subject to the following conditions:

1. Composite sections shall not be used for vertical loads which are predominately vibratory due to continuous operation of heavy machinery.
2. Where used as diaphragms:
  - (a) Allowable shears in pounds per linear foot shall not exceed the values set forth in the tables for the type of deck involved.
  - (b) Consideration shall be given to the diaphragm deflection requirements set forth in the Army Technical Manual TM 5-809-10 titled "Seismic Design for Buildings."
  - (c) The deflection of the diaphragm in masonry or concrete wall buildings does not exceed a value determined by the following formula:

$$\Delta = \frac{Hf}{.01E_wT}$$

Where:

$\Delta$  = Allowable deflection of diaphragm in inches  
 $H$  = Unsupported height of wall in feet  
 $T$  = Thickness of wall in inches  
 $f$  =  $0.45f'_c$  for concrete and  $0.33f'_m$  for masonry  
 $E_w$  = Modulus of elasticity of wall material in pounds per square inch. Where a reduced  $E_w$  is given for uninspected masonry, the reduction is not recommended in this formula

- (d) A one-third increase in allowable shear values is not permitted for short-time loading.
  - (e) The steel decks are welded as set forth in the tables accompanying this report for the particular deck involved.
  - (f) Where blended systems are used employing different sections, the lowest shear values of the sections used shall govern the design.
  - (g) All deck sections are galvanized.
3. Vertical load design shall be based on section properties set forth in this report or where composite action is considered in accordance with tables in this report.
  4. Special inspection in accordance with Section 305 of the Uniform Building Code is required.

This report is subject to annual re-examination.



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## SECTION A

TABLE NO. A-1 — DIAPHRAGM SHEARS — SECTION 3 OR QL-3 WITH BUTTON PUNCHED SEAMS<sup>1</sup>

GAUGE DECK	SPACING OF SEAM ATTACH- MENTS Button Punches (In Inches)	SPAN (In Feet)											
		6			8			10			12		
		END WELDS—NUMBER OF PUDDLE WELDS <sup>2</sup>											
		2	3	5	2	3	5	2	3	5	2	3	5
16	12	620	960	1220	520	770	960	460	660	820	420	590	730
	18	550	900	1160	450	710	900	390	600	760	340	520	660
	24	510	870	1130	410	680	870	350	570	720	310	490	620
18	12	430	710	940	360	580	750	320	500	610	290	450	530
	18	370	660	880	300	520	690	260	440	550	240	390	470
	24	340	630	850	280	500	660	240	410	530	210	360	440
20	12	250	440	540	220	350	430	200	300	360	190	270	320
	18	200	400	500	180	310	390	160	260	320	150	230	270
	24	180	370	480	160	290	360	140	240	290	130	210	250
22	12	180	300	360	160	250	290	150	210	250	140	200	230
	18	150	260	330	130	220	260	120	180	220	110	170	190
	24	130	240	310	110	200	240	100	160	200	90	150	170

TABLE NO. A-2 — DIAPHRAGM SHEARS — SECTION 3 OR QL-3 WITH TOP SEAM WELDS<sup>1, 2</sup>

DECK GAUGE	SEAM ATTACHMENT 1½-Inch Seam Welds (Spacing in Inches)	SPAN (In Feet)							
		6		8		10		12	
		END WELDS—NUMBER OF PUDDLE WELDS <sup>3</sup>							
		3	5	3	5	3	5	3	5
16	12	1540	1830	1370	1580	1290	1490	1240	1380
	18	1290	1570	1110	1310	1020	1200	960	1090
	24	1160	1440	980	1180	880	1060	820	940
18	12	1070	1220	930	1020	850	920	790	850
	18	890	1030	750	840	660	740	600	670
	24	790	940	650	760	570	640	510	580

<sup>1</sup>Top seam welds as shown in Figure No. 1 on page 23.

<sup>2</sup>The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.

<sup>3</sup>See Table No. C-1 for size, type and location of welds.

The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.  
<sup>3</sup>See Table No. C-1 for size, type and location of welds.



TABLE NO. A-3 — DIAPHRAGM SHEARS — SECTION 3 OR QL-3  
WITH SIDE SEAM WELDS<sup>1, 2</sup>

DECK GAUGE	SEAM ATTACH- MENT 1½-Inch Seam Welds (Spacing in Inches)	SPAN (In Feet)							
		6		8		10		12	
		END WELDS — NUMBER OF PUDDLE WELDS <sup>1</sup>							
		3	5	3	5	3	5	3	5
16	12	2020	2340	1870	2140	1800	2040	1530	1530
	18	1610	1910	1440	1690	1360	1570	1310	1490
	24	1400	1690	1230	1460	1140	1330	1120	1230
18	12	1440	1590	1300	1410	1220	1310	1170	1170
	18	1130	1280	990	1100	910	990	850	920
	24	970	1120	840	940	750	830	700	760
20	12	740	820	680	740	650	690	620	660
	18	570	640	510	560	480	510	450	480
	24	480	560	420	480	390	430	360	400

<sup>1</sup>Side seam welds as shown in Figure No. 1 on page 23.<sup>2</sup>The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.<sup>3</sup>See Table No. C-1 for size, type and location of welds.

TABLE NO. A-4 — DIAPHRAGM SHEARS — SECTION 3-A

DECK GAUGE	NO. OF END WELDS PER 24" WIDE DECK UNIT <sup>1, 2</sup>	SEAM ATTACHMENT															
		1½" Seam Welds at 12" on Center				1½" Seam Welds at 18" on Center				1½" Seam Welds at 24" on Center				No Seam Welds			
		Deck Span In Feet															
		6	8	10	12	6	8	10	12	6	8	10	12	6	8	10	12
16	3	1630	1510	1450	1430	1310	1260	1130	1060	1140	1000	920	870	810	610	490	410
	5	1920	1750	1670	1590	1580	1480	1330	1200	1410	1210	1100	1010	1060	800	640	530
18	3	1160	1050	970	930	920	860	750	680	790	680	600	560	620	460	370	310
	5	1280	1130	1030	980	1120	940	810	730	820	770	660	610	770	580	460	390
20	3	580	530	510	490	440	420	380	350	370	320	300	280	310	230	190	160
	5	650	580	550	520	510	480	420	380	440	370	340	310	450	340	270	230
22	3	370	340	330	320	270	270	250	230	220	200	190	180	200	150	120	100
	5	410	380	360	340	310	300	270	250	270	230	210	200	300	220	180	150

<sup>1</sup>Puddle welds shall have a fusion area to supporting members not less than ¾ inch by 1 inch. One-half inch effective diameter puddle welds to perimeter members shall be spaced as determined by the weld values set forth in Table No. C-4. Where 1½-inch long fillets are used to connect the ¾-inch wide shorter lip to marginal members, the spacing in feet shall be determined using a weld value equal to one-half of that specified in Table No. C-4. In no case shall the boundary spacing exceed 3 feet on center.<sup>2</sup>The three-weld pattern shall have welds placed in the first, third and fifth ribs of each unit.TABLE NO. A-5 — DIAPHRAGM SHEARS — SECTION 21 OR QL-21  
WITH BUTTON PUNCHED SEAMS<sup>1</sup>

DECK GAUGE	SEAM ATTACH- Button Punches (Spacing in Inches)	SPAN (In Feet)							
		8		10		12		14	
		END WELDS—NUMBER OF PUDDLE WELDS <sup>2</sup>							
		2	4	2	4	2	4	2	4
16	12	520	800	460	680	410	600	390	550
	18	460	740	400	620	360	540	330	490
	24	430	720	360	590	320	510	290	460
18	12	370	580	330	490	310	440	290	400
	18	320	530	280	440	250	390	230	350
	24	290	500	250	420	230	360	210	320
20	12	230	340	210	300	200	280	190	260
	18	190	300	170	260	160	230	150	220
	24	170	280	150	240	130	210	120	190
22	12	170	240	160	220	150	200	140	190
	18	130	210	120	180	110	160	110	150
	24	120	190	100	160	100	150	90	130

<sup>1</sup>The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.<sup>2</sup>See Table No. C-1 for size, type and location of welds.TABLE NO. A-6 — DIAPHRAGM SHEARS — SECTION 21 OR QL-21  
WITH TOP SEAM WELDS<sup>1, 2</sup>

DECK GAUGE	SEAM ATTACHMENT 1½-Inch Seam Welds (Spacing in Inches)	SPAN (In Feet)							
		8		10		12		14	
		END WELDS—NUMBER OF PUDDLE WELDS <sup>1</sup>							
		2	4	2	4	2	4	2	4
16	12	1130	1380	1080	1280	1050	1220	1050	1190
	18	870	1090	810	980	770	920	770	880
	24	740	1000	680	890	640	820	620	770
18	12	840	1020	800	960	780	920	770	890
	18	630	770	590	680	570	620	570	580
	24	530	720	490	650	460	600	450	570
20	12	390	480	380	450	370	420	360	400
	18	290	380	270	340	260	320	250	300
	24	240	330	220	290	210	260	200	250
22	12	260	310	250	290	250	280	240	270
	18	190	240	180	220	170	210	160	200
	24	150	200	140	180	140	170	130	160

<sup>1</sup>Top seam welds as shown in Figure No. 1 on page 23.<sup>2</sup>The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.<sup>3</sup>See Table No. C-1 for size, type and location of welds.

TABLE NO. A-7 — DIAPHRAGM SHEARS — SECTION 21 OR QL-21  
WITH SIDE SEAM WELDS<sup>1</sup>

DECK GAUGE	SEAM ATTACH- MENT 1½-Inch Seam Welds (Spacing in Inches).	SPAN (In Feet)							
		8		10		12		14	
		END WELDS—NUMBER OF PUDDLE WELDS <sup>3</sup>							
		2	4	2	4	2	4	2	4
16	12	1650	1880	1610	1800	1590	1760	1580	1740
	18	1220	1460	1160	1370	1130	1310	1120	1280
	24	1000	1260	940	1150	910	1090	880	1050
18	12	1130	1330	1090	1240	1060	1190	1040	1140
	18	820	1020	780	930	750	870	730	830
	24	660	870	620	780	590	720	570	680
20	12	600	690	590	650	580	630	570	610
	18	430	520	410	480	400	460	390	440
	24	340	430	320	390	310	370	300	350
22	12	410	460	400	410	390	420	390	420
	18	290	340	280	320	270	300	270	290
	24	230	280	220	260	210	240	210	230

<sup>1</sup>Side seam welds as shown in Figure No. 1 on page 23.<sup>2</sup>The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.<sup>3</sup>See Table No. C-1 for size, type and location of welds.

TABLE NO. A-8 — DIAPHRAGM SHEARS — SECTION 21-A

DECK GAUGE	NO. OF END WELDS PER 24" WIDE DECK UNIT <sup>1</sup>	SEAM ATTACHMENT															
		1½" Seam Welds at 12" on Center				1½" Seam Welds at 18" on Center				1½" Seam Welds at 24" on Center				No Seam Welds			
		Deck Span In Feet															
		8	10	12	14	8	10	12	14	8	10	12	14	8	10	12	14
16	2	1230	1190	1160	1160	1020	920	860	860	800	740	700	680	480	380	320	270
	4	1500	1430	1390	1370	1260	1120	1040	1040	1010	920	870	830	650	520	430	370
18	2	880	850	840	840	710	640	600	600	540	510	490	480	290	230	190	160
	4	1060	980	940	910	870	760	690	690	690	610	570	530	430	350	290	250
20	2	490	480	470	460	390	350	330	330	280	270	260	250	140	110	90	80
	4	540	510	500	480	430	390	360	360	330	300	290	270	230	180	150	130
22	2	320	320	310	310	250	230	210	210	180	170	160	160	80	60	50	50
	4	350	340	330	330	280	250	230	230	210	190	180	180	140	110	90	80

<sup>1</sup>Puddle welds shall have a fusion area to supporting members not less than ¾ inch by 1 inch. One-half inch effective diameter puddle welds to marginal members shall be spaced as determined by the weld values set forth in Table No. C-4. Where 1½-inch long fillets are used to connect the ¾-inch wide shorter lip to perimeter members, the spacing in feet shall be determined using a weld value equal to one-half of that specified in Table No. C-4. In no case shall the boundary weld spacing exceed 3 feet on center.<sup>2</sup>The two-weld pattern shall have welds placed in the first and third ribs of each unit.TABLE NO. A-9 — DIAPHRAGM SHEARS — SECTION UKX OR QL-UKX  
WITH BUTTON PUNCHED SEAMS<sup>1</sup>

DECK GAUGE	SEAM ATTACHMENT Button Punches (Spacing in inches)	SPAN (In Feet)											
		6			8			10			12		
		END WELDS — NUMBER OF PUDDLE WELDS <sup>2</sup>											
		2	3	5	2	3	5	2	3	5	2	3	5
16-16	12	880	1420	1740	710	1110	1350	610	930	1120	540	800	970
	18	820	1350	1670	650	1040	1280	550	850	1040	480	720	890
	24	800	1330	1650	620	1010	1250	520	820	1010	450	700	860
18-16	12	850	1380	1690	690	1080	1320	590	900	1090	530	790	950
	18	790	1300	1610	630	1000	1230	530	820	1010	460	700	860
	24	760	1280	1590	600	980	1210	500	790	980	430	670	830
18-18	12	730	1140	1380	590	900	1080	510	750	900	450	660	780
	18	670	1080	1320	540	830	1010	450	680	820	390	580	700
	24	650	1060	1290	510	800	980	420	650	800	360	560	680
20-20	12	455	873	1033	370	669	774	319	544	622	285	463	523
	18	412	830	990	327	625	731	276	501	579	242	419	480
	24	391	809	968	305	604	709	254	479	557	221	398	458

<sup>1</sup>The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.<sup>2</sup>See Table No. C-1 for size, type and location of



TABLE NO. A-14 — RECOMMENDED SHEAR IN POUNDS PER FOOT FOR TYPES DC AND ADC DIAPHRAGMS  
WITH BUTTON PUNCHED SEAMS AND WITHOUT A CONCRETE FILL

Depth (in Inches)	SECTION		Spacing of Button Punches (in Inches)	Type of Weld	SPAN OF PANEL IN FEET¹													
	GAUGE				8	10	12	14	16	18	20	22	24	26	28	30	32	34
	Top Plate	Bottom Plate²																
1½	18	18	24 18	A	670 690	550 570												
	18	16	24 18		810 840	660 690												
	16	16	24 18		810 840	660 690												
	14	14	24 18		810 840	660 690												
3	18	18	24 18	A	670 690	550 570	470 500	410 440	370 400									
	16	18	24 18		780 800	640 660	540 560	470 490	410 440									
	18	16	24 18		810 840	670 690	570 600	500 530	450 480									
	16	16	24 18		810 840	670 690	570 600	500 530	450 480									
	14	14	24 18		810 840	670 690	570 600	500 530	450 480									
4½	18	18	24 18	A			470 500	420 440	380 400	340 360	310 340	290 320						
	18	16	24 18				570 600	500 530	450 480	410 440	380 410	360 390						
	16	16	24 18				580 600	410 530	460 480	420 440	390 410	360 390						
	14	14	24 18				580 600	510 530	460 480	420 440	390 410	360 390						
6	18	16	24 18	A						420 440	380 410	360 380	340 360	320 350	310 330	290 320		
	16	16	24 18							420 450	390 420	360 390	340 370	330 350	310 330	300 320		
	14	14	24 18							420 450	390 420	360 390	340 370	330 350	310 330	300 320		
7½	18	16	24 18	A							390 420	360 390	340 370	320 350	310 330	300 320	290 310	280 300
	16	16	24 18								390 420	360 400	340 380	320 360	310 340	300 330	290 320	280 310
	14	16	24 18								390 420	360 400	340 380	320 360	310 340	300 330	290 320	280 310
	14	14	24 18								390 420	360 400	340 380	320 360	310 340	300 330	290 320	280 310
	13	14	24 18								390 420	360 400	340 380	320 360	310 340	300 330	290 320	280 310
	13	13	24 18								390 420	360 400	340 380	320 360	310 340	300 330	290 320	280 310
			24 18									420	400	380	360	340	330	320

<sup>1</sup>See Table No. C-2 for welding schedule and Table No. C-5 for span-width ratios.

