

APPENDIX A - JOIST SUBSTITUTES K-SERIES

Joist substitutes are 2.5 inch (64 mm) deep sections intended for use in very short spans (less than 8 feet (2.4 m)) where Open Web Steel Joists are impractical. They are commonly specified to span over hallways and short spans in skewed bays.

Joist substitutes are fabricated from material conforming to Steel Joist Institute Specifications. Full lateral support to the compressive flange is provided by attachments to the deck. Caution must be exercised during erection since joist sub-

stitutes exhibit some degree of instability. After erection and before loads of any description are placed on the joist substitutes, the ends must be attached to the supports per SJI K-Series specifications and the deck installed and attached to the top flange.

Tables below list uniform loads based on **LRFD** and **ASD** methods of design and listed in U.S. Customary and Metric units:

LRFD

2.5 Inch K-Series Joist Substitutes			
Based on a Maximum Yield Strength of 50 ksi			
Designation	2.5K1	2.5K2	2.5K3
Span (ft-in)	Pounds per Linear Foot		
4'-0"	825	825	825
5'-0"	825 338	825 465	825
6'-0"	561 189	778.5 260	825 354
7'-0"	405 116	562.5 160	810 218
8'-0"	306 76	426 105	612 143

LRFD

64 mm K-Series Joist Substitute			
Based on a Maximum Yield Strength of 345 MPa			
Designation	2.5K1	2.5K2	2.5K3
Span (mm)	KiloNewtons per Meter (kN/m)		
1219	12.03	12.03	12.03
1524	12.03 4.93	12.03 6.78	12.03
1828	8.18 2.75	11.36 3.79	12.03 5.16
2133	5.91 1.69	8.21 2.33	11.82 3.18
2438	4.46 1.10	6.21 1.53	8.93 2.08

ASD

2.5 Inch K-Series Joist Substitutes			
Based on a Maximum Yield Strength of 50 ksi			
Designation	2.5K1	2.5K2	2.5K3
Span (ft-in)	Pounds per Linear Foot		
4'-0"	550	550	550
5'-0"	550 338	550 465	550
6'-0"	374 189	519 260	550 354
7'-0"	270 116	375 160	540 218
8'-0"	204 76	284 105	408 143

ASD

64 mm K-Series Joist Substitutes			
Based on a Maximum Yield Strength of 345 MPa			
Designation	2.5K1	2.5K2	2.5K3
Span (mm)	KiloNewtons per Meter (kN/m)		
1219	8.02	8.02	8.02
1524	8.02 4.93	8.02 6.78	8.02
1828	5.45 2.75	7.57 3.79	8.02 5.16
2133	3.94 1.69	5.47 2.33	7.88 3.18
2438	2.97 1.10	4.14 1.53	5.95 2.08

The figures shown in red are the uniform live loads which produce an approximate deflection of 1/360 of the span.





APPENDIX B - TOP CHORD EXTENSIONS AND EXTENDED ENDS, K-SERIES

Joist extensions are commonly furnished to support a variety of overhang conditions. The two types are pictured below. The first is the TOP CHORD EXTENSION or "S" TYPE, which has only the top chord angles extended. The second is the EXTENDED END or "R" TYPE in which the standard 2 1/2 in., (64 mm) end bearing depth is maintained over the entire length of the extension. The "S" TYPE extension is so designated because of its Simple nature whereas the "R" TYPE involves Reinforcing the top chord angles. The **specifying professional** should be aware that an "S" TYPE is more economical and should be specified whenever possible.

The following load tables for K-Series TOP CHORD EXTENSIONS and EXTENDED ENDS for LRFD and ASD methods of design and listed in U.S. Customary and Metric units, have been developed as an aid to the **specifying professional**. The black number in the tables is the maximum allowable uniform load in pounds per linear foot (kiloNewton/Meter). The red number is the uniform load which will produce an approximate deflection of L1/240, where L1 is the length of the extension. The load tables are

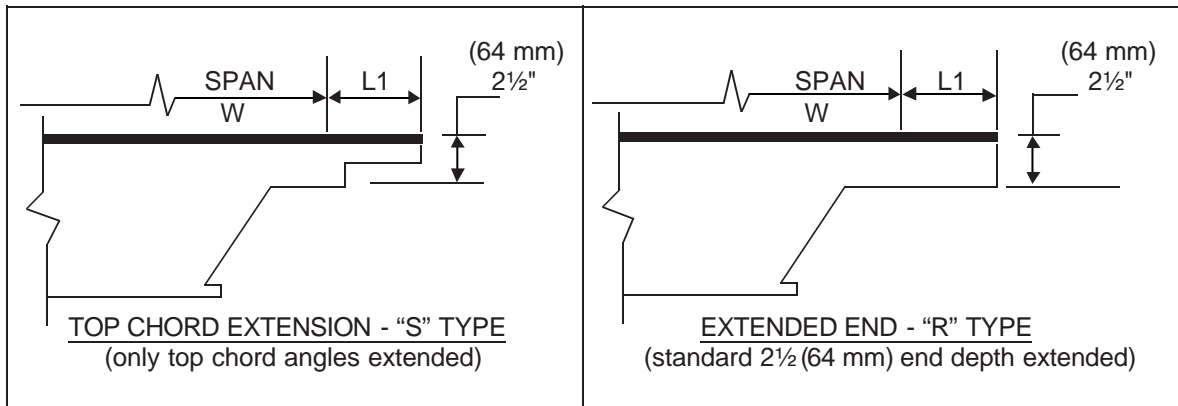
applicable for uniform loads only. If there are concentrated loads and/or non-uniform loads, a loading diagram must be provided by the **specifying professional** on the structural drawings. In cases where it is not possible to meet specific job requirements with a 2 1/2 in. (64 mm) deep "R" type extension (refer to "S" and "I" values in the Extended End Load Table), the depth of the extension must be increased to provide greater load-carrying capacity. If the loading diagram for any condition is not shown, the joist manufacturer will design the extension to support the uniform load indicated in the K-Series Joist Load Table for the span of the joist.

When TOP CHORD EXTENSIONS or EXTENDED ENDS are specified, the allowable deflection and the bracing requirements must be considered by the **specifying professional**.

It should be noted that an "R" TYPE extension must be specified when building details dictate a 2 1/2 in., (64 mm) depth at the end of the extension. In the absence of specific instructions, the joist manufacturer may provide either type.

TOP CHORD EXTENSION

EXTENDED END



- W = Uniform Load
- L1 = Length of Extension
- SPAN = See K-Series Load Table for definition of Span



LRFD

TOP CHORD EXTENSION LOAD TABLE (S TYPE)
Based on a Maximum Yield Strength of 50 ksi
Pounds per Linear Foot

TYPE	"S" (in. ³)	"I" (in. ⁴)	LENGTH (L1)										
			0'-6"	1'-0"	1'-6"	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"		
S1	0.099	0.088	825 550	544 363	267 127	157 58							
S2	0.127	0.138	825 550	700 422	343 200	202 91							
S3	0.144	0.156	825 550	793 550	388 226	229 104							
S4	0.160	0.172	825 550	825 550	432 249	255 113	168 60						
S5	0.176	0.188	825 550	825 550	474 272	280 124	184 66						
S6	0.192	0.204	825 550	825 550	517 295	306 134	202 72						
S7	0.241	0.306	825 550	825 550	649 443	384 201	253 108	180 64					
S8	0.266	0.332	825 550	825 550	717 481	424 219	280 117	198 70					
S9	0.288	0.358	825 550	825 550	777 519	459 236	303 126	214 75	160 48				
S10	0.380	0.544	825 550	825 550	825 550	606 359	400 192	283 115	211 74	163 50			
S11	0.438	0.622	825 550	825 550	825 550	699 410	460 220	327 131	243 84	189 57	150 41		
S12	0.494	0.696	825 550	825 550	825 550	789 459	520 246	369 147	274 94	213 64	169 45		

LRFD

TOP CHORD EXTENSION LOAD TABLE (R TYPE)
Based on a Maximum Yield Strength of 50 ksi
Pounds per Linear Foot

TYPE	"S" (in. ³)	"I" (in. ⁴)	LENGTH (L1)											
			0'-6"	1'-0"	1'-6"	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"	5'-6"	6'-0"
R1	0.895	1.119	825 550	825 550	825 550	825 550	825 396	669 236	498 152	385 103	307 73	250 54	208 41	175 32
R2	0.923	1.157	825 550	825 550	825 550	825 550	825 409	690 244	514 157	399 107	318 76	259 56	216 42	181 33
R3	1.039	1.299	825 550	825 550	825 550	825 550	825 459	777 274	579 176	448 120	358 85	292 63	243 47	205 37
R4	1.147	1.433	825 550	825 550	825 550	825 550	825 507	825 302	639 195	495 132	394 94	321 69	267 52	225 41
R5	1.249	1.561	825 550	825 550	825 550	825 550	825 550	825 329	696 212	538 144	429 103	349 75	291 57	246 44
R6	1.352	1.690	825 550	825 550	825 550	825 550	825 550	825 357	753 230	583 156	465 111	379 82	315 62	265 48
R7	1.422	1.802	825 550	825 550	825 550	825 550	825 550	825 380	792 245	613 167	489 119	399 87	331 66	279 51
R8	1.558	1.948	825 550	825 550	825 550	825 550	825 550	825 411	825 265	672 180	535 128	436 94	363 71	306 55
R9	1.673	2.091	825 550	825 550	825 550	825 550	825 550	825 442	825 284	721 194	576 138	469 101	390 77	328 59
R10	1.931	2.414	825 550	825 550	825 550	825 550	825 550	825 510	825 328	825 224	664 159	541 117	450 89	379 69
R11	2.183	2.729	825 550	825 550	825 550	825 550	825 550	825 550	825 371	825 253	751 180	612 132	508 100	430 78
R12	2.413	3.016	825 550	825 550	825 550	825 550	825 550	825 550	825 410	825 279	825 199	676 146	562 111	475 86



ASD

TOP CHORD EXTENSION LOAD TABLE (S TYPE)
Based on a Maximum Yield Strength of 50 ksi
Pounds per Linear Foot

TYPE	"S" (in. ³)	"I" (in. ⁴)	LENGTH (L1)									
			0'-6"	1'-0"	1'-6"	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	
S1	0.099	0.088	550	363	178	105						
			550	363	127	58						
S2	0.127	0.138	550	467	229	135						
			550	422	200	91						
S3	0.144	0.156	550	529	259	153						
			550	510	226	104						
S4	0.160	0.172	550	550	288	170	112					
			550	550	249	113	60					
S5	0.176	0.188	550	550	316	187	123					
			550	550	272	124	66					
S6	0.192	0.204	550	550	345	204	135					
			550	550	295	134	72					
S7	0.241	0.306	550	550	433	256	169	120				
			550	550	433	201	108	64				
S8	0.266	0.332	550	550	478	283	187	132				
			550	550	481	219	117	70				
S9	0.288	0.358	550	550	518	306	202	143	107			
			550	550	518	236	126	75	48			
S10	0.380	0.544	550	550	550	404	267	189	141	109		
			550	550	550	359	192	115	74	50		
S11	0.438	0.622	550	550	550	466	307	218	162	126	100	
			550	550	550	410	220	131	84	57	41	
S12	0.494	0.696	550	550	550	526	347	246	183	142	113	
			550	550	550	459	246	147	94	64	45	

ASD

TOP CHORD EXTENSION LOAD TABLE (R TYPE)
Based on a Maximum Yield Strength of 50 ksi
Pounds per Linear Foot

TYPE	"S" (in. ³)	"I" (in. ⁴)	LENGTH (L1)											
			0'-6"	1'-0"	1'-6"	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"	5'-6"	6'-0"
R1	0.895	1.119	550	550	550	550	550	446	332	257	205	167	139	117
			550	550	550	550	396	236	152	103	73	54	41	32
R2	0.923	1.157	550	550	550	550	550	460	343	266	212	173	144	121
			550	550	550	550	409	244	157	107	76	56	42	33
R3	1.039	1.299	550	550	550	550	550	518	386	299	239	195	162	137
			550	550	550	550	459	274	176	120	85	63	47	37
R4	1.147	1.433	550	550	550	550	550	550	426	330	263	214	178	150
			550	550	550	550	507	302	195	132	94	69	52	41
R5	1.249	1.561	550	550	550	550	550	550	464	359	286	233	194	164
			550	550	550	550	550	329	212	144	103	75	57	44
R6	1.352	1.690	550	550	550	550	550	550	502	389	310	253	210	177
			550	550	550	550	550	357	230	156	111	82	62	48
R7	1.422	1.802	550	550	550	550	550	550	528	409	326	266	221	186
			550	550	550	550	550	380	245	167	119	87	66	51
R8	1.558	1.948	550	550	550	550	550	550	550	448	357	291	242	204
			550	550	550	550	550	411	265	180	128	94	71	55
R9	1.673	2.091	550	550	550	550	550	550	550	481	384	313	260	219
			550	550	550	550	550	442	284	194	138	101	77	59
R10	1.931	2.414	550	550	550	550	550	550	550	550	443	361	300	253
			550	550	550	550	550	510	328	224	159	117	89	69
R11	2.183	2.729	550	550	550	550	550	550	550	550	501	408	339	287
			550	550	550	550	550	550	371	253	180	132	100	78
R12	2.413	3.016	550	550	550	550	550	550	550	550	550	451	375	317
			550	550	550	550	550	550	410	279	199	146	111	86



