

STANDARD WEIGHT TABLES FOR JOIST GIRDERS

Based on 50 ksi Maximum Yield Strength
Adopted by the Steel Joist Institute May 17, 2016

The Joist Girders presented in the following tables are based on the Steel Joist Institute Standard Specifications for K-Series, LH- Series, and DLH- Series Open Web Steel Joists and for Joist Girders adopted November 4, 1985 – revised to November 10, 2014, Effective January 1, 2015 and all the requirements contained therein shall be followed.

The Joist Girders top chords are considered as being laterally supported by positive attachment of the supported steel joists to the Joist Girder top chord.

The top of the table presents the total kip load on each panel point (joist location). The tables can be utilized with either an ASD load in the green row, or a LRFD load (factored) in the blue row.

These weight tables are intended to be a tool to assist in the preliminary design and estimate for Joist Girders used in floors and roofs. All of the values are approximate and intended as a guide for the specifying professional. The joist manufacturer will design for the specific loads of the designation at the required span, and the values for self-weight may vary from the tabulated values – the tabulated values are not design minimums or maximums. It is presumed that the designated kip load includes an allowance for the Joist Girder self-weight, unless noted otherwise on the structural drawings.

There are countless combinations of span, number of panels, kip loads, and Joist Girder depth and the tables do not represent all available combinations. Interpolation can be used for approximate values when needed between columns and rows of the tables.

Consult with a joist manufacturer for information regarding web openings available for duct passage through Joist Girders.

Joist Girders that are anticipated to have chord angles of 6 x 6 or smaller which are un-shaded in the table shall have a standard 7 ½ inch bearing seat depth (height). The weight table includes high capacity Joist Girders that may utilize 8 x 8 chord angles. The Joist Girders that weigh 150 plf or more are shaded grey in the table and shall have a standard 10 inch minimum bearing seat depth. It is suggested that the joist manufacturer be consulted for lead times and availability of Joist Girders in the grey shaded portion of the table due to the possibility of 8 x 8 chord angles.

Example

Using the Joist Girder Weight Table

- 1) Joist Girder depth = 40 inch
- 2) Joist Girder span = 50 feet
- 3) Number of joist spaces = 8
- 4) Load at each panel point = 12 kips (ASD)

In this example, the corresponding Joist Girder designation is 40G8N12K.

Entering the weight tables for a Joist Girder span of 50 feet, a number of joist spaces equal to 8, a Joist Girder depth of 40 inch, and a panel point loading of 12 kips (ASD), the approximate self-weight of the Joist Girder is 59 pounds per linear foot.

STANDARD WEIGHTS

Joist Girders

GIRDER SPAN (ft)	JOIST SPACES (ft)	GIRDER DEPTH (in)	JOIST GIRDER WEIGHT -- POUNDS PER LINEAR FOOT																							
			LOAD ON EACH PANEL POINT -- KIPS																		ASD		LRFD			
			6	8	10	12	14	16	18	20	24	28	36	40	44	48	52	56	60	70	80	90	100			
20	2N@ 10.00	20	19	19	19	19	20	24	24	25	30	37	41	46	50	56	62	70	75	75	80	91	121	128		
		24	19	19	19	19	20	21	21	25	28	32	36	41	42	49	52	53	66	66	74	83	110	118		
		28	19	19	19	19	20	20	21	23	26	28	32	39	40	42	46	48	49	56	58	74	104	108		
	3N@ 6.67	20	15	19	19	20	23	24	27	31	36	44	48	54	74	75	81	84	89	96	110	122				
		24	16	16	16	19	20	23	26	27	33	36	45	47	53	56	68	79	82	84	98	108	126			
		28	16	16	16	17	20	24	24	26	31	36	44	46	49	53	57	68	78	79	80	89	119	124		
	4N@ 5.00	20	15	19	21	25	29	33	38	41	50	57	65	71	88	97	100	107	120	126	149					
24		16	17	20	23	26	29	32	35	44	50	55	62	71	85	90	100	102	109	130	154					
28		16	17	19	22	25	28	30	34	39	49	50	59	63	72	86	91	91	93	113	126	141	160			
5N@ 4.00	20	17	21	26	31	36	39	48	51	62	71	82	99	99	109	120	141	142								
	24	16	20	23	26	30	35	39	43	53	60	68	80	91	101	103	110	120	134	158						
	28	16	18	22	27	28	33	37	39	48	55	64	68	77	93	95	107	110	119	139	162	184	216			
6N@ 3.33	20	19	25	29	36	41	50	57	58	72	82	99	107	118	138	141										
	24	18	22	28	31	37	43	46	53	61	70	85	102	102	111	123			175							
	28	18	22	26	30	33	40	42	47	58	68	76	83	96	109	112	119	130	139	183	211	223	263			
8N@ 2.50	20	25	32	41	51	58	65	72	82	99	118	139	142													
	24	22	29	36	42	50	54	61	69	86	103	107	128	149	153											
	28	22	29	34	40	47	54	61	67	76	88	107	112	124	135	155	166	196	198	246	277	285				
22	2N@ 11.00	20	21	21	22	22	23	24	24	25	34	39	43	49	55	62	69	76	78	82	90	108	129	130		
		24	21	21	22	22	23	24	24	24	30	33	41	41	45	51	55	61	73	76	82	94	116	118		
		28	21	21	21	22	22	23	24	24	29	30	33	41	41	42	46	48	51	58	59	72	81	102	112	
	3N@ 7.33	20	18	18	19	22	24	26	29	33	42	45	53	68	70	76	84	88	94	104	120	138				
		24	15	19	19	20	23	24	26	30	35	40	45	48	55	61	74	81	84	92	98	113	127			
		28	16	16	16	19	20	23	24	27	32	36	45	47	52	54	59	74	82	76	86	100	121	126		
	4N@ 5.50	20	16	19	23	26	30	36	39	44	55	62	71	82	95	96	106	119	134	144						
24		15	17	20	25	27	29	34	38	48	52	58	71	79	89	98	101	107	115	144	153					
28		16	16	19	22	25	28	32	35	40	49	54	60	72	79	87	90	97	109	120	135	158	179			
5N@ 4.40	20	17	24	27	34	38	42	49	55	65	75	96	98	111	126	137	158									
	24	16	20	24	28	33	38	40	48	56	62	73	85	100	101	110	116	133	153							
	28	16	18	22	26	30	32	38	41	51	57	65	73	86	92	102	105	111	126	159	170	183				
6N@ 3.67	20	21	27	33	39	49	56	57	65	79	97	106	118	137												
	24	19	23	28	32	39	45	51	58	66	82	98	101	109	109	120	142	144								
	28	18	22	26	30	34	39	44	50	61	70	76	89	101	102	104	113	127	148	157	181	204	245	280		
8N@ 2.75	20	27	36	43	56	64	71	80	96	106	135	138														
	24	24	31	38	46	53	60	68	75	101	105	125	145	149												
	28	22	28	34	40	47	54	62	69	79	87	106	118	131	152	164	192	214	233	265	304	310				
25	3N@ 8.33	20	18	19	22	26	27	30	37	41	49	59	66	70	76	86	89	97	102	115	137					
		24	15	19	20	22	25	26	28	32	39	43	51	59	67	71	81	84	89	96	111	122				
		28	15	19	19	20	23	24	27	29	34	39	45	47	55	59	67	81	82	83	98	113	126	141		
	4N@ 6.25	20	16	16	16	20	21	23	24	27	32	36	44	46	52	54	58	74	81	73	86	100	121	119		
		24	16	16	17	17	20	24	24	26	32	36	40	45	48	53	54	68	79	70	80	89	119	124		
		28	16	16	17	17	20	24	24	26	32	36	40	45	48	53	54	68	79	70	80	89	119	124		
	5N@ 5.00	20	18	20	25	29	35	39	42	49	55	70	78	93	99	109	119	134	135							
		24	16	19	21	26	29	33	37	40	50	57	64	72	88	97	100	106	120	126	149					
		28	15	17	20	24	25	29	34	37	43	51	58	66	72	89	90	101	102	114	129	153	177	203		
	6N@ 4.17	20	17	19	21	25	28	32	35	40	49	54	60	69	79	86	91	96	109	117	135	153				
		24	16	19	23	26	30	33	38	41	51	57	65	73	83	93	102	105	111	129	158	169	183	212		
		28	16	18	22	26	28	31	36	39	48	54	64	69	75	88	96	101	108	119	133	159	184	188		
8N@ 3.12	20	29	39	48	58	70	78	94	99	115	134															
	24	26	33	41	50	57	65	75	81	99	118	138														
	28	23	30	38	44	53	60	67	75	86	103	116	127	147	188	188	207	215	245	284						
10N@ 2.50	20	38	49	63	78	94	100	115	134																	
	24	33	42	54	65	75	89	99	104																	
	28	30	38	48	56	64	74	84	101	109	134	147	179	207	211	234	272	293	308							



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Fire Ratings Joist Girders LH & DLH K & KCS Standard Specification Code of Standard Practice Economic Joist Guide Bridging & Acc. General Information

GIRDER	JOIST SPACES	GIRDER DEPTH	JOIST GIRDER WEIGHT -- POUNDS PER LINEAR FOOT																							
			LOAD ON EACH PANEL POINT -- KIPS																		ASD		LRFD			
			9	8	10	12	14	16	18	20	24	28	32	36	40	44	48	52	56	60	70	80	90	100		
35	4N@ 8.75	28	19	23	27	31	36	41	46	52	60	74	79	94	100	111	117	137	138	156	185	194	237	256		
		32	18	21	24	28	33	37	39	45	53	60	73	80	92	100	106	112	127	144	159	171	196	229		
		36	16	20	23	27	30	33	37	41	51	55	62	74	83	94	97	107	113	115	147	162	184	194		
		40	16	17	21	26	27	30	37	38	46	52	61	64	75	90	95	96	108	107	129	153	177	185		
	5N@ 7.00	28	20	26	32	37	43	52	57	59	73	86	100	109	126	136	137	138	139	190	224	258	273			
		32	18	24	29	34	37	45	50	53	66	75	88	100	102	112	128	138	139	170	194	224	253	292		
		36	17	23	27	29	35	40	46	48	62	68	77	90	100	104	115	131	133	153	175	205	240	254		
		40	17	22	25	27	33	37	43	47	56	63	70	80	95	102	107	115	125	144	166	199	206	223		
	6N@ 5.83	28	24	30	37	44	52	58	65	73	93	103	115	134	154	166	187	202	213	230	270					
		32	21	27	33	38	46	53	57	65	79	96	100	117	139	140	170	172	191	202	236	281				
		36	20	25	31	36	41	48	54	58	70	81	99	102	113	121	142	144	174	187	211	241	269	314		
		40	20	24	28	34	38	44	49	55	64	77	84	101	104	115	123	145	146	168	208	215	244	273		
	7N@ 5.00	28	27	34	43	52	59	66	74	86	101	115	135	167	178	190	215	233	245	268						
		32	24	30	39	47	53	61	67	75	97	103	118	137	160	171	192	196	226	238	282					
		36	23	28	35	42	48	55	62	69	82	99	105	120	141	144	173	186	196	211	250	291				
		40	22	27	32	39	44	50	55	63	73	86	102	107	118	133	147	166	178	188	219	266	276			
	8N@ 4.38	28	30	39	48	59	69	78	94	98	115	136	165	187	202	217	243	269	289	296						
		32	27	36	42	53	61	69	79	88	101	118	138	170	172	191	219	223	245	272						
		36	26	32	39	48	55	62	71	77	99	109	121	141	164	175	202	207	232	248	294					
		40	24	30	37	44	54	60	65	73	86	102	113	127	147	149	185	198	210	215	273	310				
38	4N@ 9.50	32	19	21	26	31	34	39	43	48	58	67	74	87	100	101	111	127	138	144	168	190	237	248		
		36	17	21	24	28	33	35	39	44	53	60	74	75	93	97	106	112	123	125	153	170	180	225		
		40	16	20	23	27	30	34	37	41	51	55	62	74	83	94	98	107	109	115	147	153	177	202		
		44	16	20	22	26	28	30	35	38	46	52	58	65	75	90	95	95	108	112	124	150	160	177		
	5N@ 7.60	32	20	25	31	36	42	46	52	59	70	86	96	101	111	126	137	158	177	185	205	237	253			
		36	20	24	28	33	38	45	47	53	64	74	89	98	103	112	129	138	160	167	184	215	242	270		
		40	20	23	26	31	35	40	46	48	59	70	78	91	101	105	113	117	134	153	176	203	216	242		
		44	20	22	25	30	33	39	41	48	56	63	75	80	93	102	107	111	118	145	166	199	204	229		
	6N@ 6.33	32	24	30	35	41	49	55	62	70	86	98	105	125	136	167	175	189	196	222	247	293				
		36	21	27	33	39	47	50	57	61	75	89	100	107	118	141	142	172	183	194	227	250	273			
		40	21	25	31	36	40	48	55	59	71	82	99	102	109	121	143	142	174	182	206	233	257	294		
		44	20	24	29	33	38	44	49	55	64	77	84	102	104	115	123	145	147	169	190	209	245	270		
8N@ 4.75	32	29	38	47	56	64	74	86	95	105	135	156	169	189	217	229	247	271	299							
	36	28	35	42	50	57	65	76	81	101	113	138	140	172	192	212	222	245	260	315						
	40	26	32	40	48	55	62	67	78	100	103	121	142	144	175	202	205	222	238	283						
	44	24	30	39	47	51	57	64	71	86	102	113	127	147	149	187	199	210	222	272	309					
40	4N@ 10.00	32	20	23	29	37	40	47	50	56	64	73	86	103	114	126	128	149	151	164	177	195	238	249		
		36	19	22	29	31	37	40	44	51	57	65	74	87	103	104	125	127	128	144	168	180	210	228		
		40	18	22	25	29	33	37	40	47	52	62	73	77	87	96	104	117	127	132	148	171	181	203		
		44	17	20	24	29	31	36	38	41	49	59	66	74	78	84	96	106	106	111	129	150	177	186		
	5N@ 8.00	32	21	26	32	38	43	52	55	62	73	86	101	109	124	134	154	167	177	190	224	257	278			
		36	20	24	30	34	39	45	53	55	66	74	88	102	102	112	128	138	159	170	194	235	252	292		
		40	20	24	27	32	37	41	46	51	62	68	77	90	100	105	115	130	142	162	183	214	240	253		
		44	20	23	29	32	37	41	49	50	58	70	82	84	99	102	118	130	141	144	168	198	212	242		
	6N@ 6.67	32	24	30	38	44	52	58	65	72	93	100	115	133	154	166	186	190	213	221	269					
		36	22	27	34	39	47	53	60	67	79	97	102	117	137	141	170	172	191	194	235	271				
		40	21	26	30	36	43	48	54	62	71	82	99	103	114	130	142	163	174	185	219	254	271			
		44	21	24	28	36	40	47	51	55	66	78	91	102	107	116	134	142	146	177	208	234	247	291		
7N@ 5.71	32	26	33	43	52	58	66	74	86	101	115	135	167	178	191	205	233	245	258							
	36	24	31	39	47	53	61	67	75	97	103	117	136	159	171	191	206	219	237	280						
	40	24	29	35	43	49	55	62	69	82	99	105	119	140	162	174	187	199	213	256	298					
	44	22	28	33	39	48	55	59	64	78	92	102	111	122	143	165	176	187	200	230	269	276				
8N@ 5.00	32	29	38	48	58	67	78	94	96	115	135	165	188	195	217	243	259	280								
	36	27	36	46	53	60	68	80	88	102	118	137	170	180	193	219	231	245	276							
	40	25	34	39	49	58	65	72	82	99	109	120	141	173	189	205	220	226	258	291						
	44	23	33	39	47	56	63	70	75	93	103	120	136	147	185	195	205	216	240	275						
10N@ 4.00	32	39	51	64	79	92	112	123	125	149	177	195	220	244	268											
	36	36	47	60	69	81	94	103	125	150	161	182	211	234	249	280	290									
	40	36	45	56	66	75	82	96	115	129	152	173	184	216	231	257	274	304								
	44	32	41	51	60	71	82	84	99	119	143	161	178	198	220	234	254	280	297							
48	32	41	52	58	68	76	85	94	121	134	152	169	181	201	215	242	256	275								



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General Information Bridging & Acc. Economic Joist Girder Code of Standard Practice Standard Specification K & KCS LH & DLH Joist Girders Fire Ratings

GIRDER SPAN (ft)	JOIST SPACES (ft)	GIRDER DEPTH (in)	JOIST GIRDER WEIGHT -- POUNDS PER LINEAR FOOT															LOAD ON EACH PANEL POINT -- KIPS					ASD		LRFD	
			6	8	10	12	14	16	18	20	24	28	32	36	40	44	48	52	56	60	70	80	90	100		
			9	12	15	18	21	24	27	30	36	42	48	54	60	66	72	78	84	90	105	120	135	150		
42	4N@ 10.50	32	21	25	29	34	38	43	49	53	67	74	86	99	101	112	125	134	138	163	195	224	250	275		
		36	19	22	26	32	35	39	44	47	58	67	73	87	95	101	112	118	129	145	168	191	237	246		
		40	19	21	24	28	34	36	41	45	53	61	73	76	93	97	97	113	122	125	147	171	194	210		
		44	19	20	23	27	31	34	38	42	51	55	62	74	84	94	97	108	109	118	138	159	179	203		
	48	19	21	24	26	29	32	36	39	47	54	62	65	75	90	95	97	108	112	130	150	160	177			
	5N@ 8.40	32	22	28	35	41	45	52	57	66	74	88	100	110	125	152	166	176	189	199	225	258				
		36	21	25	31	36	42	46	52	59	70	85	96	102	111	126	137	158	168	179	203	235	253	275		
		40	21	24	28	33	39	44	51	54	64	74	89	98	103	113	129	130	160	171	183	213	241	263		
		44	20	24	27	31	37	40	46	52	59	69	78	91	101	105	113	126	134	151	176	207	216	242		
	48	20	23	27	30	35	39	42	48	57	63	75	81	95	102	107	115	118	145	168	199	206	229			
	6N@ 7.00	32	25	32	39	45	55	61	69	77	93	103	124	135	163	175	187	202	213	239	277					
		36	23	30	35	41	49	56	60	67	79	96	105	117	137	158	169	190	204	207	243	282				
		40	21	26	33	39	46	54	57	61	75	89	100	108	119	141	142	172	183	194	227	249	267			
		44	21	24	31	35	41	48	54	59	71	81	100	102	109	121	143	142	174	176	208	233	254	302		
	48	20	25	29	33	39	44	49	56	64	77	85	102	104	115	124	145	147	169	191	216	246	269			
	7N@ 6.00	32	28	36	45	52	65	72	85	93	102	125	154	166	187	200	225	239	252	277						
		36	26	34	40	49	56	67	74	79	98	110	127	138	169	181	194	208	235	248	289					
		40	24	31	38	46	54	61	68	75	90	101	113	129	142	172	184	195	208	230	267	297				
		44	23	29	35	41	49	55	63	70	78	100	106	116	132	145	166	184	198	203	246	281	299			
	48	23	28	34	39	44	50	56	64	73	92	102	108	118	136	149	169	184	190	220	255	265				
	8N@ 5.25	32	32	40	51	62	72	78	94	100	124	135	166	188	213	235	245	268								
		36	27	38	46	56	64	74	79	96	105	126	138	169	189	208	220	246	263	274						
		40	26	35	42	51	57	65	76	81	101	113	138	141	173	192	211	222	237	256	311					
		44	25	32	39	49	55	63	70	78	99	107	121	142	147	175	201	206	223	238	283					
48	26	32	41	48	56	63	67	74	93	103	112	128	148	169	188	198	210	230	271	307						
10N@ 4.20	32	38	52	62	77	94	101	114	134	164	187	215	239	264	291	308										
	36	36	46	60	70	86	97	102	112	140	179	193	223	244	268	298										
	40	34	45	54	64	75	89	99	104	129	161	182	205	218	237	268	301	308								
	44	31	41	52	61	70	79	91	100	114	143	164	185	208	221	241	269	284	310							
48	30	39	49	56	66	72	80	93	107	125	146	168	199	211	226	252	267	285								
45	4N@ 11.25	36	21	25	28	33	38	42	46	52	62	72	79	95	100	112	117	128	138	154	178	193	238	250		
		40	21	22	27	31	35	39	44	47	55	64	75	87	95	101	112	113	128	144	169	180	211	228		
		44	21	22	24	29	33	37	39	45	53	61	74	76	89	95	102	108	114	125	148	171	193	215		
		48	21	22	24	28	31	34	38	40	51	55	63	75	83	94	95	107	109	115	139	164	180	204		
	52	22	23	24	27	29	33	37	39	47	52	60	66	76	91	95	96	109	112	125	153	161	178			
	5N@ 9.00	36	22	27	33	38	44	52	55	63	74	86	101	109	125	136	155	167	177	191	224	256	278			
		40	21	25	30	36	42	45	53	56	68	75	88	102	111	122	128	156	159	180	203	234	253	287		
		44	21	24	29	34	38	44	46	54	65	74	85	90	103	110	123	130	142	159	184	215	248	263		
		48	21	24	27	32	36	41	45	52	59	67	75	91	95	106	112	118	134	151	179	208	232	241		
	52	21	24	27	30	35	39	42	48	57	64	75	81	94	98	107	117	119	145	169	200	212	225			
	6N@ 7.50	36	24	31	38	45	52	58	66	74	93	100	115	134	154	167	187	190	203	221	258					
		40	23	28	34	40	47	53	60	67	79	97	103	117	137	140	170	181	191	203	244	271				
		44	21	27	32	38	46	50	54	62	76	90	100	107	118	139	142	172	175	194	228	252	280			
		48	21	26	30	36	42	48	55	59	69	78	92	102	110	122	143	143	167	177	207	233	265	289		
	52	21	25	29	34	39	44	50	56	64	77	85	102	102	116	124	136	148	169	191	214	246	268			
	7N@ 6.43	36	27	35	44	52	58	66	74	86	101	115	135	158	176	191	206	233	246	258						
		40	26	33	40	47	54	61	67	75	97	105	127	138	160	179	192	206	227	237	288					
		44	24	30	39	46	54	61	62	69	90	100	113	129	143	163	184	196	201	221	256	297				
		48	23	29	36	41	49	55	63	70	79	92	107	117	133	145	166	177	190	203	246	277	299			
	52	23	28	34	39	45	50	56	65	73	93	102	109	118	136	149	170	183	194	224	254	274				
	8N@ 5.62	36	30	38	48	58	67	78	94	98	114	135	165	188	193	216	243	259	280							
		40	28	36	46	53	61	68	80	89	105	118	137	170	181	196	219	232	247	275						
		44	27	34	41	51	58	66	73	81	99	109	130	141	173	185	202	215	226	249	298					
		48	26	32	39	47	55	63	68	74	92	104	116	142	146	176	193	208	216	240	270					
52	28	33	42	48	54	59	67	71	94	102	112	127	148	167	188	198	210	219	259	304						
9N@ 5.00	36	34	45	55	66	74	88	98	104	135	165	179	203	229	241	271	294									
	40	31	39	49	61	69	80	89	100	113	138	168	188	196	223	247	263	293								
	44	31	39	48	58	66	76	89	99	108	132	162	178	190	216	241	248	275	302							
	48	29	37	47	55	63	70	79	91	106	117	133	166	188	206	224	235	251	279	298						
52	28	36	46	55	60	70	73	84	102	112	135	148	169	197	200	226	231	259	293							
10N@ 4.50	36	38	49	60	73	86	98	105	116	137	177	192	220	245	268											
	40	35	47	60	76	90	102	112	140	170	182	211	236	264		289	299									
	44	33	46	54	64	72	89	99	104	130	142	173	203	216	239	260	274	302								
	48	31	40	49	62	71	78	91	100	114	134	164	186	205	219	240	267	279	304							
52	31	39	50	56	67	72	80	93	107	123	147	168	190	211	224	251	264	282								



STANDARD WEIGHTS

Joist Girders

Fire Ratings Joist Girders LH & DLH K & KCS Standard Specification Code of Standard Practice Economic Joist Guide Bridging & Acc. General Information