<sup>2</sup>The bottom plate is flat and placed in down position in all cases.

TABLE NO. A-10 — DIAPHRAGM SHEARS — SECTION UKX OR QL-UKX  
WITH WELDED SEAMS<sup>1, 2</sup>

DECK GAUGE	SEAM ATTACH- MENT 1½-Inch Seam Welds (Spacing in Inches)	SPAN (In Feet)							
		6		8		10		12	
		END WELDS — NUMBER OF PUDDLE WELDS <sup>1</sup>							
		3	5	3	5	3	5	3	5
16-16	12	1900	2240	1620	1880	1460	1680	1360	1560
	18	1590	1920	1290	1540	1110	1320	1000	1180
	24	1490	1810	1180	1430	1000	1200	880	1050
18-16	12	1880	2220	1610	1880	1460	1690	1370	1580
	18	1550	1880	1270	1510	1110	1310	990	1170
	24	1450	1760	1150	1390	980	1180	870	1040
18-18	12	1540	1780	1310	1490	1150	1260	1030	1120
	18	1270	1520	1030	1200	870	980	750	840
	24	1190	1430	940	1110	780	890	660	740
20-20	12	849	958	698	773	610	665	552	595
	18	744	853	593	668	505	560	447	490
	24	691	800	541	616	452	508	394	437

<sup>1</sup>Top seam welds as shown in Figure No. 1 on page 23.<sup>2</sup>The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.<sup>3</sup>See Table No. C-1 for size, type and location of welds.TABLE NO. A-12 — DIAPHRAGM SHEARS — SECTION NKX OR QL-NKX  
WITH WELDED SEAMS<sup>1, 2</sup>

DECK GAUGE	SEAM ATTACH- MENT 1½-Inch Seam Welds (Spacing In Inches)	SPAN (In Feet)							
		10		12		14		16	
		END WELDS—NUMBER OF PUDDLE WELDS <sup>3</sup>							
		2	4	2	4	2	4	2	4
16-16	12	1410	1540	1330	1430	1270	1360	1230	1310
	24	1080	1190	980	1070	900	980	850	920
	36	970	1080	860	950	780	860	720	790
18-16	12	1440	1560	1350	1460	1300	1390	1260	1350
	24	1090	1190	980	1070	910	990	860	930
	36	970	1070	860	940	780	860	720	790
18-18	12	1160	1270	1080	1180	1030	1130	1000	1090
	24	880	970	790	870	730	800	690	750
	36	790	870	690	770	630	690	580	640
20-20	12	618	645	560	581	518	535	488	502
	24	461	488	402	423	361	378	330	344
	36	408	435	350	371	308	325	278	292

<sup>1</sup>Top seam welds as shown in Figure No. 1 on page 23.<sup>2</sup>The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.<sup>3</sup>See Table No. C-1 for size, type and location of welds.TABLE NO. A-11 — DIAPHRAGM SHEARS — SECTION NKX OR QL-NKX  
WITH BUTTON PUNCHED SEAMS<sup>1</sup>

DECK GAUGE	SEAM ATTACH- MENT Button Punches (Spacing in Inches)	SPAN (In Feet)							
		10		12		14		16	
		END WELDS—NUMBER OF PUDDLE WELDS <sup>2</sup>							
		2	4	2	4	2	4	2	4
16-16	12	910	1010	790	870	700	780	640	710
	24	830	930	700	790	620	690	560	620
	36	800	900	680	760	590	660	530	590
18-16	12	900	990	780	860	700	770	640	700
	24	810	910	700	780	610	680	550	610
	36	790	880	670	750	580	650	520	580
18-18	12	740	820	650	720	580	640	530	590
	24	670	750	570	640	500	560	450	500
	36	650	720	550	610	480	530	430	480
20-20	12	556	594	474	503	416	440	373	393
	24	492	529	409	439	351	375	308	329
	36	470	508	387	417	329	353	286	306

<sup>1</sup>The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.<sup>2</sup>See Table No. C-1 for size, type and location of welds.TABLE NO. A-13 — DIAPHRAGM SHEARS — SECTION NKC OR QL-NKC<sup>1</sup>

DECK GAUGE	SEAM ATTACHMENT (Spacing in Inches)	SPAN (In Feet)			
		10	12	14	16
		END WELDS — NUMBER OF PUDDLE WELDS			
		2	2	2	2
16-16	Button Punches	WITH BUTTON PUNCHED SEAMS <sup>3</sup>			
	12	990	870	780	720
	24	900	770	680	610
	36	870	740	650	580
	1½-Inch Seam Welds	WITH WELDED SEAMS <sup>2</sup>			
	12	1620	1530	1450	1350
18-18	24	1210	1100	1010	910
	36	1080	960	860	770
	Button Punches	WITH BUTTON PUNCHED SEAMS <sup>3</sup>			
	12	790	670	580	510
	24	700	580	490	430
	36	680	550	460	400
18-18	1½-Inch Seam Welds	WITH WELDED SEAMS <sup>2</sup>			
	12	1070	970	890	840
	24	790	690	610	560
	36	700	590	520	470

<sup>1</sup>The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.<sup>2</sup>Top seam welds as shown in Figure No. 1 on page 23.<sup>3</sup>Seam attachment consists of button punches spaced not over 36 inches on center between supports.



TABLE NO. A-14 — RECOMMENDED SHEAR IN POUNDS PER FOOT FOR TYPES DC AND ADC DIAPHRAGMS  
WITH BUTTON PUNCHED SEAMS AND WITHOUT A CONCRETE FILL

Depth (In Inches)	SECTION		Spacing of Button Punches (In Inches)	Type of Weld	SPAN OF PANEL IN FEET¹													
	GAUGE				8	10	12	14	16	18	20	22	24	26	28	30	32	34
	Top Plate	Bottom Plate²																
1½	18	18	24 18	A	670 690	550 570												
	18	16	24 18		810 840	660 690												
	16	16	24 18		810 840	660 690												
	14	14	24 18		810 840	660 690												
3	18	18	24 18	A	670 690	550 570	470 500	410 440	370 400									
	16	18	24 18		780 800	640 660	540 560	470 490	410 440									
	18	16	24 18		810 840	670 690	570 600	500 530	450 480									
	16	16	24 18		810 840	670 690	570 600	500 530	450 480									
	14	14	24 18		810 840	670 690	570 600	500 530	450 480									
4½	18	18	24 18	A			470 500	420 440	380 400	340 360	310 340	290 320						
	18	16	24 18				570 600	500 530	450 480	410 440	380 410	360 390						
	16	16	24 18				580 600	410 530	460 480	420 440	390 410	360 390						
	14	14	24 18				580 600	510 530	460 480	420 440	390 410	360 390						
6	18	16	24 18	A						420 440	380 410	360 380	340 360	320 350	310 330	290 320		
	16	16	24 18							420 450	390 420	360 390	340 370	330 350	310 330	300 320		
	14	14	24 18							420 450	390 420	360 390	340 370	330 350	310 330	300 320		
7½	18	16	24 18	A							390 420	360 390	340 370	320 350	310 330	300 320	290 310	280 300
	16	16	24 18								390 420	360 400	340 380	320 360	310 340	300 330	290 320	280 310
	14	16	24 18								390 420	360 400	340 380	320 360	310 340	300 330	290 320	280 310
	14	14	24 18								390 420	360 400	340 380	320 360	310 340	300 330	290 320	280 310
	13	14	24 18								390 420	360 400	340 380	320 360	310 340	300 330	290 320	280 310
	13	13	24 18								390 420	360 400	340 380	320 360	310 340	300 330	290 320	280 310
			24 18									420 400	380 360	360 340	340 320	330 310	320 300	310 290

<sup>1</sup>See Table No. C-2 for welding schedule and Table No. C-5 for span-width ratios.

<sup>2</sup>The bottom plate is flat and placed in down position in all cases.

TABLE NO. A-15 — RECOMMENDED SHEAR IN POUNDS PER FOOT ON TYPES DC AND ADC DIAPHRAGMS WITH SEAMS WELDED AND WITHOUT CONCRETE FILL

DEPTH OF PANEL (In Inches)	FLAT PLATE		TYPE <sup>1</sup> OF WELDING	ALLOWABLE SHEAR IN POUNDS (Per Foot)
	Location	Gauge		
1½	Down	16	B	520
3			C	910
4½		18	B	370
6			C	740
7½	Up	16	D	670
3		18	D	420
1½	Up	16	E	1220
3			E	770
4½		18	F	810
6			F	510
7½	Up	16	F	810
3		18	F	510

<sup>1</sup>See Table No. C-2 for welding schedule and Table No. C-5 for span-width ratios.

TABLE NO. A-17 — RECOMMENDED MAXIMUM WORKING SHEARS IN P.L.F. FOR DIAPHRAGMS OF KEYSTONE (STANDARD OR ACOUSTIC) AND ECONORIB SECTION NO. 94 ROOF DECKS

DECK GAUGE	TYPE OF WELDING (See Table No. C-3)	
	I, II or IV	III
16	1160	870
18	740	550
20	420	310
22	290	220

TABLE NO. A-18 — ALLOWABLE SHEARS — MISCELLANEOUS SECTIONS

TYPE OF DECK	MAXIMUM UNSUPPORTED SPAN OF DECK (In Feet and Inches) <sup>1</sup>	CONCRETE FILL		ALLOWABLE SHEAR (In Pounds per Foot)
		Minimum Thickness (In Inches)	Ultimate Strength p.s.i.	
UK18/16	8-0	Not required		710
RK18/18	12-0	Not required		235
RK18/16	12-0	Not required		294
RK16/16	12-0	Not required		330
RK18/16	12-0	2½	2000	1060
RK18/16	12-0	2½	2500	1330
RK18/16	12-0	2½	3500	1860
RK18/16	12-0	2½	2000	1060
RKC14/14 and 12/12	12-0	2½	2500	1330
		2½	3500	1860
FK18/16	18-0	Not required		710

<sup>1</sup>All spans may be increased up to a maximum of one-third provided the allowable shear is multiplied by the factor " $L_1/L_x$ " where " $L_x$ " is the span to be used and " $L_1$ " is the allowable span in Table No. A-18. In no case shall the span exceed that allowed for vertical loads. Location of welds shall be as specified in Tables Nos. C-1 and C-4.

TABLE NO. A-16 — ALLOWABLE SHEAR AND WELDING REQUIREMENTS FOR LS ROOF DECKS<sup>1 2 3 4</sup>

TYPE OF DECK	DEPTH (In Inches)	GAUGE	SPACING OF SEAM WELDS (In Inches)	SPACING OF PROFILE PLATES (In Inches)	ALLOWABLE SHEAR (In Pounds Per Foot)
LS1	6	20	27	30	340
			30	36	280
			36	36	250
LS1	6 or 7½	18	25	24	575
			30	36	480
			36	36	400
LS1	6 or 7½	16	25	24	650
			30	24	540
			36	36	450
LS1	6 or 7½	14	25	24	720
			30	24	600
			36	24	500
LS1	4½	20	20	22	470
			24	24	380
			30	24	300
LS1	4½	18	36	36	250
			18	12	790
			24	24	600
LS1	4½	16	30	24	480
			36	36	400
			18	12	890
LS1	4½	16	24	24	675
			30	24	540
			36	36	450
LS2	7½	16	16	12	970
			21	12	770
			30	24	540
LS2 and LS3	4½ or 6	20	36	36	450
			18	20	510
			24	24	380
LS2	4½, 6 or 7½	18	30	24	300
			36	36	250
			17	12	860
LS2	4½, 6 or 7½	18	24	24	600
			30	24	480
			36	36	400

<sup>1</sup>In no case shall the shear on any deck exceed these values regardless of the spacing of seam welds or profile plates.

<sup>2</sup>That the length-to-width ratio of the diaphragm does not exceed a value of three and one-half to one for buildings having exterior walls of masonry or concrete construction.

<sup>3</sup>That the length-to-width ratio of the diaphragm does not exceed a value of four and one-half to one for buildings having exterior walls of wood frame or steel construction.

<sup>4</sup>The seam welds are 1 inch long and are spaced not greater than 36 inches on center. Perimeter members of the diaphragm running in the same direction as the span of the deck are welded to the lower flange of the deck panels with 1-inch diameter puddle or 1-inch long fillet welds. The puddle or fillet welds have the same spacing as specified for the seam welds. The panel ends are connected to perimeter members of the diaphragm and to intermediate concentrated shear points by means of continuous No. 16 gauge Z-shaped closure sections or No. 14 gauge profile plates spaced as set forth above. The Z-shaped closure sections are welded to the deck and perimeter members with 1-inch fillet welds spaced 12 inches on center. The profile plates have a nominal width of 12 inches and are welded to the deck with two ½-inch puddle welds and to the perimeter members with two 1-inch fillet welds. The profile plate is spaced not greater than 4 feet on center. Adjoining panel ends located in the interior of the diaphragm and which are not subject to concentrated external shear forces are spliced by means of a continuous steel plate of the same thickness as the roof deck and are 4 inches wide. The plate is welded to adjoining panels with fillet welds 1 inch long spaced as required for seam welds.