LRFD

TOP CHORD EXTENSION LOAD TABLE (S TYPE)											
Based on a Maximum Yield Strength of 345 MPa											
KiloNewtons per Meter (kN/m)											
TYPE	"S" (mm ³)	"I" (mm ⁴)	LENGTH (L1) in Millimeters								
			152	305	457	610	762	914	1067	1219	1372
S1	1622	36628	12.03 8.02	7.94 5.42	3.89 1.85	2.30 0.84					
S2	2081	57340	12.03 8.02	10.19 8.02	5.00 2.91	2.96 1.32					
S3	2359	64932	12.03 8.02	11.55 8.02	5.66 3.30	3.35 1.51					
S4	2622	71592	12.03 8.02	12.03 8.02	6.30 3.63	3.72 1.64	2.45 0.87				
S5	2884	78251	12.03 8.02	12.03 8.02	6.99 3.96	4.08 1.80	2.69 0.96				
S6	3146	84911	12.03 8.02	12.03 8.02	7.55 4.30	4.46 1.95	2.96 1.05				
S7	3949	127367	12.03 8.02	12.03 8.02	9.47 6.46	5.60 2.93	3.69 1.57	2.63 0.93			
S8	4359	138188	12.03 8.02	12.03 8.02	10.46 7.01	6.20 3.19	4.08 1.70	2.88 1.02			
S9	4719	149010	12.03 8.02	12.03 8.02	11.325 7.57	6.69 3.44	4.41 1.83	3.12 1.09	2.34 0.70		
S10	6227	226430	12.03 8.02	12.03 8.02	12.03 8.02	8.835 5.23	5.835 2.80	4.125 1.67	3.075 1.07	2.385 0.72	
S11	7177	258895	12.03 8.02	12.03 8.02	12.03 8.02	10.20 5.98	6.72 3.21	4.77 1.91	3.54 1.22	2.745 0.83	2.175 0.59
S12	8095	289697	12.03 8.02	12.03 8.02	12.03 8.02	11.505 6.69	7.59 3.59	5.385 2.14	4.005 1.37	3.105 0.93	2.46 0.65

LRFD

TOP CHORD EXTENSION LOAD TABLE (R TYPE)														
Based on a Maximum Yield Strength of 345 MPa														
KiloNewtons per Meter (kN/m)														
TYPE	"S" (mm ³)	"I" (mm ⁴)	LENGTH (L1) in Millimeters											
			152	305	457	610	762	914	1067	1219	1372	1524	1676	1829
R1	14666	465762	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 5.77	9.75 3.44	7.26 2.21	5.63 1.50	4.49 1.06	3.65 0.78	3.03 0.59	2.55 0.46
R2	15174	481579	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 5.96	10.10 3.56	7.53 2.29	5.82 1.56	4.64 1.10	3.78 0.81	3.15 0.61	2.66 0.48
R3	17026	540684	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 6.69	11.34 3.99	8.45 2.56	6.54 1.75	5.21 1.24	4.25 0.91	3.53 0.68	2.97 0.53
R4	18796	596459	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 7.39	12.03 4.40	9.36 2.84	7.22 1.92	5.75 1.37	4.68 1.00	3.89 0.75	3.27 0.59
R5	20467	649763	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 4.80	10.16 3.09	7.85 2.10	6.26 1.50	5.10 1.09	4.25 0.83	3.59 0.64
R6	22155	703430	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 5.21	10.98 3.35	8.51 2.27	6.78 1.61	5.54 1.19	4.59 0.90	3.87 0.70
R7	23300	750048	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 5.54	11.55 3.57	8.94 2.43	7.13 1.73	5.82 1.26	4.83 0.96	4.07 0.74
R8	25531	810818	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 5.99	12.03 3.86	9.80 2.62	7.82 1.86	6.36 1.37	5.30 1.03	4.46 0.80
R9	27415	870339	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 6.45	12.03 4.14	10.52 2.83	8.40 2.01	6.84 1.47	5.69 1.12	4.79 0.86
R10	31643	1E+06	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 7.44	12.03 4.76	12.03 3.26	12.03 2.32	9.69 1.70	7.89 1.29	6.56 1.00
R11	35773	1E+06	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 5.41	12.03 3.69	12.03 2.62	10.97 1.92	8.93 1.45	7.41 1.13
R12	39542	1E+06	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 8.02	12.03 5.98	12.03 4.07	12.03 2.90	12.03 2.13	9.87 1.61	8.21 1.25



ASD

TOP CHORD EXTENSION LOAD TABLE (S TYPE)												
Based on a Maximum Yield Strength of 345 MPa KiloNewtons per Meter (kN/m)												
TYPE	"S" (mm ³)	"I" (mm ⁴)	LENGTH (L1) in Millimeters									
			152	305	457	610	762	914	1067	1219	1372	
S1	1622	36628	8.02	5.29	2.59	1.53						
			8.02	5.42	1.85	0.84						
S2	2081	57340	8.02	6.79	3.33	1.97						
			8.02	8.02	2.91	1.32						
S3	2359	64932	8.02	7.70	3.77	2.23						
			8.02	8.02	3.30	1.51						
S4	2622	71592	8.02	8.02	4.20	2.48	1.63					
			8.02	8.02	3.63	1.64	0.87					
S5	2884	78251	8.02	8.02	4.61	2.72	1.79					
			8.02	8.02	3.96	1.80	0.96					
S6	3146	84911	8.02	8.02	5.03	2.97	1.97					
			8.02	8.02	4.30	1.95	1.05					
S7	3949	127367	8.02	8.02	6.31	3.73	2.46	1.75				
			8.02	8.02	6.46	2.93	1.57	0.93				
S8	4359	138188	8.02	8.02	6.97	4.13	2.72	1.92				
			8.02	8.02	7.01	3.19	1.70	1.02				
S9	4719	149010	8.02	8.02	7.55	4.46	2.94	2.08	1.56			
			8.02	8.02	7.57	3.44	1.83	1.09	0.70			
S10	6227	226430	8.02	8.02	8.02	5.89	3.89	2.75	2.05	1.59		
			8.02	8.02	8.02	5.23	2.80	1.67	1.07	0.72		
S11	7177	258895	8.02	8.02	8.02	6.80	4.48	3.18	2.36	1.83	1.45	
			8.02	8.02	8.02	5.98	3.21	1.91	1.22	0.83	0.59	
S12	8095	289697	8.02	8.02	8.02	7.67	5.06	3.59	2.67	2.07	1.64	
			8.02	8.02	8.02	6.69	3.59	2.14	1.37	0.93	0.65	

ASD

TOP CHORD EXTENSION LOAD TABLE (R TYPE)														
Based on a Maximum Yield Strength of 345 MPa KiloNewtons per Meter (kN/m)														
TYPE	"S" (mm ³)	"I" (mm ⁴)	LENGTH (L1) in Millimeters											
			152	305	457	610	762	914	1067	1219	1372	1524	1676	1829
R1	14666	465762	8.02	8.02	8.02	8.02	8.02	6.50	4.84	3.75	2.99	2.43	2.02	1.70
			8.02	8.02	8.02	8.02	5.77	3.44	2.21	1.50	1.06	0.78	0.59	0.46
R2	15174	481579	8.02	8.02	8.02	8.02	8.02	6.73	5.02	3.88	3.09	2.52	2.10	1.77
			8.02	8.02	8.02	8.02	5.96	3.56	2.29	1.56	1.10	0.81	0.61	0.48
R3	17026	540684	8.02	8.02	8.02	8.02	8.02	7.56	5.63	4.36	3.47	2.83	2.35	1.98
			8.02	8.02	8.02	8.02	6.69	3.99	2.56	1.75	1.24	0.91	0.68	0.53
R4	18796	596459	8.02	8.02	8.02	8.02	8.02	8.02	6.24	4.81	3.83	3.12	2.59	2.18
			8.02	8.02	8.02	8.02	7.39	4.40	2.84	1.92	1.37	1.00	0.75	0.59
R5	20467	649763	8.02	8.02	8.02	8.02	8.02	8.02	6.77	5.23	4.17	3.40	2.83	2.39
			8.02	8.02	8.02	8.02	8.02	4.80	3.09	2.10	1.50	1.09	0.83	0.64
R6	22155	703430	8.02	8.02	8.02	8.02	8.02	8.02	7.32	5.67	4.52	3.69	3.06	2.58
			8.02	8.02	8.02	8.02	8.02	5.21	3.35	2.27	1.61	1.19	0.90	0.70
R7	23300	750048	8.02	8.02	8.02	8.02	8.02	8.02	7.70	5.96	4.75	3.88	3.22	2.71
			8.02	8.02	8.02	8.02	8.02	5.54	3.57	2.43	1.73	1.26	0.96	0.74
R8	25531	810818	8.02	8.02	8.02	8.02	8.02	8.02	8.02	6.53	5.21	4.24	3.53	2.97
			8.02	8.02	8.02	8.02	8.02	5.99	3.86	2.62	1.86	1.37	1.03	0.80
R9	27415	870339	8.02	8.02	8.02	8.02	8.02	8.02	8.02	7.01	5.60	4.56	3.79	3.19
			8.02	8.02	8.02	8.02	8.02	6.45	4.14	2.83	2.01	1.47	1.12	0.86
R10	31643	1004782	8.02	8.02	8.02	8.02	8.02	8.02	8.02	8.02	6.46	5.26	4.37	3.69
			8.02	8.02	8.02	8.02	8.02	7.44	4.78	3.26	2.32	1.70	1.29	1.00
R11	35773	1135894	8.02	8.02	8.02	8.02	8.02	8.02	8.02	8.02	7.31	5.95	4.94	4.18
			8.02	8.02	8.02	8.02	8.02	8.02	5.41	3.69	2.62	1.92	1.45	1.13
R12	39542	1255353	8.02	8.02	8.02	8.02	8.02	8.02	8.02	8.02	8.02	6.58	5.47	4.62
			8.02	8.02	8.02	8.02	8.02	8.02	5.98	4.07	2.90	2.13	1.61	1.25





APPENDIX C - ECONOMY TABLES

K-SERIES

The tables on the following pages are provided as an aid to the designer in selecting the most economical K-Series Joists for the loads and spans required. Although considerable care has been taken in developing this chart, it must be realized that each joist manufacturer has their own unique cost; consequently, the Steel Joist Institute cannot guarantee the accuracy of this Table.

The K-Series Joists are arranged in accordance with their weight per foot; where two or more joists weigh the same, they are arranged according to their depth.

To utilize these tables, determine the span (ft) and load (plf) required; go to the required span in the left hand column, then read across until a load equal to or greater than the required load is reached. The first joist that satisfies this loading is the most economical joist for those conditions. If this joist is too deep or too shallow, or does not satisfy the deflection limitations, continue on horizontally to the right until a joist is found that satisfies the depth requirements as well as the load and deflection requirements.

ASD EXAMPLE:

Floor joists @ 2'-6" on center, supporting a structural concrete slab. (Section 5.9 of the K-Series Specifications limits the deflection due to the design live load to 1/360 of the span).

Span = 30'- 0"

Maximum joist depth allowed = 20"

DL = 48 psf (includes joist weight)

LL = 100 psf

TL = 148 psf

$$W_{TL} = 148 \times 2.5 = 370 \text{ plf}$$

$$W_{LL} = 100 \times 2.5 = 250 \text{ plf}$$

A 22K6 at a span of 30 feet can carry 371 plf of Total Load and possesses a Live Load deflection figure of 266 plf. However, it exceeds the maximum depth limitation of 20 inches. A 20K7 fulfills the Total Load requirement but possesses a Live Load deflection figure of only 242 plf. It is then found that a 20K9 is the most economical joist that satisfies all the requirements of Total Load, Live Load deflection, and maximum depth limitation.

Where the joist span exceeds the unshaded area of the table, the row of bridging nearest the midspan shall be diagonal bridging with bolted connections at chords and midspan.

LRFD EXAMPLE:

Floor joists @ 2'-6" on center, supporting a structural concrete slab. (Section 5.9 of the K-Series Specifications limits the deflection due to the design live load to 1/360 of the span).

Span = 30'- 0"

Load factors per ASCE 7, "Minimum Design Loads for Buildings and Other Structures"

Maximum joist depth allowed = 20"

Factored DL = $48 \times 1.2 = 58$ psf (includes joist weight)

Factored LL = $100 \times 1.6 = 160$ psf

Factored TL = 218 psf

$$\text{Factored } W_{TL} = 218 \times 2.5 = 545 \text{ plf}$$

$$W_{LL} = 100 \times 2.5 = 250 \text{ plf}$$

A 22K6 at a span of 30 feet can carry 566 plf of Factored Total Load and possesses a Live Load deflection figure of 266 plf. However, it exceeds the maximum depth limitation of 20 inches. A 20K7 fulfills the Factored Total Load requirement but possesses a Live Load deflection figure of only 242 plf. It is then found that a 20K9 is the most economical joist that satisfies all the requirements of Factored Total Load, Live Load deflection, and maximum depth limitation.

Where the joist span exceeds the unshaded area of the table, the row of bridging nearest the midspan shall be diagonal bridging with bolted connections at chords and midspan.