GIRDER SPAN (ft)	JOIST SPACES (ft)	GIRDER DEPTH (in)	JOIST GIRDER WEIGHT -- POUNDS PER LINEAR FOOT																							
			LOAD ON EACH PANEL POINT -- KIPS																		ASD		LRFD			
			6	8	10	12	14	16	18	20	24	28	32	36	40	44	48	52	56	60	70	80	90	100		
9	12	15	18	21	24	27	30	36	42	48	54	60	66	72	78	84	90	105	120	135	150					
48	5N@ 9.60	36	26	31	37	45	52	59	66	71	87	111	113	135	136	152	167	176	189	200	228	269				
		40	23	29	35	41	46	52	59	68	77	92	112	114	136	138	155	161	178	188	203	237	272			
		44	22	27	32	37	44	48	54	61	69	80	93	113	116	126	139	150	160	174	195	226	253	275		
		48	21	25	30	36	40	48	48	55	69	78	90	96	115	116	128	140	142	166	185	219	241	263		
		52	21	25	29	33	39	42	50	54	62	71	82	92	99	117	118	130	141	157	178	206	224	241		
	56	21	24	29	33	38	40	46	50	59	71	79	85	100	100	119	120	133	146	170	200	212	226			
	6N@ 8.00	36	28	35	42	51	62	70	78	83	100	122	134	147	163	175	189	202	222	233	277					
		40	25	33	39	47	56	64	71	79	93	112	124	137	148	168	179	189	212	222	247	282				
		44	24	31	36	45	50	57	65	73	81	102	115	127	138	151	168	173	192	204	236	262	292			
		48	23	30	35	40	48	52	59	67	78	95	105	116	129	141	160	166	175	186	220	252	279	310		
		52	23	27	32	38	46	51	59	60	75	83	97	107	130	131	144	162	169	178	208	234	259	290		
	56	22	27	31	37	42	48	54	61	69	80	91	107	120	132	134	153	165	166	191	208	246	267			
	8N@ 6.00	36	36	45	56	64	78	91	100	122	134	153	167	186	213	234	257	278								
		40	33	42	51	59	70	80	92	101	124	148	157	170	191	208	229	248	272	288						
		44	32	39	49	55	65	74	82	95	114	127	150	161	185	193	212	223	244	268						
		48	30	37	47	53	60	68	76	84	105	129	131	154	174	189	197	216	226	247	290					
		52	30	36	44	51	59	65	71	80	99	119	132	146	164	185	195	209	221	239	283					
	56	28	36	43	49	57	63	69	78	90	109	123	136	155	168	189	198	209	228	258	294					
	9N@ 5.33	36	44	55	70	79	91	99	121	122	146	165	190	215	237	252	279									
		40	42	52	63	74	88	93	101	113	136	156	179	195	218	230	256	284								
44		39	50	59	69	83	91	94	103	126	150	168	182	199	222	236	257	285	302							
48		37	46	56	66	76	85	94	97	118	130	162	175	190	217	224	247	273	290							
52		36	46	54	63	72	80	95	101	108	132	152	167	188	212	220	242	251	277							
56	35	44	53	62	69	80	89	98	103	123	137	165	180	207	211	236	240	271	314							
12N@ 4.00	36	52	71	84	100	123	135	148	167	190	230	256	289													
	40	48	65	76	93	113	125	137	149	177	206	233	260	288												
	44	44	57	73	82	102	115	126	139	159	193	211	239	271	297											
	48	41	53	67	76	88	104	117	130	153	175	197	221	246	276	301										
	52	39	52	61	76	84	97	107	131	144	168	190	212	237	261	280	306									
56	38	49	61	70	81	91	108	122	135	165	183	195	217	242	266	287	312									
50	5N@ 10.00	40	23	30	38	44	47	56	60	68	79	93	113	124	136	138	155	165	177	182	216	257	279			
		44	22	29	34	40	46	51	56	61	76	89	94	113	126	137	139	157	172	180	203	236	255	292		
		48	22	28	31	38	42	48	55	61	69	78	94	96	115	127	139	141	160	172	192	207	241	262		
		52	22	25	31	35	40	45	49	55	62	74	82	96	116	117	129	141	142	161	186	203	227	243		
		56	22	25	30	32	40	43	50	51	63	71	83	92	99	117	119	131	142	146	169	199	219	231		
	60	20	24	30	33	36	42	46	51	58	65	76	86	96	101	120	121	133	142	166	174	198	226			
	6N@ 8.33	40	28	34	42	48	56	64	71	80	100	112	124	147	155	167	178	191	204	231	258					
		44	24	31	38	47	50	57	65	73	85	102	124	127	149	159	168	181	191	213	246	270				
		48	23	30	37	40	49	57	65	67	82	95	115	127	129	151	162	173	184	195	229	250	292			
		52	23	30	36	40	46	52	59	67	75	84	105	117	129	131	153	162	176	188	218	242	269	300		
		56	23	26	33	39	42	51	54	60	72	84	98	107	120	132	144	163	164	176	209	225	257	280		
	60	23	27	33	38	43	49	53	61	70	80	87	102	110	123	134	154	165	171	182	207	247	264			
	8N@ 6.25	40	31	39	51	59	67	78	86	96	110	135	166	177	193	217	244	259	281							
		44	29	37	47	53	61	70	80	96	103	118	139	170	182	198	221	230	254	276						
		48	27	35	42	51	58	69	76	81	99	114	130	142	175	186	201	224	242	255	297					
		52	25	33	40	49	55	63	70	78	99	107	121	141	164	178	197	207	218	236	281					
		56	29	36	42	47	56	64	68	78	94	108	118	137	148	169	192	204	212	230	271	315				
	60	27	35	40	47	55	61	69	74	83	103	110	123	139	149	182	200	208	215	258	291	312				
	9N@ 5.56	40	34	44	55	66	74	86	96	104	134	155	179	203	219	242	256	286								
		44	32	40	53	61	69	80	88	98	113	138	169	195	207	223	244	267	293							
48		32	42	52	58	69	77	90	99	111	133	163	184	201	216	241	250	274	300							
52		31	40	47	58	66	74	79	92	106	126	143	178	192	207	222	244	254	278	312						
56		30	38	46	55	60	68	77	89	102	116	135	166	181	197	211	237	251	272	309						
60	32	38	49	53	61	70	75	83	97	111	125	141	179	192	209	227	239	266	303							
10N@ 5.00	40	38	49	60	74	87	96	104	116	139	177	194	220	244	269											
	44	36	47	60	68	84	96	102	112	137	170	188	211	235	264	289	294									
	48	34	46	54	65	76	89	99	103	130	159	182	205	217	239	268	284	298								
	52	34	45	52	62	70	79	91	100	114	134	164	185	207	222	239	270	282	305							
	56	32	41	48	60	70	76	87	93	107	134	146	174	198	211	232	250	279	283							
60	31	40	49	57	66	73	81	94	109	119	138	169	180	201	225	230	253	272								
12N@ 4.17	40	49	65	80	100	112	125	147	157	180	206	241	269													
	44	44	57	73	86	102	126	127	149	168	192	227	248	280	302											
	48	41	58	67	82	96	115	127	130	154	184	199	230	254	284	310										
	52	39	53	68	76	84	105	118	130	154	176	189	219	244	263	289	314									
	56	40	52	61	70	85	99	108	122	135	164	182	210	228	252	270	296									
60	39	49	61	70	82	88	104	112	135	166	175	196	219	242	258	274	302									



STANDARD WEIGHTS

Joist Girders

General Information Bridging & Acc. Economic Joist Girder Code of Standard Practice Specification K & KCS LH & DLH Joist Girders Fire Ratings

GIRDER SPAN (ft)	JOIST SPACES (ft)	GIRDER DEPTH (in)	JOIST GIRDER WEIGHT -- POUNDS PER LINEAR FOOT																							
			LOAD ON EACH PANEL POINT -- KIPS																		ASD		LRFD			
			6	8	10	12	14	16	18	20	22	24	26	28	30	35	40	45	50	55	60	65	ASD	LRFD		
9	12	15	18	21	24	27	30	33	36	39	42	45	52.5	60	67.5	75	82.5	90	97.5							
55	5N@ 11.00	44	24	29	35	41	47	53	59	63	71	82	83	86	97	110	127	141	157	174	193	207				
		48	23	28	32	38	43	49	56	60	64	71	73	83	93	104	121	133	148	167	179	193				
		52	23	27	32	36	42	44	52	57	65	66	74	74	90	99	114	124	139	156	170	181				
		56	24	26	31	36	39	44	51	53	58	66	66	74	79	92	110	121	135	148	162	173				
		60	24	27	31	35	38	45	47	52	60	61	67	68	80	88	101	115	124	138	147	163				
	6N@ 9.17	44	26	33	38	45	52	59	66	75	86	86	98	101	117	136	155	174	189	207	232	247				
		48	24	31	36	44	50	56	64	68	75	87	89	94	109	122	147	155	181	194	214	237				
		52	24	29	35	41	48	54	61	64	72	75	80	88	106	117	139	149	164	188	196	208				
		56	24	28	35	39	47	52	55	63	70	71	78	82	101	113	122	140	158	176	187	195				
		60	24	29	33	38	43	48	55	60	64	71	75	80	95	108	116	132	153	158	179	187				
	7N@ 7.86	44	28	36	44	53	59	70	75	87	97	102	111	120	135	152	178	189	219	236	257	274				
		48	27	34	43	51	56	65	72	76	89	98	103	110	120	135	171	184	207	228	241	263				
		52	26	33	39	46	55	62	69	74	86	91	100	105	116	126	160	175	190	207	234	252				
		56	25	31	38	46	53	55	64	70	79	87	92	101	111	118	148	158	182	203	221	240				
		60	24	30	36	41	49	56	64	68	72	81	93	94	108	111	140	141	169	192	203	224				
	9N@ 6.11	44	34	46	55	67	74	87	98	105	116	135	137	158	169	199	229	240	284							
		48	32	40	53	61	69	81	97	103	107	118	129	139	165	183	208	238	259	291						
		52	33	43	52	65	73	77	90	104	105	114	125	133	157	177	203	231	249	273	301					
		56	32	43	51	59	67	75	87	92	105	107	117	128	143	161	193	217	242	259	286	302				
		60	32	40	47	56	67	71	80	93	95	108	109	118	139	145	188	199	224	248	277	291				
11N@ 5.00	44	43	55	67	87	97	106	126	137	158	178	180	193	208	246	285										
	48	39	54	65	76	89	103	112	128	139	160	171	183	197	235	263	272									
	52	37	52	62	73	88	99	105	115	131	142	161	174	185	211	243	266	302								
	56	39	48	60	68	80	93	102	107	118	134	146	166	174	198	230	259	290	304							
	60	37	47	58	67	77	82	95	108	110	121	137	148	164	191	227	248	275	289							
60	5N@ 12.00	48	27	33	39	44	51	57	63	69	76	87	89	94	98	108	128	152	164	180	190	208				
		52	27	31	36	44	47	52	60	65	69	77	85	90	94	103	125	133	155	168	179	189				
		56	24	30	34	41	45	52	59	63	69	74	78	87	90	100	116	128	139	156	173	185				
		60	24	29	34	40	45	49	53	60	66	70	75	80	87	95	112	121	135	145	164	175				
		66	24	30	33	36	42	47	51	56	61	67	72	73	81	92	102	117	123	133	148	167				
	6N@ 10.00	48	29	36	41	49	60	67	72	80	93	93	112	113	119	128	156	174	189	205	227	242				
		52	28	33	39	48	57	62	69	78	80	94	94	113	116	122	147	159	181	195	214	237				
		56	25	33	39	48	51	58	66	69	79	83	95	96	106	107	139	150	174	187	198	222				
		60	24	32	39	43	50	57	63	70	75	83	83	96	101	103	123	133	165	176	187	205				
		66	24	32	34	42	50	52	61	65	69	77	84	85	96	98	119	126	151	167	179	196				
	8N@ 7.50	48	34	43	56	64	72	80	93	112	123	125	136	148	155	173	194	233	248	262						
		52	31	40	50	58	72	81	94	103	114	125	127	139	146	174	191	209	231	251	276	292				
		56	31	38	49	58	66	75	83	96	104	116	127	129	139	148	176	192	215	240	251	269				
		60	32	39	47	53	61	69	77	85	98	106	118	122	124	140	170	184	205	229	242	260				
		66	33	41	46	53	62	70	78	82	90	100	108	120	122	123	161	171	198	207	231	251				
	10N@ 6.00	48	37	49	60	74	87	97	105	118	137	138	167	180	190	233	245	264								
		52	38	50	64	71	88	97	103	113	130	138	160	173	181	208	237	257								
		56	37	46	58	65	76	90	104	105	123	131	143	160	172	193	228	251	281	305						
		60	37	45	57	66	73	86	93	104	111	126	134	159	167	182	217	244	270	288						
		66	37	49	56	65	74	85	95	102	120	122	134	145	146	164	199	218	242	262	292	307				
12N@ 5.00	48	46	59	75	87	102	111	135	158	169	181	194	207	233	250	291										
	52	45	57	69	88	98	104	118	139	160	169	183	196	206	241	283										
	56	41	55	66	77	91	104	113	129	140	162	174	185	198	235	266	285									
	60	39	54	64	74	91	102	106	121	133	145	165	177	188	205	245	263	309								
	66	41	53	62	77	87	100	110	119	134	147	164	171	182	194	230	251	283	297							
15N@ 4.00	48	64	80	102	124	136	158	170	189	209	235	252	267	293												
	52	57	74	94	114	127	150	161	182	193	212	232	252	268												
	56	53	71	83	104	127	140	153	171	186	198	215	234	247	276											
	60	51	68	83	98	118	132	144	162	178	189	207	219	235	261	308										
	66	49	62	81	87	110	123	136	153	167	183	193	210	217	253	289										
72	46	64	77	90	106	125	139	142	160	171	179	200	208	248	276	289										



GIRDER SPAN (ft)	JOIST SPACES (ft)	GIRDER DEPTH (in)	JOIST GIRDER WEIGHT -- POUNDS PER LINEAR FOOT																										
			LOAD ON EACH PANEL POINT -- KIPS																		ASD			LRFD					
			6	8	10	12	14	16	18	20	22	24	26	28	30	35	40	45	50	55	60	65	45	50	55	60	65		
9	12	15	18	21	24	27	30	33	36	39	42	45	52.5	60	67.5	75	82.5	90	97.5	60	67.5	75	82.5	90	97.5				
65	6N@ 10.83	52	30	39	45	54	61	69	78	83	95	97	115	116	122	137	157	174	192	208	227	240							
		56	29	35	42	49	58	63	70	80	84	97	97	117	119	129	148	159	181	201	206	231							
		60	29	34	41	50	56	64	71	76	82	92	98	99	111	117	139	150	173	190	198	212							
		66	26	33	40	45	51	58	65	73	78	83	87	100	103	106	124	142	165	178	188	200							
	72	27	32	37	43	49	54	60	68	76	80	87	89	93	97	117	129	147	164	171	186								
	8N@ 8.12	52	38	44	58	66	74	83	97	115	127	129	141	153	161	174	195	234	249	262	286								
		56	34	43	52	63	74	83	97	105	118	129	131	143	151	168	183	209	231	251	277					286			
		60	33	41	51	60	69	77	85	99	108	119	130	133	139	151	179	204	214	239	260					269			
		66	33	42	49	56	63	75	80	89	101	110	122	124	135	141	170	190	204	229	244					252			
	72	39	42	47	56	65	75	78	89	92	104	113	125	131	137	166	182	201	213	238					249				
	9N@ 7.22	52	38	49	62	74	83	97	116	128	129	142	153	158	169	190	229	249	284										
		56	39	48	59	68	81	98	106	118	130	142	144	155	161	183	208	238	259	273									
		60	38	47	58	69	78	86	100	109	120	132	145	146	152	177	199	226	240	261	294								
		66	37	44	53	64	72	81	89	103	112	124	136	138	144	162	196	209	235	254	286					305			
	72	35	44	52	62	71	79	91	108	115	127	140	140	153	182	195	225	249	266						285				
	10N@ 6.50	52	41	58	67	82	97	116	128	131	154	155	168	180	191	233	245	276											
		56	40	52	68	77	91	107	119	132	144	151	165	175	181	208	238	262	289										
		60	40	51	61	74	87	100	109	122	134	146	162	172	182	199	228	254	280	298									
		66	39	50	60	72	82	90	103	113	125	138	140	163	169	183	218	245	263	274	296								
	72	37	47	56	67	76	87	93	110	127	129	141	143	146	165	202	219	241	252	293									
11N@ 5.91	52	45	59	75	89	106	118	131	153	158	178	186	194	209	237	273													
	56	44	60	69	85	99	119	132	144	156	161	182	187	197	226	262	269												
	60	44	55	70	79	92	109	122	134	147	162	170	184	186	214	245	258												
	66	42	54	64	73	90	104	113	125	139	147	164	166	180	188	237	248	296											
72	41	51	62	77	88	93	110	118	131	144	156	173	169	186	228	240	265	270											
13N@ 5.00	52	55	72	89	106	130	142	156	169	180	194	208	231	248	267														
	56	53	69	86	99	120	133	146	161	171	186	202	218	242	257														
	60	50	64	77	93	108	131	134	158	164	180	188	201	220	245	299													
	66	49	62	75	87	102	122	134	137	161	167	179	195	205	233	277	290												
72	46	58	72	85	90	113	127	138	141	170	171	174	187	194	251	256	314												
70	7N@ 10.00	56	30	39	46	56	64	71	83	88	102	102	110	121	136	167	178	203	218	244	257	275							
		60	30	37	44	52	61	66	73	85	90	102	105	111	131	160	172	193	208	234	251	263							
		66	30	35	44	51	58	67	73	75	87	93	104	106	122	145	164	176	190	208	233	240							
		72	29	34	42	47	54	60	69	76	78	89	94	102	116	133	144	160	187	200	215	233							
	78	28	34	40	47	50	58	63	71	78	83	90	96	109	119	139	151	179	190	201	208								
	84	29	35	39	44	51	57	65	69	72	80	85	94	103	114	129	143	171	179	192	202								
	9N@ 7.78	56	37	45	56	67	75	88	102	110	122	128	154	168	180	203	229	249	283										
		60	35	45	54	65	73	89	99	105	114	129	131	159	165	189	218	247	262	279									
		66	38	48	56	67	74	86	92	106	112	122	127	149	160	178	211	227	254	264	297								
		72	37	45	56	64	69	77	89	100	108	114	124	131	145	163	198	211	235	257	285				295				
	78	36	45	53	60	66	76	87	93	102	110	116	118	140	153	183	201	225	250	267				282					
	84	35	45	50	59	67	72	81	94	95	103	113	118	128	148	176	192	217	226	248				271					
	10N@ 7.00	56	38	53	60	75	88	100	106	118	137	161	168	180	192	233	251	264											
		60	41	55	65	71	88	102	109	122	130	157	161	175	184	208	240	254	287										
		66	42	51	62	70	85	91	105	109	123	132	157	161	173	195	228	243	278	287									
		72	38	47	59	66	78	88	94	106	112	127	133	155	162	181	218	233	262	277									
	78	37	46	55	65	71	79	94	96	108	115	130	137	151	176	203	227	247	262	290									
	84	36	47	55	63	72	80	92	98	109	112	121	133	144	167	194	207	228	255	282					298				
	11N@ 6.36	56	45	60	71	87	102	108	127	138	162	178	185	204	218	249	282												
		60	44	57	66	85	90	104	114	129	157	162	180	189	207	236	262	271											
66		43	53	67	76	88	105	106	117	132	160	166	176	181	212	244	259	305											
72		42	55	62	70	82	94	108	109	119	136	148	167	176	203	233	251	295	302										
78	40	50	61	73	80	92	98	110	118	124	140	141	169	192	226	242	273	284	310										
84	39	49	59	68	78	84	97	102	116	124	129	144	154	185	209	228	262	278	304										
12N@ 5.83	56	50	63	76	88	103	113	129	157	170	181	194	207	234	253	293													
	60	46	58	74	89	103	112	128	139	161	179	183	196	207	248	284													
	66	45	55	67	78	92	105	115	130	143	164	175	186	199	241	267	279	308											
	72	42	55	65	77	89	102	107	119	135	148	168	173	189	215	247	264	298											
78	42	51	64	72	84	97	106	113	123	141	151	167	179	201	229	256	279	308											
84	40	51	61	73	83	89	102	115	118	128	144	151	171	192	221	249	274	298	314										
14N@ 5.00	56	53	71	87	102	120	137	163	180	191	207	227	247	259	287														
	60	54	69	88	99	112	128	153	171	182	196	210	230	251	282														
	66	48	64	77	92	106	115	132	164	176	186	200	219	241	271	287													
	72	49	61	73	91	103	110	120	138	169	181	191	213	216	248	277													
78	44	58	72	84	97	111	120	138	141	172	182	194	204	226	270	272													
84	44	58	69	79	97	106	116	127	143	155	171	177	196	202	259	262	315												

STANDARD WEIGHTS

Joist Girders

General Information Bridging & Acc. Economic Joist Girder Code of Standard Practice Standard Specification K & KCS LH & DLH Joist Girders Fire Ratings

GIRDER SPAN (ft)	JOIST SPACES (ft)	GIRDER DEPTH (in)	JOIST GIRDER WEIGHT -- POUNDS PER LINEAR FOOT																								
			LOAD ON EACH PANEL POINT -- KIPS																	ASD		LRFD					
			6	8	10	12	14	16	18	20	22	24	26	28	30	35	40	45	50	55	60	65					
9	12	15	18	21	24	27	30	33	36	39	42	45	52.5	60	67.5	75	82.5	90	97.5								
75	8N@ 9.38	56	40	49	61	73	82	95	115	116	128	140	152	156	166	186	219	245	261	275							
		60	38	48	58	70	80	92	97	116	118	130	142	153	158	177	206	234	251	263	280						
		66	35	44	53	64	72	82	98	99	118	120	132	144	152	169	186	207	234	244	269	289					
		72	34	43	52	61	71	79	87	100	101	121	122	134	141	158	178	189	213	237	253	267					
		78	34	43	54	61	69	77	81	89	103	105	123	125	131	150	168	183	207	218	246	261					
	10N@ 7.50	60	42	59	69	83	98	117	129	131	154	159	170	182	194	234	247	277									
		66	42	55	69	78	87	100	119	132	134	153	163	174	184	207	241	265	292								
		72	42	54	63	73	86	101	111	123	136	138	154	163	176	194	228	256	280	289							
		78	39	48	63	74	82	91	105	114	127	139	152	157	165	177	221	237	261	278							
		84	39	49	59	69	78	94	95	110	128	131	143	156	160	166	197	225	247	267	293						
	12N@ 6.25	60	51	68	84	98	118	131	144	159	181	183	195	206	236	265											
		66	50	62	79	90	110	122	135	148	164	172	185	198	209	249	277										
		72	46	63	73	90	104	124	126	141	154	166	170	188	199	234	259	275									
		78	47	61	76	86	98	105	126	139	152	163	166	178	188	208	250	265	301								
		84	46	56	70	79	92	106	126	139	141	164	171	171	175	191	235	253	279	288							
	14N@ 5.36	66	56	72	89	111	125	137	160	171	184	199	209	232	241	270											
		72	52	70	84	101	121	134	148	166	179	190	202	221	233	260	297										
		78	53	68	80	98	107	125	139	151	174	183	192	215	225	249	277										
		84	52	64	79	92	108	127	130	153	171	179	186	196	204	227	271	284									
		90	50	66	77	94	110	119	142	144	173	176	178	179	197	203	260	275									
15N@ 5.00	66	60	77	98	118	132	146	164	185	196	215	226	244	268	273												
	72	59	74	87	110	123	146	160	169	189	201	222	221	248	264	312											
	78	54	73	88	104	124	139	152	169	177	195	207	213	228	257	308											
	84	55	67	86	93	116	131	143	171	174	189	193	206	219	250	287	302										
	90	52	69	81	95	118	133	145	146	177	179	182	202	212	246	280	294										
80	8N@ 10.00	60	37	45	56	64	75	88	97	103	112	127	137	156	162	189	208	234	261	277							
		66	35	45	52	62	70	77	90	103	105	113	129	131	155	176	197	226	243	258	287						
		72	33	41	48	59	68	76	87	92	106	108	116	126	141	170	187	203	235	250	268	288					
		78	33	41	47	56	64	73	81	88	94	109	111	118	136	156	178	195	216	238	255	269					
		84	35	39	48	56	63	71	79	83	96	98	112	114	129	146	173	184	210	216	247	256					
	10N@ 8.00	60	41	53	68	76	97	103	112	129	139	159	180	191	195	234	255	267									
		66	39	52	62	75	90	100	107	115	132	154	167	178	187	210	245	257									
		72	43	55	63	74	87	97	106	120	127	151	161	171	182	195	238	252									
		78	42	51	63	71	86	90	100	112	122	130	155	166	176	187	229	245	281	290							
		84	42	51	61	70	78	91	100	109	115	125	131	157	166	178	222	230	256	277							
	12N@ 6.67	60	49	60	68	77	87	92	102	111	118	132	136	160	169	197	221	239	261	293							
		66	50	65	73	90	103	115	130	161	172	180	195	207	220	254	290										
		72	47	59	72	86	101	107	125	133	165	174	183	196	210	243	273										
		78	46	60	69	80	94	108	114	129	136	167	176	189	197	220	263	276									
		84	47	56	70	79	92	99	111	121	138	140	170	175	193	207	250	265	301								
	14N@ 5.71	60	54	66	74	86	101	113	116	125	143	149	170	177	193	242	259	281	301								
		66	57	73	89	103	113	129	160	182	186	207	221	231	262	288											
		72	54	67	79	101	106	125	143	165	184	198	211	224	243	277											
		78	50	66	78	95	109	118	136	149	173	191	197	216	226	266	297										
		84	50	64	74	92	99	112	124	143	169	177	191	203	218	250	276										
16N@ 5.00	60	62	78	101	113	130	161	184	197	212	233	253	268	288	308												
	72	57	76	93	109	118	145	167	187	203	218	246	258	270	291												
	78	58	73	91	104	120	137	149	181	191	208	219	242	252	282												
	84	54	69	84	100	115	126	143	174	185	195	211	223	250	271	315											
	90	54	70	80	101	114	119	144	155	180	191	207	220	233	267	306											
96	55	68	81	94	110	121	133	155	164	186	201	211	226	264	298	302											



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CODE OF STANDARD PRACTICE

FOR STEEL JOISTS AND JOIST GIRDERS

Adopted by the Steel Joist Institute April 7, 1931
Revised to Nov. 10, 2014 - Effective Jan.1, 2015

SECTION 1. GENERAL

1.1 SCOPE

The practices and customs set forth herein are in accordance with good engineering practice, tend to ensure safety in steel joist and Joist Girder construction, and are standard within the industry. There shall be no conflict between this code and any legal building regulation. This code shall only supplement and amplify such laws. Unless specific provisions to the contrary are made in a contract for the purchase of steel joists or Joist Girders, this code is understood to govern the interpretation of such a contract.