## SECTION B

TABLE NO. B-1 — DIAPHRAGM SHEARS — SECTION 3, QL-3, 3A AND QL-3A  
WITH 2½-INCH CONCRETE FILL<sup>1, 2, 3, 4</sup>

DECK GAUGE	CONCRETE ULTIMATE COMPRESSIVE STRENGTH (In Pounds per Sq. In.)	SPAN (In Feet)											
		5			6			8			10		
		DENSITY (In Pounds per Cubic Foot)											
		95	105	145	95	105	145	95	105	145	95	105	145
16	2000	1840 2130	1920 2210	2300 2580	1670 1900	1750 1990	2120 2360	1450 1620	1530 1710	1900 2080	1310 1450	1400 1540	1770 1910
	2500	1900 2190	2000 2280	2410 2700	1730 1960	1820 2060	2240 2470	1510 1680	1600 1780	2020 2190	1380 1520	1470 1610	1880 2030
	3000	1960 2240	2060 2340	2510 2800	1780 2020	1880 2120	2340 2580	1560 1740	1660 1840	2120 2300	1430 1570	1530 1670	1990 2130
18	2000	1660 1890	1740 1970	2120 2340	1520 1710	1600 1790	1980 2160	1340 1480	1420 1570	1800 1940	1240 1350	1320 1430	1690 1810
	2500	1720 1950	1810 2040	2230 2460	1580 1770	1670 1860	2090 2280	1400 1550	1490 1640	1910 2060	1300 1410	1390 1510	1810 1920
	3000	1780 2000	1880 2110	2330 2560	1640 1820	1740 1930	2190 2380	1460 1600	1560 1700	2010 2160	1350 1470	1450 1570	1910 2020
20	2000	1490 1670	1580 1750	1950 2120	1390 1530	1470 1620	1840 1990	1260 1360	1340 1450	1710 1820	1180 1260	1260 1350	1630 1720
	2500	1560 1730	1650 1820	2070 2240	1450 1590	1540 1690	1960 2100	1320 1430	1410 1520	1830 1940	1240 1330	1330 1420	1750 1830
	3000	1610 1780	1710 1890	2170 2340	1500 1650	1600 1750	2060 2210	1370 1480	1470 1580	1930 2040	1290 1380	1390 1480	1850 1940
22	2000	1420 1570	1500 1650	1880 2020	1330 1450	1420 1540	1790 1910	1220 1310	1310 1400	1680 1770	1160 1230	1240 1310	1610 1690
	2500	1480 1630	1580 1720	2000 2140	1390 1520	1490 1610	1910 2020	1290 1380	1380 1470	1790 1880	1220 1290	1310 1380	1730 1700
	3000	1540 1680	1640 1780	2090 2240	1450 1570	1550 1670	2010 2130	1340 1430	1440 1530	1900 1990	1270 1350	1370 1450	1830 1900

<sup>1</sup>Sufficient seam attachment for the above deck sections consist of fastening at 36 inches on center between supports.<sup>2</sup>Values above diagonal line are for three puddle welds at ends. Values below line are for five puddle welds at ends.<sup>3</sup>The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.<sup>4</sup>The concrete shall have a minimum depth of 2½ inches above the top flute.TABLE NO. B-2 — ALLOWABLE DIAPHRAGM SHEARS FOR SECTION 3, 3A, QL-3, QL-3A, UKX AND QL-UKX WITH 3¼-INCH CONCRETE FILL  
(3000 P.S.I. STRENGTH — 105 LB. WEIGHT)<sup>1, 2, 3, 4</sup>

DECK TYPE	DECK GAUGE	SPAN (In Feet)			
		6	8	10	12
3 3A QL-3 QL-3A	16	2100 2340	1880 2060	1749 1890	1661 1781
	18	1960 2150	1779 1920	1673 1789	1603 1699
	20	1818 1963	1687 1796	1609 1696	
	22	1754 1877	1646 1704		

DECK TYPE	DECK GAUGE	SPAN (In Feet)			
		6	8	10	12
UKX QL-UKX	16-16			2020 2245	1876 2064
	18-16		2139 2387	1944 2143	1814 1980
	18-18		2026 2242	1857 2029	1744 1888
	20-18	2193 2445	1943 2131	1792 1943	1692 1817
	18-20	2167 2417	1926 2113	1781 1930	1684 1808
	20-20	2031 2232	1826 1976	1703 1822	1621 1720

<sup>1</sup>Seam attachment for Section 3, QL-3, UKX and QL-UKX consists of button punches not over 36 inches on center. For diaphragm action no seam attachment is required for Sections 3A and QL-3A.<sup>2</sup>Values above diagonal line are for three puddle welds at ends. Values below line are for five plug welds at ends.<sup>3</sup>The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.<sup>4</sup>The concrete shall have a minimum depth of 3¼ inches above the top flute.



TABLE NO. B-3 — DIAPHRAGM SHEARS — SECTION 21, QL-21, 21A AND QL-21A  
WITH 2½-INCH CONCRETE FILL<sup>1, 2, 3, 4</sup>

DECK GAUGE	CONCRETE ULTIMATE COMPRESSIVE STRENGTH (In Pounds per Sq. In.)	SPAN (In Feet)											
		8			10			12			14		
		DENSITY (In Pounds per Cubic Foot)											
		95	105	145	95	105	145	95	105	145	95	105	145
16	2000	1290 1530	1370 1610	1740 1980	1200 1380	1280 1460	1650 1830	1140 1280	1220 1360	1590 1730	1100 1210	1180 1290	1550 1660
	2500	1350 1590	1440 1680	1860 2100	1260 1440	1350 1530	1770 1950	1200 1340	1290 1430	1710 1850	1160 1270	1250 1360	1670 1780
	3000	1400 1640	1500 1750	1960 2200	1310 1490	1420 1600	1870 2050	1250 1400	1360 1500	1810 1950	1210 1320	1310 1430	1770 1880
18	2000	1240 1410	1320 1490	1690 1870	1160 1290	1250 1370	1620 1750	1120 1210	1200 1290	1570 1670	1080 1150	1170 1240	1540 1610
	2500	1300 1470	1390 1510	1810 1980	1230 1350	1320 1450	1730 1860	1180 1270	1270 1370	1690 1780	1140 1220	1240 1310	1650 1730
	3000	1350 1530	1450 1630	1910 2080	1280 1410	1380 1510	1840 1960	1230 1330	1330 1430	1790 1880	1200 1270	1300 1370	1760 1830
20	2000	1200 1310	1280 1390	1660 1760	1150 1220	1230 1300	1600 1670	1110 1160	1200 1240	1570 1610	1090 1120	1170 1200	1540 1570
	2500	1260 1370	1360 1460	1770 1880	1210 1280	1300 1370	1720 1790	1170 1220	1270 1310	1680 1730	1150 1180	1240 1270	1650 1690
	3000	1320 1420	1420 1530	1880 1980	1260 1330	1370 1440	1820 1890	1230 1270	1330 1380	1790 1830	1190 1230	1300 1330	1760 1790
22	2000	1150 1230	1230 1310	1610 1690	1110 1160	1190 1240	1570 1620	1080 1110	1170 1200	1540 1570	1060 1080	1150 1160	1520 1540
	2500	1220 1300	1310 1390	1730 1810	1180 1230	1270 1320	1690 1740	1150 1180	1240 1270	1660 1690	1130 1140	1220 1240	1640 1660
	3000	1280 1360	1380 1460	1840 1920	1240 1290	1340 1390	1800 1850	1210 1240	1310 1340	1770 1800	1190 1200	1290 1300	1720 1720

<sup>1</sup>Sufficient seam attachment for the above deck sections consists of fastening at 36 inches on center between supports.

<sup>2</sup>Values above the diagonal line are for two puddle welds at ends. Values below line are for four puddle welds at ends.

<sup>3</sup>The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.

<sup>4</sup>The concrete shall have a minimum depth of 2½ inches above the top flute.

TABLE NO. B-4 — ALLOWABLE DIAPHRAGM SHEARS FOR SECTION 21, 21A, QL-21, NKX AND QL-NKX WITH 3¼-INCH CONCRETE FILL (3000 P.S.I. STRENGTH — 105 LB. WEIGHT)<sup>1, 2, 3, 4</sup>

DECK TYPE	DECK GAUGE	SPAN (In Feet)			
		8	10	12	14
21	16	1720 1960	1630 1820	1570 1720	1530 1650
21A	18	1670 1840	1600 1720	1550 1650	1520 1590
QL-21	20	1620 1730	1570 1640	1530 1590	1510 1540
QL-21A	22	1600 1680	1560 1610	1530 1560	1510 1530

<sup>1</sup>Sufficient seam attachment for the above deck sections consists of fastening at 36 inches on center between supports.

<sup>2</sup>Values above the diagonal line are for two puddle welds at ends. Values below line are for four puddle welds at ends.

<sup>3</sup>The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.

<sup>4</sup>The concrete shall have a minimum depth of 3¼ inches above the top flute.

DECK TYPE	DECK GAUGE	SPAN (In Feet)			
		8	10	12	14
NKX	16-16		2000 2100	1860 1940	1760 1830
QL-NKX	18-16		1930 2020	1800 1880	1710 1770
	18-18	2000 2100	1840 1910	1730 1790	1650 1700
	20-18	1930 2020	1790 1850	1690 1740	1620 1660
	18-20	1900 1980	1760 1820	1670 1720	1600 1640
	20-20	1800 1870	1690 1740	1610 1650	1550 1580



TABLE NO. B-5 — DIAPHRAGM SHEARS — SECTION UKX OR QL-UKX  
WITH 2½-INCH CONCRETE FILL<sup>1, 2, 3, 4</sup>

DECK GAUGE	CONCRETE ULTIMATE COMPRESSIVE STRENGTH (In Pounds per Sq. In.)	SPAN (In Feet)											
		6			8			10			12		
		DENSITY (In Pounds per Cubic Foot)											
		95	105	145	95	105	145	95	105	145	95	105	145
16-16	2000	2190 2600	2280 2690	2650 3060	1830 2140	1910 2220	2280 2590	1600 1850	1690 1940	2060 2310	1460 1670	1540 1750	1910 2120
	2500	2260 2670	2350 2760	2760 3180	1890 2200	1980 2290	2400 2710	1670 1910	1760 2000	2180 2420	1520 1730	1610 1820	2030 2240
	3000	2300 2720	2410 2820	2870 3280	1940 2250	2040 2360	2500 2810	1720 1970	1820 2070	2280 2530	1570 1780	1680 1880	2130 2340
18-16	2000	2080 2470	2170 2550	2540 2920	1750 2030	1830 2120	2200 2490	1540 1770	1630 1860	2000 2230	1410 1600	1490 1680	1860 2060
	2500	2150 2530	2240 2620	2660 3040	1810 2090	1900 2190	2320 2600	1600 1840	1700 1930	2120 2340	1470 1660	1560 1760	1980 2170
	3000	2200 2580	2300 2690	2760 3140	1860 2150	1970 2250	2420 2710	1660 1890	1760 1990	2220 2450	1520 1720	1630 1820	2080 2270
18-18	2000	1920 2250	2000 2340	2380 2710	1630 1880	1710 1960	2090 2330	1450 1670	1540 1750	1910 2120	1340 1500	1420 1580	1790 1960
	2500	1990 2320	2080 2410	2500 2830	1690 1940	1790 2030	2200 2450	1520 1730	1610 1820	2020 2240	1400 1560	1490 1660	1910 2070
	3000	2040 2370	2140 2470	2600 2930	1750 1990	1850 2100	2300 2550	1570 1780	1670 1880	2130 2340	1450 1620	1550 1720	2010 2180
20-18	2000	1748 1997	1832 2081	2207 2456	1499 1685	1583 1769	1957 2144	1349 1489	1433 1582	1808 1956	1249 1373	1333 1457	1708 1832
	2500	1812 2063	1906 2156	2325 2575	1562 1750	1656 1843	2075 2262	1412 1562	1506 1655	1925 2074	1312 1436	1406 1530	1825 1949
	3000	1870 2122	1972 2224	2431 2683	1619 1808	1722 1910	2181 2369	1469 1619	1571 1722	2030 2181	1369 1494	1471 1596	1930 2055
18-20	2000	1715 1959	1799 2043	2174 2417	1476 1659	1560 1742	1935 2117	1333 1478	1417 1562	1791 1937	1237 1358	1321 1442	1696 1817
	2500	1783 2031	1877 2124	2296 2543	1543 1728	1637 1822	2055 2240	1398 1546	1492 1640	1911 2059	1302 1425	1396 1519	1815 1938
	3000	1844 2094	1946 2196	2405 2655	1602 1789	1705 1892	2163 2351	1457 1606	1560 1709	2018 2168	1360 1485	1463 1587	1922 2046
20-20	2000	1580 1775	1664 1859	2038 2234	1377 1523	1461 1607	1836 1982	1256 1372	1340 1456	1714 1830	1175 1271	1259 1355	1633 1730
	2500	1647 1845	1741 1939	2160 2358	1443 1591	1537 1685	1956 2104	1321 1439	1415 1533	1833 1951	1239 1337	1333 1431	1752 1850
	3000	1707 1908	1810 2011	2269 2469	1502 1652	1605 1755	2064 2214	1379 1499	1482 1601	1941 2060	1297 1397	1400 1499	1859 1958

<sup>1</sup>Seam attachment consists of button punches spaced not over 36 inches on center between supports.

<sup>2</sup>Values above the diagonal line are for three puddle welds at ends. Values below line are for five puddle welds at ends.

<sup>3</sup>The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.

<sup>4</sup>The concrete shall have a minimum depth of 2½ inches above the top flange.