LRFD

ECONOMY TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	10K1	12K1	8K1	14K1	16K2	12K3	14K3	16K3	18K3	14K4	20K3	16K4	12K5	18K4	16K5	20K4
Depth (In.)	10	12	8	14	16	12	14	16	18	14	20	16	12	18	16	20
Approx. Wt. (lbs/ft.)	5.0	5.0	5.1	5.2	5.5	5.7	6.0	6.3	6.6	6.7	6.7	7.0	7.1	7.2	7.5	7.6
Span (ft.)																
8			825 550													
9			825 550													
10	825 550		825 480													
11	825 542		798 377													
12	825 455	825 550	666 288			825 550							825 550			
13	718 363	825 510	565 225			825 510							825 510			
14	618 289	750 425	486 179	825 550		825 463	825 550			825 550			825 463			
15	537 234	651 344	421 145	766 475		814 428	825 507			825 507			825 434			
16	469 192	570 282	369 119	672 390	825 550	714 351	825 467	825 550		825 467		825 550	825 396		550 550	
17	415 159	504 234		592 324	768 488	630 291	742 404	825 526		825 443		825 526	825 366		550 526	
18	369 134	448 197		528 272	684 409	561 245	661 339	762 456	825 550	795 397		825 490	760 317	825 550	825 490	
19	331 113	402 167		472 230	612 347	502 207	592 287	682 386	771 494	712 336		820 452	681 269	825 523	825 455	
20	298 97	361 142		426 197	552 297	453 177	534 246	615 330	694 423	642 287	775 517	739 386	613 230	825 490	825 426	825 550
21		327 123		385 170	499 255	409 153	483 212	556 285	630 364	582 248	702 453	670 333	555 198	759 426	754 373	825 520
22		298 106		351 147	454 222	373 132	439 184	505 247	573 316	529 215	639 393	609 289	505 172	690 370	687 323	771 461
23		271 93		321 128	415 194	340 116	402 160	462 216	523 276	483 188	583 344	556 252	462 150	630 323	627 282	703 402
24		249 81		294 113	381 170	312 101	367 141	424 189	480 242	442 165	535 302	510 221	423 132	577 284	576 248	645 353
25				270 100	351 150		339 124	390 167	441 214	408 145	493 266	469 195		532 250	529 219	594 312
26				249 88	324 133		313 110	360 148	408 190	376 129	456 236	433 173		492 222	489 194	549 277
27				231 79	300 119		289 98	334 132	378 169	349 115	421 211	402 155		454 198	453 173	508 247
28				214 70	279 106		270 88	310 118	351 151	324 103	391 189	373 138		423 177	421 155	472 221
29					259 95			289 106	327 136		243 170	232 124		394 159	391 139	439 199
30					241 86			270 96	304 123		227 153	216 112		367 144	366 126	411 179
31					226 78			252 87	285 111		212 138	203 101		343 130	342 114	384 162
32					213 71			237 79	267 101		199 126	190 92		322 118	321 103	360 147
33									252 92		187 114			303 108		339 134
34									237 84		176 105			285 98		318 122
35									223 77		166 96			268 90		300 112
36									211 70		157 88			253 82		283 103
37											148 81					268 95
38											141 74					255 87
39											133 69					241 81
40											127 64					229 75



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ECONOMY TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	14K6	18K5	22K4	16K6	20K5	24K4	18K6	16K7	22K5	20K6	18K7	22K6	20K7	24K5	22K7	24K6
Depth (In.)	14	18	22	16	20	24	18	16	22	20	18	22	20	24	22	24
Approx. Wt. (lbs/ft.)	7.7	7.7	8.0	8.1	8.2	8.4	8.5	8.6	8.8	8.9	9.0	9.2	9.3	9.3	9.7	9.7
Span (ft.)																
14	825 550															
15	825 507															
16	825 467			825 550				825 550								
17	825 443			825 526				825 526								
18	825 408	825 550		825 490			825 550	825 490			825 550					
19	825 383	825 523		825 455			825 523	825 455			825 523					
20	787 347	825 490		825 426	825 550		825 490	825 426		825 550	825 490		825 550			
21	712 299	825 460		822 405	825 520		825 460	825 406		825 520	825 460		825 520			
22	648 259	777 414	825 548	747 351	825 490		825 438	825 385	825 548	825 490	825 438	825 548	825 490		825 548	
23	592 226	709 362	777 491	682 307	793 451		774 393	760 339	825 518	825 468	825 418	825 518	825 468		825 518	
24	543 199	651 318	712 431	627 269	727 396	780 516	709 345	697 298	804 483	792 430	789 382	825 495	825 448	825 544	825 495	825 544
25	501 175	600 281	657 381	576 238	669 350	718 456	652 305	642 263	739 427	729 380	727 337	805 464	811 421	810 511	825 474	825 520
26	462 156	553 249	606 338	532 211	618 310	663 405	603 271	592 233	682 379	673 337	672 299	744 411	750 373	748 453	825 454	814 493
27	427 139	513 222	561 301	493 188	573 277	615 361	558 241	549 208	633 337	624 301	622 267	688 367	694 333	693 404	768 406	754 439
28	397 124	477 199	522 270	459 168	532 248	571 323	519 216	510 186	588 302	579 269	577 239	640 328	645 298	643 362	712 364	700 393
29		444 179	486 242	427 151	495 223	531 290	483 194	475 167	547 272	540 242	538 215	597 295	601 268	600 325	664 327	652 354
30		414 161	453 219	399 137	462 201	496 262	451 175	444 151	511 245	504 218	502 194	556 266	561 242	559 293	619 295	609 319
31		387 146	424 198	373 124	433 182	465 237	421 158	415 137	478 222	471 198	469 175	520 241	525 219	523 266	580 267	570 289
32		363 132	397 180	349 112	406 165	435 215	396 144	388 124	448 201	442 179	441 159	489 219	492 199	490 241	544 242	535 262
33		342 121	373 164		254 150	273 196	248 131		421 183	415 163	414 145	459 199	463 181	462 220	511 221	502 239
34		321 110	352 149		358 137	257 179	233 120		397 167	391 149	390 132	432 182	435 165	435 201	481 202	472 218
35		303 101	331 137		339 126	363 164	330 110		373 153	369 137	367 121	408 167	411 151	409 184	454 185	445 200
36		286 92	313 126		319 115	343 150	312 101		354 141	348 125	348 111	385 153	388 139	387 169	429 169	421 183
37			297 116		303 106	324 138			334 130	330 115		364 141	367 128	366 155	406 156	399 169
38			280 107		286 98	307 128			316 119	312 106		345 130	348 118	346 143	384 144	378 156
39			267 98		271 90	292 118			300 110	297 98		327 120	330 109	328 132	364 133	358 144
40			253 91		258 84	277 109			285 102	282 91		310 111	313 101	312 122	346 123	340 133
41			241 85			264 101			271 95			295 103		297 114	330 114	324 124
42			229 79			252 94			259 88			282 96		283 106	313 106	309 115
43			219 73			240 88			247 82			268 89		270 98	300 99	294 107
44			208 68			229 82			235 76			256 83		258 92	286 92	280 100
45						219 76								246 86		268 93
46						208 71								235 80		256 87
47						199 67								225 75		246 82
48						192 63								216 70		235 77



LRFD

ECONOMY TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	26K5	16K9	24K7	18K9	26K6	20K9	26K7	22K9	28K6	24K8	18K10	28K7	24K9	26K8	20K10	26K9
Depth (In.)	26	16	24	18	26	20	26	22	28	24	18	28	24	26	20	26
Approx. Wt (lbs/ft.)	9.8	10	10.1	10.2	10.6	10.8	10.9	11.3	11.4	11.5	11.7	11.8	12	12.1	12.2	12.2
Span (ft.)																
16		825 550														
17		825 526														
18		825 490		825 550							825 550					
19		825 455		825 523							825 523					
20		825 426		825 490		825 550					825 490				825 550	
21		825 406		825 460		825 520					825 460				825 520	
22		825 385		825 438		825 490		825 548			825 438				825 490	
23		825 363		825 418		825 468		825 518			825 418				825 468	
24		825 346	825 344	825 396		825 448		825 495		825 544	825 396		825 344		825 448	
25		771 311	825 377	825 377		825 425		825 474		825 520	825 377		825 377		825 425	
26	813 535	711 276	825 499	807 354	825 541	825 405	825 541	825 454		825 499	825 361		825 499	825 541	825 405	825 541
27	753 477	658 246	825 479	747 315	820 519	825 389	825 522	825 432		825 479	825 347		825 479	825 522	825 389	825 522
28	699 427	612 220	781 436	694 282	762 464	775 353	825 501	825 413	822 541	825 456	822 331	825 543	825 456	825 501	825 375	825 501
29	651 384	570 198	727 392	646 254	709 417	723 317	790 463	798 387	766 486	804 429	766 298	825 522	825 436	825 479	825 359	825 479
30	607 346	532 178	679 353	603 229	661 377	675 286	738 417	745 349	715 439	750 387	715 269	796 486	816 419	816 457	799 336	825 459
31	568 314	498 161	636 320	564 207	619 341	631 259	690 378	697 316	669 397	702 350	669 243	745 440	765 379	763 413	748 304	825 444
32	534 285	466 147	595 290	529 188	580 309	592 235	648 343	654 287	627 361	658 318	627 221	699 400	717 344	715 375	702 276	778 407
33	501 259		559 265	498 171	546 282	556 214	609 312	615 261	589 329	589 289	589 201	657 364	673 313	672 342	660 251	732 370
34	472 237		526 242	468 156	514 257	523 195	573 285	579 239	555 300	582 264	555 184	618 333	634 286	633 312	621 229	688 338
35	445 217		496 221	441 143	484 236	493 179	540 261	546 219	523 275	549 242	523 168	583 305	598 262	597 286	585 210	649 310
36	420 199		469 203	417 132	457 216	466 164	510 240	516 201	495 252	519 222	495 154	550 280	565 241	564 263	553 193	613 284
37	397 183		444 187		433 199	441 151	483 221	487 185	468 232	490 205		522 257	534 222	534 242	523 178	580 262
38	376 169		421 172		411 184	418 139	457 204	462 170	444 214	465 189		493 237	507 204	505 223	496 164	550 241
39	357 156		399 159		390 170	397 129	433 188	438 157	420 198	441 174		469 219	480 189	480 206	471 151	522 223
40	340 145		379 149		370 157	376 119	412 174	417 146	399 183	420 161		445 203	456 175	456 191	447 140	496 207
41	322 134		361 137		352 146		393 162	396 135	379 170	399 150		424 189	435 162	433 177		472 192
42	307 125		343 127		336 136		373 150	378 126	361 158	379 139		403 175	414 151	412 164		450 178
43	294 116		328 118		319 126		357 140	360 117	345 147	363 130		385 163	394 140	394 153		429 166
44	280 108		313 110		306 118		340 131	343 109	330 137	346 121		367 152	376 131	376 143		409 155
45	268 101		298 103		291 110		325 122		315 128	330 113		351 142	360 122	360 133		391 145
46	256 95		286 97		279 103		310 114		301 120	316 106		336 133	345 114	343 125		375 135
47	246 89		274 90		267 96		298 107		288 112	303 99		321 125	330 107	328 117		358 127
48	235 83		262 85		256 90		285 100		276 105	291 93		309 117	316 101	315 110		343 119
49	225 78				246 85		274 94		265 99			295 110		303 103		330 112
50	216 73				235 80		262 89		255 93			283 103		291 97		316 105
51	208 69				226 75		252 83		244 88			273 97		279 91		304 99
52	199 65				217 71		243 79		235 83			262 92		268 86		292 93
53									226 78			252 87				
54									217 74			243 82				
55									210 70			234 77				
56									202 66			226 73				



LRFD

ECONOMY TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	30K7	22K10	28K8	28K9	24K10	30K8	30K9	22K11	26K10	28K10	30K10	24K12	30K11	26K12	28K12	30K12
Depth (In.)	30	22	28	28	24	30	30	22	26	28	30	24	30	26	28	30
Approx. Wt. (lbs/ft.)	12.3	12.6	12.7	13	13.1	13.2	13.4	13.8	13.8	14.3	15	16	16.4	16.6	17.1	17.6
Span (ft.)																
22		825 548						825 548								
23		825 518						825 518								
24		825 495			825 544			825 495				825 544				
25		825 474			825 520			825 474				825 520				
26		825 454			825 499			825 454	825 541			825 499		825 541		
27		825 432			825 479			825 432	825 522			825 479		825 522		
28		825 413	825 543	825 543	825 456			825 413	825 501	825 543		825 456		825 501	825 543	
29		825 399	825 522	825 522	825 436			825 399	825 479	825 522		825 436		825 479	825 522	
30	825 543	825 385	825 500	825 500	825 422	825 543	825 543	825 385	825 459	825 500	825 543	825 422	825 543	825 459	825 500	825 543
31	801 508	825 369	825 480	825 480	825 410	825 520	825 520	825 369	825 444	825 480	825 520	825 410	825 520	825 444	825 480	825 520
32	751 461	775 337	772 438	823 463	823 393	823 500	823 500	823 355	823 431	823 463	823 500	823 393	823 500	823 431	823 463	823 500
33	706 420	729 307	726 399	790 432	798 368	780 460	798 468	798 334	798 404	798 435	798 468	798 368	798 468	798 404	798 435	798 468
34	664 384	687 280	684 364	744 395	753 337	735 420	774 441	774 314	774 378	774 410	774 441	774 344	774 441	774 378	774 410	774 441
35	627 351	648 257	645 333	702 361	709 308	693 384	751 415	741 292	751 356	751 389	751 415	751 324	751 415	751 356	751 389	751 415
36	592 323	612 236	609 306	663 332	670 283	654 353	712 383	700 269	729 334	730 366	730 392	730 306	730 392	730 334	730 366	730 392
37	559 297	579 217	576 282	627 305	634 260	619 325	673 352	663 247	690 308	711 344	711 374	711 290	711 374	711 315	711 344	711 374
38	531 274	549 200	546 260	594 282	601 240	586 300	639 325	628 228	654 284	691 325	691 353	691 275	691 353	691 299	691 325	691 353
39	504 253	520 185	519 240	564 260	570 222	556 277	606 300	595 211	619 262	670 306	673 333	673 261	673 333	673 283	673 308	673 333
40	478 234	495 171	492 222	535 241	541 206	529 256	576 278	565 195	589 243	636 284	657 315	657 247	657 315	657 269	657 291	657 315
41	454 217	471 159	468 206	510 224	516 191	502 238	547 258	538 181	561 225	606 263	640 300	640 235	640 300	640 256	640 277	640 300
42	433 202	448 148	445 192	486 208	490 177	480 221	522 240	513 168	534 210	576 245	619 282	625 224	625 284	625 244	625 264	625 284
43	414 188	427 138	426 179	463 194	468 165	457 206	498 223	489 157	508 195	550 228	591 263	609 213	610 270	610 232	610 252	610 270
44	394 176	408 128	406 167	442 181	447 154	436 192	475 208	466 146	486 182	525 212	564 245	580 199	597 258	597 222	597 240	597 258
45	376 164		388 156	423 169	427 144	417 179	454 195		465 170	501 198	538 229	555 185	583 246	583 212	583 229	583 246
46	361 153		372 146	405 158	408 135	399 168	435 182		444 159	480 186	516 214	531 174	570 236	570 203	570 219	570 236
47	345 144		355 136	387 148	391 126	382 157	415 171		426 149	459 174	493 201	508 163	558 226	553 192	558 210	558 226
48	331 135		340 128	370 139	375 118	366 148	399 160		408 140	441 163	472 188	487 153	543 215	529 180	547 201	547 216
49	318 127		327 120	355 130		351 139	382 150		391 131	423 153	454 177		520 202	508 169	535 193	535 207
50	304 119		313 113	342 123		337 130	367 141		375 124	405 144	436 166		499 190	487 159	525 185	525 199
51	292 112		301 106	328 115		324 123	352 133		361 116	390 136	418 157		480 179	469 150	507 175	514 192
52	282 106		289 100	315 109		312 116	339 126		346 110	375 128	402 148		462 169	451 142	487 165	504 184
53	271 100		279 95	304 103		300 109	327 119			360 121	387 140		444 159		469 156	495 177
54	261 94		268 89	292 97		288 103	313 112			348 114	373 132		427 150		451 147	486 170
55	252 89		259 85	282 92		277 98	303 106			334 108	360 125		412 142		435 139	468 161
56	243 84		249 80	271 87		268 92	292 100			322 102	346 118		397 135		420 132	451 153
57	234 80					259 88	282 95				334 112		384 128			435 145
58	226 76					250 83	271 90				322 106		370 121			420 137
59	219 72					241 79	262 86				312 101		358 115			406 130
60	211 69					234 75	253 81				301 96		346 109			393 124