1.2 APPLICATION

This Code of Standard Practice is to govern as a standard unless otherwise covered in the architects' and engineers' plans and specifications.

1.3 DEFINITIONS

Add-Load. A single vertical concentrated load that occurs at any one panel point along the joist chord. This load is in addition to any other gravity loads specified.

Bend-Check Load. A vertical concentrated load used to design the joist chord for the additional bending stresses resulting from this load being applied at any location between the joist panel points. This load shall already be accounted for in the specified joist designation load, uniform load, or Add-Load and is used only for the additional bending check in the chord and does not contribute to the overall axial forces within the joist. An ideal use of this is for incidental loads which have already been accounted for in the design loading but may induce additional bending stress due to this load occurring at any location along the chord.

Buyer. The entity that has agreed to purchase Material from the manufacturer and has also agreed to the terms of sale.

Erector. The entity that is responsible for the safe and proper erection of the materials in accordance with all applicable codes and regulations.

Material. Steel joists, Joist Girders and accessories as provided by the seller.

Owner. The entity that is identified as such in the contract documents.

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Placement Plans. Drawings that are prepared depicting the interpretation of the contract document's requirements for the Material to be supplied by the Seller. These floor or roof plans are approved by the Specifying Professional, Buyer, or Owner for conformance with the design requirements. The Seller uses the information contained on these drawings for final material design. A unique piece mark number is typically shown for the individual placement of the steel joists, Joist Girders and accessories along with sections that describe the end bearing conditions and minimum attachment required so that material is placed in the proper location in the field.

Seller. A company certified by the Steel Joist Institute engaged in the manufacture and distribution of steel joists, Joist Girders and accessories.

Specifying Professional. The licensed professional who is responsible for sealing the building contract documents, that indicates that he or she has performed or supervised the analysis, design and document preparation for the structure and has knowledge of the load-carrying structural system.

Structural Drawings. The graphic or pictorial portions of the contract documents showing the design, location and dimensions of the work. These documents generally include plans, elevations, sections, details, connections, all loads, schedules, diagrams and notes.

1.4 DESIGN

In the absence of ordinances or specifications to the contrary, all designs prepared by the Specifying Professional shall be in accordance with the Steel Joist Institute Standard Specifications of latest adoption.

1.5 RESPONSIBILITY FOR DESIGN AND ERECTION

When material requirements are specified, the seller shall assume no responsibility other than to furnish the items listed in Section 5.2(a). When material requirements are not specified, the seller shall furnish the items listed in Section 5.2(a) in accordance with Steel Joist Institute Standard Specifications of latest adoption, and this code. Pertinent design information shall be provided to the seller as stipulated in Section 6.1. The seller shall identify material by showing size and type. In no case shall the seller assume any responsibility for the erection of the item furnished.

1.6 PERFORMANCE TESTS FOR OPEN WEB STEEL JOIST CONSTRUCTION

When a performance test on a joist is required, the following criteria shall be used:

- a) The performance test load shall be the maximum factored uniformly distributed downward design load for the selected joist.
 - (1) The TOTAL safe factored uniformly distributed load-carrying capacity tabulated in the Standard LRFD Load Table for the specific joist designation and span.
 - (2) For a joist with factored loading conditions other than those found in the Standard LRFD Load Table, this is the LRFD Load Combination resulting in the highest uniformly distributed downward factored design load.
 - (3) For a joist with loading conditions other than those found in the Standard ASD Load Table, this is the ASD Load Combination resulting in the highest uniformly distributed downward design load multiplied times 1.50.
- b) Joist self-weight and the weight of all test materials shall be included in the calculation of applied performance test loading as appropriate for the joist during testing.

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- c) Loading shall be uniformly distributed across the full length of the joist top chord, and the load application shall maintain uniform distribution throughout the test. At any stage during the application of the test loading, the test load shall not be distributed in such a manner as to result in any joist component being subjected to a higher proportion of force than intended by the joist design.
- d) If tested as a panel assembly, the joists shall be tested in pairs with deck, deck attachments, and bridging installed per the approved joist and deck Placement Plans. All bottom chord horizontal bridging rows shall be terminated by bracing back to the top chord of the adjacent joist or by a lateral restraint system which does not inhibit the vertical deflection of the test joist.
- e) If tested singly in a load test machine apparatus, the joist chords shall be braced to prevent lateral movement, without inhibiting vertical displacement. The joist top chord shall have lateral braces located at equal spacing of no more than 36 inches (914 mm) on center. The joist bottom chord shall have lateral braces located, at a minimum, per the bottom chord bridging locations shown on the approved joist placement plan.
- f) The performance test loading shall be applied at a rate of no greater than 25 plf per minute and shall be sustained for no less than 15 minutes. After the maximum test load has been removed for a minimum of 10 minutes, the remaining vertical displacement at midspan shall not exceed 20% of the vertical midspan deflection sustained under the full performance test load.
- g) All costs associated with such testing shall be borne by the purchaser.
- h) Joists that have been designed and manufactured and have satisfied the above performance test criteria shall be considered to satisfy the intent of the Steel Joist Institute Standard Specifications, and shall be considered acceptable for use in construction. No further proof of strength of individual joist components or connections is required.

SECTION 2.

JOISTS, JOIST GIRDERS, AND ACCESSORIES

2.1 STEEL JOISTS AND JOIST GIRDERS

Steel joists and Joist Girders shall carry the designations and meet the requirements of the Steel Joist Institute Standard Specifications of latest adoption.

K-Series, LH-Series, DLH-Series joists, and Joist Girders are furnished either underslung or square ended, with top chords either parallel, pitched one way or pitched two ways. It is not recommended that any Joist Girder, or any DLH-Series joist that exceeds 72 inches (1829 mm) in depth and has a span greater than 80 feet (24384 mm), be used in a bottom bearing configuration.

The steel joist or Joist Girder designation depth or nominal depth shall be the depth at midspan, except for double pitched joists which shall be the depth at the ridge. K-Series, LH-Series, DLH-Series joists, and Joist Girders shall be permitted to have either parallel chords or a top chord pitch of up to 1/2 inch per foot (1:24).

2.2 BEARING SEATS

Underslung types are furnished with minimum end bearing depths as shown in Table 2.2-1. A standard maximum joist bearing seat width (perpendicular to the joist length) is provided. This width shall be permitted to vary based on the joist design and joist manufacturer.



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TABLE 2.2-1

STANDARD END BEARING SEAT DEPTH AND STANDARD MAXIMUM SEAT WIDTH		
JOIST SECTION NUMBER ¹	MINIMUM BEARING DEPTH	MAXIMUM SEAT WIDTH ²
K1-12	2 ½" (64 mm)	6" (152 mm)
LH02-06	5" (127 mm)	6" (152 mm)
LH07-17, DLH10-17	5" (127 mm)	8" (203 mm)
JG	7 ½" (191 mm)	8" (203 mm)
LH/DLH18-25, JG ³	7 ½" (191 mm)	13" (330 mm)
JG ⁴	10" (254 mm)	13" (330 mm)
⁽¹⁾ Last two digits of joist designation shown in Load Table. ⁽²⁾ THE SEAT WIDTH MAY VARY BASED ON DESIGN. ⁽³⁾ Joist Girders with a self weight greater than 50 plf (0.73 kN/m). ⁽⁴⁾ Joist Girders with a self weight equal to or greater than 150 plf (2.19 kN/m).		

Joist Girder bearing seat widths vary depending on the Joist Girder size and shall be permitted to be up to 13" (330 mm) wide. The supporting structural member shall be made wide enough to accommodate the seat widths.

Where steel joists or Joist Girders are sloped, sloped end bearings may be provided where the slope exceeds 1/4 inch per foot (1:48). When sloped end bearings are required, the seat depths shall be adjusted to maintain the standard height at the shallow end of the sloped bearing. For Open Web Steel Joists, K-Series, bearing ends shall be permitted to not be beveled for slopes of 1/4 inch or less per foot (1:48). For sloped joist bearing seats refer to the sloped seat depth requirements of Table 2.2-2 and Table 2.2-3.



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TABLE 2.2-2
SLOPED SEAT REQUIREMENTS FOR SLOPES 3/8":12 AND GREATER
K-SERIES OPEN WEB STEEL JOISTS

LOW END W/OUT TOP CHORD EXTENSIONS	HIGH END W/OUT TOP CHORD EXTENSIONS	SLOPE "X":12	MINIMUM HIGH END SEAT DEPTH "d"
		3/8	3 1/2
		1/2	3 1/2
		1	3 1/2
		1 1/2	4
		2	4
		2 1/2	4
		3	4 1/2
		3 1/2	4 1/2
		4	4 1/2
		4 1/2	5
		5	5
		5 1/2	5 1/2
SEE NOTE (2) FOR SLOPE RATES GREATER THAN 6:12		6	5 1/2

Notes:

- (1) Depths shown are the minimum required for manufacturing of sloped seats. Depths may vary depending on actual bearing conditions.
- (2) $d = 1/2 + 2.5/\cos\theta + 4\tan\theta$ (Rounded up to the nearest 1/2".)
- (3) Clearance must be checked at outer edge of support. Increase bearing depths as required to allow passage of 2 1/2" deep extension.
- (4) If extension depth greater than 2 1/2" is required, increase bearing depths accordingly.
- (5) If slope is 1/4 : 12 or less, sloped seats are not required.
- (6) Required bearing seat depth is determined at END OF SEAT.
- (7) Also refer to SJI Specification 5.4 for special considerations of joist end reaction location.

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TABLE 2.2-3
SLOPED SEAT REQUIREMENTS FOR SLOPES 3/8":12 AND GREATER
LH- AND DLH-SERIES OPEN WEB STEEL JOISTS

LOW END W/OUT TOP CHORD EXTENSIONS	HIGH END W/OUT TOP CHORD EXTENSIONS	SLOPE "X" : 12	MINIMUM HIGH END SEAT DEPTH "d"
		3/8	6
		1/2	6
		1	6 1/2
		1 1/2	6 1/2
		2	7
		2 1/2	7
LOW END W/ TOP CHORD EXTENSIONS	HIGH END W/ TOP CHORD EXTENSIONS	3 1/2	7 1/2
		4	8
		4 1/2	8 1/2
		5	8 1/2
		5 1/2	9
		6	9 1/2
		SEE NOTE (2) FOR SLOPE RATES GREATER THAN 6:12	

Notes:

- (1) Depths shown are the minimum required for manufacturing of sloped seats. Depth may vary depending on actual bearing condition.
- (2) $d = 1/2 + 5 / \cos\theta + 6 \tan\theta$
- (3) Clearance must be checked at outer edge of support. Increase bearing seat depth as required to allow passage of 5" deep extension.
- (4) If extension depth greater than 5" is required, increase bearing depths accordingly.
- (5) Add 2 1/2" to seat depth at 18 thru 25 chord section numbers. Consult with joist manufacturer for information when TCXs are present.
- (6) If slope is 1/4 : 12 or less, sloped seats may not be required.
- (7) Required bearing seat depth shall be determined at END OF SEAT.
- (8) Also refer to SJI Specification 5.4 for special considerations of joist end reaction location.

2.3 JOIST LOCATION AND SPACING

The uniform loads as shown in the Standard Specifications Load Tables & Weight Tables of latest adoption shall be used to determine maximum joist spacing.

Where sidewalls, wall beams or tie beams are capable of supporting the floor slab or roof deck, the first adjacent joists should be placed one full space from these members. Joists are provided with camber and may have a significant difference in elevation with respect to the adjacent structure because of this camber. This difference in elevation shall be given consideration when locating the first joist adjacent to a side wall, wall beam, or tie beam.

K-Series Joists should be placed no closer than 6 inches (152 mm) to adjacent walls or structural members. LH-Series and DLH-Series Joists should be placed no closer than 12 inches (305 mm) to adjacent walls or structural members. Where partition walls are supported by parallel floor joists, there shall be at least one joist provided under each such partition, and more than one such joist shall be provided if necessary to safely support the weight of such partition and the adjacent floor. When partitions occur perpendicular to the joists, they shall be treated as concentrated loads on the supporting joists.

2.4 SPECIFYING DESIGN LOADS

Neither the Steel Joist Institute nor the joist manufacturer establishes the loading requirements for which structures are designed.

The *specifying professional* shall provide the nominal loads and load combinations as stipulated by the applicable code under which the structure is designed and shall provide the design basis (ASD or LRFD).

The *specifying professional* shall calculate and provide the magnitude and location of ALL JOIST and JOIST GIRDER LOADS. This includes all special loads (drift loads, mechanical units, net uplift, axial loads, moments, structural bracing loads, or other applied loads) which are to be incorporated into the joist or Joist Girder design. For Joist Girders, reactions from supported members shall be clearly denoted as point loads on the Joist Girder. When necessary to clearly convey the information, a load diagram or load schedule shall be provided.

The *specifying professional* shall give due consideration to the following loads and load effects:

- Ponded rain water.
- Accumulation of snow in the vicinity of obstructions such as penthouses, signs, parapets, adjacent buildings, etc.
- Wind and seismic forces. Indicate wind NET uplift in pounds per square foot (Pascals) and any other wind or seismic forces required to be incorporated into the joist or Joist Girder design. If applicable, make clear if loads specified are reduced (i.e. for ASD $0.6W=$, $0.7E=$) and provide any pertinent S_{Ds} values. Connection details shall be designed by the *specifying professional*.
- Movable partitions. Convey any special deflection requirements as well as any stacked loading conditions.
- Type and magnitude of end moments and/or axial forces at the joist and Joist Girder end supports shall be shown on the Structural Drawings. For moment resisting joists or Joist Girders framing at or near the top of a column, due consideration shall be given to extend the column length to allow a plate type connection between the top of the joist or Joist Girder top chord and the column.
Avoid transferring joist or Joist Girder end moments and axial forces through the bearing seat connection.
A note shall be provided on the structural drawings stating that all moment resisting joists shall have all dead loads applied to the joist before the bottom chord struts are welded to the supporting connection whenever the design moments provided do not include dead load.
The top and bottom chord moment connection details shall be designed by the *specifying professional*. The joist designer shall furnish the *specifying professional* with the joist detail information if requested. Additional design tools and details are available at the Steel Joist Institute's website, www.steeljoist.org.
- Joist chords shall not carry out-of-plane or torsional loads, such as from horizontal components of concentrated loads applied to laterally sloped joists, braces, screen walls, posts, etc. The structural contract drawings shall show the required structural bracing to resolve these forces.



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Where concentrated loads occur, the magnitude and location of these concentrated loads shall be shown on the structural drawings when, in the opinion of the *specifying professional*, they shall require consideration by the joist manufacturer. For nominal concentrated loads, which have been accounted for in the specified uniform design loads, a “strut” to transfer the load to a panel point on the opposite chord shall not be required provided that the sum of the concentrated loads within a chord panel does not exceed 100 pounds (445 N) and the attachments are concentric to the chord. When exact dimensional locations for concentrated loads which do not meet the above criteria are provided by the *specifying professional*, the joist shall be designed for the loads and load locations provided without the need for additional field applied web members at the specified locations.

(a) Specifying Joist Design Loads

The Steel Joist Institute Load Tables are based on uniform loading conditions and are valid for use in selecting joist sizes for gravity loads that can be expressed in terms of “pounds per linear foot” (kiloNewtons per meter) of joist.

For other loads, the Specifying Professional shall use one of the five options described below that allows:

- The estimator to price the joists.
- The joist manufacturer to design the joists in accordance with the Standard Specifications of latest adoption.
- The owner to obtain the most economical joists.

Option 1: Select a joist designation from the Standard Load Table (or specify a joist type using a uniform load in the designation) which has been determined to be adequate for all design loads. The shear and moment envelope resulting from the selected uniform load shall meet the actual shear and moment requirements. Thus, this option alone may not be adequate if large concentrated loads need to be designed for.

Option 2: Select a joist designation from the Standard Load Table (or specify a joist type using a uniform load in the designation) and also provide the load and location of any additional loads on the structural plan with a note “Joist manufacturer shall design joists for additional loads at locations shown.” This option works well for a few added loads per joist with known magnitude and locations.

Option 3: For additional point loads with exact locations not known along the joist or for incidental loads, any one, or both, of the following can be specified on the structural plan in addition to option 1 or 2 above:

- a) “**Design for a () lb. concentrated load located at any one panel point along the joist**”. This is referred to as an *Add-Load*.
- b) “**Design for additional bending stresses resulting from a () lb. concentrated load located at any location along () chord**”. This is referred to as a *Bend-Check* and can be specified on the top chord, bottom chord, or both top and bottom chords. This can be used when the concentrated load is already accounted for in the joist designation, uniform load, or specified *Add-Load* yet this specified amount of load shall be permitted to also be located at any location between panel points. The additional bending stresses as a result of this load are then designed for. A *Bend-Check* load shall not exceed (*Add-Load* + 400 lbs.) A *Bend-Check* load can be specified by itself without an *Add-Load*.
- c) Both (a) and (b) above can be specified with equal concentrated loads for each; or simply denote “**Design joist for a () lb. concentrated load at any location along the () chord.**”

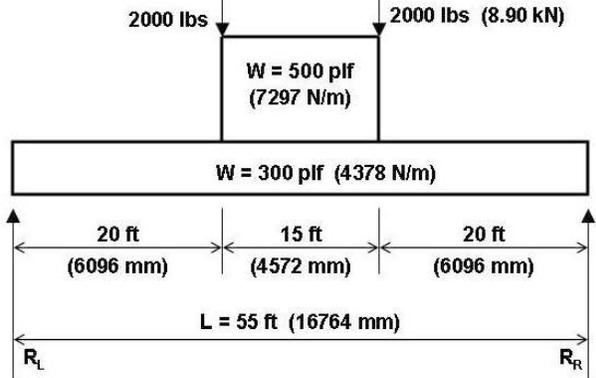
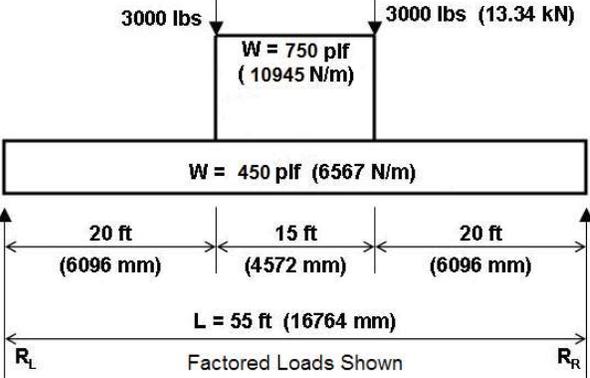
Example uses:

- *Specifying professional* selects a standard joist capable of carrying a 500 lb. RTU. However, the location and exact frame size is not yet known but the frame load shall result in two- 250 lb. point loads at least 5'-0" apart. **Specify a 250 lb. Bend-Check.**
- Standard joist specified but not selected for 500 lb. RTU load, location not known. **Specify a 500 lb. Add-Load and 250 lb. Bend-Check.**
- Standard SJI joist selected to carry collateral load of 3 psf. *Specifying professional* wants bending from 150 lb. incidental loads to also be designed for. **Specify a 150 lb. Bend-Check.**

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OPTION 4 - ASD EXAMPLE 2:	OPTION 4 - LRFD EXAMPLE 2:
U.S. CUSTOMARY UNITS AND (METRIC UNITS)	U.S. CUSTOMARY UNITS AND (METRIC UNITS)
<p>M = 443 k-in. (50.1 kN-m) R_L = 5000 lbs (22.24 kN), R_R = 5340 lbs (23.75 kN) Select a 22KCS2, M = 488 k-in. (55.1 kN-m) R = 5900 lbs (26.2 kN) Bridging section no. 6 for L = 30 ft. (9144 mm) Use 22K6 to determine bridging and stability requirements. Since the maximum uniform load of 430 plf [6275 N/m] (270 plf (3940 N/m) + 160 plf (2335 N/m)) does not exceed the maximum KCS Joist uniform load of 550 plf (8020 N/m) and a standard KCS Joist can be selected from the load table, a load diagram is not required.</p>	<p>M = 664 k-in. (75.03 kN-m) R_L = 7500 lbs (33.36 kN), R_R = 8010 lbs (35.63 kN) Select a 22KCS2, M = 732 k-in. (82.64 kN-m) R = 8850 lbs (39.3 kN) Bridging section no. 6 for L = 30 ft. (9144mm) Use 22K6 to determine bridging and stability requirements. Since the maximum factored uniform load of 645 plf (9413 N/m) (405 plf (5911 N/m) + 240 plf (3503 N/m)) does not exceed the maximum KCS Joist uniform load of 825 plf (12030 N/m) and a standard KCS Joist can be selected from the load table, a load diagram is not required.</p>

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OPTION 4 - ASD EXAMPLE 3:	OPTION 4 - LRFD EXAMPLE 3:
U.S. CUSTOMARY UNITS AND (METRIC UNITS)	U.S. CUSTOMARY UNITS AND (METRIC UNITS)
	
<p>M = 2910 k-in. (328.8 kN-m) RL = RR = 14000 lbs (62.28 kN) EXCEEDS CAPACITY OF 30KCS5 (MAXIMUM KCS JOIST) AND EXCEEDS MAXIMUM UNIFORM LOAD OF 550 plf (8027 N/m). OPTION A: Use double joists each having a minimum moment capacity, M = 1455 k-in. (164.4 kN-m) and shear capacity, R = 7000 lbs (31.14 kN) and a uniform load of 400 plf (5838 N/m). Select two 28KCS5, M = 1704 k-in. (192.5 kN-m), R = 9200 lbs (40.9 kN). Bridging section no. 12 for L = 55 ft. (16764 mm). Use 28K12 to determine bridging and stability requirements. OPTION B: Select a LH-Series Joist. See OPTION 5.</p>	<p>M = 4365 k-in. (493.2 kN-m) RL = RR = 21000 lbs (93.41 kN) EXCEEDS CAPACITY OF 30KCS5 (MAXIMUM KCS JOIST) AND EXCEEDS MAXIMUM FACTORED UNIFORM LOAD OF 825 plf (12040 N/m). OPTION A: Use double joists each having a minimum moment capacity, M = 2183 k-in. (246.65 kN-m) and shear capacity, R = 10500 lbs (46.71 kN) and a uniform load of 600 plf (8756 N/m). Select two 28KCS5, M = 2556 k-in. (288.7 kN-m), R = 13800 lbs (61.3 kN). Bridging section no. 12 for L = 55 ft. (16764 mm) Use 28K12 to determine bridging and stability requirements. OPTION B: Select a LH-Series Joist. See OPTION 5.</p>

Option 5: Specify a SPECIAL joist designation when the joist includes more complex loading or for conditions which need consideration of multiple potentially controlling load combinations.

- Provide a load diagram and/or enough information on the drawings to clearly define ALL loads.
- If the loading criteria are too complex to adequately communicate on the drawings or with a simple load diagram, then the *specifying professional* shall provide a load schedule along with the appropriate load combinations. Regardless of where the loads are shown, unfactored design loads broken down by load categories shall be provided in order to design the joists correctly with applicable load combinations.

Place the designation (e.g. 28K SP or 28LH SP) with the following note: "Joist manufacturer to design joist to support loads as shown."



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OPTION 5 - ASD EXAMPLE: U.S. CUSTOMARY UNITS AND (METRIC UNITS)	OPTION 5 - LRFD EXAMPLE: U.S. CUSTOMARY UNITS AND (METRIC UNITS)
Load diagram per ASCE 7 2.4.1(3), D + S	Unfactored Load diagram per ASCE 7 2.3.2(3), 1.2D+1.6S
<p style="text-align: center; font-size: small;">Joist manufacturer to design joist to support loads as shown above.</p>	<p style="text-align: center; font-size: small;">Joist manufacturer to design joist to support unfactored loads as shown above.</p>
PLEASE NOTE THE LOAD COMBINATIONS SHOWN ARE FOR REFERENCE EXAMPLES ONLY.	