TABLE NO. B-6 — DIAPHRAGM SHEARS — SECTION NKX OR QL-NKX  
WITH 2½-INCH CONCRETE FILL<sup>1, 2, 3, 4</sup>

GAUGE DECK	CONCRETE ULTIMATE COMPRESSIVE STRENGTH (In Pounds per Sq. In.)	SPAN (In Feet)											
		8			10			12			14		
		DENSITY (In Pounds per Cubic Foot)											
		95	105	145	95	105	145	95	105	145	95	105	145
16-16	2000	1830 1960	1910 2050	2080 2420	1600 1720	1690 1800	2060 2170	1460 1550	1540 1630	1910 2010	1350 1430	1440 1520	1810 1890
	2500	1890 2030	1980 2120	2400 2540	1670 1780	1760 1870	2180 2290	1520 1610	1610 1710	2030 2120	1410 1490	1510 1590	1920 2000
	3000	1940 2080	2040 2180	2500 2640	1720 1830	1820 1930	2280 2390	1570 1670	1680 1770	2130 2220	1470 1550	1570 1650	2020 2110
18-16	2000	1750 1870	1830 1960	2200 2330	1540 1650	1630 1730	2000 2100	1410 1490	1490 1580	1860 1950	1310 1380	1400 1470	1770 1840
	2500	1810 1940	1900 2030	2320 2450	1610 1710	1700 1800	2120 2220	1470 1560	1560 1650	1980 2060	1370 1450	1470 1540	1880 1960
	3000	1860 1990	1970 2090	2420 2550	1660 1760	1760 1860	2220 2320	1520 1610	1630 1710	2080 2170	1430 1500	1530 1600	1990 2060
18-18	2000	1630 1740	1720 1820	2090 2200	1450 1540	1540 1630	1910 2000	1340 1410	1420 1490	1790 1870	1250 1320	1330 1400	1710 1770
	2500	1690 1800	1790 1900	2200 2310	1520 1600	1610 1700	2020 2110	1400 1470	1490 1560	1910 1980	1320 1380	1410 1470	1820 1890
	3000	1750 1860	1850 1960	2300 2420	1570 1660	1670 1760	2130 2220	1450 1530	1550 1630	2010 2080	1370 1430	1470 1530	1930 1990
20-18	2000	1490 1572	1574 1656	1949 2030	1342 1407	1426 1491	1801 1866	1243 1297	1327 1381	1702 1756	1173 1219	1257 1303	1631 1677
	2500	1553 1635	1647 1729	2066 2148	1405 1470	1498 1564	1917 1983	1306 1360	1399 1454	1818 1873	1235 1281	1329 1375	1748 1794
	3000	1610 1692	1713 1795	2171 2253	1461 1527	1564 1629	2023 2088	1362 1416	1465 1519	1943 1978	1291 1338	1394 1440	1853 1899
18-20	2000	1445 1520	1529 1604	1904 1978	1307 1367	1391 1451	1766 1825	1215 1264	1299 1348	1674 1723	1149 1191	1233 1275	1608 1650
	2500	1514 1591	1608 1684	2027 2103	1375 1436	1469 1529	1887 1948	1282 1332	1376 1426	1794 1845	1215 1259	1309 1352	1728 1771
	3000	1576 1653	1678 1756	2137 2215	1435 1497	1538 1600	1997 2058	1341 1393	1444 1495	1903 1954	1291 1318	1377 1421	1863 1880
20-20	2000	1357 1418	1441 1502	1815 1877	1239 1287	1322 1371	1697 1746	1160 1200	1244 1284	1618 1659	1104 1138	1187 1222	1562 1596
	2500	1422 1484	1516 1578	1935 1997	1303 1353	1397 1447	1816 1865	1224 1265	1318 1359	1737 1778	1167 1202	1261 1296	1680 1715
	3000	1481 1544	1584 1647	2043 2105	1362 1412	1464 1514	1923 1973	1282 1323	1385 1426	1843 1885	1225 1260	1328 1363	1787 1822

<sup>1</sup>Seam attachment consists of button punches spaced not over 36 inches on center between supports.

<sup>2</sup>Values above the diagonal line are for two puddle welds at ends. Values below line are for four puddle welds at ends.

<sup>3</sup>The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.

<sup>4</sup>The concrete shall have a minimum depth of 2½ inches above the top flute.



TABLE NO. B-7 — RECOMMENDED SHEAR PER FOOT FOR TYPES DC AND ADC DIAPHRAGMS WITH STRUCTURAL CONCRETE FILL<sup>1</sup>

DEPTH OF PANEL (In Inches)	FLAT PLATE		TYPE <sup>2</sup> OF WELDING	REQUIRED STRENGTH OF 2½-INCH THICK FILL IN POUNDS PER SQUARE INCH	ALLOWABLE SHEAR IN POUNDS (Per Foot)
	Location	Gauge			
1½	Down	16	G-1	2,000	1,800
3			G-2	2,500	2,250
4½			G-3	3,000	2,700
6		18	H-1	2,000	1,800
7½			H-2	2,500	2,250
			H-3	3,000	2,700

<sup>1</sup>The deflection of diaphragm is determined by the following criteria:

- Flexural deflections shall be based on the moment of inertia of the flange areas which serve as chords for the diaphragm.
- Shear deflections shall be based on a web area equal to the thickness of the flat plate multiplied by the depth of the diaphragm. The thickness of the concrete fill shall be used for diaphragms covered in Table No. B-7.

<sup>2</sup>See Table No. C-2 for welding schedule.

TABLE NO. B-8 — DIAPHRAGM SHEARS — SECTION NKC OR QL-NKC<sup>1, 2</sup>

DECK GAUGE	SEAM ATTACHMENT (Spacing in Inches)	SPAN (In Feet)			
		8	10	12	14
		END WELDS — NUMBER OF PUDDLE WELDS			
		2	2	2	2
	Ultimate Compressive Strength (Pounds per Square Inch)	WITH 2½-INCH CONCRETE FILL ABOVE TOP FLUTE (145 Pounds per Cubic Foot Density) <sup>3</sup>			
16-16	2000	2240	2030	1890	1790
	2500	2360	2150	2010	1900
	3000	2460	2250	2110	2010
18-18	2000	2060	1890	1770	1690
	2500	2170	2000	1890	1810
	3000	2280	2110	1990	1910

<sup>1</sup>The spacing of boundary puddle welds at perimeter supports shall be determined in accordance with the values set forth in Table No. C-4.

<sup>2</sup>Top seam welds as shown in Figure No. 1.

<sup>3</sup>Seam attachment consists of button punches spaced not over 36 inches on center between supports.

TABLE NO. B-9 — DIAPHRAGM SHEARS — SECTION 3, QL-3, 3A AND QL-3A WITH 2-INCH VERMICULITE CONCRETE FILL<sup>1</sup>

DECK GAUGE	SEAM ATTACH- MENT <sup>2</sup> Button Punches (Spacing in Inches)	SPAN (In Feet)							
		6		8		10		12	
		END WELDS—NUMBER OF PUDDLE WELDS							
		3	5	3	5	3	5	3	5
20	36	780	940	670	790	600	700	580	640
22		670	810	590	700	540	630	510	590
24		540	660	490	590	460	540	440	510

<sup>1</sup>Fill to have a minimum density of 27 pounds per cubic foot. An anchor washer shall be installed in each deck unit at diaphragm perimeter supports and at points of shear transfer where the shear exceeds 75 per cent of the values tabulated above. The anchor washer shall consist of a 1-inch by 2½-inch by No. 14 gauge 1-inch long angle installed perpendicular to the deck flutes with the long leg vertical. The base leg contains a ½-inch diameter hole for a ½-inch puddle weld to beam connection. The vertical leg contains a ¾-inch diameter slotted hole for a ¾-inch diameter continuous reinforcing bar.

<sup>2</sup>For diaphragm action no seam attachment is required for Sections 3A and QL-3A.

## SECTION C

TABLE NO. C-1 — SIZE, TYPE AND LOCATION OF WELDS — WELDING REQUIRED

TYPE PANEL	AT TRANSVERSE SUPPORTS			AT PERIMETER SUPPORTS				SEAM ATTACHMENT OR SIDE LAP CONNECTION	
	Puddle			Puddle		Fillet		Weld 1½-Inch Top or Side	Button Punch
	Effective Diameter (In Inches)	No. of Welds per Unit Each Support	Location	Effective Diameter (In Inches)	Space (In Inches)	Size (In Inches)	Space (In Inches)		
No. 3 & 3A QL-3 & 3A	½ ½ ½	2 3 5	2 and 4 1, 3 and 5 1, 2, 3, 4 and 5	½ ½ ½	To be calculated based on allowable weld values See Table No. C-4	—	—	12, 18 or 24	12, 18, 24 or 36 <sup>1</sup>
No. 21 QL-21	½ ½	2 4	1 and 3 1, 2, 3 and 4	½ ½		—	—	12, 18, 24 or 36 <sup>1</sup>	12, 18, 24 or 36 <sup>1</sup>
UKX QL-UKX	½ ½ ½	2 3 5	2 and 4 1, 3 and 5 1, 2, 3, 4 and 5	½ ½ ½		—	—	12, 18, 24 or 36 <sup>1</sup>	12, 18, 24 or 36 <sup>1</sup>
NKX QL-NKX	½ ½	2 4	1 and 4 1, 2, 3 and 4	½ ½		—	—	12, 18, 24 or 36 <sup>1</sup>	12, 18, 24 or 36 <sup>1</sup>
NKC QL-NKC	½	2	11 Inches Apart	½		—	—	12, 18, 24 or 36 <sup>1</sup>	12, 18, 24 or 36 <sup>1</sup>
UK	½	2	1 and 3	—	—	2½	12	1 Inch, 12 Inches o.c.	—
RK	½	2	1 and 3	—	—	2½	12	—	24
RKC	½	2	7 Inches Apart	—	—	2½	12	—	24
FK	½	2	1 and 3	—	—	2½	12	24	—
No. 3, QL-3, 3A Vermiculite Fill	½ ½	3 5	1, 3 and 5 1, 2, 3, 4 and 5	½ ½	See note above	— —	— —	— —	36 36
ADC DC	½	3	1, 2 and 3	½	See note above	—	—	—	12, 18 or 24

<sup>1</sup>Thirty-six-inch spacing used only with structural concrete fill.

TABLE NO. C-2 — WELDING SCHEDULE — TYPES DC AND ADC

TYPE OF WELDING	MINIMUM CONNECTIONS		
	Panel Ends	Panel Edges To Framing	Panel Seams
A	3-1" ∅ puddle welds at ends and at each support	1" ∅ puddle welds at 36" on center	button-punched see Table No. A-14 for spacing
B	3-¾" fillet welds	¾" fillet welds at 36" on center	1" seam welds at 36" on center
C	3-1" ∅ puddle welds	1" ∅ puddle welds at 24" on center	1½" seam welds at 18" on center
D	3-¾" fillet welds	¾" fillet welds at 36" on center	¾" seam welds at 36" on center
E	4-¾" fillet welds with No. 16 gauge continuous angle welded to panels and beams with ¾" fillet welds at 24" on center	1" fillet welds at 24" on center	1" fillet welds at 24" on center
F	4-¾" fillet welds with No. 16 gauge continuous angle welded to panels and beams with ¾" fillet welds at 24" on center	1" fillet welds at 24" on center	1" fillet welds at 36" on center
G-1	3-1" ∅ puddle welds	1" ∅ puddle welds at 21" on center	button-punched at 24" on center
G-2	3-1" ∅ puddle welds	1" ∅ puddle welds at 17" on center	
G-3	3-1" ∅ puddle welds	1" ∅ puddle welds at 14" on center	
H-1	3-1" ∅ puddle welds	1" ∅ puddle welds at 14" on center	button-punched at 24" on center
H-2	3-1" ∅ puddle welds	1" ∅ puddle welds at 11" on center	
H-3	3-1" ∅ puddle welds	1" ∅ puddle welds at 9" on center	



TABLE NO. C-3 — WELDING PATTERNS FOR KEYSTONE AND ECONORIB SECTION NO. 94 ROOF DECK DIAPHRAGMS

DECK SECTION	WELD TYPE	WELD DESCRIPTION <sup>1</sup>
3 @ 6" = 18" Seam weld End weld 1 1/4" KEYSTONE	I	End welds 1/2" x 1" puddle, one per rib Edge welds 1/2" x 1" puddle, 18" o.c. Seam welds 1" puddle, 24" o.c.
	III	End welds 1/2" x 1" puddle, 2 per end Edge welds 1/2" x 1" puddle, 24" o.c. Seam welds 1" puddle, 24" o.c.
3 @ 6" = 18" 1 1/4" Seam weld End weld ACOUSTIC KEYSTONE	II	End welds, 1/2" puddle, one per rib Edge welds 1/2" puddle, 18" o.c. Seam welds 1" puddle, 18" o.c.
4 @ 6" = 24" 3/4" Seam weld End weld Econorib Section No. 94	IV	End welds 3/8" x 1" puddle, one per rib Edge welds 3/8" x 1" puddle, 18" o.c. Seam welds 1" puddle, 18" o.c.

<sup>1</sup>Edge welds are located at the perimeter of the diaphragm and connect longitudinal edges of the panels to the wall ledger elements.

TABLE NO. C-5 — ALLOWABLE LENGTH TO WIDTH RATIO FOR TYPES DC AND ADC DIAPHRAGMS

TYPE OF DIAPHRAGM	TYPE OF EXTERIOR WALL CONSTRUCTION	
	Masonry or Concrete	Steel or Wood Frame
See Table No. A-14	2 1/2	3 1/2
See Table No. A-15	4	No Limitation
See Table No. B-7	No Limitation	No Limitation

TABLE NO. C-4 — ALLOWABLE SHEAR FOR BOUNDARY PUDDLE WELDS FOR GALVANIZED DECKS<sup>1</sup>

A. MAXIMUM ALLOWABLE SHEAR ON MARGINAL PUDDLE WELDS (In Pounds per Lineal Foot)			
Gauge <sup>2</sup>	Spacing <sup>3</sup>		
	1 Foot	2 Feet	3 Feet
16-16	3200	1600	1070
18-16	2940	1470	980
18-18	2560	1280	850
20-20	1920	960	640
16	1920	960	640
18	1540	770	510
20	1150	570	380
22	960	480	320
24	770	380	250
B. MAXIMUM ALLOWABLE SHEAR ON BOUNDARY 1 1/2-INCH FILLET WELDS (In Pounds per Lineal Foot)			
Spacing			
1'0"	2'0"	3'0"	
720	360	240	

<sup>1</sup>Values are based on the formula  $q = \frac{32,000 (t_1 + t_2)}{S}$

where  $S$  = spacing in feet;

$t_1$  = bottom sheet thickness in inches;

$t_2$  = effective thickness of upper sheet in inches ( $t_2 = 2/3 t_1$ ).

<sup>2</sup>In no case shall the spacing of boundary welds exceed 3 feet.

<sup>3</sup>Where the deck gauge is represented by two numbers, the first represents the thickness of the fluted sheet and the second represents the thickness of the flat sheet.

<sup>4</sup>Values are based on the formula  $q = \frac{480 l_w}{S}$ , where  $l_w$  = length of fillet

weld (not less than 1 1/4"). Where fillet welds attach the diaphragm to struts, ties, or other collector elements, the values shall be reduced to 63 percent of those tabulated.