ASD

ECONOMY TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	10K1	12K1	8K1	14K1	16K2	12K3	14K3	16K3	18K3	14K4	20K3	16K4	12K5	18K4	16K5	20K4
Depth (In.)	10	12	8	14	16	12	14	16	18	14	20	16	12	18	16	20
Approx. Wt. (lbs/ft.)	5.0	5.0	5.1	5.2	5.5	5.7	6.0	6.3	6.6	6.7	6.7	7.0	7.1	7.2	7.5	7.6
Span (ft.)																
8			550 550													
9			550 550													
10	550 550		550 480													
11	550 542		532 377													
12	550 455	550 550	444 288			550 550							550 550			
13	479 363	550 510	377 225			550 510							550 510			
14	412 289	500 425	324 179	550 550		550 463	550 550			550 550			550 463			
15	358 234	434 344	281 145	511 475		543 428	550 507			550 507			550 434			
16	313 192	380 282	246 119	448 390	550 550	476 351	550 467	550 550		550 467		550 550	550 396		550 550	
17	277 159	336 234		395 324	512 488	420 291	495 404	550 526		550 443		550 526	550 366		550 526	
18	246 134	299 197		352 272	456 409	374 245	441 339	508 456	550 550	530 397		550 490	507 317	550 550	550 490	
19	221 113	268 167		315 230	408 347	335 207	395 287	455 386	514 494	475 336		547 452	454 269	550 523	550 455	
20	199 97	241 142		284 197	368 297	302 177	356 246	410 330	463 423	428 287	517 517	493 386	409 230	550 490	550 426	550 550
21		218 123		257 170	333 255	273 153	322 212	371 285	420 364	388 248	468 453	447 333	370 198	506 426	503 373	550 520
22		199 106		234 147	303 222	249 132	293 184	337 247	382 316	353 215	426 393	406 289	337 172	460 370	458 323	514 461
23		181 93		214 128	277 194	227 116	268 160	308 216	349 276	322 188	389 344	371 252	308 150	420 323	418 282	469 402
24		166 81		196 113	254 170	208 101	245 141	283 189	320 242	295 165	357 302	340 221	282 132	385 284	384 248	430 353
25				180 100	234 150		226 124	260 167	294 214	272 145	329 266	313 195		355 250	353 219	396 312
26				166 88	216 133		209 110	240 148	272 190	251 129	304 236	289 173		328 222	326 194	366 277
27				154 79	200 119		193 98	223 132	252 169	233 115	281 211	268 155		303 198	302 173	339 247
28				143 70	186 106		180 88	207 118	234 151	216 103	261 189	249 138		282 177	281 155	315 221
29					173 95			193 106	218 136		243 170	232 124		263 159	261 139	293 199
30					161 86			180 96	203 123		227 153	216 112		245 144	244 126	274 179
31					151 78			168 87	190 111		212 138	203 101		229 130	228 114	256 162
32					142 71			158 79	178 101		199 126	190 92		215 118	214 103	240 147
33									168 92		187 114			202 108		226 134
34									158 84		176 105			190 98		212 122
35									149 77		166 96			179 90		200 112
36									141 70		157 88			169 82		189 103
37											148 81					179 95
38											141 74					170 87
39											133 69					161 81
40											127 64					153 75



ASD

ECONOMY TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	14K6	18K5	22K4	16K6	20K5	24K4	18K6	16K7	22K5	20K6	18K7	22K6	20K7	24K5	22K7	24K6
Depth (In.)	14	18	22	16	20	24	18	16	22	20	18	22	20	24	22	24
Approx. Wt. (lbs/ft.)	7.7	7.7	8.0	8.1	8.2	8.4	8.5	8.6	8.8	8.9	9.0	9.2	9.3	9.3	9.7	9.7
Span (ft.)																
14	550															
	550															
	507															
16	550			550				550								
	467			550				550								
17	550			550				550								
	443			526				526								
18	550	550		550			550	550			550					
	408	550		490			550	490			550					
19	550	550		550			550	550			550					
	383	523		455			523	455			523					
20	525	550		550	550		550	550		550	550		550			
	347	490		426	550		490	426		550	490		550			
21	475	550		548	550		550	550		550	550		550			
	299	460		405	520		460	406		520	460		520			
22	432	518	550	498	550		550	550	550	550	550	550	550		550	
	259	414	548	351	490		438	385	548	490	438	548	490		548	
23	395	473	518	455	529		516	507	550	550	550	550	550		550	
	226	362	491	307	451		393	339	518	468	418	518	468		518	
24	362	434	475	418	485	520	473	465	536	528	526	550	550	550	550	550
	199	318	431	269	396	516	345	298	483	430	382	495	448	544	495	544
25	334	400	438	384	446	479	435	428	493	486	485	537	541	540	550	550
	175	281	381	238	350	456	305	263	427	380	337	464	421	511	474	520
26	308	369	404	355	412	442	402	395	455	449	448	496	500	499	550	543
	156	249	338	211	310	405	271	233	379	337	299	411	373	453	454	493
27	285	342	374	329	382	410	372	366	422	416	415	459	463	462	512	503
	139	222	301	188	277	361	241	208	337	301	267	367	333	404	406	439
28	265	318	348	306	355	381	346	340	392	386	385	427	430	429	475	467
	124	199	270	168	248	323	216	186	302	269	239	328	298	362	364	393
29		296	324	285	330	354	322	317	365	360	359	398	401	400	443	435
		179	242	151	223	290	194	167	272	242	215	295	268	325	327	354
30		276	302	266	308	331	301	296	341	336	335	371	374	373	413	406
		161	219	137	201	262	175	151	245	218	194	266	242	293	295	319
31		258	283	249	289	310	281	277	319	314	313	347	350	349	387	380
		146	198	124	182	237	158	137	222	198	175	241	219	266	267	289
32		242	265	233	271	290	264	259	299	295	294	326	328	327	363	357
		132	180	112	165	215	144	124	201	179	159	219	199	241	242	262
33		228	249		254	273	248		281	277	276	306	309	308	341	335
		121	164		150	196	131		183	163	145	199	181	220	221	239
34		214	235		239	257	233		265	261	260	288	290	290	321	315
		110	149		137	179	120		167	149	132	182	165	201	202	218
35		202	221		226	242	220		249	246	245	272	274	273	303	297
		101	137		126	164	110		153	137	121	167	151	184	185	200
36		191	209		213	229	208		236	232	232	257	259	258	286	281
		92	126		115	150	101		141	125	111	153	139	169	169	183
37			198		202	216			223	220		243	245	244	271	266
			116		106	138			130	115		141	128	155	156	169
38			187		191	205			211	208		230	232	231	256	252
			107		98	128			119	106		130	118	143	144	156
39			178		181	195			200	198		218	220	219	243	239
			98		90	118			110	98		120	109	132	133	144
40			169		172	185			190	188		207	209	208	231	227
			91		84	109			102	91		111	101	122	123	133
41			161		176				181			197		198	220	216
			85		101				95			103		114	114	124
42			153		168				173			188		189	209	206
			79		94				88			96		106	106	115
43			146		160				165			179		180	200	196
			73		88				82			89		98	99	107
44			139		153				157			171		172	191	187
			68		82				76			83		92	92	100
45					146									164		179
					76									86		93
46					139									157		171
					71									80		87
47					133									150		164
					67									75		82
48					128									144		157
					63									70		77



ASD

ECONOMY TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	26K5	16K9	24K7	18K9	26K6	20K9	26K7	22K9	28K6	24K8	18K10	28K7	24K9	26K8	20K10	26K9
Depth (In.)	26	16	24	18	26	20	26	22	28	24	18	28	24	26	20	26
Approx. Wt (lbs/ft.)	9.8	10	10.1	10.2	10.6	10.8	10.9	11.3	11.4	11.5	11.7	11.8	12	12.1	12.2	12.2
Span (ft.)																
16		550 550														
17		550 526														
18		550 490		550 550							550 550					
19		550 455		550 523							550 523					
20		550 426		550 490		550 550					550 490				550 550	
21		550 406		550 460		550 520					550 460				550 520	
22		550 385		550 438		550 490		550 548			550 438				550 490	
23		550 363		550 418		550 468		550 518			550 418				550 468	
24		550 346	550 544	550 396		550 448		550 495		550 544	550 396		550 544		550 448	
25		514 311	550 520	550 377		550 426		550 474		550 520	550 377		550 520		550 426	
26	542 535	474 276	550 499	538 354	550 541	550 405	550 541	550 454		550 499	550 361		550 499	550 541	550 405	550 541
27	502 477	439 246	550 479	498 315	547 519	550 389	550 522	550 432		550 479	550 347		550 479	550 522	550 389	550 522
28	466 427	408 220	521 436	463 282	508 464	517 353	550 501	550 413	548 541	550 456	548 331	550 543	550 456	550 501	550 375	550 501
29	434 384	380 198	485 392	431 254	473 417	482 317	527 463	532 387	511 486	536 429	511 298	550 522	550 436	550 479	550 359	550 479
30	405 346	355 178	453 353	402 229	441 377	450 286	492 417	497 349	477 439	500 387	477 269	531 486	544 419	544 457	533 336	459 459
31	379 314	332 161	424 320	376 207	413 341	421 259	460 378	465 316	446 397	468 350	446 243	497 440	510 379	509 413	499 304	550 444
32	356 285	311 147	397 290	332 188	387 309	395 235	432 343	436 287	418 361	439 318	418 221	466 400	478 344	477 375	468 276	519 407
33	334 259		373 265	332 171	364 282	371 214	406 312	410 261	393 329	413 289	393 201	438 364	449 313	448 342	440 251	488 370
34	315 237		351 242	312 156	343 257	349 195	382 285	386 239	370 300	388 264	370 184	412 333	423 286	422 312	414 229	459 338
35	297 217		331 221	294 143	323 236	329 179	360 261	364 219	349 275	366 242	366 168	389 305	399 262	398 286	390 210	433 310
36	280 199		313 203	278 132	305 216	311 164	340 240	344 201	330 252	346 222	330 154	367 280	377 241	376 263	369 193	409 284
37	265 183		296 187		289 199	294 151	322 221	325 185	312 232	327 205		348 257	356 222	356 242	349 178	387 262
38	251 169		281 172		274 184	279 139	305 204	308 170	296 214	310 189		329 237	338 204	337 223	331 164	367 241
39	238 156		266 159		260 170	265 129	289 188	292 157	280 198	294 174		313 219	320 189	320 206	314 151	348 223
40	227 145		253 148		247 157	251 119	275 174	278 146	266 183	280 161		297 203	304 175	304 191	298 140	331 207
41	215 134		241 137		235 146		262 162	264 135	253 170	266 150		283 189	290 162	289 177		315 192
42	205 125		229 127		224 136		249 150	252 126	241 158	253 139		269 175	276 151	275 164		300 178
43	196 116		219 118		213 126		238 140	240 117	230 147	242 130		257 163	263 140	263 153		286 166
44	187 108		209 110		204 118		227 131	229 109	220 137	231 121		245 152	251 131	251 143		273 155
45	179 101		199 103		194 110		217 122		210 128	220 113		234 142	240 122	240 133		261 145
46	171 95		191 97		186 103		207 114		201 120	211 106		224 133	230 114	229 125		250 135
47	164 89		183 90		178 96		199 107		192 112	202 99		214 125	220 107	219 117		239 127
48	157 83		175 85		171 90		190 100		184 105	194 93		206 117	211 101	210 110		229 119
49	150 78				164 85		183 94		177 99			197 110		202 103		220 112
50	144 73				157 80		175 89		170 93			189 103		194 97		211 105
51	139 69				151 75		168 83		163 88			182 97		186 91		203 99
52	133 65				145 71		162 79		157 83			175 92		179 86		195 93
53									151 78			168 87				
54									145 74			162 82				
55									140 70			156 77				
56									135 66			151 73				





ECONOMY TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown in Pounds per Linear Foot (plf)