CAUTION FOR OPTIONS 1 thru 5 ABOVE:

If a K-Series joist is being specified, the Specifying Professional shall compare the equivalent uniform loads derived from the maximum moment and shear to the uniform loads tabulated in the K-Series Load Table. An equivalent unfactored uniform load in excess of 550 plf (8020 N/m) or a maximum unfactored end reaction exceeding 9200 lbs. (40.9 kN) indicates that the *specifying professional* shall use additional joists to reduce the loading or use an LH-Series joist and make provisions for 5 inch (127 mm) deep bearing seats.

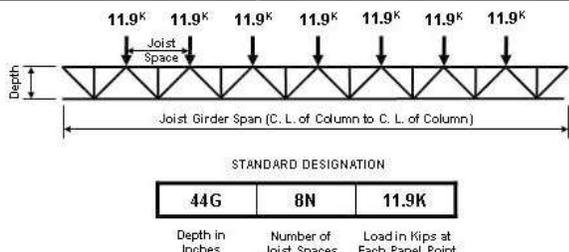
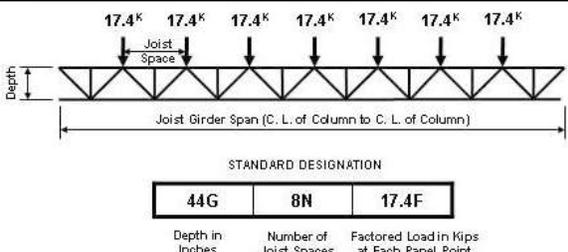
If the joist has not been designed for localized accumulation of loads that results in a point or concentrated load, this load attachment shall be made at top or bottom chord panel points. Therefore, specify on the structural drawings, "Where concentrated loads do not occur at panel points, an extra web shall be field applied from the point of attachment to a panel point on the opposite chord", and indicate the extra web size and weld requirements. When exact dimensional locations for concentrated loads are provided by the *specifying professional*, the joist shall be designed for the loads and load locations provided without the need for additional field applied web members at the specified locations.

(b) Specifying Joist Girder Design Loads

The Steel Joist Institute's Design Guide ASD or LRFD Weight Tables for Joist Girders are based on uniformly spaced panel point loading conditions and are valid for use in selecting Joist Girder sizes for gravity conditions that can be expressed in kips (kiloNewtons) per panel point on the Joist Girder. Note that anything other than point loads shall be shown unfactored or in a Load Schedule. For a given Joist Girder span, the *specifying professional* first determines the number of joist spaces. Then the panel point loads are calculated and a depth is selected. The information provided in the tables gives the Joist Girder weight in pounds per linear foot (kiloNewtons per meter) for various depths and loads.

1. The purpose of the Joist Girder Design Guide Weight Table is to assist the *specifying professional* in the selection of a roof or floor support system.
2. It is not necessary to use only the depths, spans, or loads shown in the tables.
3. Holes in chord elements present special problems that shall be considered by both the *specifying professional* and the Joist Girder Manufacturer. The sizes and locations of such holes shall be clearly indicated on the structural drawings.
4. Live load deflection rarely governs because of the relatively small span to depth ratios of Joist Girders. However, it is recommended that a breakdown of the point loads, by load category (i.e. TL/LL), be provided so specified deflection requirements and load combinations can be properly accounted for in design.

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Example using <u>Allowable Strength Design (ASD)</u> and U. S. Customary units:	Example using <u>Load and Resistance Factor Design (LRFD)</u> and U. S. Customary units:
	
<p>Given 42'-0" x 50'-0" bay. Joists spaced on 5'-3" centers</p> <p>Live Load = 30 psf Dead Load = 15 psf (includes the approximate Joist Girder weight) Total Load = 45 psf</p> <p>Note: Web configuration may vary from that shown. Contact joist manufacturer if exact layout must be known.</p> <ol style="list-style-type: none"> 1. Determine number of actual joist spaces (N). In this example, N = 8. 2. Compute total load: Total load = 5.25 x 45 psf = 236.25 plf 3. Joist Girder Section: (Interior) <ol style="list-style-type: none"> a) Compute the concentrated load at top chord panel points $P = 236.25 \times 50 = 11,813 \text{ lbs} = 11.9 \text{ kips}$ (use 12K for depth selection). b) Select Joist Girder depth: Refer to the ASD Joist Girder Design Guide Weight Table for the 42'-0" span, 8 panel, 12.0K Joist Girder. The rule of about one inch of depth for each foot of span is a good compromise of limited depth and economy. Therefore, select a depth of 44 inches. c) The Joist Girder shall then be designated 44G8N11.9K. d) The ASD Joist Girder Design Guide Weight Table shows the weight for a 44G8N12K as 49 pounds per linear foot. The designer should verify that the weight is not greater than the weight assumed in the Dead Load above. 	<p>Given 42'-0" x 50'-0" bay. Joists spaced on 5'-3" centers</p> <p>Live Load = 30 psf x 1.6 Dead Load = 15 psf x 1.2 (includes the approximate Joist Girder weight) Total Load = 66 psf (factored)</p> <p>Note: Web configuration may vary from that shown. Contact joist manufacturer if exact layout must be known.</p> <ol style="list-style-type: none"> 1. Determine number of actual joist spaces (N). In this example, N = 8. 2. Compute total factored load: Total load = 5.25 x 66 psf = 346.50 plf 3. Joist Girder Section: (Interior) <ol style="list-style-type: none"> a) Compute the factored concentrated load at top chord panel points $P = 346.5 \times 50 = 17,325 \text{ lbs} = 17.4 \text{ kips}$ (use 18K for depth selection). b) Select Joist Girder depth: Refer to the LRFD Joist Girder Design Guide Weight Table for the 42'-0" span, 8 panel, 18.0K Joist Girder. The rule of about one inch of depth for each foot of span is a good compromise of limited depth and economy. Therefore, select a depth of 44 inches. c) The Joist Girder shall then be designated 44G8N17.4F. Note that the letter "F" is included at the end of the designation to clearly indicate that this is a factored load. d) The LRFD Joist Girder Design Guide Weight Table shows the weight for a 44G8N18.0F as 49 pounds per linear foot. The designer should verify that the weight is not greater than the weight assumed in the Dead Load above.

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<p>e) Check live load deflection:</p> <p>Live load = 30 psf x 50 ft. = 1500 plf</p> <p>Approximate Joist Girder moment of inertia = 0.027 NPLd</p> <p>= 0.027 x 8 x 11.9 x 42 x 44 = 4750 in.⁴</p> <p>Allowable deflection for plastered ceilings</p> <p>= L/360 = $\frac{42(12)}{360} = 1.40$ in.</p> <p>$\Delta = 1.15 \left[\frac{5wL^4}{384EI} \right] = \frac{1.15(5)(1.500/12)[(42)(12)]^4}{384(29000)(4750)}$</p> <p>= 0.88 in. <1.40 in., Okay</p>	<p>e) Check live load deflection:</p> <p>Live load = 30 psf x 50 ft. = 1500 plf</p> <p>Approximate Joist Girder moment of inertia = 0.018 NPLd</p> <p>= 0.018 x 8 x 17.4 x 42 x 44 = 4630 in.⁴</p> <p>Allowable deflection for plastered ceilings</p> <p>= L/360 = $\frac{42(12)}{360} = 1.40$ in.</p> <p>$\Delta = 1.15 \left[\frac{5wL^4}{384EI} \right] = \frac{1.15(5)(1.500/12)[(42)(12)]^4}{384(29000)(4630)}$</p> <p>= 0.90 in. <1.40 in., Okay</p>
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(c) Load Schedule Example

LOAD SCHEDULE (all loads are to be shown as unfactored)

MARK	DESIGNATION ⁽¹⁾ (TL/LL) Joists: (plf) Girders: (kips)	LOADING ⁽²⁾		W WIND		ADD-LOAD ⁽⁶⁾ TL/LL (kips/kips)	BEND-CHECK ⁽⁷⁾		REMARKS
		DL ⁽³⁾ (plf)	LL ⁽⁴⁾ or L _r /S/R (plf)	DOWN WARD (plf)	NET ⁽⁵⁾ UPLIFT (plf)		D TC (kips)	D BC (kips)	
J1	18KSP	120	185		180	1.0/0.6		0.3	Axial Loads Wind Moments Drift Loads, see diagram
J2	24K7SP	85	155						
J3	28LHSP	110	355	95	175	0.5			
G1	36G5N6.5K/3.5K				360				End Moments

- (1) Joist designation loads include all uniform gravity loads. **Provide both Total and Live loads.**
- (2) Loading values are not required if designation loading values are correct for deflection and load combinations.
- (3) When standard SJI designations are used, the design Dead Load is required for load combinations with Wind or Seismic.
- (4) The Floor or Roof Live load, Snow, or Rain load.
- (5) When Net Uplift is specified for simple loading, it shall already take into account possible reduced Dead Loading present in order to create the largest Net uplift load combination. For more complex loading or when the Dead Load varies greatly for use in load combinations below, **Gross** uplift should be specified with the minimum and maximum Dead Loading values clearly defined. If the uplift cannot be assigned in pounds per lineal foot, a diagram can be shown for joist loading using pounds per square foot.
- (6) A concentrated load applied at any panel point on both the top chord and bottom chord.
- (7) Chord members shall be designed for additional bending stresses created by this concentrated Total load.



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When in-plane moments (wind load, seismic load) are specified, continuity moments (live load) **shall** also be specified. A Load Schedule that shows a complete breakdown of all loads by Load Category may be required.

AXIAL and END MOMENT LOAD SCHEDULE

MARK	DESIGNATION (TL/LL) Joists: (plf) Girders: (kips)	MIN. I (in. ⁴)	AXIAL			END MOMENTS								TRANSFER DETAILS @ GRIDS	
			W WIND (kips)	E SEISMIC (kips)	E _m (kips)	LIVE LOAD CONTINUITY MOMENTS (k-ft.)	LATERAL MOMENTS (k-ft.)								
							W WIND		E		E _m				
							LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT		RIGHT
J1	18KSP		W=18.0	E=21.8											9/S8 @ 4
J2	24K7SP				40	40	35	35							
G1	36G5N6.5K/3.5K	985			75	95	55	60							11/S8 @ B,C

When special loads as shown in the tables above are specified, the load combinations to be used for joist and Joist Girder design **shall** be provided. Two examples showing how to list load combinations are shown below:

LRFD example- Basic Load Combinations	ASD example - Basic Load Combinations
1. 1.4D	1. D
2. 1.2D + 1.6L + 0.5(L _r or S or R)	2. D + L
3. 1.2D + 1.6(L _r or S or R) + (1.0L or 0.5W)	3. D + (L _r or S or R)
4. 1.2D + 1.0W + 1.0L + 0.5(L _r or S or R)	4. D + 0.75L + 0.75(L _r or S or R)
5. 1.2D + 1.0E + 1.0L + 0.2S	5. D + (0.6W or 0.7E)
6. 0.9D + 1.0W	6a. D + 0.75L + 0.75(0.6W) + 0.75(L _r or S or R)
7. 0.9D + 1.0E	6b. D + 0.75L + 0.75(0.7E) + 0.75S
	7. 0.6D + 0.6W
	8. 0.6D + 0.7E
Special Seismic Load Combinations	Special Seismic Load Combinations
8. (1.2 + 0.2S _{DS})D + E _h + L + 0.2S	9. (1.0 + 0.14S _{DS})D + 0.7E _h
9. (0.9 – 0.2S _{DS})D + E _h	10. (1.0 + 0.105S _{DS})D + 0.525E _h + 0.75L + 0.75(L _r or S or R)
	11. (0.6 – 0.14S _{DS})D + 0.7E _h

2.5 JOIST AND JOIST GIRDER EXTENSIONS

Steel joist and Joist Girder extensions shall be specified and designed in accordance with the requirements of the Steel Joist Institute Standard Specifications of latest adoption.



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2.6 CEILING EXTENSIONS

Ceiling extensions shall be furnished to support ceilings that are to be attached directly to the bottom of the joists. They are not furnished for the support of suspended ceilings. The ceiling extension shall be either an extended bottom chord element or a loose unit, whichever is standard with the manufacturer, and shall be of sufficient strength to properly support any specified ceiling loads.

2.7 BRIDGING AND BRIDGING ANCHORS

- (a) Bridging standard with the manufacturer and complying with the Steel Joist Institute Standard Specifications of latest adoption shall be used for bridging all joists furnished by the joist manufacturer. Positive anchorage shall be provided at the ends of each bridging row at both top and bottom chords.
- (b) For K-Series and LH-Series joists, horizontal bridging is recommended for spans up to and including 60 feet (18288 mm) except where the Steel Joist Institute Standard Specifications Load Tables & Weight Tables require bolted diagonal bridging for erection stability.

LH-Series and DLH-Series joists exceeding 60 feet (18288 mm) in length shall have bolted diagonal bridging for all rows.

Refer to Section 5.5 in the Steel Joist Institute Standard Specification for erection stability requirements.

Refer to Appendix B for OSHA steel joist erection stability requirements.

Horizontal bridging shall consist of continuous horizontal steel members designed per Section 5.5 in the Steel Joist Institute Standard Specifications. The material sizes listed in Table 2.7-1 meet the requirements of the specifications. Alternately, or for "load/length" designation joists, Table 2.7-2 provides the maximum horizontal bridging force, P_{br} , for various combinations of joist spacing and bridging angle size.

- (c) Diagonal cross bridging consisting of angles or other shapes connected to the top and bottom chords of K-Series, LH-Series, and DLH-Series joists shall be used when required by the Steel Joist Institute Standard Specifications of latest adoption.

Diagonal bridging, when used, shall be designed per Section 5.5 in the Steel Joist Institute Standard Specifications.

When the bridging members are connected at their point of intersection, the material sizes listed in Table 2.7-3 and Table 2.7-4 meet the requirements of the specifications.

For LH-Series and DLH-Series joists, where the joist spacing is less than 70 percent of the joist depth, bolted horizontal bridging shall be provided in addition to the diagonal bridging, as shown in Table 2.7-4.

- (d) When bolted diagonal erection bridging is required, the following shall apply:
1. The bridging shall be indicated on the joist placement plans.
 2. The joist placement plans shall be the exclusive indicator for the proper placement of this bridging.
 3. Shop installed bridging clips, or functional equivalents, shall be provided where the bridging bolts to the steel joist.
 4. When two pieces of bridging are attached to a 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 piece.
 5. Bridging attachments shall not protrude above the top chord of the steel joists.
 6. See Table 2.7-5 for bolt sizes that meet the connection requirements of the Steel Joist Institute Standard Specifications Section 5.5.

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TABLE 2.7-1

MAXIMUM JOIST SPACING FOR HORIZONTAL BRIDGING							
SPANS OVER 60 ft. (18.3 m) REQUIRE BOLTED DIAGONAL BRIDGING							
JOIST SECTION NUMBER ¹	Nominal Unfactored Force P _{br} lbs (N)	BRIDGING MATERIAL SIZE ²					
		Equal Leg Angles					
		1 x 7/64 (25 x 3 mm) r = 0.20" (5.08 mm)	1-1/4 x 7/64 (32 x 3 mm) r = 0.25" (6.35 mm)	1-1/2 x 7/64 (38 x 3 mm) r = 0.30" (7.62 mm)	1-3/4 x 7/64 (45 x 3 mm) r = 0.35" (8.89 mm)	2 x 1/8 (52 x 3 mm) r = 0.40" (10.16 mm)	2-1/2 x 5/32 (64 x 4 mm) r = 0.50" (12.70 mm)
ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)		
K1 – 8	340 (1512)	5'-0" (1524)	6'-3" (1905)	7'-6" (2286)	8'-9" (2667)	10'-0" (3048)	12'-6" (3810)
K9-10, LH02-03	450 (2002)	4'-4" (1321)	6'-1" (1854)	7'-6" (2286)	8'-9" (2667)	10'-0" (3048)	12'-6" (3810)
K11-12, LH04-05	560 (2491)	3'-11" (1194)	5'-6" (1676)	7'-4" (2235)	8'-9" (2667)	10'-0" (3048)	12'-6" (3810)
LH06-08	750 (3336)		4'-9" (1448)	6'-3" (1905)	7'-11" (2413)	10'-0" (3048)	12'-6" (3810)
LH09	850 (3781)		4'-5" (1346)	5'-10" (1778)	7'-5" (2261)	9'-9" (2972)	12'-6" (3810)
LH/DLH10	900 (4003)		4'-4" (1321)	5'-8" (1727)	7'-3" (2210)	9'-5" (2870)	12'-6" (3810)
LH/DLH11	950 (4226)		4'-2" (1270)	5'-7" (1702)	7'-0" (2134)	9'-2" (2794)	12'-6" (3810)
LH/DLH12	1100 (4893)		3'-11" (1194)	5'-2" (1575)	6'-8" (2032)	8'-6" (2591)	12'-6" (3810)
LH/DLH13	1200 (5338)		3'-9" (1143)	4'-11" (1499)	6'-3" (1905)	8'-2" (2489)	12'-6" (3810)
LH/DLH14	1300 (5783)			4'-9" (1448)	6'-0" (1829)	7'-10" (2388)	12'-4" (3759)
LH/DLH15	1450 (6450)			4'-6" (1372)	5'-8" (1727)	7'-5" (2261)	11'-8" (3556)
LH/DLH16-17	1850 (8229)			4'-0" (1219)	5'-0" (1524)	6'-7" (2007)	10'-4" (3150)
LH/DLH18-20	2350 (10453)			3'-7" (1067)	4'-4" (1321)	5'-10" (1778)	9'-1" (2769)
LH/DLH21-22	3150 (14012)				3'-10" (1168)	5'-0" (1524)	7'-11" (2413)
LH/DLH23-24	4130 (18371)				3'-4" (1016)	4'-5" (1346)	6'-11" (2108)
LH/DLH25	4770 (21218)					4'-1" (1245)	6'-5" (1956)

(1) Refer to last two digit(s) of Joist Designation

(2) Connection to joist shall resist force listed in the Steel Joist Institute Standard Specifications Table 5.5-2



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TABLE 2.7-2

JOIST SPACING (ft.-in.)	MAXIMUM BRIDGING FORCE (P_{br}) FOR HORIZONTAL BRIDGING (lbs)						
	BRIDGING ANGLE SIZE (EQUAL LEG ANGLE)						
	1 x 7/64 r = 0.20"	1¼ x 7/64 r = 0.25"	1½ x 7/64 r = 0.30"	1¾ x 7/64 r = 0.35"	2 x 1/8 r = 0.40"	2½ x 5/32 r = 0.50"	3 x 3/16 r = 0.60"
2'-0"	2150	3960	5600				
2'-6"	1370	2730	4410	5910			
3'-0"	950	1890	3290	4850			
3'-6"	700	1390	2420	3840	6180		
4'-0"	530	1060	1850	2960	5030		
4'-6"	420	840	1460	2340	4000		
5'-0"	340	680	1180	1890	3240		
5'-6"	-	560	980	1560	2670		
6'-0"	-	470	820	1310	2250	5490	
6'-6"	-	-	700	1120	1910	4680	
7'-0"	-	-	600	960	1650	4030	
7'-6"	-	-	520	840	1440	3510	
8'-0"	-	-	-	740	1260	3090	
8'-6"	-	-	-	650	1120	2740	5680
9'-0"	-	-	-	-	1000	2440	5060
9'-6"	-	-	-	-	890	2190	4540
10'-0"	-	-	-	-	810	1970	4100
10'-6"	-	-	-	-	-	1790	3720
11'-0"	-	-	-	-	-	1630	3390
11'-6"	-	-	-	-	-	1490	3100
12'-0"	-	-	-	-	-	1370	2850



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TABLE 2.7-3

K, LH, and DLH SERIES JOISTS MAXIMUM JOIST SPACING FOR DIAGONAL BRIDGING ¹								
JOIST DEPTH	BRIDGING ANGLE SIZE – (EQUAL LEG ANGLE) ²							
	1 x 7/64 (25 x 3 mm) r = 0.20" (5.08 mm)	1-1/4 x 7/64 (32 x 3 mm) r = 0.25" (6.35 mm)	1-1/2 x 7/64 (38 x 3 mm) r = 0.30" (7.62 mm)	1-3/4 x 7/64 (45 x 3 mm) r = 0.35" (8.89 mm)	2 x 1/8 (50 x 3 mm) r = 0.40" (10.16 mm)	2 1/2 x 5/32 (64 x 4 mm) r = 0.50" (12.70 mm)	3 x 3/16 (76 x 5 mm) r = 0.60" (15.24 mm)	3 1/2 x 1/4 (89 x 6 mm) r = 0.70" (17.78 mm)
in. (mm)	ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)	ft.-in. (mm)
12" (305)	6'-7" (2007)	8'-3" (2514)	9'-11" (3022)	11'-7" (3530)	13'-3" (4038)	16'-7" (5055)	19'-11" (6070)	23'-3" (7086)
14" (356)	6'-6" (1981)	8'-3" (2514)	9'-11" (3022)	11'-7" (3530)	13'-3" (4038)	16'-7" (5055)	19'-11" (6070)	23'-3" (7086)
16" (406)	6'-6" (1981)	8'-2" (2489)	9'-10" (2997)	11'-7" (3530)	13'-3" (4038)	16'-7" (5055)	19'-11" (6070)	23'-3" (7086)
18" (457)	6'-6" (1981)	8'-2" (2489)	9'-10" (2997)	11'-6" (3505)	13'-3" (4038)	16'-7" (5055)	19'-11" (6070)	23'-3" (7086)
20" (508)	6'-5" (1955)	8'-2" (2489)	9'-10" (2997)	11'-6" (3505)	13'-2" (4013)	16'-7" (5055)	19'-11" (6070)	23'-3" (7086)
22" (559)	6'-4" (1930)	8'-1" (2463)	9'-10" (2997)	11'-6" (3505)	13'-2" (4013)	16'-6" (5029)	19'-11" (6070)	23'-3" (7086)
24" (610)	6'-4" (1930)	8'-1" (2463)	9'-9" (2971)	11'-5" (3479)	13'-2" (4013)	16'-6" (5029)	19'-10" (6045)	23'-3" (7086)
26" (660)	6'-3" (1905)	8'-0" (2438)	9'-9" (2971)	11'-5" (3479)	13'-1" (3987)	16'-6" (5029)	19'-10" (6045)	23'-2" (7061)
28" (711)	6'-3" (1905)	8'-0" (2438)	9'-8" (2946)	11'-5" (3479)	13'-1" (3987)	16'-6" (5029)	19'-10" (6045)	23'-2" (7061)
30" (762)	6'-2" (1879)	7'-11" (2413)	9'-8" (2946)	11'-4" (3454)	13'-1" (3987)	16'-5" (5004)	19'-10" (6045)	23'-2" (7061)
32" (813)	6'-1" (1854)	7'-10" (2387)	9'-7" (2921)	11'-4" (3454)	13'-0" (3962)	16'-5" (5004)	19'-9" (6020)	23'-2" (7061)
36" (914)	5'-11" (1803)	7'-9" (2362)	9'-6" (2895)	11'-3" (3429)	12'-11" (3973)	16'-4" (4979)	19'-9" (6020)	23'-1" (7035)
40" (1016)	5'-9" (1753)	7'-7" (2311)	9'-5" (2870)	11'-2" (3403)	12'-10" (3911)	16'-4" (4979)	19'-8" (5994)	23'-1" (7035)
44" (1118)	5'-6" (1676)	7'-5" (2260)	9'-3" (2819)	11'-0" (3352)	12'-9" (3886)	16'-3" (4953)	19'-7" (5969)	23'-0" (7010)
48" (1219)	5'-4" (1626)	7'-3" (2209)	9'-2" (2794)	10'-11" (3327)	12'-8" (3860)	16'-2" (4928)	19'-7" (5969)	22'-11" (6985)
52" (1321)	5'-0" (1524)	7'-1" (2159)	9'-0" (2743)	10'-10" (3302)	12'-7" (3835)	16'-1" (4902)	19'-6" (5943)	22'-11" (6985)
56" (1422)	4'-9" (1448)	6'-10" (2083)	8'-10" (2692)	10'-8" (3251)	12'-5" (3784)	16'-0" (4877)	19'-5" (5918)	22'-10" (6960)
60" (1524)	4'-4" (1321)	6'-8" (2032)	8'-7" (2616)	10'-6" (3200)	12'-4" (3759)	15'-10" (4826)	19'-4" (5893)	22'-9" (6935)
64" (1626)	**	6'-4" (1931)	8'-5" (2565)	10'-4" (3149)	12'-2" (3708)	15'-9" (4801)	19'-3" (5867)	22'-8" (6909)
68" (1727)	**	6'-1" (1854)	8'-2" (2489)	10'-2" (3098)	12'-0" (3657)	15'-8" (4775)	19'-2" (5842)	22'-7" (6884)
72" (1829)	**	5'-9" (1753)	8'-0" (2438)	10'-0" (3048)	11'-10" (3606)	15'-6" (4724)	19'-1" (5816)	22'-6" (6858)
80" (2032)	**	5'-0" (1524)	7'-5" (2260)	9'-6" (2895)	11'-6" (3505)	15'-3" (4648)	18'-10" (5740)	22'-4" (6808)
88" (2235)		**	6'-9" (2058)	9'-0" (2743)	11'-1" (3378)	14'-11" (4546)	18'-7" (5664)	22'-1" (6731)
96" (2438)		**	6'-0" (1829)	8'-5" (2565)	10'-8" (3251)	14'-7" (4445)	18'-4" (5588)	21'-11" (6680)
104" (2642)			**	7'-9" (2362)	10'-1" (3073)	14'-2" (4318)	18'-0" (5486)	21'-8" (6604)
112" (2845)			**	7'-0" (2134)	9'-6" (2895)	13'-9" (4191)	17'-8" (5385)	21'-4" (6503)
120" (3048)				**	8'-9" (2667)	13'-4" (4064)	17'-3" (5258)	21'-1" (6426)

**** INTERPOLATION BELOW THE MINIMUM VALUES SHOWN IS NOT ALLOWED.**

1) SEE TABLE 2.7-4 FOR MINIMUM JOIST SPACE FOR DIAGONAL ONLY BRIDGING.
 2) In the shaded range of the Table, for LH23, 24, and 25, compressive strength requirements may control, reducing the maximum joist spacing shown. Either select a larger bridging angle size (outside of the shaded area) or check compression strength (Ref. Section 2.7(c)) for LH23, 24, and 25.