## SECTION D

TABLE NO. D-1 — SUPERIMPOSED VERTICAL LOADS FOR Q-LOCK DECKS WITH 2½-INCH STONE AGGREGATE CONCRETE FILL<sup>1,2,3</sup>  
(In Pounds per Square Foot)

DECK TYPE	DECK GAUGE	DECK SPAN (In Feet)																		
		6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5	15
QL-UKX	20-20	470	434	403	376	352	305	287 (266)	270 (222)	255 (186)	242 (157)									
	20-18	473	437	406	379	355	307	289	272 (252)	257 (212)	243 (179)									
	18-20	466	430	399	373	349	329	310	294 (269)	253 (203)	240 (171)									
	18-18	464	428	398	371	348	328	309	293	278 (262)	238 (226)	226 (196)								
	18-16	464	428	398	371	348	328	309	293	278	238	226 (215)								
	16-16	464	428	398	371	348	328	309	293	278	265 (260)	253 (226)								
	16-14	464	428	398	371	348	328	309	293	278	265	253 (247)								
QL-3 & QL-3A	22	347	277	271	236	205	181 (171)	159 (144)	142 (123)	126 (105)	113 ( 91)	102 ( 79)								
	20	347	320	287	229	234	213 (196)	189 (165)	167 (140)	149 (120)	132 (104)	121 ( 90)								
	18	347	320	297	278	260	236	202	193 (171)	182 (147)	172 (127)	156 (110)								
	16	347	320	297	278	260	245	231	219 (199)	182 (171)	172 (148)	163 (128)								
QL-21 & QL-21A	22					228	197	166	158	139	123	109	97	87	77	69	61	54	48	43
	20					242	228	210	184	156	150	133	119	106	95	85	76	69	61	55
	18					242	228	216	204	194	184	175	156	133	114	117	103	96	87	76
	16					242	228	216	204	194	184	176	169	161	155	145	129	111	104	102 ( 94)
QL-NKX	20-20					278	262	247	234	223	212	202	166	158	150	143	137	131 (123)	126 (108)	
	20-18					282	266	251	238	226	215	205	168	160	153	146	139	133	128 (126)	
	18-20					277	261	247	234	222	211	202	193	185	178	171	137	131	126 (118)	
	18-18					280	263	248	235	224	213	203	194	186	179	172	165	133	128	122
	18-16					280	263	248	235	224	213	203	194	186	179	172	165	133	128	122
	16-16					280	263	248	235	224	213	203	194	186	179	172	165	159	154	149
	16-14					280	263	248	235	224	213	203	194	186	179	172	165	159	154	149
QL-NKC	18-18					220	207	195	185	176	168	160	153	146	115	109	105	100	96	91
	16-16					220	207	195	185	176	168	160	153	146	140	134	129	100	96	91

<sup>1</sup>Values tabulated represent the maximum allowable superimposed vertical loads for simply supported deck sections. These loads may be used with the steel floor units on simple or continuous spans. Composite slab design to be based on simple span analysis. Where two values are shown, the smaller value, shown in parentheses, is the load which limits the deflection to the span divided by 360; whereas, the other value, not in parentheses, is the limiting load due to stress considerations. Where only one value is shown, this is the limiting load due to stress considerations and the deflection will be less than the span divided by 360.

The Q-Lock deck sections require a 2½-inch depth of concrete having a minimum compressive strength of 3000 pounds per square inch above the top flange of the steel sections. The concrete shall be reinforced in accordance with Table No. D-7.

<sup>2</sup>Values located within the double line boundary represent allowable superimposed loads that require temporary midspan shoring for single span deck construction.

<sup>3</sup>Where the deck gauge is represented by two numbers, the first represents the thickness of the fluted sheet and the second represents the thickness of the flat sheet.



TABLE NO. D-2 — SUPERIMPOSED VERTICAL LOADS FOR Q-LOCK DECKS WITH 2½-INCH STRUCTURAL LIGHTWEIGHT CONCRETE FILL<sup>1</sup>  
(In Pounds per Square Foot)

DECK TYPE	DECK GAUGE	DECK SPAN (In Feet)																		
		6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5	15
QL-UKX	20-20	464	428	398	371	348	327 (303)	289 (231)	272 (193)	258 (162)	245 (136)									
	20-18	467	431	400	374	350	330 (260)	290 (217)	274 (182)	259 (153)	246									
	18-20	461	426	395	369	346	325 (275)	307 (234)	291 (201)	277 (173)	263									
	18-18	460	424	394	368	345	324 (289)	306 (246)	290 (211)	276 (182)	263 (159)	251								
	18-16	460	424	394	368	345	324 (267)	306 (229)	290 (198)	276 (172)	263	251								
	16-16	460	424	394	368	345	324 (280)	306 (240)	290 (207)	276 (180)	263	251								
	16-14	460	424	394	368	345	324 (260)	306 (225)	290 (195)	276	263	251								
QL-3	22	341	286	243	203	193 (176)	170 (147)	150 (124)	133 (105)	119 (90)	106 (78)	95 (68)								
	20	342	316	290	249 (242)	215 (200)	177 (166)	166 (140)	146 (119)	130 (102)	115 (88)	102 (77)								
	18	342	316	293	274	257 (240)	242 (200)	217 (168)	188 (143)	159 (123)	128 (106)	114 (92)								
	16	342	316	293	274	257 (229)	242 (193)	228 (164)	216 (140)	205 (140)	187 (121)	123 (106)								
QL-21	22					221	193	169	148	131	119	106	95	85	76	68	61	55	49	44
	20					241	227	204	180	159	142	126	115	103	93	84	75	68	61	55
	18					241	227	215	203	193	184	171	153 (150)	138 (132)	125 (117)	113 (104)	102 (93)	93 (83)	85 (75)	77 (68)
	16					241	227	215	203	193	184	176	168 (155)	161 (137)	155 (122)	149 (109)	131 (109)	119 (97)	109 (88)	100 (79)
QL-NKX	20-20					277	261	246	233	222	211	202	193	185	156 (143)	149 (125)	143 (110)	137 (96)		
	20-18					281	265	250	237	225	214	204	196	187	158	152	145 (144)	139 (126)	134 (111)	
	18-20					278	262	247	234	222	212	202	193	185	178	171	165 (159)	159 (143)	153 (128)	
	18-18					282	265	250	237	225	215	205	196	188	180	173	167 (157)	161 (142)	155 (128)	150
	18-16					282	265	250	237	225	215	205	196	188	180	173	167 (153)	161 (138)	155	150
	16-16					282	265	250	237	225	215	205	196	188	180	173	167	161	155 (146)	150
	16-14					282	265	250	237	225	215	205	196	188	180	173	167	161	155	150
QL-NKC	18-18					226	213	201	191	181	173	165	158	151	145	139	116	112	107	103
	16-16					226	213	201	191	181	173	165	158	151	145	139	134	129	125	120

<sup>1</sup>Values tabulated represent the maximum allowable superimposed vertical loads for simply supported deck sections. These loads may be used with the steel floor units on simple or continuous spans. Composite slab design to be based on simple span analysis. Where two values are shown, the smaller value, shown in parentheses, is the load which limits the deflection to the span divided by 360; whereas, the other value, not in parentheses, is the limiting load due to stress considerations. Where only one value is shown, this is the limiting load due to stress considerations and the deflection will be less than the span divided by 360.

The Q-Lock deck sections require a 2½-inch depth of concrete having a minimum compressive strength of 3000 pounds per square inch above the top flange of the steel sections. The concrete shall be reinforced in accordance with Table No. D-7.

<sup>2</sup>Values located within the double line boundary represent superimposed loads that require temporary midspan shoring for single span deck construction.

<sup>3</sup>Where the deck gauge is represented by two numbers, the first represents the thickness of the fluted sheet and the second represents the thickness of the flat sheet.

TABLE NO. D-3 — SUPERIMPOSED VERTICAL LOADS FOR Q-LOCK DECKS WITH 3¼-INCH STRUCTURAL LIGHTWEIGHT CONCRETE FILL<sup>1, 2, 3</sup>  
(In Pounds Per Square Foot)

DECK TYPE	DECK GAUGE	DECK SPAN (In Feet)																					
		6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5	15	15.5	16	16.5
QL-UKX	20-20	554	512	475	443	416	466	455	325 (311)	307 (262)	291 (223)	277 (190)	264 (163)	252 (140)	236 (121)								
	20-18	557	514	478	446	418	367	346	326 (295)	308 (251)	293 (214)	278 (184)	265 (158)	253 (137)									
	18-20	548	506	470	438	411	387	365	346 (314)	329 (241)	288 (206)	273 (176)	260 (152)	238 (131)									
	18-18	548	506	470	438	411	387	365	346	329 (273)	287 (233)	273 (200)	260 (172)	248 (148)									
	18-16	550	508	472	440	413	389	367	348	330	288 (253)	274 (217)	261 (187)	249 (161)									
	16-16	547	505	469	438	410	386	365	345	328	313	298 (264)	285 (196)	247 (169)									
	16-14	551	508	472	440	413	389	367	348	330	315	300 (286)	287 (214)	249 (185)	238 (161)	227							
QL-3 and QL-3A	22	419	368	335	297	256	222	193 (189)	169 (158)	148 (132)	130 (112)	115 (94)	101 (80)	89 (68)	79 (58)								
	20	418	385	358	305	289	268 (260)	234 (216)	205 (180)	181 (151)	160 (128)	142 (108)	126 (92)	112 (78)	100 (67)								
	18	415	383	356	332	311	293	257 (219)	224 (184)	212 (156)	193 (132)	172 (113)	154 (96)	138 (82)									
	16	412	381	354	330	309	291	275	260 (213)	222 (180)	211 (153)	200 (131)	190 (112)	181 (96)	173								
QL-21 and QL-21A	22					280	253	213	201	177	156	138	122	108	96	85	75	66	59	52	45	39	34
	20					280	264	249	236	201	169	170	151	135	120	108 (94)	96 (82)	86 (72)	77 (63)	68 (55)	61 (48)	54 (42)	48
	18					282	266	251	238	226	215	205	197	171	148 (135)	148 (118)	136 (103)	123 (91)	111 (79)	100 (70)	91 (61)	82 (54)	74
	16					285	268	253	240	228	217	207	198	190	182	175 (108)	163 (95)	143 (83)	132 (70)	126 (58)	119 (46)	109 (34)	99
QL-NKX	20-20					313	295	278	264	251	239	228	192	182	174	166	159	153	146 (140)	141 (124)	135 (110)	130 (98)	126 (87)
	20-18					317	299	282	267	254	242	231	194	185	176	169	161	155	148 (142)	143 (126)	137 (112)	132 (100)	127
	18-20					311	293	276	262	249	237	226	216	207	199	191	184	152	146 (135)	140 (119)	134 (106)	129 (94)	125
	18-18					314	295	279	264	251	239	228	218	209	201	193	186	153	147	141	136 (126)	131 (112)	126
	18-16					315	296	280	265	252	240	229	219	210	202	194	187	153	147	141	136	131 (121)	126
	16-16					316	297	281	266	253	241	230	220	211	202	195	187	181	174	169	163	132	127
	16-14					319	301	284	269	256	243	232	222	213	204	197	189	183	176	170	165	160	128

<sup>1</sup>Values tabulated represent the maximum allowable superimposed vertical loads for simply supported deck sections. These loads may be used with the steel floor units on simple or continuous spans. Composite slab design to be based on simple span analysis. Where two values are shown, the smaller value, shown in parentheses, is the load which limits the deflection to the span divided by 360; whereas, the other value, not in parentheses, is the limiting load due to stress considerations. Where only one value is shown, this is the limiting load due to stress considerations and the deflection will be less than the span divided by 360.

The Q-Lock deck sections require a 3¼-inch depth of concrete having a minimum compressive strength of 3000 pounds per square inch above the top flange of the steel sections. The concrete shall be reinforced in accordance with Table No. D-7.

<sup>2</sup>Values located within the double line boundary represent allowable superimposed loads that require temporary mid-span shoring for single span deck construction.

<sup>3</sup>Where the deck gauge is represented by two numbers, the first represents the thickness of the fluted sheet and the second represents the thickness of the flat sheet.



TABLE NO. D-4 — SUPERIMPOSED VERTICAL LOADS FOR DC, ADC AND SECTION NO. 5 DECKS  
WITH 2½-INCH STONE AGGREGATE CONCRETE FILL<sup>1,2,3</sup>

DECK TYPE	DECK GAUGE <sup>3</sup>	DECK SPAN (in Feet)																												
		12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
DC-45 ADC-45	20-18		188	175	135	125	116	108	101	94	89	78	68	58																
	18-18		187	173	162	152	143	108	100	94	88	83	74	64																
	18-16		190	176	164	154	145	109	102	96	90	84	80	75																
	16-16		190	176	164	154	145	137	130	96	90	85	80	75																
	18-14		193	179	167	156	147	111	104	97	91	86	81	77																
	16-14		193	179	167	157	147	139	132	98	92	86	81	77																
	14-14		194	180	168	157	148	140	132	126	93	87	82	78																
	16-13		195	181	169	159	149	141	133	99	93	88	83	78																
DC-60 ADC-60	18-18					189	177	168	159	151	114	108	101	89	77	67	58													
	18-16					192	181	170	161	153	117	110	104	99	93	84	74													
	16-16					192	181	171	162	154	147	111	105	100	94	90	80													
	18-14					194	183	172	163	155	118	112	105	100	95	90	85													
	16-14					196	184	174	165	157	149	142	107	101	96	91	87													
	14-14					198	186	176	166	158	150	144	137	103	98	93	89													
	16-13					199	187	176	167	159	151	144	109	103	98	93	88													
DC-75 ADC-75	18-18							201	190	180	172	154	126	116	102	90	78	69	60	52	44	38	32	26						
	18-16							204	193	184	175	167	129	122	116	110	97	86	76	67	58	51	44	38	32	27				
	16-16							206	195	185	176	168	161	154	117	112	106	94	83	73	65	57	49	42	36	31				
	18-14							208	197	187	178	170	162	124	118	112	107	102	96	85	75	67	59	52	45	39				
	16-14							209	198	188	179	171	164	157	119	114	108	103	99	91	81	72	63	56	49	42				
	14-14							212	201	191	182	173	166	159	152	116	111	106	101	97	89	80	71	62	55	48				
	16-13							212	201	191	182	174	166	159	122	116	110	105	100	96	92	88	79	70	62	55				
	14-13							215	204	194	184	176	168	161	155	149	113	108	103	99	94	91	85	76	68	60				
	13-13							219	207	197	187	179	171	164	157	151	116	111	106	101	97	93	89	83	79	65				
# 5-45	18	178	157	128	106	89	73	60	49	40	32	25																		
	16	180	166	154	138	115	96	80	67	55	46	37	30																	
	14	183	169	157	146	137	125	106	88	74	62	52	43	35																
	13	186	171	159	148	139	131	124	91	85	79	67	56	47																
# 5-60	18	222	205	180	150	126	105	88	74	61	51	41	33	26																
	16	226	209	194	181	163	139	118	100	83	70	59	49	40	33	26														
	14	231	213	198	185	173	163	153	131	113	93	80	68	57	48	40	33													
	13	236	218	202	189	177	167	157	149	140	122	101	87	75	64	54	46													
# 5-75	18	267	247	229	203	171	145	123	104	88	74	62	51	42	34	27														
	16	273	252	234	218	205	188	161	139	119	103	88	72	61	51	43	35	28												
	14	281	259	240	224	210	196	187	177	156	136	118	103	85	73	62	53	44	37	30										
	13	288	266	297	231	216	203	192	182	173	165	147	129	114	94	81	70	61	52	44	37	30								

<sup>1</sup>Values tabulated represent the maximum allowable superimposed vertical loads for simply supported deck sections. These loads may be used with the steel floor units on simple or continuous spans. Composite design is based on simple span analysis. For each value shown, this is the limiting load due to either the horizontal shear or a steel stress of 20,000 pounds per square inch governing. The deflection will be less than the span divided by 360 in all cases.