Joist Designation	30K7	22K10	28K8	28K9	24K10	30K8	30K9	22K11	26K10	28K10	30K10	24K12	30K11	26K12	28K12	30K12
Depth (In.)	30	22	28	28	24	30	30	22	26	28	30	24	30	26	28	30
Approx. Wt. (lbs/ft.)	12.3	12.6	12.7	13	13.1	13.2	13.4	13.8	13.8	14.3	15	16	16.4	16.6	17.1	17.6
Span (ft.)																
22		550 548						550 548								
23		550 518						550 518								
24		550 495			550 544			550 495				550 544				
25		550 474			550 520			550 474				550 520				
26		550 454			550 499			550 454	550 541			550 499		550 541		
27		550 432			550 479			550 432	550 522			550 479		550 522		
28		550 413	550 543	550 543	550 456			550 413	550 501	550 543		550 456		550 501	550 543	
29		550 399	550 522	550 522	550 436			550 399	550 479	550 522		550 436		550 479	550 522	
30	550 543	550 385	550 500	550 500	550 422	550 543	550 543	550 385	550 459	550 500	550 543	550 422	550 543	550 459	550 500	550 543
31	534 508	550 369	550 480	550 480	550 410	550 520	550 520	550 369	550 444	550 480	550 520	550 410	550 520	550 444	550 480	550 520
32	501 461	517 337	515 438	549 463	549 393	549 500	549 500	549 355	549 431	549 463	549 500	549 393	549 500	549 431	549 463	549 500
33	471 420	486 307	484 399	527 432	532 368	520 460	532 468	532 334	532 404	532 435	532 468	532 368	532 468	532 404	532 435	532 468
34	443 384	458 280	456 364	496 395	502 337	490 420	516 441	516 314	516 378	516 410	516 441	516 344	516 441	516 378	516 441	516 441
35	418 351	432 257	430 333	468 361	442 308	473 384	462 415	494 292	501 356	487 389	501 415	501 324	501 415	501 356	501 389	501 415
36	395 323	408 236	406 306	442 332	447 283	436 353	475 383	467 269	486 334	487 366	487 392	487 306	487 392	487 334	487 366	487 392
37	373 297	386 217	384 282	418 305	423 260	413 325	449 352	442 247	460 308	474 344	474 374	474 290	474 374	474 315	474 344	474 374
38	354 274	366 200	364 260	396 282	401 240	391 300	426 325	419 228	436 284	461 325	461 353	461 275	461 353	461 299	461 325	461 353
39	336 253	347 185	346 240	376 260	380 222	371 277	404 300	397 211	413 262	447 306	449 333	449 261	449 333	449 283	449 308	449 333
40	319 234	330 171	328 222	357 241	361 206	353 256	384 278	377 195	393 243	424 284	438 315	438 247	438 315	438 269	438 291	438 315
41	303 217	314 159	312 206	340 224	344 191	335 238	365 258	359 181	374 225	404 263	427 300	427 235	427 300	427 256	427 277	427 300
42	289 202	299 148	297 192	324 208	327 177	320 221	348 240	342 168	356 210	384 245	417 282	417 224	417 282	417 244	417 264	417 284
43	276 188	285 138	284 179	309 194	312 165	305 206	332 223	326 157	339 195	367 228	394 263	406 213	407 270	407 232	407 252	407 270
44	263 176	272 128	271 167	295 181	298 154	291 192	317 208	311 146	324 182	350 212	376 245	387 199	398 258	398 222	398 240	398 258
45	251 164		259 156	282 169	285 144	278 179	303 195		310 170	334 198	359 229	370 185	389 246	389 212	389 229	389 246
46	241 153		248 146	270 158	272 135	266 168	290 182		296 159	320 186	344 214	354 174	380 236	380 203	380 219	380 236
47	230 144		237 136	258 148	261 126	255 157	277 171		284 149	306 174	329 201	339 163	372 226	369 192	372 210	372 226
48	221 135		227 128	247 139	250 118	244 148	266 160		272 140	294 163	315 188	325 153	362 215	353 180	365 201	365 216
49	212 127		218 120	237 130		234 139	255 150		261 131	282 153	303 177		347 202	339 169	357 193	357 207
50	203 119		209 113	228 123		225 130	245 141		250 124	270 144	291 166		333 190	325 159	350 185	350 199
51	195 112		201 106	219 115		216 123	235 133		241 116	260 136	279 157		320 179	313 150	338 175	343 192
52	188 106		193 100	210 109		208 116	226 126		231 110	250 128	268 148		308 169	301 142	325 165	336 184
53	181 100		186 95	203 103		200 109	218 119			240 121	258 140		296 159		313 156	330 177
54	174 94		179 89	195 97		192 103	209 112			232 114	249 132		285 150		301 147	324 170
55	168 89		173 85	188 92		185 98	202 106			223 108	240 125		275 142		290 139	312 161
56	162 84		166 80	181 87		179 92	195 100			215 102	231 118		265 135		280 132	301 153
57	156 80					173 88	188 95				223 112		256 128			290 145
58	151 76					167 83	181 90				215 106		247 121			280 137
59	146 72					161 79	175 86				208 101		239 115			271 130
60	141 69					156 75	169 81				201 96		231 109			262 124





APPENDIX D - FIRE-RESISTANCE RATINGS WITH STEEL JOISTS

The Underwriters Laboratories (U.L.) Fire Resistance Directory lists hundreds of assemblies and their fire resistance ratings. The Specifying Professional can choose between numerous Floor-Ceiling and Roof-Ceiling assemblies that include steel joists and Joist Girders.

As a convenience, a selected number of assemblies are listed on the following pages. In addition, the Steel Joist Institute's Technical Digest #10 "Design of Fire Resistive Assemblies with Steel Joists" has a complete listing of steel joist assemblies and additional information about fire ratings. However, the listing that follows and the Technical Digest are intended as a guide only, and the Specifying Professional must refer to the current U.L. Fire Resistance Directory for complete design requirements.

Hundreds of fire tests on steel joist-supported assemblies have been conducted at nationally recognized testing laboratories in accordance with ASTM Standard E119, ANSI A2.1/UL 263, and NFPA 251. Because of practical loading restrictions and limitations of furnace dimensions, the vast majority of these tests were run using lightweight joists – normally from 8 inches to 14 inches (203 mm to 356 mm) deep. This practice was advantageous in that it established the minimum acceptable joists at the shallow and lightweight end of the joist load tables. This also resulted in a specified minimum joist designation being listed in the U.L. Fire Resistance Assembly, which is the joist that combines the required minimum depth and minimum weight per foot. Joists of the same series which equal or exceed the specified minimum joist depth and joist weight per foot may be used provided the accessories are compatible. The dimension from the bottom chord of the joists to the ceiling, whether given or calculated, is a minimum.

Where a U.L. Fire Resistance Assembly is being utilized, the Specifying Professional shall indicate the assembly number being used on the structural contract drawings. In addition, the Specifying Professional shall consider the following, as applicable:

- Joist designations specified on the structural contract drawings shall not be less than the minimum size for that assembly. The assembly may also require a minimum bridging size that may be larger than required by the SJI Specifications for the particular designation and joist spacing.
- Some assemblies stipulate minimum size materials or minimum cross sectional areas for individual joist and Joist Girder components. It is the responsibility of the Specifying Professional to show all special requirements on the contract drawings.
- Note that the maximum joist spacing shown for Floor-Ceiling Assemblies may be increased from the spacing listed in the U.L. Fire Resistance Directory to a maximum of 48 inches on center, provided the floor slab meets the structural requirements and the spacing of hanger wires supporting the ceiling is not increased.

- Some assemblies stipulate an allowable maximum joist design stress level less than the 30 ksi (207 MPa) used in the joist and Joist Girder Specifications. It is the responsibility of the Specifying Professional to apply the proper stress level reductions (when applicable) when selecting joists and/or Joist Girders. This is accomplished by prorating the joist and/or Joist Girder capacities. To adjust the stress level of joists or Joist Girders, multiply the design load by the ratio of the joist design stress to the required maximum [e.g. 30/26 (207/179), 30/24 (207/165), 30/22 (207/152)], and then using this increased load, select a joist or Joist Girder from the load and/or weight tables.
- Some U.L. Roof-Ceiling Assemblies using direct applied protection limit the spacing of the joists for certain types and gages of metal decking – refer to the U.L. Fire Resistance Directory for this information.
- Where fire protective materials are to be applied directly to the steel joists or Joist Girders, it is often desired to have the joist furnished as unpainted. The Specifying Professional should indicate on the structural contract drawings if the joists or Joist Girders are to be painted or not.
- Certain older U.L. fire rated assemblies may refer to joist series that predate the K-Series joists. Where one of these assemblies is selected, refer to the U.L. Fire Resistance Directory for special provisions for substituting a K-Series joist in lieu of an S-, J-, and/or H-Series joist.



FLOOR – CEILING ASSEMBLIES WITH MEMBRANE PROTECTION

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Concrete		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number	
			Minimum Thickness (in.)	Type				
1 Hr.	Acoustical	12K1, 18LH02	2.5	LW, NW	NL	20G@13plf W8 x 15	D216 D219	
	Exposed Grid	10K1	2.5	NW	72	20G@14plf* W6 x 12	G205	
		10K1	2		72	W6 x 12	G208	
		10K1	2.5		72	20G@14plf* W6 x 12	G256	
	Gypsum Board	10K1	2.5	NW	48	W8 x 24	G548	
1 1/2 Hr.	Acoustical	12K1, 18LH02	2.5	LW, NW	NL	20G@13plf W8 x 15	D216 D219	
	Gypsum Board			NW		20G@20plf W8 x 28	D502	
	Exposed Grid	10K1	2.5	NW	24 (48)	20G@13plf W6 x 12	G203	
		10K1	2.5		72	20G@14plf* W6 x 12	G205	
		10K1	2		72	W6 x 12	G208	
		10K1	2.5		24 (48)	W6 x 12	G213	
		10K1	2.5		24 (48)	20G@13plf W8 x 31	G228	
		10K1	2		24 (48)	20G@13plf W8 x 24	G229	
		10K1	2.5		24 (48)	20G@13plf W6 x 12	G243	
		10K1	2.5		24 (48)	20G@13plf W8 x 31	G268	
	Gypsum Board	12K1	2	NW	24 (48)	NS	G502	
	2 Hr.	Acoustical	12K1, 18LH02	2.5	LW, NW	NL	20G@13plf W8 x 15	D216 D219
		Gypsum Board			NW		20G@20plf W8 x 28	D502
		Concealed Grid	10K1	2.25	NW	24 (48)	W6 x 25	G023
8K1			2.5	24 (48)		20G@13plf W8 x 20	G031	
10K1				30 (48)		20G@13plf W10 x 21	G036	
Exposed Grid		10K1	2.5	NW	24 (48)	20G@13plf W6 x 12	G203	
		10K1	2.5		72	20G@14plf* W6 x 12	G205	
		10K1	2.5		72	W6 x 12	G208	
		10K1	2.5		24 (48)	W6 x 12	G213	
		10K1	2.5		24 (48)	W8 x 31	G227	
		10K1	2.5		24 (48)	20G@13plf W8 x 31	G228	

(Continued Next Page)



FLOOR – CEILING ASSEMBLIES WITH MEMBRANE PROTECTION

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Concrete		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number
			Minimum Thickness (in.)	Type			
2 Hr.	Exposed Grid	10K1	2.5	NW	24 (48)	20G@13plf W8 x 24	G229
		10K1	2.5		24 (48)	20G@13plf W6 x 12	G243
		10K1	2.5		72	20G@14plf* W6 x 12	G256
		10K1	2.5		24 (48)	20G@13plf W8 x 31	G268
	Gypsum Board	10K1	2	NW	24 (48)	NS	G505
		10K1	2.5		24 (48)	20G@14plf* W8 x 31	G514
		10K1	2.5		24 (48)	20G@13plf W10 x 21	G523
		10K1	2.5		24 (48)	20G@13plf W8 x 24	G529
		10K1	2.5		24 (48)	20G@13plf W10 x 21	G547
	3 Hr.	Acoustical	12K1, 18LH02	3.25	LW, NW	NL	20G@13plf W8 x 15
Concealed Grid		10K1	3.5	NW	24 (48)	20G@13plf W8 x 20	G033
		10K1	3.25		30 (48)	20G@13plf W10 x 21	G036
Exposed Grid		10K1	3.5	NW	48	20G@14plf* W6 x 12	G205
		10K1	3.5		24 (48)	W6 x 12	G213
		10K1	3.25		24 (48)	20G@13plf W8 x 24	G229
		10K1	3.5		48	20G@14plf* W6 x 12	G256
		10K1 (22 ksi max.)	2.63		24 (48)	20G@13plf W8 x 31	G268
Gypsum Board		10K1	3	NW	24 (48)	20G@13plf W10 x 21	G523
		10K1	2.75		24 (48)	20G@13plf W8 x 24	G529
		10K1	3		24 (48)	20G@13plf W10 x 21	G547

* Special Area Requirements

NL = Not Listed

NS = Not Specified



FLOOR – CEILING ASSEMBLIES WITH SPRAY APPLIED FIRE RESISTIVE MATERIALS

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Concrete		Maximum Joist Spacing	Minimum Primary Support Member	UL Design Number
			Minimum Thickness (in.)	Type			
1 Hr.	SAFRM	NS	2.5	LW, NW	NL	W8 x 28	D759
		10K1	2.5				D779
		10K1	2.5				D780
		NS	3.25	LW			D782
		10K1*	2.5	LW			D925
			3.5	NW			
		16K6*	NS	LW, NW	42	20G@20plf W8 x 28	G701
		16K6	3	LW	50.5	NS	G702
			3.75	NW			
		16K6*	2.5	LW, NW	42	NS	G705
		16K6	3	LW	50.5	NS	G706
			3.75	NW			
		16K6*	2.5	LW, NW	42	20G@20plf W8 x 28	G708
		NS	2.5		42	W8 x 28	G709
		16K6*	2.5		42	20g@20plf W8 x 24	G801
12K1	3	LW	50.5	NS	G802		
	3.75	NW					
1 1/2 Hr.	SAFRM	NS	2.5	LW, NW	NL	W8 x 28	D759
		10K1	2.5				D779
		10K1	2.5				D780
		NS	3.25	LW			D782
		10K1*	3	LW			D925
			4	NW			
		16K6*	2.5	LW, NW	42	20G@20plf W8 x 28	G701
		16K6	3.5	LW	50.5	NS	G702
			4.5	NW			
		16K6*	2.5	LW, NW	42	NS	G705
		16K6	3.5	LW	50.5	NS	G706
			4.5	NW			
		16K6*	2.5	LW, NW	42	20G@20plf W8 x 28	G708
		NS	2.5		42	W8 x 28	G709
		16K6*	2.5		42	20G@20plf W8 x 24	G801
12K5	3.5	LW	50.5	NS	G802		
	4.5	NW					

(Continued Next Page)