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TABLE 2.7-4

LH AND DLH SERIES JOISTS HORIZONTAL PLUS DIAGONAL BRIDGING REQUIREMENTS		
JOIST DEPTH	MINIMUM JOIST SPACE FOR DIAGONAL ONLY BRIDGING	HORIZONTAL AND DIAGONAL MINIMUM ANGLE SIZE REQUIRED
	(0.70 x DEPTH)*	FOR JOIST SPACING < (0.70 X DEPTH) AND JOIST SPANS > 60'-0" (18.3 m)
in. (mm)	ft.-in. (mm)	in. (mm)
52" (1321)	3'- 0" (914)	1" x 1" x 7/64" (25 x 3)
56" (1422)	3'- 3" (990)	1" x 1" x 7/64" (25 x 3)
60" (1524)	3'- 6" (1066)	1" x 1" x 7/64" (25 x 3)
64" (1626)	3'- 8" (1117)	1 1/4" x 1 1/4" x 7/64" (32 x 3)
68" (1727)	3'-11" (1193)	1 1/4" x 1 1/4" x 7/64" (32 x 3)
72" (1829)	4'- 2" (1270)	1 1/4" x 1 1/4" x 7/64" (32 x 3)
80" (2032)	4'- 8" (1422)	1 1/4" x 1 1/4" x 7/64" (32 x 3)
88" (2235)	5'- 1" (1549)	1 1/2" x 1 1/2" x 7/64" (38 x 3)
96" (2438)	5'- 7" (1702)	1 1/2" x 1 1/2" x 7/64" (38 x 3)
104" (2642)	6'- 0" (1829)	1 3/4" x 1 3/4" x 7/64" (44 x 3)
112" (2845)	6'- 6" (1981)	1 3/4" x 1 3/4" x 7/64" (44 x 3)
120" (3048)	7'- 0" (2134)	2" x 2" x 1/8" (51 x 3)

*NOTE: WHEN THE JOIST SPACING IS LESS THAN 0.70 x JOIST DEPTH,
BOLTED HORIZONTAL BRIDGING SHALL BE USED IN ADDITION TO DIAGONAL BRIDGING.

TABLE 2.7-5

BOLT SIZES WHICH MEET BOLTED BRIDGING CONNECTION REQUIREMENTS		
JOIST SERIES	SECTION NUMBER*	BOLT DIAMETER
K	ALL	3/8" (10 mm) A307
LH/DLH	2 – 12	3/8" (10 mm) A307
LH/DLH	13 – 17	1/2" (13 mm) A307
LH/DLH	18 – 20	5/8" (16 mm) A307
LH/DLH	21 – 22	5/8" (16 mm) A325
LH/DLH	23 – 25	3/4" (19 mm) A325

*REFER TO LAST DIGIT(S) OF JOIST DESIGNATION
NOTE: WASHERS SHALL BE USED WITH SLOTTED OR OVERSIZED HOLES. BOLTS SHALL BE TIGHTENED TO A MINIMUM SNUG TIGHT CONDITION.

2.8 HEADERS

Where the end reaction of a steel joist is supported by a header, as outlined and defined in Section 5.2(a), and is not more than 10,000 pounds (44482 N), the header shall be furnished by the Seller. Such headers shall be any type standard with the joist manufacturer. Conditions involving headers shall be investigated during erection and, if necessary, provisions made to provide a safe condition. Headers are not provided for steel joists with end reactions greater than 10,000 pounds (44482 N).

2.9 BOTTOM CHORD LATERAL BRACING FOR JOIST GIRDERS

Bottom chord lateral bracing shall be furnished as required to prevent lateral movement of the bottom chord of the Joist Girder and to prevent the ratio of chord length to chord radius of gyration from exceeding that specified in the Steel Joist Institute Standard Specifications of latest adoption. The lateral bracing shall be that which is standard with the joist manufacturer, and shall be sufficient to properly brace the bottom chord of the Joist Girder.

2.10 CONNECTIONS

The adequacy of the end anchorage connection (bolted or welded) between the joist or Joist Girder bearing seat and the supporting structure is the responsibility of the *specifying professional*. The contract documents shall clearly illustrate the end anchorage connection. Forces to be considered include end moments, axial loads, and diaphragm boundaries. Particular attention is required where there is net uplift.

Welded End Anchorage for Uplift

The strength of the joist bearing seat for an uplift loading combination is a function of both the joist seat thickness and length of the end anchorage welds. The minimum end anchorage welds as shown in the Steel Joist Institute Standard Specifications Table 5.7-1 may not develop the full capacity of the joist seat assembly for the specified uplift resistance. When the support dimensions allow, it is recommended the *specifying professional* use a small fillet weld thickness in conjunction with a longer weld length for the connection design to facilitate the design of the joist bearing seat. The joist manufacturer will provide a seat of sufficient thickness and strength to resist the uplift end reaction resulting from the specified uplift. For additional information, including tables for welded end anchorage uplift capacities, refer to Steel Joist Institute Technical Digest 6, "Structural Design of Steel Joist Roofs to Resist Uplift Loads"

Bolted End Anchorage for Uplift

Typically, joists and Joist Girders with bolted end anchorage also require a final connection by welding in order to provide lateral stability to the supporting member. However, only the bolts are relied on to provide uplift anchorage. The bolt type and diameter designed by the *specifying professional* shall provide sufficient tensile strength to resist the uplift end reaction resulting from the specified uplift. Bolts of higher strength than the minimum required by the Steel Joist Institute Standard Specifications may be required.

When the bearing seats are detailed for a bolted connection, bolts shall be installed. If the bolts are not installed, an equivalent welded connection may be permitted by the *specifying professional*, provided the weld is deposited in the slot on the side farthest from the edge of the seat. Additional weld required to meet that specified for the welded connection shall be placed at a location on the seat away from the outer edge of the slot as shown in Figure 2.10-1.

For additional information, including tables for bolted end anchorage uplift capacities, refer to Steel Joist Institute Technical Digest 6, "Structural Design of Steel Joist Roofs to Resist Uplift Loads"

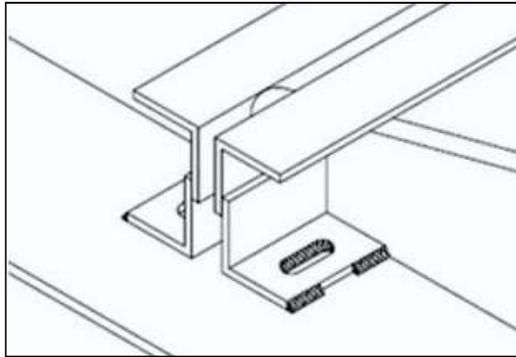


Figure 2.10-1

SECTION 3. MATERIALS

3.1 STEEL

The steel used in the manufacture of joists and Joist Girders shall comply with the Steel Joist Institute Standard Specifications of latest adoption.

3.2 PAINT

- (a) Standard Shop Paint - The shop coat of paint, when specified, shall comply with the Steel Joist Institute Standard Specifications of latest adoption.
- (b) Disclaimer - The typical shop applied paint that is used to coat steel joists and Joist Girders is a dip applied, air dried paint. The paint is intended to be an impermanent and provisional coating which shall protect the steel for only a short period of exposure in ordinary atmospheric conditions.

Since most joists and Joist Girders are painted using a standard dip coating, the coating shall be permitted to not be uniform and shall be permitted to include drips, runs, and sags. Compatibility of any coating including fire protective coatings applied over the standard shop paint shall be the responsibility of the specifier and/or painting contractor.

The shop applied paint may require field touch-up/repair as a result of, but not limited to, the following:

1. Abrasions from: Bundling, banding, loading and unloading, chains, dunnage during shipping, cables and chains during erection, bridging, installation, and other handling at the jobsite.
NOTE: Rusting should be expected at any abrasion.
2. Dirt.
3. Diesel smoke.
4. Road salt.
5. Weather conditions during storage.

The joist manufacturer shall not be responsible for the condition of the paint if it is not properly protected after delivery.

SECTION 4. **INSPECTION**

Inspections shall be made in accordance with Section 5.14 of the Steel Joist Institute Standard Specifications of latest adoption.

SECTION 5. **ESTIMATING**

5.1 PLANS FOR BIDDING

Plans to serve as the basis for bids shall show the character of the work with sufficient clarity to permit making an accurate estimate and shall show the following:

- Designation and location of Materials [see Section 5.2(a)], including any special design or configuration requirements
- Locations and elevations of all steel and concrete supporting members and bearing walls
- Location and length of joist extended ends
- Location and size of all openings in floors and roofs
- Location of all partitions
- Loads and their locations as defined in Section 6.1
- Construction and thickness of floor slabs, roof deck, ceilings and partitions
- Joists or Joist Girders requiring extended bottom chords
- Paint, if other than manufacturer's standard

5.2 SCOPE OF ESTIMATE

(a) Unless otherwise specified, the following items shall be included in the estimate, and requirements shall be determined as outlined in Section 6.1:

- Steel Joists
- Joist Girders
- Joist Substitutes
- Joist Extended Ends
- Ceiling Extensions
- Extended bottom chord used as strut
- Bridging
- Joist Girder bottom chord bracing
- Headers which are defined as members supported by and carrying Open Web Steel Joists with end reactions of no more than 10,000 lbs. (44482 N)
- One shop coat of paint, when specified, shall be in accordance with Section 3.2

(b) The following items shall not be included in the estimate but shall be permitted to be quoted and identified by the joist manufacturer as separate items:

- Headers carrying Open Web Steel Joists with end reactions greater than 10,000 lbs. (44482 N)
- Headers for Deep Longspan Steel Joists, **DLH-Series**

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- Reinforcement in slabs over joists
- Centering material, decking, and attachments
- Miscellaneous framing between joists for openings at ducts, dumbwaiters, ventilators, skylights, etc.
- Loose individual or continuous bearing plates and bolts or anchors for such plates
- Erection bolts for joist and Joist Girder end anchorage
- Horizontal bracing in the plane of the top and bottom chords from joist to joist or joist to structural framing and walls
- Bridging anchors and anchorage
- Wood nailers
- Moment plates
- Special joist configuration or bridging layouts for ductwork or sprinkler systems
- Shear studs

SECTION 6.

PLANS AND SPECIFICATIONS**6.1 PLANS FURNISHED BY BUYER**

The Buyer shall furnish the Seller plans and specifications as prepared by the *specifying professional* showing all Material requirements and steel joist and/or steel Joist Girder designations, the layout of walls, columns, beams, girders and other supports, as well as floor and roof openings and partitions correctly dimensioned. The elevation of finished floors, roofs, and bearings shall be shown.

(a) Loads

The *specifying professional* shall clearly provide all design loads as described in Section 2.4 This includes the live loads to be used, the wind uplift if any, the weights of partitions and the location and amount of any special loads, such as monorails, fans, blowers, tanks, etc.

(b) Connections

Minimum end anchorage for simple span gravity loading shall be in accordance with Steel Joist Institute Standard Specifications of latest adoption, Section 5.7. The end anchorage of a steel joist or Joist Girder is the connection of the joist or Joist Girder bearing seat to the support of the joist or Joist Girder.

The adequacy of the end anchorage connection (bolted or welded) between the joist or Joist Girder bearing seat and the supporting structure is the responsibility of the *specifying professional*. The contract documents shall clearly illustrate the end anchorage connection.

The joist manufacturer is responsible for the design of the bearing seats of joists or Joist Girders for the loads designated by the *specifying professional* in the contract documents.

The *specifying professional* is responsible for bridging termination connections. The contract documents shall clearly illustrate these termination connections.

(c) Special Considerations

The *specifying professional* shall indicate on the construction documents special considerations including:

- 1) Profiles for non-standard joist and Joist Girder configurations (Standard joist and Joist Girder configurations are as indicated in the Steel Joist Institute Standard Specifications of latest adoption).
- 2) Oversized or other non-standard web openings
- 3) Extended Ends

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- 4) Deflection criteria for live and total loads for non-SJI standard joists
- 5) Non-SJI standard bridging

6.2 PLANS FURNISHED BY SELLER

The Seller shall furnish the buyer with steel joist placement plans to show the material as specified on the construction documents and are to be utilized for field installation in accordance with specific project requirements as stated in Section 6.1. Steel placement plans shall include, at a minimum, the following:

- a) Listing of all applicable loads as stated in Section 6.1 and used in the design of the steel joists and Joist Girders as specified in the construction documents.
- b) Profiles for non-standard joist and Joist Girder configurations (standard joist and Joist Girder configurations are as indicated in the Steel Joist Institute Standard Specifications of latest adoption).
- c) Connection requirements for:
 - 1) Joist supports
 - 2) Joist Girder supports
 - 3) Field splices
 - 4) Bridging attachments
- d) Deflection criteria for live load and total loads for non-SJI standard joists.
- e) Size, location, and connections for all bridging
- f) Joist headers

All Material shall be identified with its mark which also appears on the Bill of Materials. The shop paint shall be as noted on the joist placement plans. **Steel joist placement plans do not require the seal and signature of the joist manufacturer's registered design professional.**

6.3 DISCREPANCIES

The *specifying professional's* bid plans and specifications shall be assumed to be correct in the absence of written notice from the Buyer to the contrary. When plans are furnished by the Buyer that do not agree with the Architect's bid plans, such detailed plans shall be considered as a written notice of change of plans. However, it shall be the Buyer's responsibility to advise the Seller of those changes which affect the joists or Joist Girders.

6.4 APPROVAL

When joist placement plans are furnished by the Seller, they are submitted to the Buyer and owner for examination and approval. The Seller allows a maximum of fourteen (14) calendar days in their schedule for the return of placement plans noted with the owner's and customer's approval, or approval subject to corrections as noted. The Seller makes the corrections, furnishes corrected prints for field use to the owner/customer and is released by the owner/customer to start joist manufacture.

Approval by the owner/customer of the placement plans, sections, notes and joist schedule prepared by the Seller indicates that the Seller has correctly interpreted the contract requirements, and is released by the owner/customer to start joist manufacture. This approval constitutes the owner's/customer's acceptance of all responsibility for the design adequacy of any detail configuration of joist support conditions shown by the Seller as part of the preparation of these placement plans.

Approval does not relieve the Seller of the responsibility for accuracy of detail dimensions on the plans, nor the general fit-up of joists to be placed in the field.

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6.5 CHANGES

When any changes in plans are made by the Buyer (or the buyer's representative) either prior to or after approval of detailed plans, or when any Material is required and was not shown on the plans used as the basis of the bid, the cost of such changes and/or extra Material shall be paid by the Buyer at a price to be agreed upon between Buyer and Seller.

6.6 CALCULATIONS

The Seller shall design the steel joists and/or steel Joist Girders in accordance with the current Steel Joist Institute Standard Specifications of latest adoption to support the load requirements of Section 6.1. The *specifying professional* may require submission of the steel joist and Joist Girder calculations as prepared by a registered design professional responsible for the product design. If requested by the *specifying professional*, the steel joist manufacturer shall submit design calculations with a cover letter bearing the seal and signature of the joist manufacturer's registered design professional. In addition to standard calculations under this seal and signature, submittal of the following shall be included:

- a) Non-SJI standard bridging details (e.g. for cantilevered conditions, net uplift, etc.)
- b) Connection details for:
 - 1) Non-SJI standard connections (e.g. flush framed or framed connections)
 - 2) Field splices
 - 3) Joist headers

SECTION 7.**HANDLING AND ERECTION**

The Buyer and Erector shall comply with the requirements of the Steel Joist Institute Standard Specifications of latest adoption in the handling and erection of Material. For additional coverage of this topic, refer to the Steel Joist Institute's Technical Digest 9, "Handling and Erection of Steel Joists and Joist Girders".

The Buyer and/or Erector shall check all materials on arrival at job site and promptly report to Seller any discrepancies and/or damages.

When joists cannot be delivered as a single piece, they shall be permitted to be delivered in several pieces therefore requiring the pieces to be spliced together in the field. The manufacturer's instructions SHALL be followed to ensure matching pieces are joined, proper bolts are used, and any required bolt tensioning is incorporated.

All joists shall be handled by methods which avoid damage to any part of the joist. For long LH-Series joists, DLH-Series joists, or Joist Girders this may require the use of spreader bars, multiple hoisting cables, or multiple cranes as necessary to safely handle the joist. Hoisting cables shall be attached at panel points and shall be at panel point locations selected to minimize erection stresses.

The current OSHA, 29 CFR Part 1926, Safety Standards for Steel Erection; Subpart R- Steel Erection, refers to certain joists at or near columns to be designed with sufficient strength to allow one employee to release the hoisting cable without the need for erection bridging. **This STANDARD shall not be interpreted that any joist at or near a column line is safe to support an employee without bridging installed.** Many limitations exist that prevent these joists from being designed to safely allow an employee on an un-bridged joist. Because of these limitations these joists shall be erected by incorporating erection methods ensuring joist stability and either:

- 1) Installing bridging or otherwise stabilizing the joist prior to releasing the hoisting cable, or
- 2) Releasing the hoisting cable without having a worker on the joist.

A steel joist or Joist Girder shall not be placed on any support structure unless such structure is stabilized. When steel joists or Joist Girders are landed on a structure, they shall be secured to prevent unintentional displacement prior to installation.

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A bridging terminus point shall be established before joist bridging is installed.

Steel joist and Joist Girders shall not be used as anchorage points for a fall arrest system unless written directions to do so is obtained from a “qualified person”. (For definition of “qualified person” see Code of Federal Regulations (CFR), Occupational Safety and Health Administration (OSHA), 29 CFR Part 1926, Safety Standards for Steel Erection; Subpart R- Steel Erection, §1926.751 Definitions, January 18, 2001, Washington, D.C.)

No modification that affects the strength of a steel joist or Joist Girder shall be made without the written approval of the project engineer of record.

The Seller shall not be responsible for the condition of paint finish on Material if it is not properly protected after delivery.

The Seller shall not be responsible for improper fit of Material due to inaccurate construction work.

SECTION 8.

BUSINESS RELATIONS

8.1 PRESENTATION OF PROPOSALS

All proposals for furnishing Material shall be made on a sales contract form. After acceptance by the Buyer, these proposals shall be approved or executed by a qualified official of the Seller. Upon such approval the proposal becomes a contract.

8.2 ACCEPTANCE OF PROPOSALS

All proposals are intended for prompt acceptance and are subject to change without notice.

8.3 BILLING

Contracts on a lump sum basis are to be billed proportionately as shipments are made.

8.4 PAYMENT

Payments shall be made in full on each invoice without retention.

8.5 ARBITRATION

All business controversies which cannot be settled by direct negotiations between Buyer and Seller shall be submitted to arbitration. Both parties shall sign a submission to arbitration and if possible agree upon an arbitrator. If they are unable to agree, each shall appoint an arbitrator and these two shall appoint a third arbitrator. The expenses of the arbitration shall be divided equally between the parties, unless otherwise provided for in the agreements to submit to arbitration. The arbitrators shall pass final judgment upon all questions, both of law and fact, and their findings shall be conclusive.

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STANDARD SPECIFICATION

FOR K-SERIES, LH-SERIES, AND DLH-SERIES OPEN WEB STEEL JOISTS AND FOR JOIST GIRDERS.

K-Series Adopted by the Steel Joist Institute November 4, 1985
 LH/DLH-Series Adopted by the Steel Joist Institute May 10, 2006
 Joist Girders Adopted by the Steel Joist Institute November 4, 1985
 Revised to April 27, 2020, Effective July 1, 2020

SECTION 1.

SCOPE AND DEFINITIONS

1.1 SCOPE

The *Standard Specification for K-Series, LH-Series, DLH-Series Open Web Steel Joists and for Joist Girders*, hereafter referred to as the Specification, covers the design, manufacture, application, and erection stability and handling of Joist Girders and Open Web Steel Joists K-Series, LH-Series, and DLH-Series in buildings or other structures, where other structures are defined as those structures designed, manufactured, and erected in a manner similar to buildings. Joist Girders and K-Series, LH-Series, and DLH-Series joists shall be designed using Allowable Stress Design (ASD) or Load and Resistance Factor Design (LRFD) in accordance with this Specification. Included as part of this Specification are KCS joists, K-Series; Joist Substitutes, K-Series; and Top Chord Extensions and Extended Ends, K-Series.

1.2 OTHER REGULATIONS

Joist Girders and K-Series, LH-Series, and DLH-Series joists shall be erected in accordance with the Occupational Safety and Health Administration (OSHA), 29 CFR Part 1926, Safety Standards for Steel Erection, Subpart R – Steel Erection. The erection of Joist Girders and K-Series, LH-Series, and DLH-Series joists 144 ft. (43.9 m) or less in length shall be in accordance with the requirements of Section 1926.757, Open Web Steel Joists. Joist Girders and DLH-Series joists greater than 144 ft. (43.9 m) in length shall be in accordance with the requirements of Section 1926.756 Beams and Columns.

1.3 APPLICATION

This Specification includes Section 1 through Section 6. The user notes shall not be part of the Specification.

User Note: User notes are intended to provide practical guidance in the use and application of this Specification.

1.4 DEFINITIONS

The following terms shall, for the purposes of this Specification, have the meanings shown in this Section. Where terms are not defined in this Section, those terms shall have their ordinary accepted meanings in the context in which it applies.

Joist Girders, K-Series, LH-Series, and DLH-Series shall be open web, in-plane load-carrying steel members utilizing hot-rolled or cold-formed steel, including cold-formed steel whose yield strength has been attained by cold working.

Joist Girders shall be open web steel trusses used as primary framing members designed as simple spans supporting in-plane concentrated loads for a floor or roof system. These concentrated loads shall be considered to act at the top chord panel points of the Joist Girders unless otherwise specified.



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The Joist Girder standard designation in ASD shall be established by its nominal depth in inches (mm), the letter “G”, followed by the number of joist spaces, the letter “N”, the load in kips (kN) at each panel point, and the letter “K”. The Joist Girder standard designation in LRFD shall be established by its nominal depth in inches (mm), the letter “G”, followed by the number of joist spaces, the letter “N”, the factored load in kips (kN) at each panel point, and the letter “F”. Joist Girders shall be designed in accordance with this Specification to support the loads defined by the specifying professional.

Joist Girders shall be designed and manufactured as either simple framing members with underslung ends and bottom chord extensions or as part of an ordinary steel moment frame (OMF). Where used as part of an OMF the specifying professional shall be responsible for carrying out all the required frame analyses (i.e. first-order and second-order), provide all the required load information and stiffness data to the joist manufacturer, and indicate the type of **Joist Girder** to column connections that are being designed on the structural drawings.

User Note: Joist Girders have been standardized in depths from 20 inches (508 mm) through 120 inches (3048 mm), for spans from 20 feet (6096 mm) through 120 feet (36576 mm).

Where this Specification refers to “steel joists”, this shall mean the K-Series, LH-Series, and DLH-Series joists.

User Note: Joists are suitable for the direct support of floors and roof slabs or decks. The K-Series joists are standardized in depths from 10 inches (254 mm) through 30 inches (762 mm), for spans up through 60 feet (18288 mm). The LH-Series joists are standardized in depths from 18 inches (457 mm) through 48 inches (1219 mm), for spans up through 96 feet (29261 mm). The DLH-Series joists are standardized in depths from 52 inches (1321 mm) through 120 inches (3048 mm), for spans up through 240 feet (73152 mm).