The loads shown are the lesser of the DC or ADC value for the same depth-gauge combination. Generally, the DC is 1-3 per cent greater than the ADC value.

The above deck sections require a 2½-inch depth of concrete cover having a minimum compressive strength of 3000 pounds per square inch above the top flange of the steel sections. The concrete shall be reinforced in accordance with Table No. D-7.

<sup>2</sup>Values located within the double line boundary represent superimposed loads that require temporary mid-span shoring.

<sup>3</sup>Where the deck gauge is represented by two numbers, the first represents the thickness of the fluted top sheets and the second represents the thickness of the flat bottom sheet.

TABLE NO. D-5 — SUPERIMPOSED VERTICAL LOADS FOR DC, ADC AND SECTION NO. 5 DECKS  
WITH 2½-INCH STRUCTURAL LIGHTWEIGHT CONCRETE FILL<sup>1,2,3</sup>

DECK TYPE	DECK GAUGE <sup>2</sup>	DECK SPAN (in Feet)																											
		12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36			
DC-45 ADC-45	20-18		191	177	165	134	125	117	110	103 ( 99)	95 ( 86)	83 ( 74)	73 ( 65)	63 ( 57)															
	18-18		191	177	165	155	146	138 (133)	110	104	98 ( 90)	90 ( 79)	78 ( 69)	69 ( 60)															
	18-16		194	180	168	158	148	140	133	106	100	94 ( 88)	89 ( 77)	85 ( 68)															
	16-16		195	181	169	159	149	141	134	127 (122)	101	95 ( 92)	90 ( 80)	86 ( 71)															
	18-14		197	183	171	160	151	142	135	107	101	96 ( 86)	91 ( 86)	86 ( 76)															
	16-14		199	185	172	161	152	143	136	129	103	97 ( 89)	92 ( 89)	87 ( 79)															
	14-14		201	187	175	164	154	145	138	131	125 (123)	99 ( 93)	94 ( 82)	89 ( 82)															
	16-13		202	187	175	164	154	145	138	131	104	99	93 ( 86)	89 ( 86)															
DC-60 ADC-60	18-18					194	183	173	164	155	140	120	106	94	83	73	65												
	18-16					198	186	176	167	158	151	144 (141)	116 (109)	110 (109)	101 ( 96)	90 ( 85)	80 ( 76)												
	16-16					200	189	178	169	160	153	146 (130)	139 (130)	112 (101)	107 (101)	96 ( 90)	86 ( 80)												
	18-14					200	189	178	169	160	153	146	118	112	106 (105)	101 ( 93)	94 ( 83)												
	16-14					204	192	181	172	163	155	148	142	114	109	104 ( 99)	99 ( 89)												
	14-14					208	196	185	175	166	158	151	145	138 (133)	112	107 (104)	102 ( 93)												
	16-13					207	195	184	174	165	157	150	144	116	111	106 ( 97)	101 ( 97)												
DC-75 ADC-75	18-18							208	197	187	178	158	141	125	108	96	85	76	67	59	52	46	40	35	30	26			
	18-16							212	201	191	182	173	166	149	130	116	104	93	83	74	66	59	52	46	41	36			
	16-16							216	204	194	185	176	169	161	145	125	112	101	90	81	72	65	58	51	45	40			
	18-14							216	204	194	185	176	169	162	132	126	120	113	102	92	83	74	67	60	53	48			
	16-14							219	208	197	188	179	172	164	158	152 (148)	123	118	108 (107)	98 ( 96)	88 ( 87)	79	71	64	57	51			
	14-14							225	213	202	193	184	176	168	162	155 (139)	122	117 (112)	106 (101)	96 ( 92)	87 ( 84)	78 ( 76)	70	63	57				
	16-13							223	211	200	191	182	174	167	160	159	125	120	115 (105)	110 (105)	105 ( 95)	95 ( 86)	86 ( 79)	78 ( 72)	70 ( 66)	63 ( 60)			
	14-13							228	216	205	196	187	178	171	164	158	152 (151)	124	119 (110)	114 (110)	110 (100)	102 ( 91)	92 ( 83)	84 ( 75)	76 ( 69)	69 ( 63)			
	13-13							234	222	211	201	191	183	175	168	162	156 (142)	123	118 (115)	114 (104)	109 ( 95)	99 ( 86)	90 ( 79)	82 ( 72)	74 ( 66)				



TABLE NO. D-5 — (Continued)

DECK TYPE	DECK GAUGE <sup>1</sup>	DECK SPAN (in Feet)																											
		12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36			
# 5-45	18	181	158	131	109	91	77	64	54	45	37	30																	
	16	185	170	158	139	118	100	85	70	59	50	42																	
	14	189	174	162	151	142	127	109	94	77	66	56	48	40															
	13	194	179	166	155	145	136	129	114 (110)	99 (94)	82 (81)	70	60	52															
# 5-60	18	228	211	183	154	130	111	94	80	67	57	48	40	33	27														
	16	234	216	201	187	166	142	122	105	91	78	64	55	47	39	33	27												
	14	242	223	207	193	181	171	155	134	117	102	89	73	63	54	47	40												
	13	250	231	214	200	187	176	166	158	142	125	110	96	80	69	60	52												
# 5-75	18	277	255	237	205	175	150	129	111	95	82	69	59	50	42	35	29												
	16	286	264	245	228	214	190	165	143	124	108	95	83	68	59	51	43	37	31	25									
	14	297	274	254	237	222	209	198	181	159	140	123	108	95	79	69	60	52	45	39	33	28							
	13	308	284	264	246	231	217	205	194	185	170	150	133	118	105	88	77	68	59	52	45	39	33	28					

<sup>1</sup>Values tabulated represent the maximum allowable superimposed vertical loads for simply supported deck sections. These loads may be used with the steel floor units on simple or continuous spans. Composite design is based on simple span analysis. Where two values are shown, the smaller value, shown in parentheses, is the load which limits the deflection to the span divided by 360; whereas, the other value, not in parentheses, is the limiting load due to stress considerations. Where only one value is shown, this is the limiting load due to stress consideration and the deflection will be less than the span divided by 360.

The loads shown are the lesser of the DC or ADC value for the same depth-gauge combination. Generally the DC is 1-3 per cent greater than the ADC values.

The above deck sections require a 2½-inch depth of concrete cover having a minimum compressive strength of 3000 pounds per square inch above the top flange of the steel sections. The concrete shall be reinforced in accordance with Table No. D-7.

<sup>2</sup>Values located within the double line boundary represent superimposed loads that require temporary mid-span shoring.

<sup>3</sup>Where the deck gauge is represented by two numbers, the first represents the thickness of the fluted top sheets and the second represents the thickness of the flat bottom sheet.

TABLE NO. D-6 — ALLOWABLE LIVE LOADS  
IN POUNDS PER SQUARE FOOT — KEYSTONE  
COMPOSITE FLOOR<sup>1,2</sup>

SPAN (Ft.)	OVER- ALL SLAB DEPTH (In.)	GAUGE			
		16	18	20	22
5	2½	314	314	314	223
	3	398	398	398	281
6	2½	262	262	262	186
	3	332	332	332	234
	3½	403	403	403	282
7	3	284	284	284	200
	3½	345	345	345	242
	4	407	407	372	284
	4½	468	468	398	271
8	3	238	228	197	138
	3½	302	302	222	169
	4	356	356	235	199
	4½	410	410	355	230
	5	464	464	403	261
9	3½	259	226	189	145
	4	316	316	252	172
	4½	353	309	309	199
	5	363	352	352	226
	5½	394	394	394	253
10	4	226	213	195	150
	4½	273	273	249	173
	5	310	310	309	197
	5½	348	348	348	221
	6	386	386	386	245
	6½	424	424	424	268
11	4	178	167	152	132
	4½	231	216	196	152
	5	271	271	245	173
	5½	310	310	279	194
	6	344	344	309	216
	6½	379	379	340	237
	7	413	413	370	258

SPAN (Ft.)	OVER- ALL SLAB DEPTH (In.)	GAUGE			
		16	18	20	22
12	4½	186	173	156	135
	5	234	217	196	154
	5½	273	265	224	173
	6	310	310	248	192
	6½	334	330	273	210
	7	371	371	297	
13	5	190	176	158	
	5½	234	217	181	
	6	274	260	201	
	6½	306	306	221	
	7	336	336	241	
14	5½	192	178	147	
	6	232	214		
	6½	275	253		
	7	300	284		

<sup>1</sup>Values approved for sand and gravel or lightweight concrete — 3000 pounds per square inch strength.

<sup>2</sup>The above loads may be used with the floor units on simple or continuous spans. Composite slab design to be based upon simple span analysis. Shoring requirements are based on 200 lb. concentrated construction load at mid-span plus the weight of the wet concrete. Deflection under weight of concrete does not exceed L/240 of the span. Shoring is also calculated for deck continuous across two or more spans. A limit of L/360 was placed upon deflection of the composite slab.

<sup>3</sup>Values indicated within the double line boundary represent allowable superimposed loads that require temporary mid-span shoring.

TABLE NO. D-7 — STRUCTURAL CONCRETE MINIMUM REINFORCING<sup>1</sup>

SLAB THICKNESS (In Inches)	6 BY 6 WELDED WIRE FABRIC <sup>2</sup> (Wire Size)
¾ or less	W 1.4 x W 1.4
3½	W 1.7 x W 1.7
4	W 2.1 x W 2.1
4½	W 2.5 x W 2.5
5	W 2.9 x W 2.9
5½	W 2.9 x W 2.9
6	W 3.4 x W 3.4

<sup>1</sup>A 6 by 6 welded wire fabric shrinkage mesh, located 1 inch from the top of the concrete slab, is recommended for all slab thicknesses. Listed above are the recommended wire sizes for respective slab thicknesses measured from top of deck to top of slab. These wire sizes apply to both stone and lightweight concrete.

<sup>2</sup>Other reinforcement having an equivalent area and a maximum spacing of 18 inches may be substituted.



## SECTION E

TABLE NO. E-1

SECTION AND GAUGE	WEIGHT Sq. Ft. Lbs.	Y DIST. (In Inches)	I FOR DEFLECTION (In Inches <sup>4</sup> )	S.M. (In Inches <sup>3</sup> )	SAFE END REACTION 3-INCH BEARING
3 & 3A-22	1.8	.826	.180	.203	855
3 & 3A-20	2.3	.804	.230	.265	1294
3 & 3A-18	3.1	.764	.337	.398	2240
3 & 3A-16	3.8	.732	.442	.506	3357
3 & 3A-14	4.7	.712	.562	.633	4916
3 & 3A-12	6.5	.745	.756	.880	8648
UKX 20-20	3.7	1.127	.381	.310	1294
UKX 18-20	4.4	1.045	.520	.462	2240
UKX 20-18	4.3	1.183	.411	.317	1294
UKX 18-18	5.1	1.105	.566	.472	2240
UKX 18-16	5.6	1.152	.603	.481	2240
UKX 16-16	6.3	1.089	.763	.654	3357
UKX 16-14	6.9	1.144	.820	.667	3357
UKX 14-14	7.9	1.078	1.011	.893	4916
UKX 12-12	11.0	1.085	1.373	1.353	8648
RK 18-18	5.9	1.630	1.899	1.104	2240
RK 18-16	6.7	1.726	2.128	1.168	2240
RK 16-16	7.4	1.606	2.497	1.483	3357
RK 14-14	9.2	1.611	3.304	1.982	4916
RK 12-12	12.4	1.584	4.446	2.865	8648
RKC 16-16	6.73	1.840	2.238	1.140	1679
RKC 14-14	8.41	1.800	3.009	1.560	2458
RKC 12-12	11.78	1.750	4.729	2.520	4324
21 & 21A-22	2.3	1.633	.675	.386	468
21 & 21A-20	2.8	1.595	.855	.500	766
21 & 21A-18	3.7	1.530	1.258	.755	1442
21 & 21A-16	4.6	1.462	1.703	.982	2266
21 & 21A-14	5.8	1.393	2.264	1.261	3409
21 & 21A-12	8.1	1.313	3.381	1.823	6191
NKX 20-20	4.1	2.199	1.431	.600	766
NKX 18-20	4.9	2.035	1.951	.884	1442
NKX 20-18	4.7	2.311	1.542	.613	766

SECTION AND GAUGE	WEIGHT Sq. Ft. lbs.	Y DIST. (In Inches)	I FOR DEFLECTION (In Inches <sup>4</sup> )	S.M. (In Inches <sup>3</sup> )	SAFE END REACTION 3-INCH BEARING
NKX 18-18	5.7	2.149	2.125	.909	1442
NKX 18-16	6.3	2.214	2.226	.923	1442
NKX 16-16	7.2	2.109	2.888	1.260	2266
NKX 16-14	7.9	2.204	3.084	1.285	2266
NKX 14-14	9.0	2.068	3.903	1.746	3409
NKX 12-12	12.6	2.014	6.049	2.833	6191
NKC 18-18	5.46	1.868	2.765	1.405	964
NKC 16-16	6.83	1.837	3.572	1.881	1510
NKC 14-14	8.54	1.822	4.514	2.460	2270
QLNKC 18-18	5.20	2.285	1.668	.669	964
QLNKC 16-16	6.50	2.252	2.304	.926	1510
12-20	3.7	2.494	2.933	1.126	940
12-18	4.9	2.447	4.078	1.610	1922
12-16	6.0	2.419	5.195	2.107	3026
12-14	7.5	2.410	6.180	2.694	4608
12-12	10.4	2.501	8.587	3.433	8366
FKX 18-18	6.7	3.01	5.93	1.90	1922
FKX 18-16	7.2	3.13	6.30	1.94	1922
FKX 16-16	8.4	2.98	7.57	2.49	3026
FKX 16-14	9.1	3.11	8.06	2.54	3026
FKX 14-14	10.4	2.98	9.02	3.18	4608
FKX 12-12	14.5	3.07	12.59	4.10	8366
CK 18-18	7.0	3.38	8.28	2.32	1442
CK 18-16	7.9	3.57	9.24	2.45	1442
CK 16-18	7.9	3.13	9.81	2.95	1442
CK 16-16	8.8	3.33	10.94	3.11	2266
CK 16-14	9.9	3.52	12.20	3.28	2266
CK 14-16	9.9	3.07	12.97	3.97	2266
CK 14-14	11.0	3.27	14.40	4.18	3409
CK 14-12	13.1	3.57	17.00	4.51	3409
CK 12-14	13.3	2.86	18.32	5.31	3409
CK 12-12	15.4	3.19	21.62	6.50	6191