FLOOR – CEILING ASSEMBLIES WITH SPRAY APPLIED FIRE RESISTIVE MATERIALS

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Concrete		Maximum Joist Spacing	Minimum Primary Support Member	UL Design Number
			Minimum Thickness (in.)	Type			
2 Hr.	SAFRM	NS	2.5	LW, NW	NL	W8 x 28	D759
		10K1	2.5				D779
		10K1	2.5				D780
		NS	3.25	LW			D782
		10K1*	3.25	LW			D925
			4.5	NW			
		16K6*	2.5	LW, NW	42	20G@20plf W8 x 28	G701
		16K6	4	LW	50.5	NS	G702
			5.25	NW			
		16K6*	2.5	LW,NW	42	NS	G705
		16K6	4	LW	50.5	NS	G706
			5.25	NW			
		16K6*	2.5	LW, NW	42	20G@20plf W8 x 28	G708
		NS	2.5		42	W8 x 28	G709
		16K6*	2.5		42	20G@20plf W8 x 24	G801
12K5	4	LW	50.5	NS	G802		
	5.25	NW					
3 Hr.	SAFRM	NS	2.5	LW, NW	NL	W8 x 28	D759
		10K1	2.5				D779
		10K1	2.5				D780
		NS	3.25	LW			D782
		10K1*	4.19	LW			D925
			5.25	NW			
		16K6*	NS	LW, NW	42	20G@20plf W8 x 28	G701
		16K6*	2.75		42	NS	G705
		16K6*	2.75		42	20G@20plf W8 x 28	G708
		NS	2.75		42	W8 x 28	G709
16K6*	2.75	42	20G@20plf W8 x 24		G801		
4 Hr.	SAFRM	10K1	2.5	LW, NW	NL	W8 x 28	D779
		NS	3.25	LW			D782

* Special Area Requirements

NL = Not Listed

NS = Not Specified



ROOF – CEILING ASSEMBLIES WITH MEMBRANE PROTECTION

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Built Up Roof		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number	
			Deck Material Description	Insulation				
1 Hr.	Exposed Grid	12K1	22 MSG Min.	Fiber Board	84	W8 x 17	P201	
		10K1	26 MSG Min.		48	W6 x 12	P202	
		10K1	26 MSG Min.		48	20G@13plf	P211	
		12K3	28 MSG Min.	72	20G@13plf W8 x 17	P214		
		12K1	26 MSG Min.	72	20G@13plf W6 x 12	P225		
		12K3	24 MSG Min.	Building Units	48	NS	P227	
		12K3	26 MSG Min.	Fiber Board	72	20G@13plf W6 x 12	P230	
		12K1	26 MSG Min.	Insulating Concrete	48	20G@14plf* W8 x 15	P231	
		12K3	24 MSG Min.	Foamed Plastic	72	W8 x 15	P235	
		10K1	28 MSG Min.	Insulating Concrete	72	20G@13plf W8 x 15	P246	
		12K5	26 MSG Min.	Fiber Board	48	W6 x 12	P250	
		12K1	28 MSG Min.	Insulating Concrete	72	20G@13plf W6 x 12	P251	
		10K1	22 MSG Min.	Fiber Board	72	W6 x 12	P254	
		10K1	28 MSG Min.	Insulating Concrete	72	W8 x 15	P255	
		10K1	24 MSG Min.	Fiber Board	72	NS	P259	
		12K1	28 MSG Min.	Insulating Concrete	72	20G@13plf W6 x 12	P261	
		12K1	26 MSG Min.	Insulating Concrete	72	20G@14plf* W8 x 15	P264	
		10K1	Metal Roof Deck Panels	Batts and Blankets	60	NS	P265	
		10K1	26 MSG Min.	Fiber Board	48	W6 x 16	P267	
		10K1	Metal Roof Deck Panels	Batts and Blankets	60	NS	P268	
		12K1	26 MSG Min.	Insulating Concrete	72	20G@14plf* W8 x 15	P269	
		Fiber Board	10K1	24 MSG Min.	Fiber Board	NS	W6 x 16	P301
			10K1	22 MSG Min.		48	NS	P302
			10K1	22 MSG Min.		NS	W6 x 16	P303
	Gypsum Board	12K3	26 MSG Min.	Insulating Concrete	60	W8 x 24	P509	
		12K3	24 MSG Min.	Fiber Board	72	20G@13plf W8 x 13	P510	
		10K1	20 MSG Min.	Fiber Board	48	NS	P519	

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ROOF – CEILING ASSEMBLIES WITH MEMBRANE PROTECTION

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Built Up Roof		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number
			Deck Material Description	Insulation			
1 1/2 Hr.	Exposed Grid	12K1	26 MSG Min.	Fiber Board	72	20G@13plf W6 x 12	P225
		12K3	24 MSG Min.	Building Units	48	NS	P227
		12K3	26 MSG Min.	Fiber Board	48	20G@13plf W6 x 12	P230
		12K1	26 MSG Min.	Insulating Concrete	48	20G@14plf* W8 x 24	P231
		12K5	26 MSG Min.	Fiber Board	48	W6 x 12	P250
		12K1	28 MSG Min.	Insulating Concrete	72	20G@13plf W6 x 12	P251
		10K1	24 MSG Min.	Fiber Board	72	NS	P259
		10K1	Metal Roof Deck Panels	Batts and Blankets	60	NS	P265
		10K1	20 MSG Min.	Fiber Board	48	NS	P266
		10K1	Metal Roof Deck Panels	Batts and Blankets	60	NS	P268
	12K1	26 MSG Min.	Insulating Concrete	72	20G@14plf* W8 x 24	P269	
	Fiber Board	10K1	24 MSG Min.	Fiber Board	NS	W6 x 16	P301
	Metal Lath	12K5	22 MSG Min.	Fiber Board	72	NS	P404
Gypsum Board	12K3	24 MSG Min.	Fiber Board	72	20G@13plf W8 x 13	P510	
2 Hr.	Exposed Grid	10K1	24 MSG Min.	Fiber Board	72	W6 x 12	P237
		12K1	28 MSG Min.	Insulating Concrete	72	20G@13plf W6 x 12	P251
		10K1	20 MSG Min.	Fiber Board	48	NS	P266
	Fiber Board	10K1	24 MSG Min.	Fiber Board	NS	W6 x 16	P301
	Metal Lath	12K5	22 MSG Min.	Fiber Board	72	NS	P404
	Gypsum Board	10K1	22 MSG Min.	Fiber Board	72	20G@13plf	P514
			20 MSG Min.		48	NS	P519
		14K1	26 MSG Min.	Insulating Concrete	66	NS	P520
3 Hr.	Metal Lath	10K1	28 MSG Min.	Insulating Concrete	48	NS	P405

* Special Area Requirements

NL = Not Listed

NS = Not Specified



ROOF – CEILING ASSEMBLIES WITH SPRAY APPLIED FIRE RESISTIVE MATERIALS

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Built Up Roof		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number
			Deck Material Description	Insulation			
1 Hr.	SAFRM	10K1	22 MSG Min.	Building Units	NS	NS	P822
		12K3	22 MSG Min.	Fiber Board	NS	W8 x 20	P824
1 Hr. and 1-1/2 Hr.	SAFRM	12K5	28 MSG Min.	Insulating Concrete	96	W6 x 16	P919
1-1/2 Hr. and 2 Hr.	SAFRM	10K1	22 MSG Min.	Building Units	NS	W6 x 16	P728
1 Hr., 1-1/2 Hr. and 2 Hr.	SAFRM	14K4	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P701
		14K4	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P711
		12K3	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P717
		10K1	22 MSG Min.	Foamed Plastic	NS	20G@13plf W8 x 28	P725
		10K1	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P726
		14K4	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P734
		14K4	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P736
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P739
		10K1	22 MSG Min.	Fiber Board	NS	W6 x 16	P740
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P743
		12K3	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P801
		10K1	22 MSG Min.	Fiber Board	NS	20G@13plf W6 x 16	P815
		10K1	22 MSG Min.	Fiber Board	NS	W6 x 16	P816
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P819
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P825
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P827
		12K1	22 MSG Min.	Fiber Board	NS	20G@13plf W8 x 20	P828
		10K1	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P902
		10K1	28 MSG Min.	Insulating Concrete	NS	W8 x 10	P907
		10K1	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P908

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ROOF – CEILING ASSEMBLIES WITH SPRAY APPLIED FIRE RESISTIVE MATERIALS

Restrained Assembly Rating	Protection Material	Minimum Joist Size	Built Up Roof		Maximum Joist Spacing (in.)	Minimum Primary Support Member	UL Design Number
			Deck Material Description	Insulation			
1 Hr., 1-1/2 Hr. and 2 Hr.	SAFRM	10K1	28 MSG Min.	Insulating Concrete	NS	W8 x 10	P920
		12K5	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P921
		10K1	28 MSG Min.	Insulating Concrete	NS	W6 x 16	P922
		10K1	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P923
		10K1	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P925
		12K5	28 MSG Min.	Insulating Concrete	NS	W8 x 10	P926
		14K4	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P927
		12K5	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P928
		12K3	28 MSG Min.	Insulating Concrete	NS	20G@13plf W8 x 10	P929
		10K1	28 MSG Min.	Insulating Concrete	NS	W6 x 16	P936
2 Hr.	SAFRM	12K3	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P718
		12K3	22 MSG Min.	Foamed Plastic	NS	20G@13plf W6 x 16	P720
		12K3	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P729
1 Hr., 1-1/2 Hr., 2 Hr. and 3 Hr.	SAFRM	10K1	22 MSG Min.	Foamed Plastic	NS	20G@13plf W6 x 16	P719
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P722
		10K1	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P723
		10K1	22 MSG Min.	Foamed Plastic	NS	W8 x 28	P732
		10K1*,16K2	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P733
		10K1*	22 MSG Min.	Foamed Plastic	NS	W6 x 16	P826

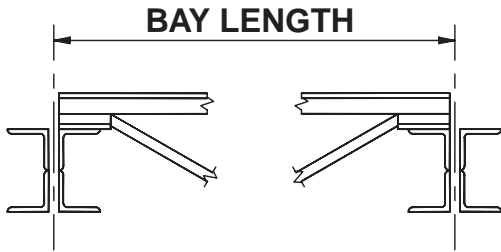
* Special Area Requirements
NS = Not Specified



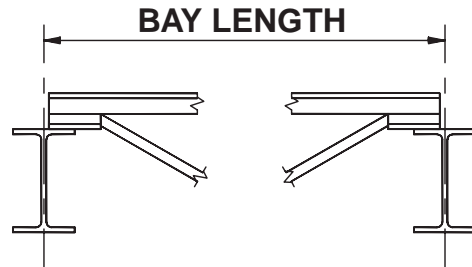


APPENDIX E - OSHA SAFETY STANDARDS FOR STEEL ERECTION

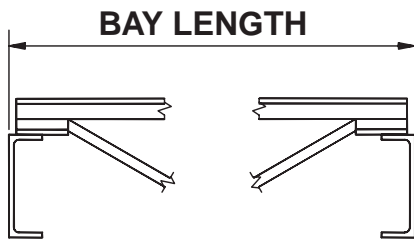
BAY LENGTH DEFINITIONS



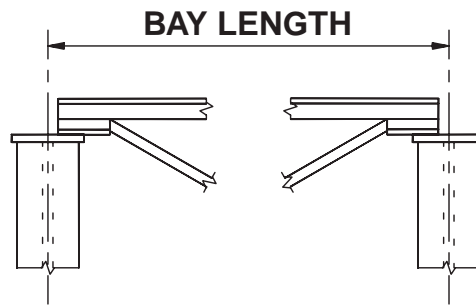
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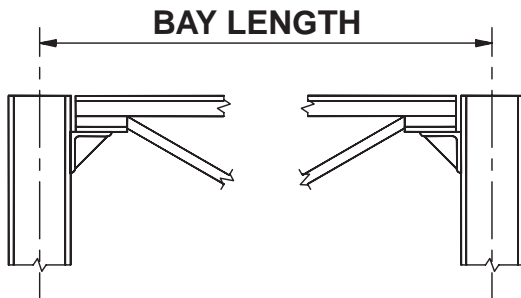
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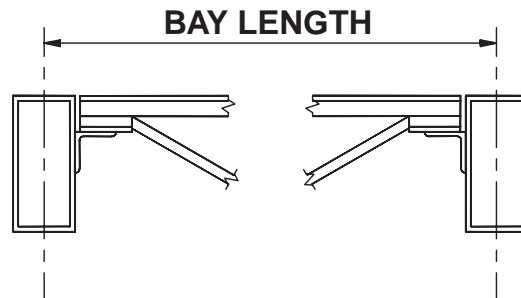
STEEL CHANNEL



STEEL COLUMN

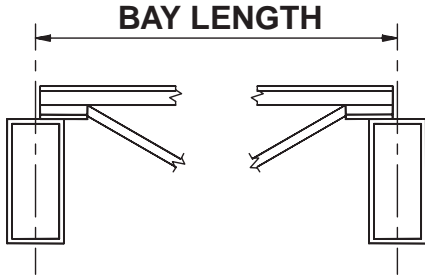


STEEL COLUMN

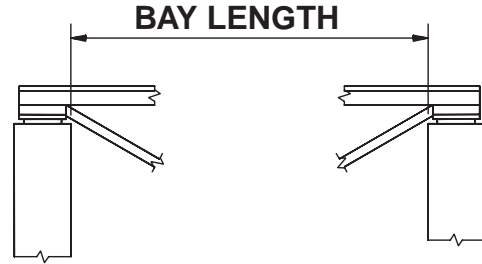


STEEL TUBE

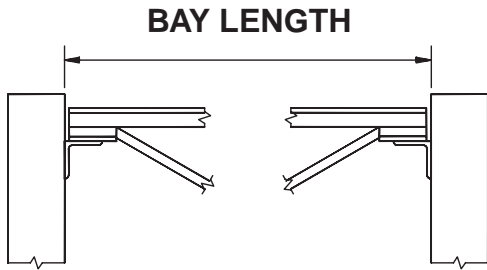




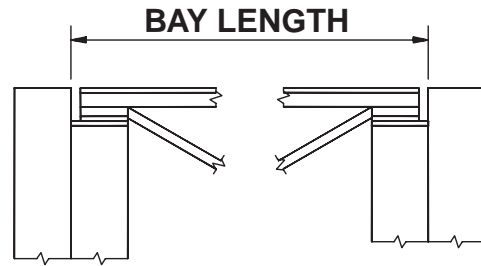
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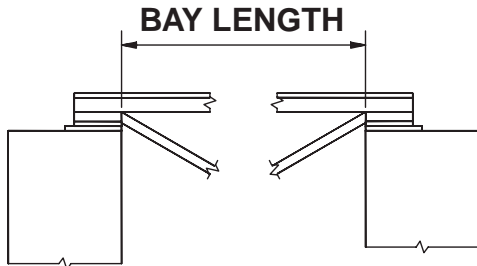
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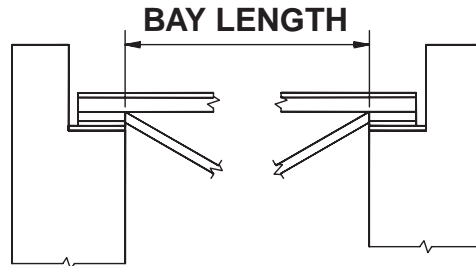
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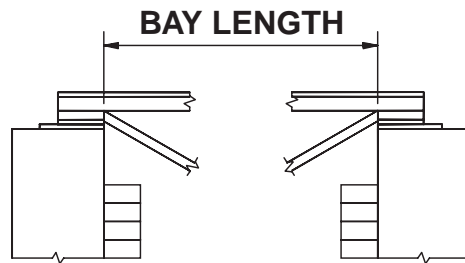
MASONRY WITH PILASTER



MASONRY OR TILT-UP



MASONRY OR TILT-UP



MASONRY WITH FACE BRICK



§ 1926.751 DEFINITIONS (Selected items only).