The K-Series, LH-Series and DLH-Series standard joist designations shall be established by their nominal depth, followed by the letters K, LH or DLH as appropriate, and then by the Section Number designation assigned. The Section Number designations shall range from 01 to 25. The K-Series, LH-Series and DLH-Series standard joist designations listed in the following Standard Load Tables shall support the uniformly distributed loads as provided in the applicable tables:

Standard LRFD Load Table Open Web Steel Joists, K-Series – U.S. Customary Units
 Standard ASD Load Table Open Web Steel Joists, K-Series – U.S. Customary Units
 Standard LRFD Load Table Longspan Steel Joists, LH-Series – U.S. Customary Units
 Standard ASD Load Table Longspan Steel Joists, LH-Series – U.S. Customary Units
 Standard LRFD Load Table Deep Longspan Steel Joists, DLH-Series – U.S. Customary Units
 Standard ASD Load Table Deep Longspan Steel Joists, DLH-Series – U.S. Customary Units
 Standard LRFD Load Table Open Web Steel Joists, K-Series – S.I. Units
 Standard ASD Load Table Open Web Steel Joists, K-Series – S.I. Units
 Standard LRFD Load Table Longspan Steel Joists, LH-Series – S.I. Units
 Standard ASD Load Table Longspan Steel Joists, LH-Series – S.I. Units
 Standard LRFD Load Table Deep Longspan Steel Joists, DLH-Series – S.I. Units
 Standard ASD Load Table Deep Longspan Steel Joists, DLH-Series – S.I. Units

Wherever a standard SJI Section Number is specified in the joist designation (e.g. 18K4, 32LH10) and other design load cases are also specified for the joist, the steel joist shall be designed for the corresponding total load as shown in the Standard Load Tables as a minimum.

User Note: Six standard types of K-Series, LH-Series and DLH-Series joists are designed and manufactured. These types are underslung (top chord bearing) or square-ended (bottom chord bearing), with parallel chords or with single or double pitched top chords. The Standard Load Tables apply for a pitched top chord up to 1/2 inch per foot (1:24).

The steel joist or Joist Girder designation depth shall be the depth at mid-span.

An alternate method of specifying a standard K-Series, LH-Series, or DLH-Series joist shall be permitted by providing the designation in a “load/load” sequence. The format used shall be ddKt/ll, ddLHt/ll, or ddDLHt/ll where:

dd is the nominal depth of the joist in inches (mm)

tl is the total uniformly distributed load applied to the joist top chord, plf (kN/m)

ll is the uniform live load for which the deflection shall be checked and limited as required by this Specification, plf (kN/m)

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User Note: The load/load K-Series, LH-Series, or DLH-Series joists can be specified in depths from 10 inches (254 mm) through 120 inches (3048 mm) and spans up through 240 feet (73152 mm). The maximum uniformly distributed load-carrying capacity of 2400 plf (35.03 kN/m) in ASD and 3600 plf (52.54 kN/m) in LRFD has been established for this alternate K-Series, LH-Series, or DLH-Series format. The maximum capacity for any given load/load joist designation is a function of span, depth and chord member size. When requirements exceed the standard K-Series load table limitations for loading, span, and depth, an LH-Series designation is recommended to facilitate the proper determination of minimum seat depth, end anchorage, bridging size, deck attachment, etc. Thus, any joist exceeding a 30 inch depth, a span of 60 feet, an in-kip moment of Depth x 61 kips in ASD or Depth x 91.5 kips in LRFD, or an end reaction of 9.2 kips in ASD or 13.8 kips in LRFD should be designated as an LH-Series which allows for a cross-reference with a standard LH designation as listed in this Specification for seat, end anchorage, bridging, attachment tables, etc.

A KCS Joist is a particular type of K-Series joist, and shall be designed in accordance with this Specification based on an envelope of moment and shear capacity, rather than uniform load capacity, to support uniform plus concentrated loads or other non-uniform loads. The KCS Joists shall be selected from standardized depths from 10 inches (254 mm) through 30 inches (762 mm), for spans up through 60 feet (18288 mm). The maximum total safe uniformly distributed load-carrying capacity of a KCS Joist, K-Series, shall be 550 plf (8.02 kN/m) in ASD or 825 plf (12.03 kN/m) in LRFD. A KCS Joist shall be parallel chord only and shall be permitted to be underslung or bottom chord bearing.

The KCS Joists, K-Series, standard designations shall be established by their nominal depth, followed by the letters "KCS", and then by the Section Number designation assigned. The Section Number designations shall range from 1 to 5. A KCS Joist shall not be designated using the alternate "load/load" method. The KCS Joists, K-Series, standard designations listed in the following Standard Load Tables shall provide the moment capacity and shear capacity as listed in the applicable tables:

- Standard LRFD Load Table for KCS Open Web Steel Joists – U.S. Customary Units
- Standard ASD Load Table for KCS Open Web Steel Joists – U.S. Customary Units
- Standard LRFD Load Table for KCS Open Web Steel Joists – S.I. Units
- Standard ASD Load Table for KCS Open Web Steel Joists – S.I. Units

Where an open web configuration becomes impractical, a Joist Substitute, K-Series, shall be designed in accordance with this Specification to support uniform loads when the span is less than 10 feet (3048 mm). The maximum total safe uniformly distributed load-carrying capacity of a Joist Substitute shall be 550 plf (8.02 kN/m) in ASD or 825 plf (12.03 kN/m) in LRFD.

The Joist Substitutes, K-Series, standard designations shall be established by their nominal depth, e.g. 2.5, followed by the letter "K" and then by the chord size designation assigned. The chord size designations shall range from 1 to 3. The Joist Substitutes, K-Series, standard designations listed in the following Load Tables shall support the uniformly distributed loads as provided in the applicable tables:

User Note: The Joist Substitutes, K-Series, are standardized as 2.5 inch (64 mm) deep sections for spans up through 10'-0" (3048 mm).

- LRFD Simple Span Load Table for 2.5 Inch K-Series Joist Substitutes – U.S. Customary Units
- ASD Simple Span Load Table for 2.5 Inch K-Series Joist Substitutes – U.S. Customary Units
- LRFD Simple Span Load Table for 64 mm K-Series Joist Substitutes – S.I. Units
- ASD Simple Span Load Table for 64 mm K-Series Joist Substitutes – S.I. Units

- LRFD Outriggers Load Table for 2.5 Inch K-Series Joist Substitutes – U.S. Customary Units
- ASD Outriggers Load Table for 2.5 Inch K-Series Joist Substitutes – U.S. Customary Units
- LRFD Outriggers Load Table for 64 mm K-Series Joist Substitutes – S.I. Units
- ASD Outriggers Load Table for 64 mm K-Series Joist Substitutes – S.I. Units

A Top Chord Extension or Extended End, K-series, shall be a joist accessory that shall be designed in accordance with this Specification to support uniform loads when one or both ends of an underslung joist needs to be cantilevered beyond its bearing seat.

User Note: The Top Chord Extensions and Extended Ends are standardized as an "S" Type (top chord angles extended only) and an "R" Type (top chord and bearing seat angles extended), respectively.

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Standard designations for the “S” Type shall range from S1 to S12 for spans from 0'-6" to 4'-6" (152 to 1372 mm). Standard designations for the “R” Type shall range from R1 to R12 for spans from 0'-6" to 6'-0" (152 to 1829 mm). The maximum total safe uniformly distributed load-carrying capacity of either an “R” or “S” Type extension shall be 550 plf (8.02 kN/m) in ASD or 825 plf (12.03 kN/m) in LRFD. The “S” Type Top Chord Extensions and “R” Type Extended Ends listed in the following Standard Load Tables shall support the uniformly distributed loads as provided in the applicable tables:

LRFD Top Chord Extension Load Table (S Type) – U.S. Customary Units
 ASD Top Chord Extension Load Table (S Type) – U.S. Customary Units
 LRFD Top Chord Extension Load Table (R Type) – U.S. Customary Units
 ASD Top Chord Extension Load Table (R Type) – U.S. Customary Units
 LRFD Top Chord Extension Load Table (S Type) – S.I. Units
 ASD Top Chord Extension Load Table (S Type) – S.I. Units
 LRFD Top Chord Extension Load Table (R Type) – S.I. Units
 ASD Top Chord Extension Load Table (R Type) – S.I. Units

1.5 STRUCTURAL DESIGN DRAWINGS AND SPECIFICATIONS

The structural design drawings and specifications shall meet the requirements in the *Code of Standard Practice for Steel Joists and Joist Girders*, except for deviations specifically identified in the design drawings and/or specifications.

SECTION 2. **REFERENCED SPECIFICATIONS, CODES AND STANDARDS**

2.1 REFERENCES

The standards listed below shall be considered as part of the requirements of this Specification. Where conflicts occur between this Specification and a referenced standard, the provisions of this Specification shall take precedence unless otherwise stated. This section lists the standards that are referenced in this Specification. The standards are listed in alphabetical order by name of standards developer organization, with the specific standard designations, title and dates of each of the referenced standards below.

American Institute of Steel Construction, Inc. (AISC), Chicago, IL

ANSI/AISC 360-10 *Specification for Structural Steel Buildings*

American Iron and Steel Institute (AISI), Washington, DC

ANSI/AISI S100-2012 *North American Specification for the Design of Cold-Formed Steel Structural Members*

American Society of Civil Engineers (ASCE), Reston, VA

SEI/ASCE 7-10 *Minimum Design Loads for Buildings and Other Structures*

American Society of Testing and Materials, ASTM International (ASTM), West Conshohocken, PA

ASTM A6/A6M-13A, *Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling*

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- ASTM A36/A36M-12, *Standard Specification for Carbon Structural Steel*
- ASTM A242/242M-13, *Standard Specification for High-Strength Low-Alloy Structural Steel*
- ASTM A307-12a, *Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength*
- ASTM A325/325M-13, *Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi [830 MPa] Minimum Tensile Strength*
- ASTM A370-12a, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*
- ASTM A500/A500M-13, *Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes*
- ASTM A501-07 *Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing* ASTM A529/A529M-05(2009), *Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality* ASTM A572/A572M-13a, *Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel*
- ASTM A588/A588M-10, *Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance*
- ASTM A606/A606M-09a, *Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance*
- ASTM A992/A992M-11, *Standard Specification for Structural Steel Shapes*
- ASTM A1008/A1008M-13, *Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable*
- ASTM A1011/A1011M-13, *Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength*
- ASTM A1065/A1065M-09(2014) *Standard Specification for Cold-Formed Electric-Fusion (ARC) Welded High-Strength Low-Alloy Structural Tubing in Shapes with 50 ksi (345 MPA) Minimum Yield Point*
- ASTM A1085-13 *Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS)*

American Welding Society (AWS), Miami, FL

- AWS A5.1/A5.1M-2012, *Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding*
- AWS A5.5/A5.5M:2006, *Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding*
- AWS A5.17/A5.17M-97:R2007, *Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding*
- AWS A5.18/A5.18M:2005, *Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding*
- AWS A5.20/A5.20M:2005, *Specification for Carbon Steel Electrodes for Flux Cored Arc Welding*
- AWS A5.23/A5.23M:2011, *Specification for Low-Alloy Steel Electrodes and Fluxes for Submerged Arc Welding*
- AWS A5.28/A5.28M:2005, *Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding*
- AWS A5.29/A5.29M:2010, *Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding*
- AWS D1.1/D1.1M:2015, *Structural Welding Code - Steel*
- AWS D1.3/D1.3M:2008, *Structural Welding Code Sheet Steel*

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User Note: The following informative references provide practical guidance in the use and application of this Specification:

Code of Federal Regulations (CFR), Occupational Safety and Health Administration (OSHA), 29 CFR Part 1926, Safety Standards for Steel Erection; Subpart R - Steel Erection; January 18, 2001, Washington, D.C.

Steel Joist Institute (SJI), Florence, SC

SJI-COSP-2015, *Code of Standard Practice for Steel Joists and Joist Girders*

Technical Digest No. 3 (2007), *Structural Design of Steel Joist Roofs to Resist Ponding Loads*

Technical Digest No. 5 (2015), *Vibration of Steel Joist-Concrete Slab Floors*

Technical Digest No. 6 (2012), *Structural Design of Steel Joist Roofs to Resist Uplift Loads*

Technical Digest No. 8 (2008), *Welding of Open Web Steel Joists and Joist Girders*

Technical Digest No. 9 (2008), *Handling and Erection of Steel Joists and Joist Girders*

Technical Digest No. 10 (2003), *Design of Fire Resistive Assemblies with Steel Joists*

Technical Digest No. 11 (2007), *Design of Lateral Load Resisting Frames Using Steel Joists and Joist Girders*

Technical Digest No. 12 (2007), *Evaluation and Modification of Open-Web Steel Joists and Joist Girders*

The Society for Protective Coatings (SSPC), *Steel Structures Painting Manual, Volume 2, Systems and Specifications*, Paint Specification No. 15, Steel Joist Shop Primer, May 1, 1999, Pittsburgh, PA.

Van Malssen, S.H. (1984), *The Effects of Arc Strikes on Steel Used in Nuclear Construction*, Welding Journal, American Welding Society, Miami, FL, July 1984.

SECTION 3. MATERIALS

3.1 STEEL

The steel used in the manufacture of Joist Girders and K-Series, LH-Series, and DLH-Series joists shall conform to one of the following ASTM specifications:

ASTM A36/A36M, Carbon Structural Steel

ASTM A242/A242M, High-Strength Low-Alloy Structural Steel

ASTM A500/A500M, Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A529/A529M, High-Strength Carbon-Manganese Steel of Structural Quality

ASTM A572/A572M, High-Strength Low-Alloy Columbium-Vanadium Structural Steel

ASTM A588/A588M, High-Strength Low-Alloy Structural Steel up to 50 ksi [345 MPa] Minimum Yield Point with Atmospheric Corrosion Resistance

ASTM A606/A606M, Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance

ASTM A992/A992M, Structural Steel Shapes

ASTM A1008/A1008M, Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

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ASTM A1011/A1011M, Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

ASTM A1018/A1018M, Steel, Sheet and Strip, Heavy Thickness Coils, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, Columbium or Vanadium, and High-Strength Low-Alloy with Improved Formability and Ultra-High Strength

EXCEPTION: Steel used in the manufacture of Joist Girders and K-Series, LH-Series, and DLH-Series joists shall be permitted to be of suitable quality ordered or produced to other than the listed ASTM specifications, provided that such material in the state used for final assembly and manufacture is weldable and is proven by tests performed by the producer or manufacturer to have properties, in accordance with Section 3.2.

3.2 MECHANICAL PROPERTIES

3.2.1 Minimum Yield Strength: Steel used for Joist Girders and K-Series, LH-Series, and DLH-Series joists shall have a minimum yield strength determined in accordance with one of the procedures specified in this section, which is equal to the yield strength assumed in the design.

User note: The term "Yield Strength" as used herein designates the yield level of a material as determined by the applicable method outlined in paragraph 13.1 "Yield Point", and in paragraph 13.2 "Yield Strength", of ASTM A370, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*, or as specified in Section 3.2.3.

Evidence that the steel furnished meets or exceeds the design yield strength shall, if requested, be provided in the form of an affidavit or by witnessed or certified test reports.

For material used without consideration of increase in yield strength resulting from cold forming, the specimens shall be taken from as-rolled material. In the case of such material, the mechanical properties of which conform to the requirements of one of the listed ASTM specifications in Section 3.1, the test specimens and procedures shall conform to those of the applicable ASTM specification and to ASTM A370.

3.2.2 Other Materials: For materials where the mechanical properties do not conform to the requirements of one of the ASTM specifications listed in Section 3.1, these materials shall conform to the following requirements:

- a) The specimens shall comply with ASTM A370,
- b) The specimens shall exhibit a yield strength equal to or exceeding the design yield strength,
- c) The specimens shall have an elongation of not less than 20 percent in 2 inches (51 mm) for sheet strip, or 18 percent in 8 inches (203 mm) for plates, shapes and bars with adjustments for thickness for plates, shapes and bars as prescribed in either ASTM A36/A36M, A242/A242M, A500/A500M, A529/A529M, A572/A572M, A588/A588M, or A992/A992M, whichever ASTM specification is applicable, on the basis of design yield strength.
- d) The number of tests for a), b), and c) above shall be as prescribed in ASTM A6/A6M for plates, shapes, and bars; and ASTM A606/A606M, A1008/A1008M and A1011/A1011M for sheet and strip.

3.2.3 As-Formed Strength: If as-formed strength is utilized, the test reports shall show the results of tests performed on full section specimens in accordance with the provisions of the AISI S100. The reports shall also indicate compliance with the following additional requirements:

- a) The yield strength calculated from the test data shall equal or exceed the design yield strength.
- b) Where tension tests are made for acceptance and control purposes, the tensile strength shall be at least 8 percent greater than the yield strength of the section.
- c) Where compression tests are used for acceptance and control purposes, the specimen shall withstand a gross shortening of 2 percent of its original length without cracking. The length of the specimen shall be not greater than 20 times the least radius of gyration.
- d) If any test specimen fails to pass the requirements of the subparagraphs (a), (b), or (c) above, as applicable, two retests shall be made of specimens from the same lot. Failure of one of the retest specimens to meet such requirements shall be the cause for rejection of the lot represented by the specimens.

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3.3 WELDING ELECTRODES

3.3.1 Welding Electrodes: The welding electrodes used for arc welding shall be in accordance with the following:

- a) For connected members both having a specified minimum yield strength greater than 36 ksi (250 MPa), one of the following electrodes shall be used:

AWS A5.1:	E70XX
AWS A5.5:	E70XX-X
AWS A5.17:	F7XX-EXXX, F7XX-ECXXX flux electrode combination
AWS A5.18:	ER70S-X, E70C-XC, E70C-XM
AWS A5.20:	E7XT-X, E7XT-XM
AWS A5.23:	F7XX-EXXX-XX, F7XX-ECXXX-XX
AWS A5.28:	ER70S-XXX, E70C-XXX
AWS A5.29:	E7XTX-X, E7XTX-XM

- b) For connected members both having a specified minimum yield strength of 36 ksi (250 MPa) or one having a specified minimum yield strength of 36 ksi (250 MPa), and the other having a specified minimum yield strength greater than 36 ksi (250 MPa), one of the following electrodes shall be used:

AWS A5.1:	E60XX
AWS A5.17:	F6XX-EXXX, F6XX-ECXXX flux electrode combination
AWS A5.20:	E6XT-X, E6XT-XM
AWS A5.29:	E6XTX-X, E6XTX-XM

or any of those listed in Section 3.3.1(a).

3.3.2 Other Welding Methods: Other welding methods, providing equivalent strength as demonstrated by tests, shall be permitted to be used.

3.4 PAINT

The standard shop paint shall be considered an impermanent and provisional coating.

User Note: The standard shop paint is intended to protect the steel for only a short period of exposure in ordinary atmospheric conditions.

When specified, the standard shop paint shall conform to one of the following:

- The Society for Protective Coatings, SSPC Paint Specification No. 15.
- Or, shall be a shop paint which meets the minimum performance requirements of SSPC Paint Specification No. 15.

SECTION 4.**DESIGN AND MANUFACTURE****4.1 METHOD**

Joist Girders support steel joists or other secondary members and shall be designed in accordance with this Specification as simply-supported primary load-carrying members for in-plane loading. Steel joists shall be designed in accordance with this Specification as simply-supported trusses supporting a floor or roof deck so constructed as to brace the top chord of the steel joists against lateral buckling. Where any applicable design feature is not specifically covered herein, the design shall be in accordance with the following Specifications:

- Where the steel used consists of hot-rolled shapes, bars or plates, AISC 360.
- For members which are cold-formed from sheet or strip steel, AISI S100.

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4.1.1 Design Basis:

Steel joist and Joist Girder designs shall be in accordance with the provisions in this Specification using Load and Resistance Factor Design (LRFD) or Allowable Strength Design (ASD) as specified by the specifying professional for the project.

4.1.2 Loads, Forces and Load Combinations:

The loads and forces used for the steel joist and Joist Girder design shall be calculated by the specifying professional in accordance with the applicable building code and specified and provided on the structural drawings.

For nominal concentrated loads, which have been accounted for in the specified uniform loads, the addition of chord bending moments or an added shop or field web member due to these nominal concentrated loads shall not be required provided that the sum of the concentrated loads within a chord panel does not exceed 100 pounds and the attachments are concentric to the chord. When exact dimensional locations for concentrated loads which do not meet the above criteria are provided by the specifying professional, the joist shall be designed for the loads and load locations provided without the need for additional field applied web members at the specified locations.

The load combinations shall be specified by the specifying professional on the structural drawings in accordance with the applicable building code. In the absence of an applicable building code, the load combinations shall be those stipulated in SEI/ASCE 7 Section 2.3 and Section 2.4 as appropriate. For LRFD designs, the load combinations in SEI/ASCE 7, Section 2.3 shall apply. For ASD designs, the load combinations in SEI/ASCE 7, Section 2.4 shall apply.

4.2 DESIGN AND ALLOWABLE STRESSES

4.2.1 Design Using Load and Resistance Factor Design (LRFD)

Joists and Joist Girders shall have their components so proportioned that the required stresses, f_u , shall not exceed ϕF_n where

f_u	= required stress	ksi (MPa)
F_n	= nominal stress	ksi (MPa)
ϕ	= resistance factor	
ϕF_n	= design stress	ksi (MPa)

4.2.2 Design Using Allowable Strength Design (ASD)

Joists and Joist Girders shall have their components so proportioned that the required stresses, f , shall not exceed F_n / Ω where

f	= required stress	ksi (MPa)
F_n	= nominal stress	ksi (MPa)
Ω	= safety factor	
F_n / Ω	= allowable stress	ksi (MPa)

4.2.3 Stresses:

The calculation of design stress or allowable stress for chords shall be based on a yield strength, F_y , of the material used in manufacturing equal to 50 ksi (345 MPa). The calculation of design stress or allowable stress for all other joist elements shall be based on a yield strength, F_y , of the material used in manufacturing, but shall not be less than 36 ksi (250 MPa) nor greater than 50 ksi (345 MPa). Yield strengths greater than 50 ksi shall not be used for the design of any members.

4.2.3.1 Tension: $\phi_t = 0.90$ (LRFD), $\Omega_t = 1.67$ (ASD)

$$\text{Design Stress} = 0.9F_y \text{ (LRFD)} \tag{4.2-1}$$

$$\text{Allowable Stress} = 0.6F_y \text{ (ASD)} \tag{4.2-2}$$

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4.2.3.2 Compression: $\phi_c = 0.90$ (LRFD), $\Omega_c = 1.67$ (ASD)

$$\text{Design Stress} = 0.9F_{cr} \text{ (LRFD)} \quad (4.2-3)$$

$$\text{Allowable Stress} = 0.6F_{cr} \text{ (ASD)} \quad (4.2-4)$$

Where:

For members with $k\ell/r \leq 4.71\sqrt{E/QF_y}$

$$F_{cr} = Q \left[0.658^{\left(\frac{QF_y}{F_e} \right)} \right] F_y \quad (4.2-5)$$

For members with $k\ell/r > 4.71\sqrt{E/QF_y}$

$$F_{cr} = 0.877F_e \quad (4.2-6)$$

Where F_e = Elastic buckling stress determined in accordance with Equation 4.2-7

$$F_e = \frac{\pi^2 E}{\left(\frac{k\ell}{r} \right)^2} \quad (4.2-7)$$

In the above equations, ℓ is the length, k is the effective length factor, and r is the corresponding radius of gyration of the member as defined in Section 4.3. E is equal to 29,000 ksi (200,000 MPa).

For hot-rolled sections and cold-formed angles, Q shall be taken as the full reduction factor for slender compression members as determined in accordance with AISC 360-10.

Exception: Where a compression web member is a crimped-end angle member intersecting at the first bottom chord panel point, whether hot-rolled or cold-formed, then Q shall be determined as follows:

$$Q = [5.25/(w/t)] + t \leq 1.0 \quad (4.2-8a)$$

Where: w = angle leg length, inches
 t = angle leg thickness, inches

or,

$$Q = [5.25/(w/t)] + (t/25.4) \leq 1.0 \quad (4.2-8b)$$

Where: w = angle leg length, millimeters
 t = angle leg thickness, millimeters

For all other cold-formed sections the method of calculating the nominal compression strength shall be in accordance with AISI S100.

4.2.3.3 Bending: $\phi_b = 0.90$ (LRFD), $\Omega_b = 1.67$ (ASD)

Bending calculations shall be based on the elastic section modulus.