(Continued)

TABLE NO. E-1 — (Continued)

SECTION	GAUGE	WEIGHT (Sq. Ft. Pounds)	I FOR DEFLECTION (In Inches <sup>4</sup> )	S.M. (In Inches <sup>3</sup> )	SAFE END REACTION 3-INCH BEARING
DC 15 <sup>1</sup>	20-18	3.8	.35	.25	569
	18-18	4.4	.52	.43	927
	18-16	4.9	.56	.43	927
	16-18	5.0	.68	.61	1348
	16-16	5.5	.73	.62	1348
	16-14	6.2	.79	.63	1348
	14-16	6.3	.92	.91	1935
	14-14	6.9	.99	.93	1935
DC 30 <sup>1</sup>	20-18	4.2	1.75	.63	714
	18-18	4.9	2.19	.97	1223
	18-16	5.4	2.35	.99	1223
	16-18	5.6	2.81	1.31	1801
	16-16	6.1	3.04	1.39	1801
	16-14	6.8	3.28	1.41	1801
	14-16	7.0	3.81	1.97	2580
	14-14	7.6	4.07	2.01	2580
DC 45 <sup>1</sup>	20-18	4.6	3.72	1.05	527
	18-18	5.4	5.26	1.62	1028
	18-16	5.9	5.64	1.65	1028
	16-18	6.2	6.63	2.25	1602
	16-16	6.8	7.20	2.29	1602
	16-14	7.4	7.77	2.33	1602
	14-16	7.7	9.09	3.21	2375
	14-14	8.4	9.58	3.27	2375
DC 60 <sup>1</sup>	18-18	6.0	9.87	2.37	834
	18-16	6.4	10.61	2.41	834
	16-18	6.8	12.45	3.23	1402
	16-16	7.3	13.44	3.30	1402
	16-14	8.0	14.47	3.36	1402
	14-16	8.5	16.68	4.57	2174
	14-14	9.1	17.78	4.67	2174
DC 75 <sup>1</sup>	18-18	6.6	16.33	3.20	639
	18-16	6.9	17.46	3.27	639
	16-18	7.4	20.30	4.32	1203
	16-16	8.0	21.95	4.42	1203
	16-14	9.2	23.62	4.52	1203
	14-16	9.3	26.85	6.06	1974
	14-14	10.0	28.93	6.20	1974
	13-14	11.1	34.01	7.69	2833
	13-13	11.6	36.23	7.84	2833

SECTION	GAUGE	WEIGHT (Sq. Ft. Pounds)	I FOR DEFLECTION (In Inches <sup>4</sup> )	S.M. (In Inches <sup>3</sup> )	SAFE END REACTION 3-INCH BEARING
4.5-LS2	20	3.0	2.03	.75	1020 <sup>2</sup>
4.5-LS2	18	3.8	2.93	1.05	2120 <sup>2</sup>
4.5-LS1	18	4.4	3.91	1.34	2120 <sup>2</sup>
4.5-LS1	16	5.1	5.08	1.69	3240 <sup>2</sup>
6.0-LS2	20	3.3	3.82	1.14	650 <sup>2</sup>
6.0-LS2	18	4.1	5.60	1.55	1720 <sup>2</sup>
6.0-LS1	18	4.5	7.30	1.90	1720 <sup>2</sup>
6.0-LS1	16	5.4	9.50	2.40	2840 <sup>2</sup>
7.5-LS2	18	4.3	9.24	2.07	1320 <sup>2</sup>
7.5-LS2	16	5.6	13.22	3.05	2440 <sup>2</sup>
7.5-LS1	18	4.6	11.86	2.50	1320 <sup>2</sup>
7.5-LS1	16	5.7	15.56	3.18	2440 <sup>2</sup>
7.5-LS1	14	7.0	19.85	3.97	3960 <sup>2</sup>
Keystone Deck	16		.383	.353	
	18		.289	.286	
	20		.201	.213	
	22		.156	.177	
Econorib Section No. 94	18		.187	.166	
	20		.131	.121	
	22		.103	.099	
	24		.076	.077	
#5-45	18	4.1	3.38	1.32	1028
	16	5.1	4.57	1.71	1602
	14	6.5	5.68	2.08	2375
	13	7.8	6.86	2.51	3235
#5-60	18	4.6	6.55	1.96	834
	16	5.7	8.85	2.54	1402
	14	7.2	10.99	3.09	2174
	13	8.6	13.31	3.74	3034
#5-75	18	5.1	11.02	2.68	639
	16	6.4	14.84	3.47	1203
	14	7.9	18.44	4.22	1974
	13	9.4	22.36	5.11	2833

<sup>1</sup>The properties shown are for units used in "Flat Plate Down" position. When ADC units are used: if all units in area are ADC, reduce properties shown above by 10 per cent. When alternating units (50 per cent plain—50 per cent ADC) are used, reduce properties by 5 per cent.

<sup>2</sup>Safe end reactions for LS Sections are based on 2-inch bearing.

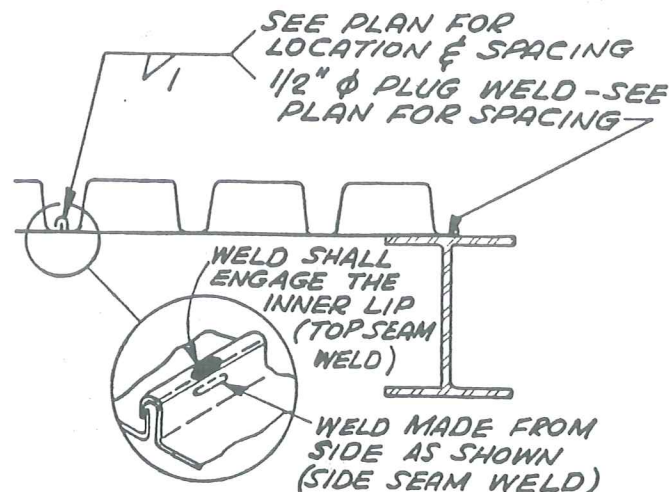
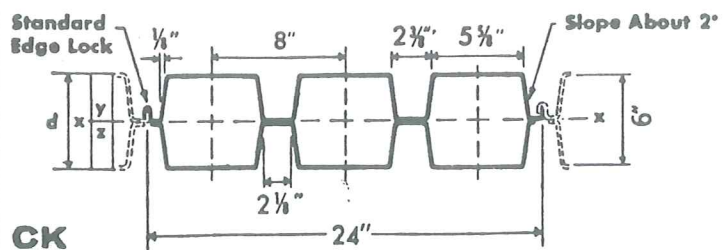
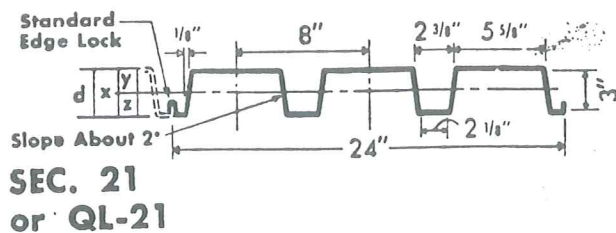
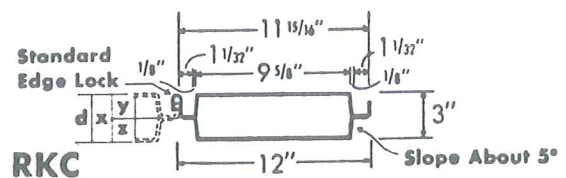
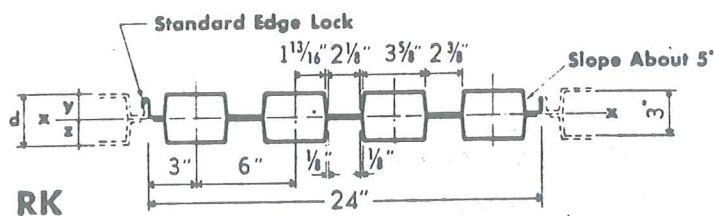
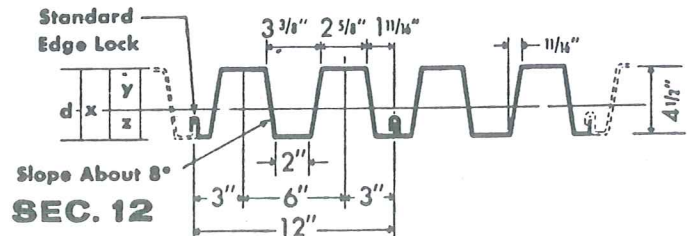
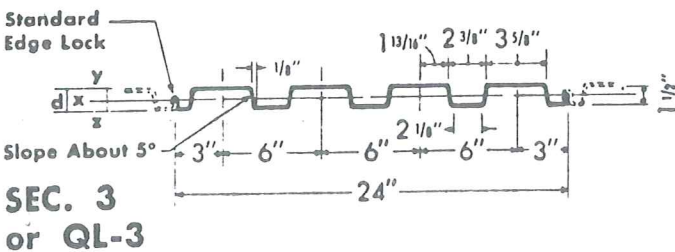
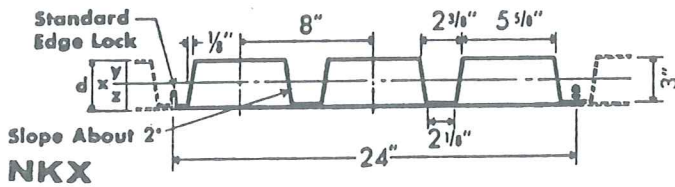
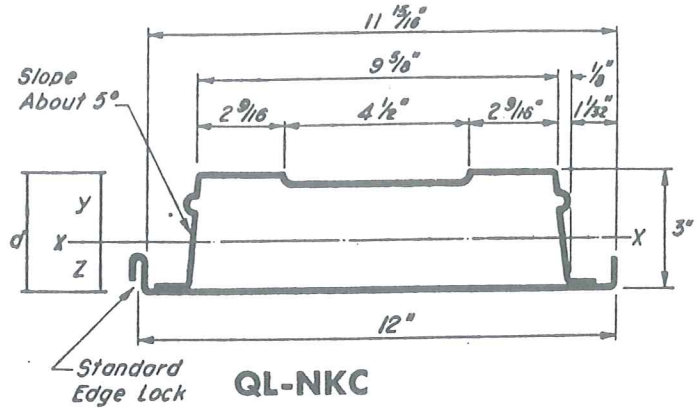
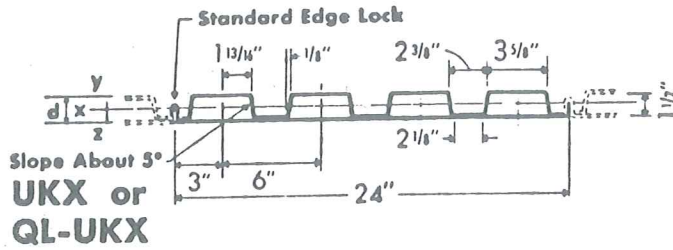
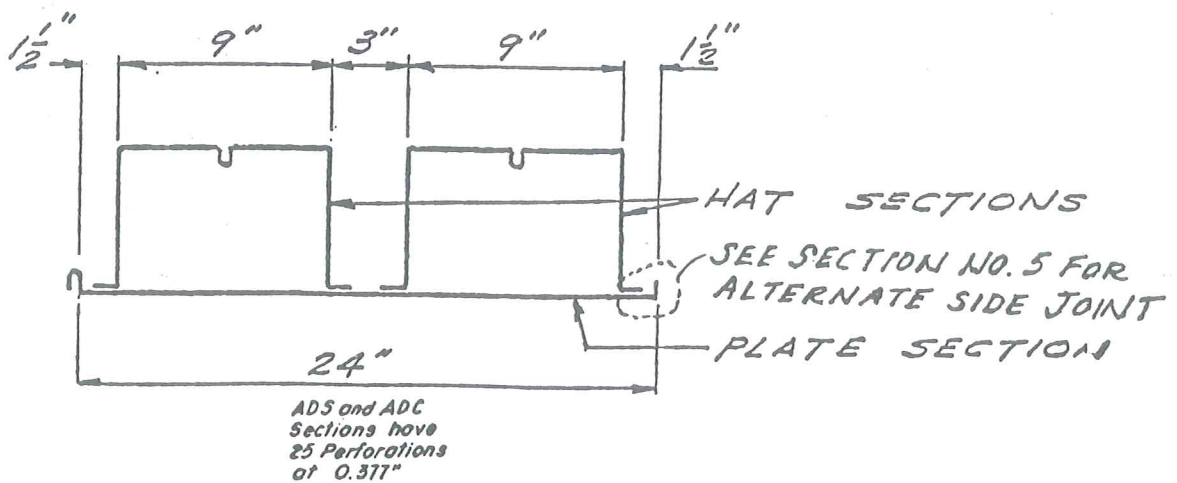
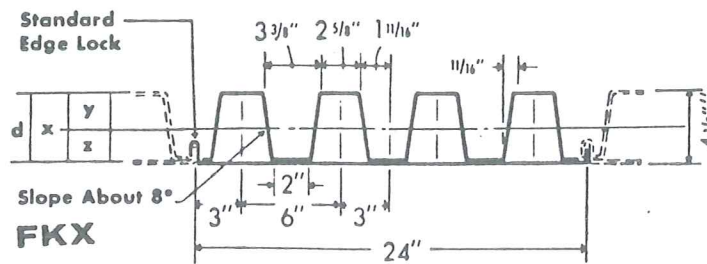
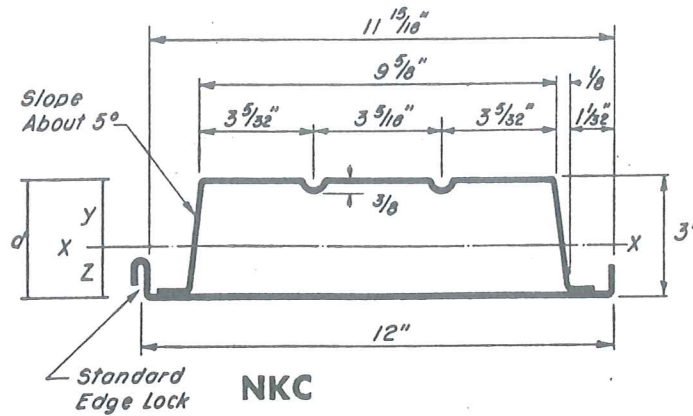