Anchored bridging means that the steel joist bridging is connected to a bridging terminus point.

Bolted diagonal bridging means diagonal bridging that is bolted to a steel joist or joists.

Bridging clip means a device that is attached to the steel joist to allow the bolting of the bridging to the steel joist.

Bridging terminus point means a wall, a beam, tandem joists (with all bridging installed and a horizontal truss in the plane of the top chord) or other element at an end or intermediate point(s) of a line of bridging that provides an anchor point for the steel joist bridging.

Column means a load-carrying vertical member that is part of the primary skeletal framing system. Columns do not include posts.

Constructibility means the ability to erect structural steel members in accordance with subpart R without having to alter the over-all structural design.

Construction load (for joist erection) means any load other than the weight of the employee(s), the joists and the bridging bundle.

Erection bridging means the bolted diagonal bridging that is required to be installed prior to releasing the hoisting cables from the steel joists.

Personal fall arrest system means a system used to arrest an employee in a fall from a working level. A personal fall arrest system consists of an anchorage, connectors, a body harness and may include a lanyard, deceleration device, lifeline, or suitable combination of these. The use of a body belt for fall arrest is prohibited.

Project structural engineer means the registered, licensed professional responsible for the design of structural steel framing and whose seal appears on the structural contract documents.

Qualified person (also defined in § 1926.32) means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project.

Steel joist means an open web, secondary load-carrying member of 144 feet (43.9 m) or less, designed by the manufacturer, used for the support of floors and roofs. This does not include structural steel trusses or cold-formed joists.

Steel joist girder means an open web, primary load-carrying member, designed by the manufacturer, used for the support of floors and roofs. This does not include structural steel trusses.

Structural steel means a steel member, or a member made of a substitute material (such as, but not limited to, fiberglass, aluminum or composite members). These members include, but are not limited to, steel joists, joist girders, purlins, columns, beams, trusses, splices, seats, metal decking, girts, and all bridging, and cold formed metal framing which is integrated with the structural steel framing of a building.

§ 1926.757 OPEN WEB STEEL JOISTS

(a) General.

(1) Except as provided in paragraph (a)(2) of this section, where steel joists are used and columns are not framed in at least two directions with solid web structural steel members, a steel joist shall be field-bolted at the column to provide lateral stability to the column during erection. For the installation of this joist:

- (i) A vertical stabilizer plate shall be provided on each column for steel joists. The plate shall be a minimum of 6 inch by 6 inch (152 mm by 152 mm) and shall extend at least 3 inches (76 mm) below the bottom chord of the joist with a 13/16 inch (21 mm) hole to provide an attachment point for guying or plumbing cables.
- (ii) The bottom chords of steel joists at columns shall be stabilized to prevent rotation during erection.
- (iii) Hoisting cables shall not be released until the seat at each end of the steel joist is field-bolted, and each end of the bottom chord is restrained by the column stabilizer plate.

(2) Where constructibility does not allow a steel joist to be installed at the column:

- (i) an alternate means of stabilizing joists shall be installed on both sides near the column and shall:
 - (A) provide stability equivalent to paragraph (a)(1) of this section;
 - (B) be designed by a qualified person;
 - (C) be shop installed; and
 - (D) be included in the erection drawings.
- (ii) hoisting cables shall not be released until the seat at each end of the steel joist is field-bolted and the joist is stabilized.

(3) Where steel joists at or near columns span 60 feet (18.3 m) or less, the joist shall be designed with sufficient strength to allow one employee to release the hoisting cable without the need for erection bridging.

(4) Where steel joists at or near columns span more than 60 feet (18.3 m), the joists shall be set in tandem with all bridging installed unless an alternative method of erection, which provides equivalent stability to the steel joist, is designed by a qualified person and is included in the site-specific erection plan.



(5) A steel joist or steel joist girder shall not be placed on any support structure unless such structure is stabilized.

(6) When steel joist(s) are landed on a structure, they shall be secured to prevent unintentional displacement prior to installation.

(7) No modification that affects the strength of a steel joist or steel joist girder shall be made without the approval of the project structural engineer of record.

(8) *Field-bolted joists.*

- (i) Except for steel joists that have been pre-assembled into panels, connections of individual steel joists to steel structures in bays of 40 feet (12.2 m) or more shall be fabricated to allow for field bolting during erection.
- (ii) These connections shall be field-bolted unless constructibility does not allow.

(9) Steel joists and steel joist girders shall not be used as anchorage points for a fall arrest system unless written approval to do so is obtained from a qualified person.

(10) A bridging terminus point shall be established before bridging is installed. (See Appendix C to this subpart.)

(b) Attachment of steel joists and steel joist girders.

(1) Each end of "K" series steel joists shall be attached to the support structure with a minimum of two 1/8 -inch (3 mm) fillet welds 1 inch (25 mm) long or with two 1/2 -inch (13 mm) bolts, or the equivalent.

(2) Each end of "LH" and "DLH" series steel joists and steel joist girders shall be attached to the support structure with a minimum of two 1/4 -inch (6 mm) fillet welds 2 inches (51 mm) long, or with two 3/4 -inch (19 mm) bolts, or the equivalent.

(3) Except as provided in paragraph (b)(4) of this section, each steel joist shall be attached to the support structure, at least at one end on both sides of the seat, immediately upon placement in the final erection position and before additional joists are placed.

(4) Panels that have been pre-assembled from steel joists with bridging shall be attached to the structure at each corner before the hoisting cables are released.

(c) Erection of steel joists.

(1) Both sides of the seat of one end of each steel joist that requires bridging under Tables A and B shall be attached to the support structure before hoisting cables are released.

(2) For joists over 60 feet, both ends of the joist shall be attached as specified in paragraph (b) of this section and the provisions of paragraph (d) of this section met before the hoisting cables are released.

(3) On steel joists that do not require erection bridging under Tables A and B, only one employee shall be allowed on the joist until all bridging is installed and anchored.

► **NOTE: TABLES "A" & "B" HAVE BEEN EDITED TO CONFORM WITH STEEL JOIST INSTITUTE BOLTED DIAGONAL BRIDGING REQUIREMENTS. EDITED ITEMS ARE SHOWN WITH A STRIKE THROUGH NOTATION.**

► **TABLE A. — ERECTION BRIDGING FOR SHORT SPAN JOISTS**

Joist	Span
8L4 8K1	NM
10K1	NM
12K1	23-0
12K3	NM
12K5	NM
14K1	27-0
14K3	NM
14K4	NM
14K6	NM
16K2	29-0
16K3	30-0
16K4	32-0
16K5	32-0
16K6	NM
16K7	NM
16K9	NM
18K3	31-0
18K4	32-0
18K5	33-0
18K6	35-0
18K7	NM
18K9	NM
18K10	NM
20K3	32-0
20K4	34-0
20K5	34-0
20K6	36-0
20K7	39-0
20K9	39-0
20K10	NM
22K4	34-0
22K5	35-0
22K6	36-0
22K7	40-0
22K9	40-0
22K10	40-0 NM
22K11	40-0 NM
24K4	36-0
24K5	38-0
24K6	39-0
24K7	43-0
24K8	43-0
24K9	44-0
24K10	NM
24K12	NM
26K5	38-0
26K6	39-0

NM = diagonal bolted bridging not mandatory for joists under 40 feet.



► **TABLE A. — ERECTION BRIDGING FOR SHORT SPAN JOISTS (continued)**

Joist	Span
26K7	43-0
26K8	44-0
26K9	45-0 44-0
26K10	49-0
26K12	NM
28K6	40-0
28K7	43-0
28K8	44-0
28K9	45-0
28K10	49-0
28K12	53-0
30K7	44-0
30K8	45-0
30K9	45-0
30K10	50-0
30K11	52-0
30K12	54-0
10KCS1	NM
10KCS2	NM
10KCS3	NM
12KCS1	NM
12KCS2	NM
12KCS3	NM
14KCS1	NM
14KCS2	NM
14KCS3	NM
16KCS2	NM
16KCS3	NM
16KCS4	NM
16KCS5	NM
18KCS2	35-0
18KCS3	NM
18KCS4	NM
18KCS5	NM
20KCS2	36-0
20KCS3	39-0
20KCS4	NM
20KCS5	NM
22KCS2	36-0
22KCS3	40-0
22KCS4	NM
22KCS5	NM
24KCS2	39-0
24KCS3	44-0
24KCS4	NM
24KCS5	NM
26KCS2	39-0
26KCS3	44-0
26KCS4	NM
26KCS5	NM
28KCS2	40-0
28KCS3	45-0
28KCS4	53-0
28KCS5	53-0
30KCS3 30KCS3	45-0
30KCS4	54-0
30KCS5	54-0

NM = diagonal bolted bridging not mandatory for joists under 40 feet.

► **TABLE B. — ERECTION BRIDGING FOR LONG SPAN JOISTS**

Joist	Span
18LH02	33-0
18LH03	NM
18LH04	NM
18LH05	NM
18LH06	NM
18LH07	NM
18LH08	NM
18LH09	NM
20LH02	33-0
20LH03	38-0
20LH04	NM
20LH05	NM
20LH06	NM
20LH07	NM
20LH08	NM
20LH09	NM
20LH10	NM
24LH03	35-0
24LH04	39-0
24LH05	40-0
24LH06	45-0
24LH07	NM
24LH08	NM
24LH09	NM
24LH10	NM
24LH11	NM
28LH05	42-0
28LH06	42-0 46-0
28LH07	NM 54-0
28LH08	NM 54-0
28LH09	NM
28LH10	NM
28LH11	NM
28LH12	NM
28LH13	NM
32LH06	47-0 through 60-0
32LH07	47-0 through 60-0
32LH08	55-0 through 60-0
32LH09	NM through 60-0
32LH10	NM through 60-0
32LH11	NM through 60-0
32LH12	NM through 60-0
32LH13	NM through 60-0
32LH14	NM through 60-0
32LH15	NM through 60-0
36LH07	47-0 through 60-0
36LH08	47-0 through 60-0
36LH09	57-0 through 60-0
36LH10	NM through 60-0
36LH11	NM through 60-0
36LH12	NM through 60-0
36LH13	NM through 60-0
36LH14	NM through 60-0
36LH15	NM through 60-0

NM = diagonal bolted bridging not mandatory for joists under 40 feet.



(4) Employees shall not be allowed on steel joists where the span of the steel joist is equal to or greater than the span shown in Tables A and B except in accordance with § 1926.757(d).

(5) When permanent bridging terminus points cannot be used during erection, additional temporary bridging terminus points are required to provide stability. (See appendix C of this subpart.)

(d) Erection bridging.

(1) Where the span of the steel joist is equal to or greater than the span shown in Tables A and B, the following shall apply:

- (i) A row of bolted diagonal erection bridging shall be installed near the midspan of the steel joist;
- (ii) Hoisting cables shall not be released until this bolted diagonal erection bridging is installed and anchored; and
- (iii) No more than one employee shall be allowed on these spans until all other bridging is installed and anchored.

(2) Where the span of the steel joist is over 60 feet (18.3 m) through 100 feet (30.5 m), the following shall apply:

- (i) All rows of bridging shall be bolted diagonal bridging;
- (ii) Two rows of bolted diagonal erection bridging shall be installed near the third points of the steel joist;
- (iii) Hoisting cables shall not be released until this bolted diagonal erection bridging is installed and anchored; and
- (iv) No more than two employees shall be allowed on these spans until all other bridging is installed and anchored.

(3) Where the span of the steel joist is over 100 feet (30.5 m) through 144 feet (43.9 m), the following shall apply:

- (i) All rows of bridging shall be bolted diagonal bridging;
- (ii) Hoisting cables shall not be released until all bridging is installed and anchored; and
- (iii) No more than two employees shall be allowed on these spans until all bridging is installed and anchored.

(4) For steel members spanning over 144 feet (43.9 m), the erection methods used shall be in accordance with § 1926.756.

(5) Where any steel joist specified in paragraphs (c)(2) and (d)(1), (d)(2), and (d)(3) of this section is a bottom chord bearing joist, a row of bolted diagonal bridging shall be provided near the support(s). This bridging shall be installed and anchored before the hoisting cable(s) is released.

(6) When bolted diagonal erection bridging is required by this section, the following shall apply:

- (i) The bridging shall be indicated on the erection drawing;
- (ii) The erection drawing shall be the exclusive indicator of the proper placement of this bridging;
- (iii) Shop-installed bridging clips, or functional equivalents, shall be used where the bridging bolts to the steel joists;
- (iv) When two pieces of bridging are attached to the steel joist by a common bolt, the nut that secures the first piece of bridging shall not be removed from the bolt for the attachment of the second; and
- (v) Bridging attachments shall not protrude above the top chord of the steel joist.

(e) Landing and placing loads.