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For chords and web members other than solid rounds: $F_n = F_y$

$$\text{Design Stress} = \phi_b F_n = 0.9F_y \text{ (LRFD)} \quad (4.2-9)$$

$$\text{Allowable Stress} = F_n/\Omega_b = 0.6F_y \text{ (ASD)} \quad (4.2-10)$$

For web members of solid round cross section: $F_n = 1.6 F_y$

$$\text{Design Stress} = \phi_b F_n = 1.45F_y \text{ (LRFD)} \quad (4.2-11)$$

$$\text{Allowable Stress} = F_n/\Omega_b = 0.95F_y \text{ (ASD)} \quad (4.2-12)$$

For bearing plates used in joist seats: $F_n = 1.5 F_y$

$$\text{Design Stress} = \phi_b F_n = 1.35F_y \text{ (LRFD)} \quad (4.2-13)$$

$$\text{Allowable Stress} = F_n/\Omega_b = 0.90F_y \text{ (ASD)} \quad (4.2-14)$$

4.2.3.4 Weld Strength:

Shear at throat of fillet welds, flare bevel groove welds, partial joint penetration groove welds, and plug/slot welds shall be determined as follows:

$$\text{Nominal Shear Stress} = F_{nw} = 0.6F_{exx} \quad (4.2-15)$$

LRFD: $\phi_w = 0.75$

$$\text{Design Shear Strength} = \phi R_n = \phi_w F_{nw} A = 0.45F_{exx} A_w \quad (4.2-16)$$

ASD: $\Omega_w = 2.0$

$$\text{Allowable Shear Strength} = R_n/\Omega_w = F_{nw}A/\Omega_w = 0.3F_{exx} A_w \quad (4.2-17)$$

Where:

F_{exx} is determined as follows:

E70 series electrodes or F7XX-EXXX flux-electrode combinations $F_{exx} = 70 \text{ ksi (483 MPa)}$

E60 series electrodes or F6XX-EXXX flux-electrode combinations $F_{exx} = 60 \text{ ksi (414 MPa)}$

A_w = effective throat area, where:

For fillet welds, A_w = effective throat area

Other design methods demonstrated to provide sufficient strength by testing shall be permitted to be used.

For flare bevel groove welds, the effective weld area is based on a weld throat width, T, where:

$$T \text{ (inches)} = 0.12D + 0.11 \quad (4.2-18a)$$

Where D = web diameter, inches

or,

$$T \text{ (mm)} = 0.12D + 2.8 \quad (4.2-18b)$$

Where D = web diameter, mm

For plug/slot welds, A_w = cross-sectional area of the hole or slot in the plane of the faying surface provided that the hole or slot meets the requirements of AISC 360.

User Note: For more on plugs/slot welds see Steel Joist Institute Technical Digest No. 8, "Welding of Open-Web Steel Joists and Joist Girders".

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Strength of resistance welds and complete-joint-penetration groove or butt welds in tension or compression (only where the stress is normal to the weld axis) shall be equal to the base metal strength:

$$\phi_t = \phi_c = 0.90 \text{ (LRFD)} \quad \Omega_t = \Omega_c = 1.67 \text{ (ASD)}$$

$$\text{Design Stress} = 0.9 F_y \text{ (LRFD)} \quad (4.2-19)$$

$$\text{Allowable Stress} = 0.6 F_y \text{ (ASD)} \quad (4.2-20)$$

4.3 MAXIMUM SLENDERNESS RATIOS

The slenderness ratios, $1.0\ell/r$ and $1.0\ell_s/r$ of members as a whole or any component part shall not exceed the values given in Table 4.3-1, Part A.

4.3.1 Effective Slenderness Ratios: The effective slenderness ratio, $k\ell/r$ to be used in calculating the nominal stresses, F_{cr} and F'_e , is the largest value as determined from Table 4.3-1, Part B and Part C, and modified where required with equation 4.3-1. The effective length k shall be taken as 1.0 for all components in Joist Girders.

4.3.2 Compressive Members: In compression members where fillers or ties are used, they shall be spaced so that the ℓ_s/r_z ratio of each component does not exceed the governing ℓ/r ratio of the member as a whole. The terms used in Table 4.3-1 shall be defined as follows:

- ℓ = length center-to-center of panel points, except $\ell = 36$ inches (914 millimeters) for calculating ℓ/r_y of the top chord member for joists, and for Joist Girders this distance shall be the unbraced length between joists which are positively attached to the top chord, in. (mm).
- ℓ_s = maximum length center-to-center between panel point and filler (tie), or between adjacent fillers (ties), in. (mm).
- r_x = member radius of gyration about the horizontal axis of the joist or Joist Girder cross section, in. (mm).
- r_y = member radius of gyration about the vertical axis of the joist or Joist Girder cross section, in. (mm).
- r_z = least radius of gyration of a member component, in. (mm).

Compression web members shall be those web members subject to compressive axial loads under gravity loading.

4.3.3 Tension Members: Tension web members shall be those web members subject to tension axial loads under gravity loading, and which shall be permitted to be subject to compressive axial loads under alternate loading conditions

User Note: An example of a non-gravity alternate loading condition is net uplift.

4.3.4 Top Chords: For top chords, the end panel(s) shall be the panels between the bearing seat and the first primary interior panel point comprised of at least two intersecting web members.

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4.3.5 Built-Up Web Members: For built-up web members composed of two interconnected shapes, where $\ell_s/r_z > 40$,

a modified slenderness ratio $\left(\frac{k\ell}{r_y}\right)_m$ shall replace $\frac{k\ell}{r_y}$ in equations 4.2-5, 4.2-6, and 4.2-7, where:

$$\left(\frac{k\ell}{r_y}\right)_m = \sqrt{\left(\frac{k\ell}{r_y}\right)^2 + \left(\frac{k_i\ell_s}{r_z}\right)^2} \quad (4.3-1)$$

and,

$$\begin{aligned} k_i &= 0.50 \text{ for angles back-to-back} \\ &= 0.75 \text{ for channels back-to-back} \end{aligned}$$

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TABLE 4.3-1

MAXIMUM AND EFFECTIVE SLENDERNESS RATIOS¹

Description		$k\ell/r_x$	$k\ell/r_y$	$k\ell/r_z$	$k\ell_s/r_z$
I. TOP CHORD INTERIOR PANELS					
A.	The slenderness ratios, $1.0\ell/r$ and $1.0\ell_s/r$, of members as a whole or any component part shall not exceed 90.				
B.	The effective slenderness ratio for joists, $k\ell/r$, to determine F_{cr} where k is:				
1.	Two shapes with fillers or ties	0.75	0.94	---	1.0
2.	Two shapes without fillers or ties	---	---	0.75	---
3.	Single component members	0.75	0.94	---	---
C.	For bending, the effective slenderness ratio, $k\ell/r$, to determine F'_e where k is:				
		0.75	---	---	---
II. TOP CHORD END PANELS					
A.	The slenderness ratios, $1.0\ell/r$ and $1.0\ell_s/r$, of members as a whole or any component part shall not exceed 120.				
B.	The effective slenderness ratio for joists, $k\ell/r$, to determine F_{cr} where k is:				
1.	Two shapes with fillers or ties	1.0	0.94	---	1.0
2.	Two shapes without fillers or ties	---	---	1.0	---
3.	Single component members	1.0	0.94	---	---
C.	For bending, the effective slenderness ratio, $k\ell/r$, to determine F'_e where k is:				
		1.0	---	---	---
III. ALL BOTTOM CHORD PANELS					
A.	The slenderness ratios, $1.0\ell/r$ and $1.0\ell_s/r$, of members as a whole or any component part shall not exceed 240.				
B.	For members subject to compression, the effective slenderness ratio for joists, $k\ell/r$, to determine F_{cr} where k is:				
1.	Two shapes with fillers or ties	0.9	0.94	---	1.0
2.	Two shapes without fillers or ties	---	---	0.9	---
3.	Single component members	0.9	0.94	---	---
C.	For bending, the effective slenderness ratio, $k\ell/r$, to determine F'_e where k is:				
		0.9	---	---	---
IV. WEB MEMBERS					
A.	The slenderness ratios, $1.0\ell/r$ and $1.0\ell_s/r$, of members as a whole or any component part shall not exceed 240 for a tension member or 200 for a compression member.				
B.	For members subject to compression, the effective slenderness ratio for joists, $k\ell/r$, to determine F_{cr} where k is:				
1.	Two shapes with fillers or ties	0.75	1.0	---	1.0
2.	Two shapes without fillers or ties	---	---	1.0	---
3.	Single component members	0.75	0.9*	---	---
	*For end tension web members subject to compression, k shall equal 0.8				
(1) The effective length k shall equal 1.0 for all components of Joist Girders.					

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4.4 MEMBERS

4.4.1 Chords

The joist and Joist Girder bottom chord shall be designed as an axially loaded tension member.

For Joist Girders, the radius of gyration of the bottom chord about its vertical axis shall not be less than $\ell/240$ where ℓ is the distance between lines of bracing. The radius of gyration of a Joist Girder top chord about the vertical axis shall not be less than $\text{Span}/575$.

For steel joists, the radius of gyration of the top chord about its vertical axis shall not be less than the results of equation 4.4-1 or 4.4-2:

$$r_y \geq \ell_{br} / \left(124 + 0.67 d_j + 28 \frac{d_j}{L} \right), \text{ in.} \quad (4.4-1a)$$

$$r_y \geq \ell_{br} / \left(124 + 0.026 d_j + 0.34 \frac{d_j}{L} \right), \text{ mm} \quad (4.4-1b)$$

or,

$$r_y \geq \ell_{br} / 170 \quad (4.4-2)$$

Where:

d_j is the steel joist depth, in. (mm)

L is the joist span length, ft. (m)

r_y is the radius of gyration of the top chord about the vertical axis of the joist cross section, in. (mm)

ℓ_{br} is the spacing in inches (millimeters) between lines of bracing as specified in Section 5.5.3.1.

A steel joist top chord shall be considered as laterally braced by the floor slab or roof deck provided the requirements of Section 5.9 are met.

A Joist Girder top chord shall be considered as laterally braced by the steel joists provided positive attachment is made. The outstanding part of the top chord member shall be designed such that the allowable reaction from a single joist shall not exceed equation 4.4-3 or 4.4-4:

$$\phi P_p \text{ and } \phi P_p (1.6 - f_{au}/\phi Q F_y) \quad (\text{LRFD, } \phi = 0.9) \quad (4.4-3)$$

$$P_p/\Omega \text{ and } P_p/\Omega (1.6 - \Omega f_{au}/Q F_y) \quad (\text{ASD, } \Omega = 1.67) \quad (4.4-4)$$

Where:

F_y = Specified minimum yield strength, ksi (MPa)

P_p = Plastic failure mode = $[(t^2 F_y) / [2(b-k)]] [g + 5.66(b-k)]$, kips (N)

Q = Form factor defined in Section 4.2.3.2

b = width of the outstanding part of the top chord member, in. (mm)

f_{au} = P_u/A = Required compressive stress, ksi (MPa)

f_a = P/A = Required compressive stress, ksi (MPa)

g = width of bearing seat, in. (mm)

k = value from angle properties or similar dimension for other members, in (mm)

t = thickness of the outstanding part of the top chord member, in. (mm)

The top chord of a steel joist or Joist Girder shall be designed as a continuous member subject to combined axial and bending stresses, except a Joist Girder loaded only at panel points shall be designed as an axial loaded compression member. For combined stresses the top chord shall be so proportioned that:



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For LRFD:

at the panel point:

$$f_{au} + f_{bu} \leq 0.9F_y \quad (4.4-5)$$

at the mid panel:

$$\text{for, } \frac{f_{au}}{\phi_c F_{cr}} \geq 0.2,$$

$$\frac{f_{au}}{\phi_c F_{cr}} + \frac{8}{9} \left[\frac{C_m f_{bu}}{\left[1 - \left(\frac{f_{au}}{\phi_c F'_e} \right) \right] Q \phi_b F_y} \right] \leq 1.0 \quad (4.4-6)$$

$$\text{for, } \frac{f_{au}}{\phi_c F_{cr}} < 0.2,$$

$$\frac{f_{au}}{2\phi_c F_{cr}} + \left[\frac{C_m f_{bu}}{\left[1 - \left(\frac{f_{au}}{\phi_c F'_e} \right) \right] Q \phi_b F_y} \right] \leq 1.0 \quad (4.4-7)$$

f_{au} = P_u/A = Required compressive stress using LRFD load combinations, ksi (MPa)

P_u = Required axial strength using LRFD load combinations, kips (N)

A = Area of the top chord, in.² (mm²)

f_{bu} = M_u/S = Required bending stress at the location under consideration using LRFD load combinations, ksi (MPa)

M_u = Required flexural strength using LRFD load combinations, kip-in. (N-mm)

S = Elastic Section Modulus, in.³ (mm³)

F_{cr} = Nominal axial compressive stress in ksi (MPa) based on $k\ell/r$ as defined in Section 4.3

C_m = $1 - 0.3 f_{au}/\phi_c F'_e$ for end panels

C_m = $1 - 0.4 f_{au}/\phi_c F'_e$ for interior panels

Q = Form factor defined in Section 4.2.3.2

ϕ_c = Resistance factor for compression = 0.9

ϕ_b = Resistance factor for flexure = 0.9

F_y = Specified minimum yield strength, ksi (MPa)

$$F'_e = \frac{\pi^2 E}{(k\ell/r_x)^2}, \text{ ksi (MPa),}$$

where ℓ is the length, k is the effective length factor, and r_x is the corresponding radius of gyration of the member as defined in Section 4.3

E = Modulus of elasticity, 29,000 ksi (200,000 MPa)

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For **ASD**:

at the panel point:

$$f_a + f_b \leq 0.6F_y \quad (4.4-8)$$

at the mid panel:

for, $\frac{f_a}{F_a} \geq 0.2$,

$$\frac{f_a}{F_a} + \frac{8}{9} \left[\frac{C_m f_b}{\left[1 - \left(\frac{1.67f_a}{F'_e} \right) \right] QF_b} \right] \leq 1.0 \quad (4.4-9)$$

for $\frac{f_a}{F_a} < 0.2$,

$$\left(\frac{f_a}{2F_a} \right) + \left[\frac{C_m f_b}{\left[1 - \left(\frac{1.67f_a}{F'_e} \right) \right] QF_b} \right] \leq 1.0 \quad (4.4-10)$$

- f_a = P/A required compressive stress using ASD load combinations, ksi (MPa)
- A = Area of the top chord, in.² (mm²)
- P = Required axial strength using ASD load combinations, kips (N)
- f_b = M/S = required bending stress at the location under consideration using ASD load combinations, ksi (MPa)
- S = Elastic Section Modulus, in.³ (mm³)
- M = Required flexural strength using ASD load combinations, k-in. (N-mm)
- F_a = Allowable axial compressive stress based on $k\ell/r$ as defined in Section 4.3; $0.6F_{cr}$, ksi (MPa)
- F_b = Allowable bending stress; $0.6F_y$, ksi (MPa)
- C_m = $1 - 0.50 f_a/F'_e$ for end panels
- C_m = $1 - 0.67 f_a/F'_e$ for interior panels
- Q = Form factor defined in Section 4.2.3.2
- $F'_e = \frac{\pi^2 E}{(k\ell/r_x)^2}$, ksi (MPa),
where ℓ is the length, k is the effective length factor, and r_x is the corresponding radius of gyration of the member as defined in Section 4.3
- E = Modulus of elasticity, 29,000 ksi (200,000 MPa)

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The top chord and bottom chord shall be designed such that at each joint complies with equation 4.4-11 or 4.4-12:

$$f_{vmod} \leq \phi_v F_n \quad (\text{LRFD, } \phi_v = 1.00) \quad (4.4-11)$$

$$f_{vmod} \leq F_n / \Omega_v \quad (\text{ASD, } \Omega_v = 1.50) \quad (4.4-12)$$

F_n = nominal shear stress = $0.6F_y$, ksi (MPa)

f_t = axial stress = P/A , ksi (MPa)

f_v = shear stress = V/bt , ksi (MPa)

f_{vmod} = modified shear stress = $(1/2)\sqrt{f_t^2 + 4f_v^2}$

b = length of vertical part(s) of cross section, in. (mm)

t = thickness of vertical part(s) of cross section, in. (mm)

It shall not be necessary to design the top chord and bottom chord for the modified shear stress, f_{vmod} , where a round bar web member is continuous through a joint. The minimum required shear of section 4.4.2 (25 percent of the maximum end reaction) shall not be required when evaluating Equation 4.4-11 or 4.4-12.

KCS Joist, K-Series, chords shall be designed for a flat positive bending moment envelope where the moment capacity is constant at all interior panels. The top chord end panel(s) shall be designed for an axial load based on the force in the first tension web resulting from the specified shear. A uniform load of 550 plf (8.02 kN/m) in ASD or 825 plf (12.03 kN/m) in LRFD shall be used to check bending in the end panel(s). The top chord interior panels shall be designed for an axial stress resulting from the constant moment capacity plus the bending stress. The bending stress shall be determined from the smaller uniform load derived from the constant moment and constant shear, not to exceed 550 plf (ASD) or 825 plf (LRFD). The constant moment and shear shall be those values as listed in the Standard Load Table for KCS Steel Joists.

4.4.2 Web

The vertical shears to be used in the design of the web members shall be determined by including all loads, but such vertical shears shall be not less than 25 percent of the maximum end reaction from the design load combinations.

4.4.2.1 Redundant Web Members: Redundant web members used in modified Warren type web systems shall be designed to resist the gravity loads supported by the member plus an additional axial load of $1/2$ of 1.0 percent of the top chord axial force. For a **Joist Girder**, this total axial load shall not be less than 2 percent of the top chord axial force.

4.4.2.2 Joist Girders: For Joist Girders, the tension web members shall be designed to resist at least 25 percent of their axial force in compression.

4.4.2.3 KCS Joist Web Forces: KCS Joist web forces shall be determined based on a flat shear envelope, and the following:

- a) All webs shall be designed for a vertical shear equal to the specified shear capacity.
- b) All webs shall be designed for 100 percent stress reversal except for the first tension web which remains in tension under all simple span gravity loads.

4.4.2.4 Single Component Web Member: In those cases where a single component web member is attached to the outside of the stem of a tee or double angle chord or any other orientation of a single web member which creates an out-of-plane moment, the web member design shall account for the stresses due to eccentricity.

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4.4.2.4.1 Uncrimped Single Angle Web Members

For 1 inch uncrimped single angle web members where one leg is placed flat against one chord member in the gap, the resulting eccentricities and the effects in loading shall be considered in the design. A minimum of 50 percent of the required weld shall be deposited to each chord angle.

For angles subjected to tensile loading, the following requirements shall be met:

For **LRFD**: combined axial and bending stresses shall be proportioned in accordance with Eq. 4.4-5.

For **ASD**: combined axial and bending stresses shall be proportioned in accordance with Eq. 4.4-8.

For angles subjected to compression loading, the following requirements shall be met:

For **LRFD**:

at the panel point, combined axial and bending stresses shall be proportioned in accordance with Eq. 4.4-5.

at the mid length, the strength shall meet Eqs. 4.4-6 or 4.4-7, and 4.4-13:

$$\frac{f_{au}}{\phi_c F_{crz}} \leq 1.0 \quad (4.4-13)$$

where

f_{au} = P_u/A = Required tensile or compressive stress, ksi (MPa)

P_u = Required axial strength using LRFD load combinations, kips (N)

A = Area of the uncrimped angle web, in.², (mm²)

f_{bu} = M_u/S = required bending stress, ksi (MPa)

M_u = Required flexural strength = $0.5 P_u \left(\frac{\text{chord gap}}{2} - \bar{y} \right)$, kip-in. (N-mm)

S = Minimum Elastic Section Modulus, in.³ (mm³)

F_{cr} = F_{crx} , ksi (MPa)

F_{crx} = Nominal axial compressive stress in ksi (MPa) based on $k\ell/r_x$, where ℓ is the length, k is the effective length factor, and r_x is the corresponding radius of gyration of the member as defined in Section 4.3

F_{crz} = Nominal axial compressive stress in ksi (MPa) based on $k\ell/r_z$ where $k = 1.0$

C_m = 1.0

F_y = Specified minimum yield strength, ksi (MPa)

$F'_c = \frac{\pi^2 E}{(k\ell/r_x)^2}$, ksi (MPa)

Q = Form factor defined in Section 4.2.3.2

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For **ASD**:

at the panel point, combined axial and bending stresses shall be proportioned in accordance with Eq. 4.4-8.

at the mid length the strength shall meet Eqs. 4.4-9 or 4.4-10, and 4.4-14:

$$\frac{f_a}{F_{az}} \leq 1.0 \quad (4.4-14)$$

where

f_a = P/A = Required tensile or compressive stress, ksi (MPa)

P = Required axial strength using ASD load combinations, kips (N)

A = Area of the uncrimped angle web, in.², (mm²)

f_b = M/S = required bending stress, ksi (MPa)

S = Minimum Elastic Section Modulus, in.³ (mm³)

M = Required flexural strength = $0.5 P \left(\frac{\text{chord gap}}{2} - \bar{y} \right)$, kip-in. (N-mm)

F_a = F_{ax} , ksi (MPa)

F_{ax} = Nominal axial compressive stress in ksi (MPa) based on $k\ell/r_x$, where ℓ is the length, k is the effective length factor, and r_x is the corresponding radius of gyration of the member as defined in Section 4.3

F_{az} = Nominal axial compressive stress in ksi (MPa) based on $K\ell/r_z$, where $k = 1.0$

F_b = Allowable bending stress; $0.6F_y$, ksi (MPa)

Alternate methods of design shall be permitted provided they provide strength equal to or greater than those given. Alternate design procedures shall be submitted to the Steel Joist Institute's consulting engineer for approval.

4.4.3 Fillers and Ties

Fillers or ties added on chord or web compression members shall be designed and connected for a force equal to 2 percent of the required member axial force.

4.4.4 Joist and Joist Girder Extensions

Joist and Joist Girder extensions shall be designated as one of three extension types, as follows: top chord extensions (TCX), extended ends, or full depth cantilevers.

Design criteria for joist extensions shall be specified using one of the following methods:

- A joist top chord extension (TCX), extended end, or full depth cantilevered end shall be designed for the load from the Standard Load Tables based on the design length and designation of the specified joist. In the absence of other design information, the joist manufacturer shall design the joist extension for this loading as a default.
- A loading diagram shall be provided for the joist extension, extended end, or full depth cantilevered end. The diagram shall include the magnitude and location of the loads to be supported, as well as the applicable load combinations.

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- c) 2½" deep steel joist extensions shall be permitted to be specified using extension designations found in the Top Chord Extension Load Table (S Type) for TCXs or the Top Chord Extension Load Table (R Type) for extended ends.

Any deflection requirements or limits due to the accompanying loads and load combinations on the steel joist or Joist Girder extension shall be provided by the specifying professional, regardless of the method used to specify the extension. Unless otherwise specified, the joist manufacturer shall check the extension for the specified deflection limit under uniform live load acting simultaneously on both the joist base span and the extension.

The joist manufacturer shall consider the effects of steel joist or Joist Girder extension loading on the base span of the steel joist or Joist Girder. This shall include carrying the design bending moment due to the loading on the extension into the top chord end panel(s), and the effect on the overall steel joist or Joist Girder chord and web axial forces. In the case of a K-Series Standard Type 'R' Extended End or 'S' TCX, the design bending moment shall be determined by the tabulated extension section modulus (S) multiplied by the appropriate allowable (ASD) or design (LRFD) flexural stress.

Bracing of extensions shall be clearly indicated on the structural drawings.

4.5 CONNECTIONS

4.5.1 Methods

Member connections and splices shall be made by attaching the members to one another by arc or resistance welding or other accredited methods in accordance with the following:

- a) Steel joist and Joist Girder arc welded joints shall be in accordance with the American Welding Society, "Structural Welding Code-Steel", D1.1, and/or the "Structural Welding Code Sheet Steel", D1.3 with the following seven modified acceptance criteria as permitted by AWS D1.1 Clause 6.8:

- 1) Undercut shall not exceed 1/16 inch (2 mm) for welds oriented parallel to the principal stress.

User Note: The typical diagonal web member connection to one leg of a chord angle is considered to be parallel to the principal stress.

- 2) Discontinuities outside of the weld design length shall be permitted provided no cracks exist and undercut does not exceed the limits of item 1).

User Note: The weld design length is the minimum weld length needed for the connection force and weld thickness. Portions of the actual weld length with imperfections or discontinuities such as porosity or lack of a full profile are not included when comparing the actual weld length to the weld design length.

- 3) One unrepaired arc strike shall be permitted per joint provided it does not result in other unacceptable defects.

User Note: Minor arc strikes do not reduce the strength of AWS Group II materials (refer to Van Malssen, 1984).

- 4) The effective throat for flare bevel groove welds shall be calculated in accordance with equation 4.2-18.

User Note: The effective weld throat used by the SJI with round bars is based on SJI research and is more conservative than AWS D1.1 for GMAW for round bars in excess of 9/16" (14 mm). See Steel Joist Institute Technical Digest 8, "Welding of Open Web Steel Joists and Joist Girders".