FIGURE NO. 1

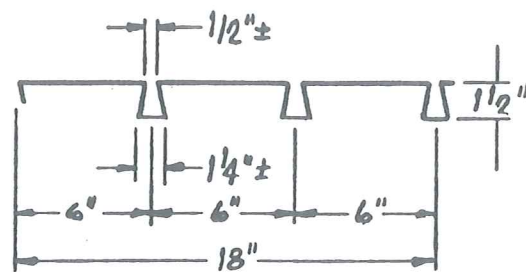




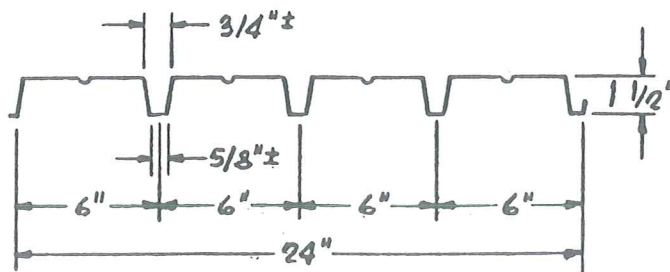


DC, ADC or ADS

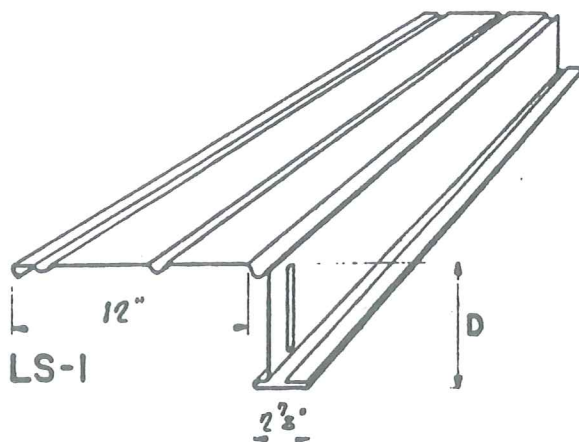




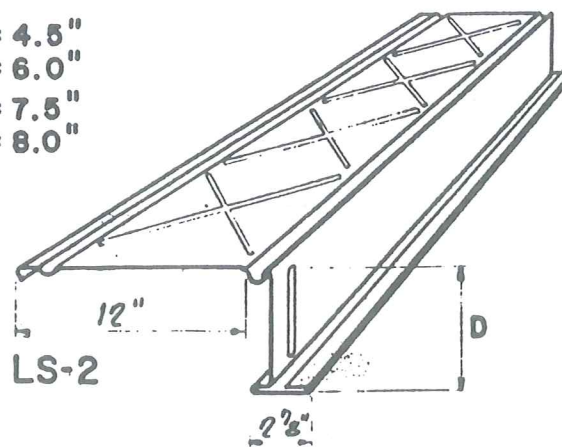
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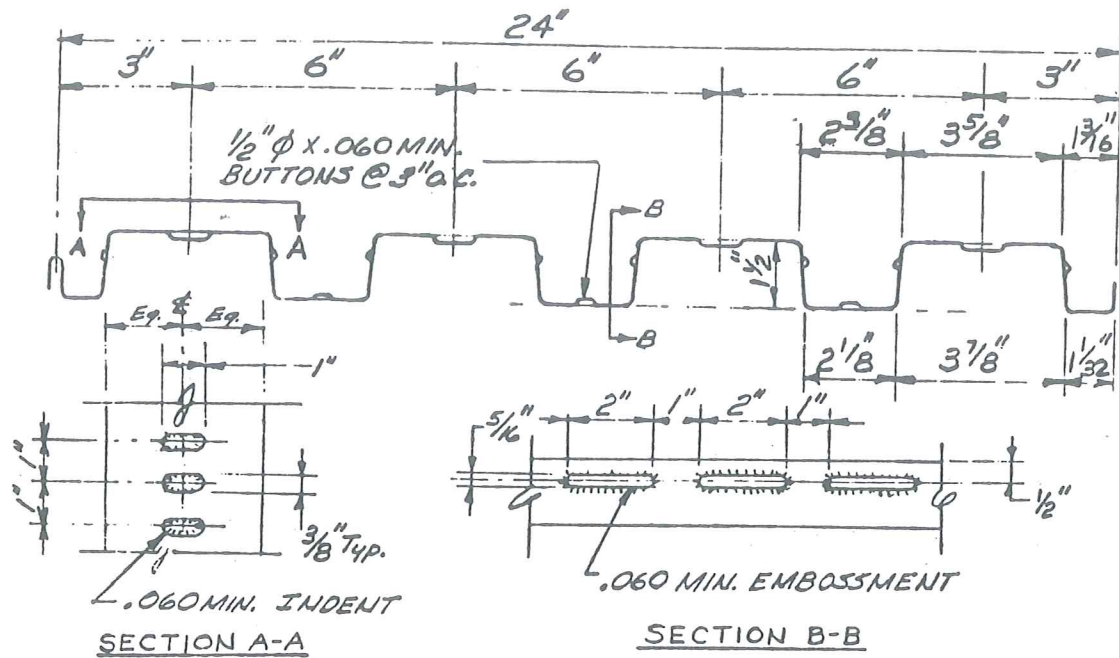


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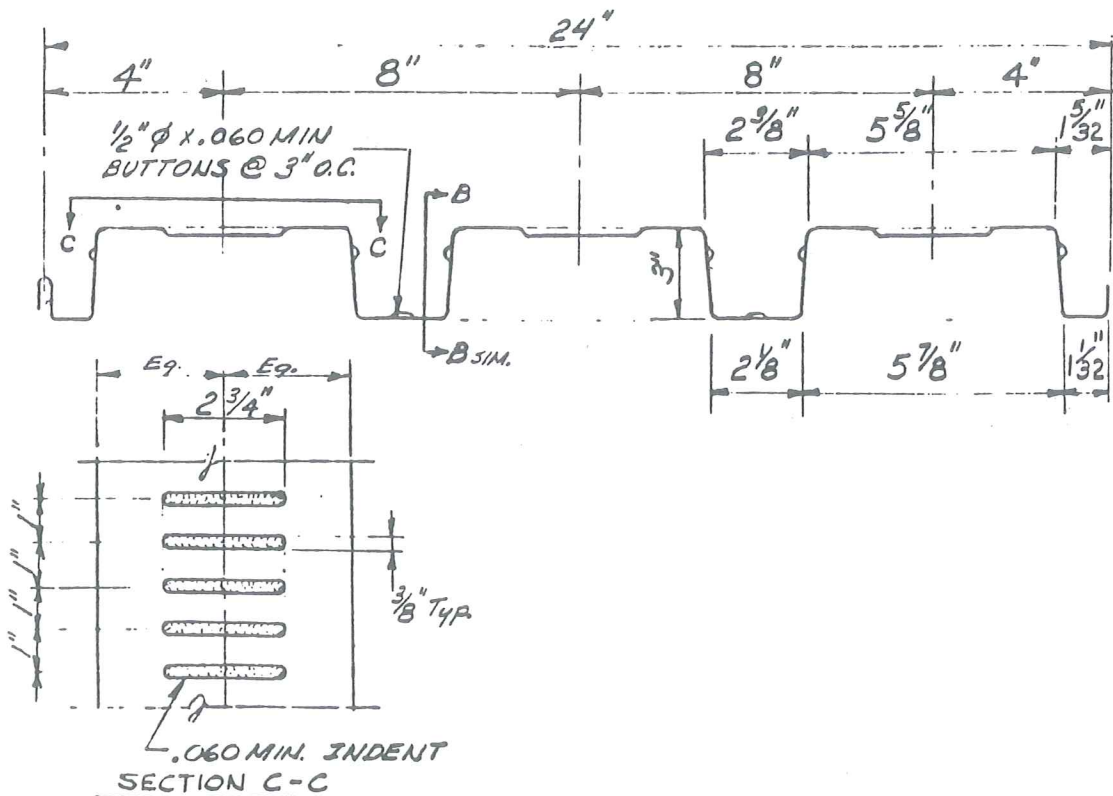


D = 4.5"  
= 6.0"  
= 7.5"  
= 8.0"

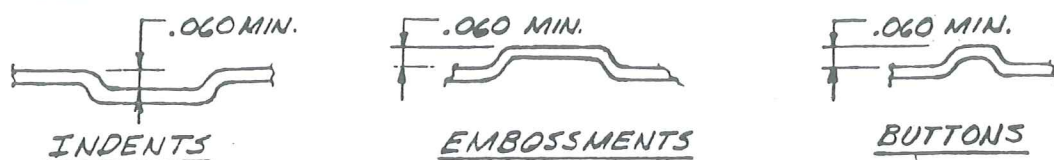




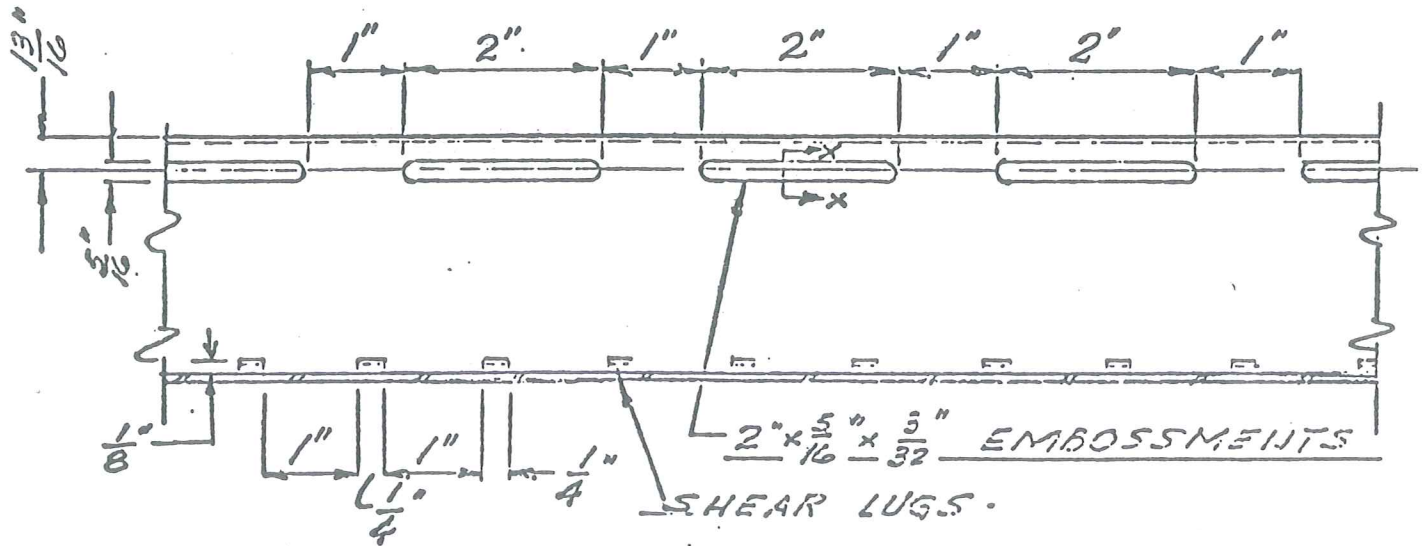
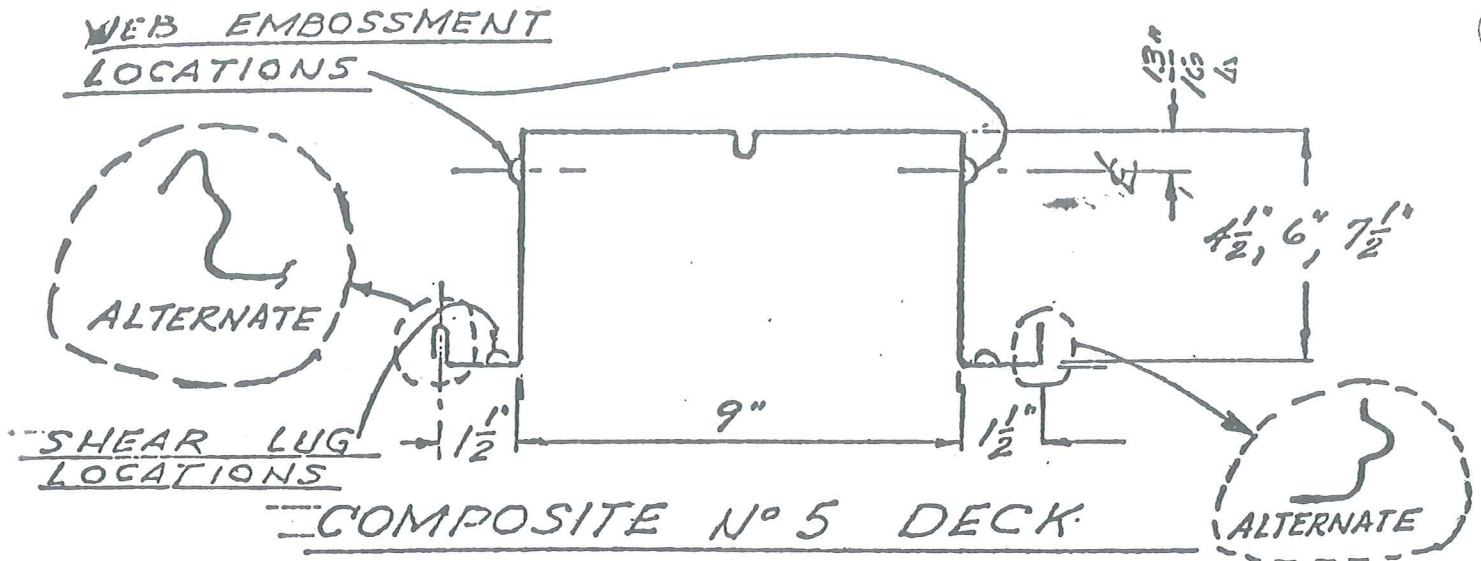
QL-3 & QL-UKX INDENTS, EMBOSSEMENTS & BUTTONS



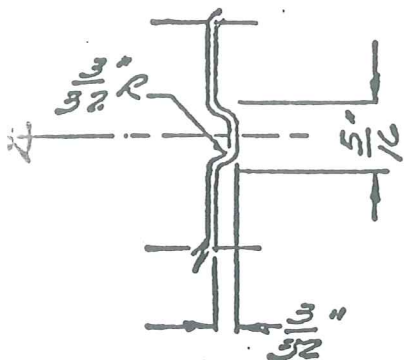
QL-21, QL-NKX INDENTS, EMBOSSEMENTS & BUTTONS







SIDE VIEW OF WEB SHOWING EMBOSSEMENTS & SHEAR LUGS



TYPICAL SECTION "X" THROUGH EMBOSSEMENT