(1) During the construction period, the employer placing a load on steel joists shall ensure that the load is distributed so as not to exceed the carrying capacity of any steel joist.

(2) Except for paragraph (e)(4) of this section, no construction loads are allowed on the steel joists until all bridging is installed and anchored and all joist-bearing ends are attached.

(3) The weight of a bundle of joist bridging shall not exceed a total of 1,000 pounds (454 kg). A bundle of joist bridging shall be placed on a minimum of three steel joists that are secured at one end. The edge of the bridging bundle shall be positioned within 1 foot (.30 m) of the secured end.

(4) No bundle of decking may be placed on steel joists until all bridging has been installed and anchored and all joist bearing ends attached, unless all of the following conditions are met:

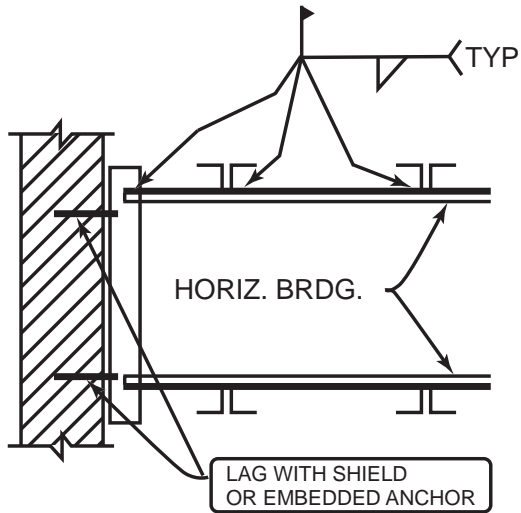
- (i) The employer has first determined from a qualified person and documented in a site-specific erection plan that the structure or portion of the structure is capable of supporting the load;
- (ii) The bundle of decking is placed on a minimum of three steel joists;
- (iii) The joists supporting the bundle of decking are attached at both ends;
- (iv) At least one row of bridging is installed and anchored;
- (v) The total weight of the bundle of decking does not exceed 4,000 pounds (1816 kg); and
- (vi) Placement of the bundle of decking shall be in accordance with paragraph (e)(5) of this section.

(5) The edge of the construction load shall be placed within 1 foot (.30 m) of the bearing surface of the joist end.

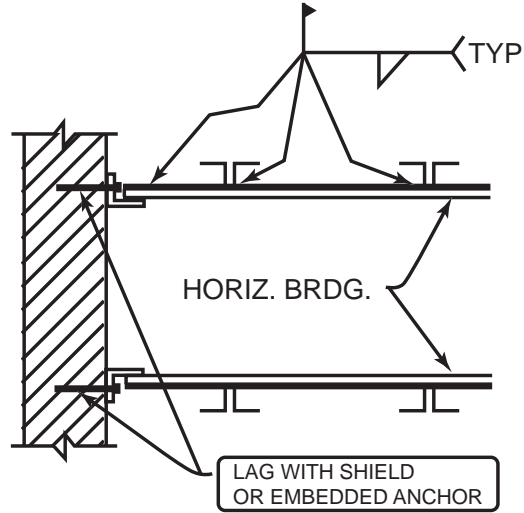


ILLUSTRATIONS OF OSHA BRIDGING TERMINUS POINTS (NON-MANDATORY)

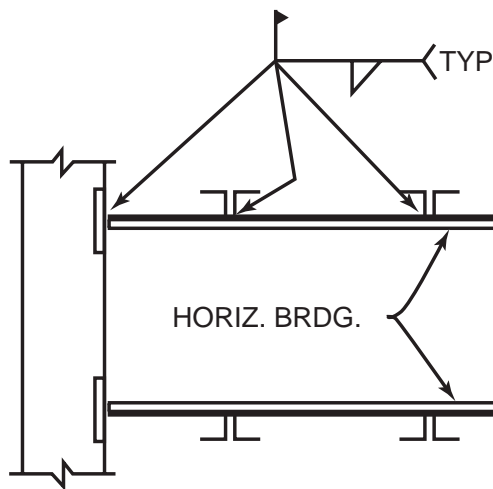
Guidelines for Complying with OSHA Steel Erection Standard, Paragraph §1926.757(a)(10) and §1926.757(c)(5).



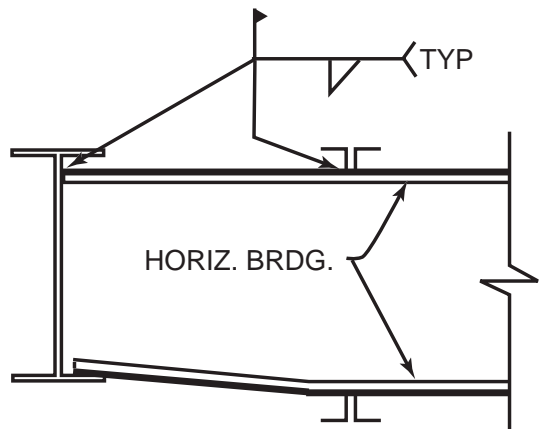
HORIZONTAL BRIDGING
TERMINUS AT WALL



HORIZONTAL BRIDGING
TERMINUS AT WALL

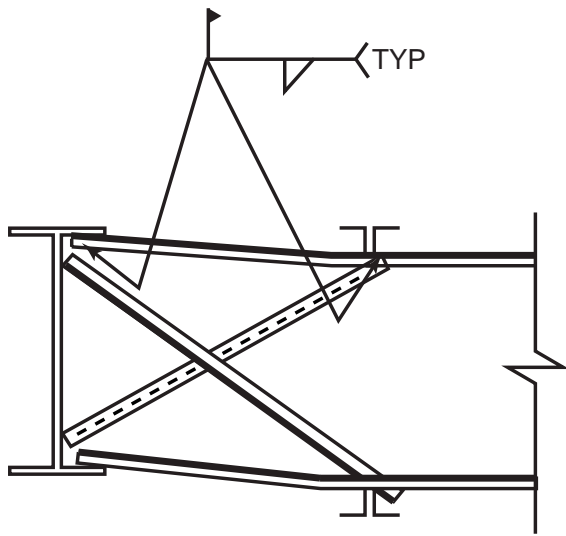


HORIZONTAL BRIDGING
TERMINUS AT PANEL WALL

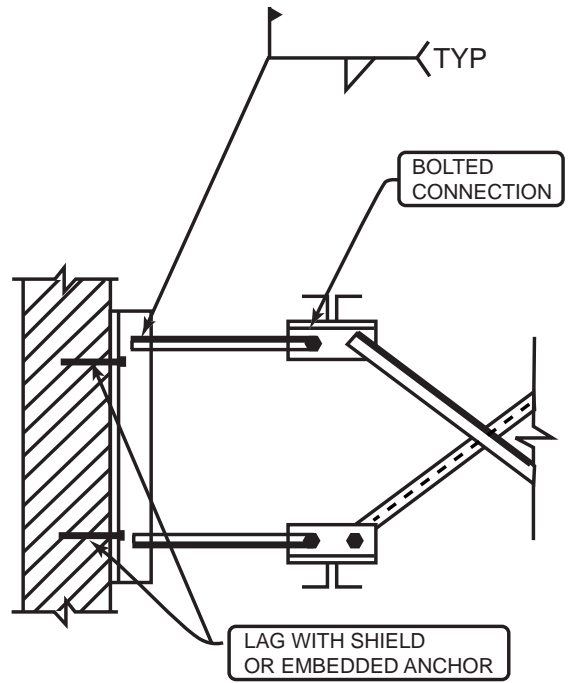


HORIZONTAL BRIDGING
TERMINUS AT
STRUCTURAL SHAPE

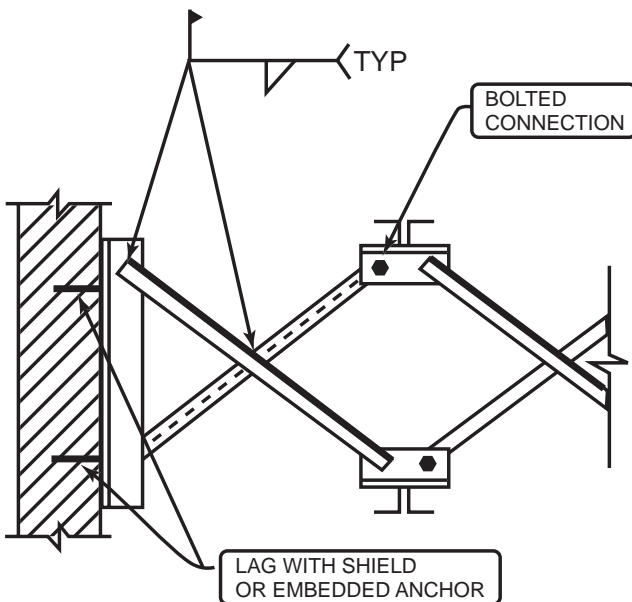




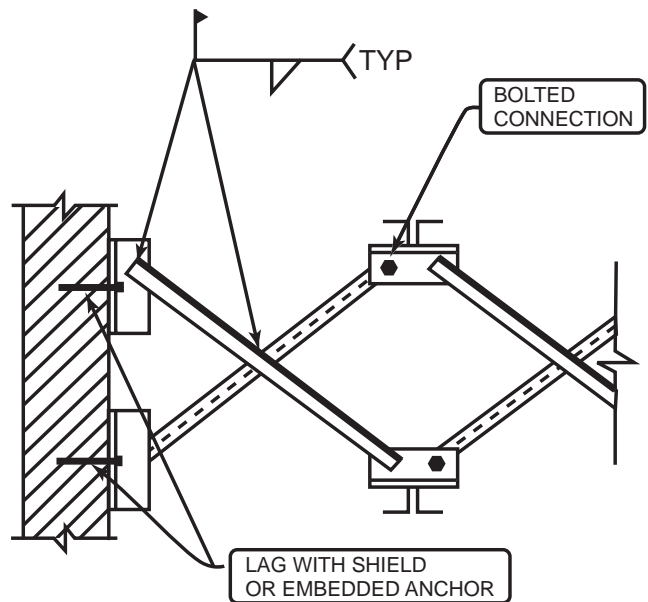
HORIZONTAL BRIDGING
TERMINUS AT STRUCTURAL
SHAPE WITH OPTIONAL
"X-BRIDGING"



BOLTED DIAGONAL BRIDGING
TERMINUS AT WALL

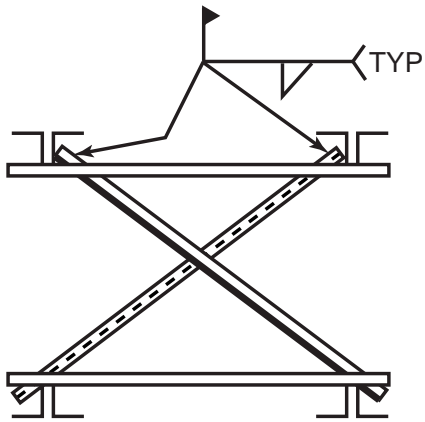


BOLTED DIAGONAL BRIDGING
TERMINUS AT WALL

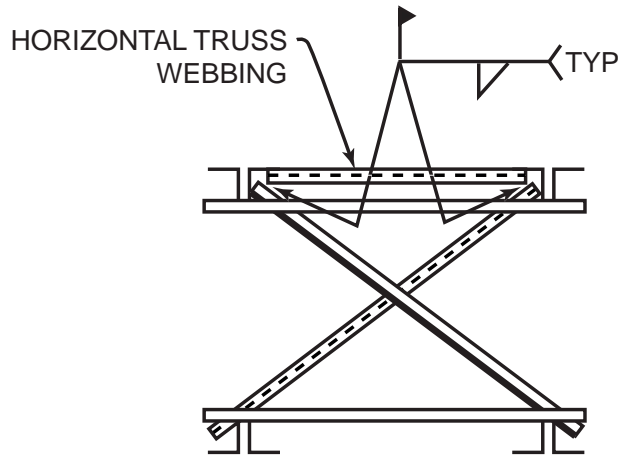


BOLTED DIAGONAL BRIDGING
TERMINUS AT WALL

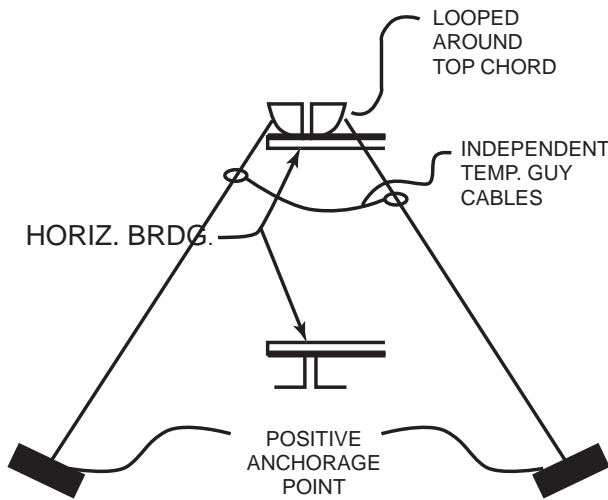




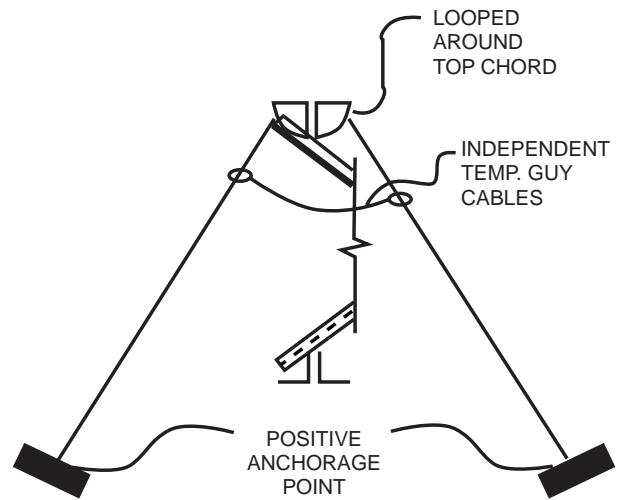
JOISTS PAIR BRIDGING
TERMINUS POINT



JOISTS PAIR BRIDGING
TERMINUS POINT



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