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- 5) Tack welds that are discontinuous from other welds shall meet the criteria for undercut, but shall be exempt from all other acceptance criteria.

User Note: Joist manufacturers use tack welds in the assembly process, and so long as they do not diminish the strength of the base metal and are not incorporated into the final weld for strength, they are not required to meet other inspection criteria.

- 6) The weld profile shall be considered acceptable provided neither the weld leg nor the weld throat is undersized less than AWS D1.1 limits within the weld design length.
- 7) For material with thickness less than 1/8", AWS D1.1 or D1.3 shall be considered appropriate.

User Note: AWS D1.1 does not address thicknesses less than 1/8" for hot rolled material and AWS D1.3 does not address hot rolled material, thus SJI has extended the ranges to include these material thicknesses.

- b) Steel joist and Joist Girder resistance welded joints shall follow a preproduction validation procedure and a production checking procedure and shall meet the strength requirements of this Specification.

User Note: Spot, flash or upset resistance welds should have a written welding procedure qualification record and a systematic quality plan. For further information, see Steel Joist Institute Technical Digest 8, "Welding of Open Web Steel Joists and Joist Girders".

- c) Welded Connections for Crimped-End Angle Web Members

- 1) The connection of each end of a crimped angle web member to each side of the chord shall consist of a weld group made of more than a single line of weld. The design weld length shall include an end return of no less than two times the nominal weld size.

- d) Welding Program

- 1) The manufacturer's welders shall be qualified in accordance with either AWS D1.1 or AWS D1.3 for the applicable weld type, position, and material.
- 2) Manufacturers shall have a program for establishing weld procedures and operator qualification, and for weld sampling and testing. Each manufacturing facility shall have trained inspectors, and an engineer responsible for all welding procedures.

- e) Weld Inspection by Outside Agencies (See Section 5.14)

- 1) The agency shall arrange for visual inspection to determine that welds meet the acceptance standards of Section 4.5.1.

User Note: Ultrasonic, X-ray, and magnetic particle testing are inappropriate for joists due to the configurations of the components and welds.

4.5.2 Strength

4.5.2.1 Joint Connections: Joint connections shall develop the maximum force due to any of the design loads, but not less than 50 percent of the strength of the member in tension or compression, whichever force is the controlling factor in the selection of the member.

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4.5.2.2 Shop Splices: Shop splices shall be permitted to occur at any point in chord or web members. Splices shall be designed for the member force, but not less than 50 percent of the member strength. All component parts comprising the cross section of the chord or web member (including reinforcing plates, rods, etc.) at the point of the splice shall develop a nominal tensile strength of at least 1.2 times the product of the yield strength and the full design area of the chord or web. The "full design area" shall be defined as the minimum required area such that the required stress will be less than the design (LRFD) or allowable (ASD) stress.

User Note: For more information on welding, see Steel Joist Institute Technical Digest 8, "Welding of Open Web Steel Joists and Joist Girders".

4.5.3 Field Splices

Field Splices shall be designed by the manufacturer and shall be either bolted or welded. Splices shall be designed for the member force, but not less than 50 percent of the member strength.

4.5.4 Eccentricity

Members connected at a joint shall have their center of gravity lines meet at a point, where practical. Ends of joists or Joist Girders shall be proportioned to resist bending produced by eccentricity at the support.

For a single component web member, the eccentricity shall be permitted to be neglected where it does not exceed the lesser of three-quarters of the over-all dimension of the chord or 2" (51 mm). This eccentricity, measured in the plane of the joist, shall be the perpendicular distance from the centroidal axis of that web member to the point on the centroidal axis of the chord which is vertically above or below the intersection of the centroidal axis of the web member(s) forming the joint in accordance with Figure 4.5-1.

For a web member composed of at least two shapes, the eccentricity on either side of the neutral axis of chord members, measured in the plane of the joist at the joint work point, shall be permitted to be neglected where the web intersect point does not exceed one and one-half times the distance between the neutral axis and the back of the chord in accordance with Figure 4.5-2.

If these limits are exceeded, provision shall be made for the stresses due to eccentricity.

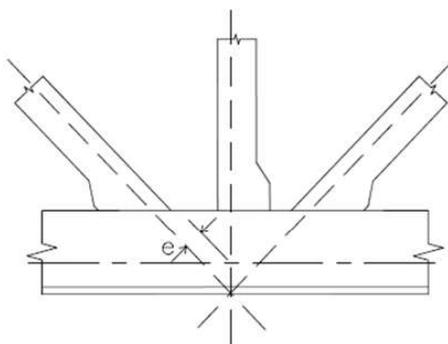


FIGURE 4.5-1

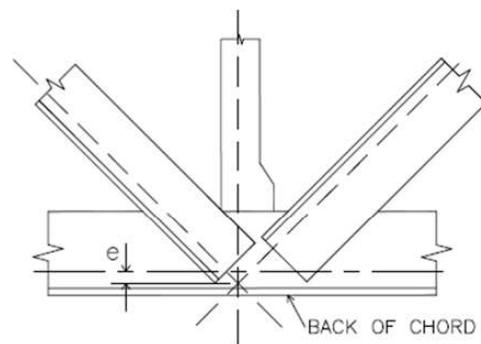


FIGURE 4.5-2

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4.6 CAMBER

Steel joists and Joist Girders 100'-0" or less shall have a manufactured camber in accordance with Table 4.6-1:

TABLE 4.6-1

TOP CHORD LENGTH		APPROXIMATE CAMBER	
20'-0"	(6096 mm)	1/4"	(6 mm)
30'-0"	(9144 mm)	3/8"	(10 mm)
40'-0"	(12192 mm)	5/8"	(16 mm)
50'-0"	(15240 mm)	1"	(25 mm)
60'-0"	(18288 mm)	1 1/2"	(38 mm)
70'-0"	(21336 mm)	2"	(51 mm)
80'-0"	(24384 mm)	2 3/4"	(70 mm)
90'-0"	(27432 mm)	3 1/2"	(89 mm)
100'-0"	(30480 mm)	4 1/4"	(108 mm)

For lengths exceeding 100'-0", manufactured camber equal to Span/300 shall be used.

User Note: The specifying professional shall give consideration to coordinating this approximate camber with adjacent framing.

4.7 VERIFICATION OF DESIGN AND MANUFACTURE

User Note: This Section is included as part of this Specification since the verification of design and manufacture is a requirement of any Steel Joist Institute member company in order to be in compliance with this Specification. This Section applies only to a Steel Joist Institute member manufacturer.

4.7.1 Design Calculations

Companies manufacturing any K-Series, LH-Series, DLH-Series Joists or Joist Girders shall submit design data to the Steel Joist Institute, or an independent agency approved by the Steel Joist Institute, for verification of compliance with this Specification. Design data shall be submitted in detail and in the format specified by the Steel Joist Institute.

4.7.2 Tests of Chord and Web Members

Each manufacturer shall, at the time of design review by the Steel Joist Institute, verify by tests that the design, in accordance with Section 4.1 through Section 4.5, provides the theoretical strength of critical members. Such tests shall be evaluated considering the actual yield strength of the members of the test joists.

Material tests for determining mechanical properties of component members shall be conducted.

4.7.3 Tests of Joints and Connections

Each manufacturer shall, at the time of design review by the Steel Joist Institute, verify by shear tests on representative joints of typical joists that connections will meet the provision of Section 4.5.2. Chord and web members shall be permitted to be reinforced for such tests.

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4.7.4 In-Plant Inspections

Each manufacturer shall verify their ability to manufacture K-Series, LH-Series, DLH-Series Joists and Joist Girders through periodic In-Plant Inspections. Inspections shall be performed by an independent agency approved by the Steel Joist Institute. The frequency, manner of inspection, and manner of reporting shall be determined by the Steel Joist Institute. The plant inspections shall not represent a guarantee of the quality of any specific joists; this responsibility shall lie fully and solely with the individual manufacturer.

**SECTION 5.
APPLICATION****5.1 USAGE**

5.1.1 Scope: This Specification shall apply to any type of structure where floors or roofs are to be supported directly by steel joists installed as hereinafter specified or where steel joists are to be supported directly by Joist Girders installed as hereinafter specified. Where joists or Joist Girders are used other than on simple spans under uniformly distributed loading for joists, or under equal concentrated gravity loading for Joist Girders, as prescribed in Section 4.1, they shall be designed to limit the required stresses to those listed in Section 4.2. The magnitude and location of all loads and forces to be considered in the joist or Joist Girder design shall be provided on the structural drawings.

5.1.2 Continuous Frame Action: Where a rigid connection of the bottom chord is to be made to a column or other structural support, the steel joist or Joist Girder is then no longer simply-supported, and the system shall be investigated for continuous frame action by the specifying professional. The specifying professional shall design the supporting structure, including the design of columns, connections, and moment plates. This design shall account for the stresses caused by lateral forces and the stresses due to connecting the bottom chord to the column or other structural support.

The designed detail of a rigid type connection and moment plates shall be shown on the structural drawings by the specifying professional. The moment plates shall be furnished by other than the joist manufacturer.

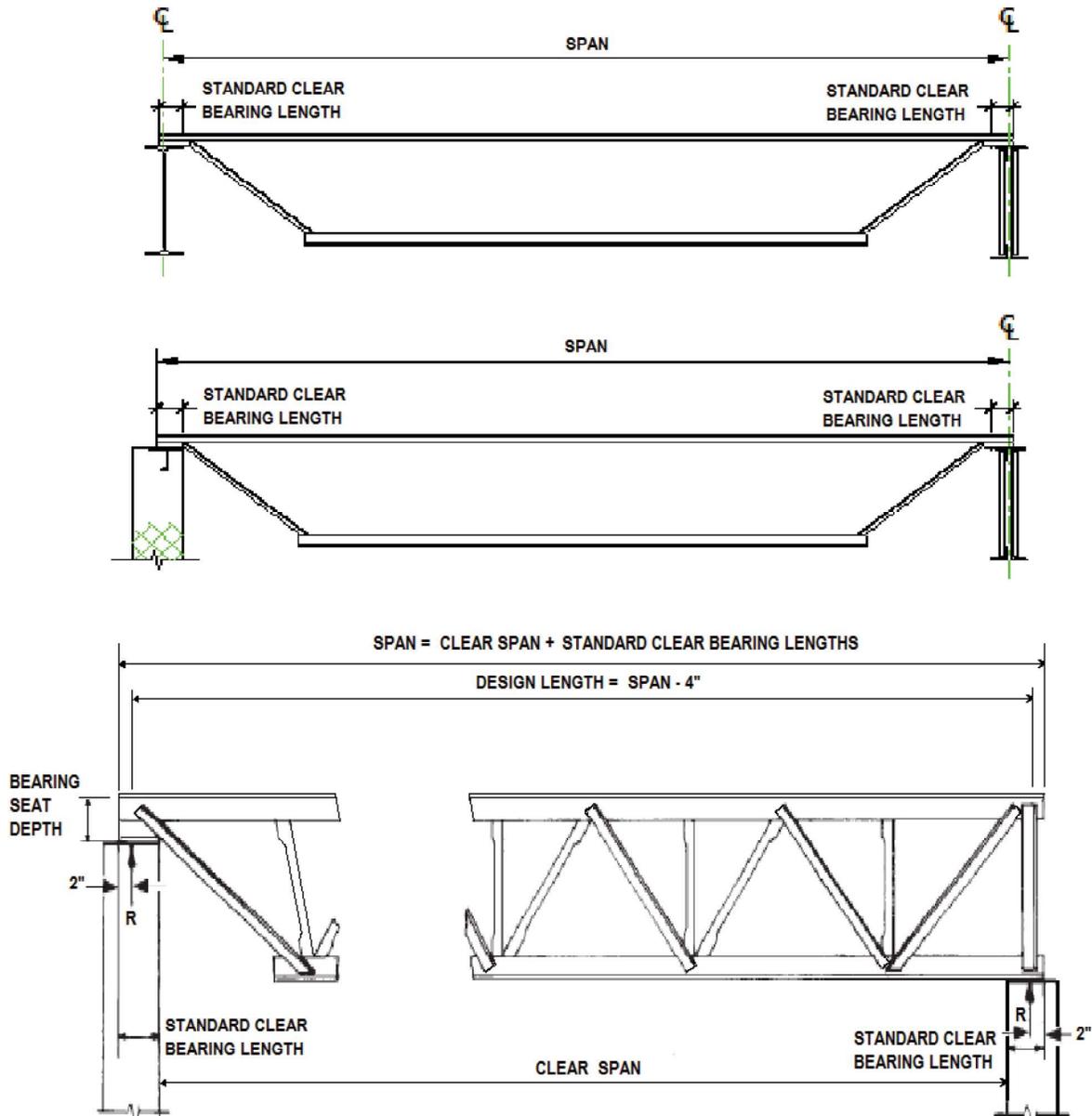
User Note: For further reference concerning continuous frame action and their connections, refer to Steel Joist Institute Technical Digest No. 11, "Design of Lateral Load Resisting Frames Using Steel Joists and Joist Girders".

5.2 SPAN

Except for joist substitutes, the span of a joist or Joist Girder shall not exceed 24 times the depth. Design length shall equal the span minus 4 inches (102 mm) as shown in Figure 5.2-1 "Definition of Span".

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Figure 5.2-1
DEFINITION OF SPAN
(U. S. Customary Units)



- NOTES:
- 1) DESIGN LENGTH = SPAN - 4"
 - 2) MINIMUM BEARING LENGTHS SHALL MEET THE REQUIREMENTS OF SECTION 5.4. BEARING LENGTHS SHOWN MAY VARY BETWEEN STANDARD CLEAR BEARING AND MINIMUM BEARING LENGTH.
 - 3) PARALLEL CHORD JOISTS INSTALLED TO A SLOPE GREATER THAN 1/2 INCH PER FOOT SHALL USE A SPAN DEFINED BY THE LENGTH ALONG THE SLOPE.

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5.3 DEPTH

Steel joists or Joist Girders shall have either parallel chords or a top chord pitch of up to 1/2 inch per foot (1:24). The steel joist or Joist Girder designation depth or nominal depth shall be the depth at mid-span, except for double pitched joists which shall be the depth at the ridge.

5.4 END SUPPORTS

Consideration of the reactions, vertical and lateral, shall be taken by the specifying professional in the design of the steel support, or the steel bearing plate on masonry or concrete. The standard location of the end reaction shall be 2" (51 mm) from the end of the span (exclusive of extensions) at each end of the steel joist or Joist Girder as shown in Figure 5.2-1 "Definition of Span". The standard end reaction location shall require the minimum bearing lengths shown in Table 5.4-1.

TABLE 5.4-1

JOIST SECTION NUMBER ¹	STANDARD CLEAR BEARING LENGTH	MINIMUM BEARING LENGTH ON STEEL
K1-12	4" (102 mm)	2 ½" (64 mm)
LH02-06	6" (152 mm)	2 ½" (64 mm)
LH07-17, DLH10-17, JG	6" (152 mm)	4" (102 mm)
LH/DLH18-25, JG ²	6" (152 mm)	6" (152 mm)
⁽¹⁾ Last digit(s) of joist designation shown in Load Table. ⁽²⁾ Joist Girders with a self weight greater than 50 plf (0.73 kN/m).		

If the specifying professional requires the end reaction to be located at a distance from the face of support more than the standard clear bearing length values shown in Table 5.4-1 minus 2" (51 mm), the structural drawings shall indicate the required special location of the end reaction. The seat depth shall also be increased to the special minimum bearing seat depth per Table 5.4-3.

5.4.1 Masonry and Concrete

5.4.1.1 Scope: A K-Series, LH-Series, DLH-Series Joist or Joist Girder end supported by masonry or concrete shall bear on steel bearing plates and shall be designed as steel bearing.

5.4.1.2 Bearing Length: The ends of K-Series Joists shall extend a distance of not less than 4 inches (102 mm) over the face of masonry or concrete support unless it is deemed necessary to bear less than 4 inches (102 mm) over the support. The ends of LH-Series, DLH-Series Joists and Joist Girders shall extend a distance of not less than 6 inches (152 mm) over the face of masonry or concrete support unless it is deemed necessary to bear less than 6 inches (152 mm) over the support.

5.4.1.3 Anchorage: K-Series, LH-Series, DLH-Series Joists and **Joist Girders** shall be anchored to the steel bearing plate per Section 5.7.

The steel bearing plate shall be located not more than 1/2 inch (13 mm) from the face of the wall. If the steel bearing plate is located more than 1/2 inch (13 mm) from the face of the wall, or the minimum bearing over the masonry or concrete support cannot be provided as shown in Table 5.4-1, special consideration shall be given to the design of the steel bearing plate and the masonry or concrete by the specifying professional.

The steel bearing plate width shall not be less than that shown in Table 5.4-2 perpendicular to the length of the joist. The plate is to be designed by the specifying professional and shall be furnished by other than the joist manufacturer.

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TABLE 5.4-2

JOIST SECTION NUMBER ¹	MINIMUM BEARING PLATE WIDTH
K1-12, LH02-06	7" (178 mm)
LH07-17, DLH10-17, JG	9" (229 mm)
LH/DLH18-25, JG ²	14" (356 mm)
⁽¹⁾ Last digit(s) of joist designation shown in Load Table.	
⁽²⁾ Joist Girders with a self weight greater than 50 plf (0.73 kN/m).	

5.4.2 Steel

The ends of K-Series, LH-Series, DLH-Series Joists and Joist Girders shall be anchored to the support per Section 5.7.

5.4.3 Bearing Depth

The standard non-sloping bearing seat depths shall be as shown in Table 5.4-3. If the steel joist slopes 3/8 inch per foot or greater, the high end bearing seat shall require additional depth due to the slope.

User Note: The Steel Joist Institute Code of Standard Practice provides guidance for determining additional seat depth requirements for sloped joists.

TABLE 5.4-3

JOIST SECTION NUMBER ¹	STANDARD BEARING SEAT DEPTH	STANDARD CLEAR BEARING LENGTH	SPECIAL MINIMUM BEARING SEAT DEPTH ²
K1-12	2 1/2" (64 mm)	4" (102 mm)	0.6 x (RP + 2 1/2" (64 mm))
LH02-17, DLH10-17	5" (127 mm)	6" (152 mm)	0.6 x (RP + 4" (102 mm))
LH/DLH18-25	7 1/2" (191 mm)	6" (152 mm)	0.6 x (RP + 4" (102 mm)) + 2 1/2" (64 mm)
JG	7 1/2" (191 mm)	6" (152 mm)	RP + 4" (102 mm)
⁽¹⁾ Last digit(s) of joist designation shown in Load Table.			
⁽²⁾ RP is equal to the distance the reaction is to occur from the face of the wall or leading edge of support member. The equation is not applicable for the high end of a sloped joist or Joist Girder.			

When the specifying professional requires the steel joist or Joist Girder reaction to occur at or near the centerline of the wall or other support, a special bearing seat depth shall be required and a note shall be placed on the structural drawings identifying where the reaction is to occur. The specified bearing seat depth shall be increased according to Table 5.4-3 to allow for this special requirement.

5.5 BRIDGING or BRACING

Joist Girders shall be proportioned such that they can be erected without bridging. Therefore, the following requirements shall be met:

- The ends of the bottom chord shall be restrained from lateral movement to brace the girder from overturning. For Joist Girders at columns in steel frames, restraint shall be provided by a stabilizer plate on the column.
- No other loads shall be placed on the Joist Girder until the steel joists bearing on the Joist Girder are in place and positively attached to the Joist Girder.

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User Note: See Section 5.12 for bridging or bracing required for uplift forces.

Steel joist top and bottom chord bridging shall be required and shall consist of one or both of either horizontal or diagonal bridging.

5.5.1 Horizontal Bridging

Horizontal bridging lines shall consist of continuous horizontal steel members. The ℓ/r ratio of the bridging member shall not exceed 300, where ℓ is the distance in inches (millimeters) between attachments and r is the least radius of gyration of the bridging member.

5.5.2 Diagonal Bridging

Diagonal bridging lines shall consist of cross-bracing with a ℓ/r ratio of not more than 200, where ℓ is the distance in inches (millimeters) between connections and r is the least radius of gyration of the bracing member. Where cross-bracing members are connected at their point of intersection, the ℓ distance shall be taken as the distance in inches (millimeters) between connections at the point of intersection of the bridging members and the connections to the chords of the joists.

5.5.2.1 Diagonal Erection Bridging

User Note: Joists exhibit varying degrees of stability dependent upon the span, depth, member sizes, self weight and other parameters. Bolted diagonal Erection Bridging which must be installed prior to releasing hoisting cables may be required.

Where required as identified below, bolted diagonal Erection Bridging shall be required and shall be in accordance with the following:

- (a) For joist spans up through and including 60 feet (18288 mm) in length;

Welded horizontal bridging shall be permitted except where the row of bridging nearest the center is required to be bolted diagonal Erection Bridging as indicated by the **Red shaded area** in the Load Tables. Hoisting cables shall not be released until this row of bolted diagonal Erection Bridging is completely installed and anchored.

Bolted diagonal Erection Bridging shall be provided as required in the SJI Load Tables wherever a standard SJI Section Number designation is specified. For spans 60 feet (18288mm) or less, in the absence of a standard SJI Section Number designation, minimum bolted diagonal Erection Bridging requirements shall be determined by:

- 1) Matching the joist design to an equivalent standard SJI Section Number designation to determine the span at which Erection Bridging is needed as designated in the tables; or
- 2) Using Equation 5.5-1 to determine the joist stability and the need for Erection Bridging.

$$W = \frac{-b + \sqrt{b^2 - 4 \cdot a \cdot c}}{2 \cdot a} ; \quad \text{If, } \frac{w_u}{w_{actual}} > 1.00 \text{ Erection Bridging is not required.} \quad (5.5-1)$$

$$a = \left(\frac{\pi^2 + 3}{24} \right)^2$$

$$b = P \cdot \frac{\pi^2 + 3}{12} \cdot \frac{\pi^2 + 4}{16} - \frac{\pi^4 \cdot E \cdot I_y}{2 \cdot (k \cdot L)^3} \cdot \left[\beta_x \cdot \left(\frac{\pi^2 - 3}{24} \right) - \frac{y_o}{2} \right]$$

$$c = (P)^2 \left(\frac{\pi^2 + 4}{16} \right)^2 - \frac{\pi^4 \cdot E \cdot I_y}{2 \cdot (k \cdot L)^3} \cdot \left[P \cdot \left(\beta_x \cdot \frac{\pi^2 - 4}{16} - a_e \right) + \frac{\pi^4 \cdot E \cdot C_w}{2 \cdot (k \cdot L)^3} + \frac{\pi^2 \cdot G \cdot J}{2 \cdot k \cdot L} \right]$$



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Where:

P = Factored weight of erector = 1.2 x (assumed weight of 250 lbs.) = 300 lbs. (1334 N)

E = Modulus of elasticity = 29,000,000 psi (200,000 MPa)

I_y = Joist moment of inertia about y-axis, in.⁴ (mm⁴) $I_y = I_{yt} + I_{yb}$

I_{yt} = Top chord moment of inertia about y-axis, in.⁴ (mm⁴)

I_{yb} = Bottom chord moment of inertia about y-axis, in.⁴ (mm⁴)

L = Joist Span, in. (mm)

k = Effective length factor = 0.85

β_x = Cross-Sectional parameter
$$\beta_x = \frac{1}{I_x} \left[A_b \cdot (d_e - y)^3 - A_t \cdot y^3 \right] - 2 \cdot y_o$$

A_b = Area of bottom chord, in.² (mm²)

A_t = Area of top chord, in.² (mm²)

d_e = Joist effective depth, in. (mm) $d_e = d - y_t - y_b$

y_t = Neutral axis of top chord, in. (mm)

y_b = Neutral axis of bottom chord, in. (mm)

y = Distance from centroid of top chord to centroid of cross section, in. (mm) $y = \frac{A_b \cdot d_e}{A_t + A_b}$

I_x = Joist moment of inertia about x-axis, in.⁴ (mm⁴) $I_x = A_t y^2 + A_b (d_e - y)^2$

y_o = Distance from centroid of cross section to shear center, in. (mm) $y_o = -y + \frac{I_{yb} \cdot d_e}{I_y}$

a_e = Vertical location of load P from shear center (locate at joist center of gravity), in. (mm), where $a_e = y_o$

C_w = Warping constant
$$C_w = \frac{d_e^2 \cdot I_{yb} \cdot I_{yt}}{I_y}$$

G = Shear modulus, psi (MPa) $G = 0.385E$

J = St. Venant torsion constant, in.⁴ (mm⁴) $J = \frac{1}{3} (A_t \cdot t_t^2 + A_b \cdot t_b^2)$

t_t = Thickness of top chord, in. (mm)

t_b = Thickness of bottom chord, in. (mm)

w_u = Ultimate lateral buckling load $w_u = \frac{W \cdot 12}{L}$, plf $w_u = \frac{W}{L}$, (kN/m)

w_{actual} = Joist self-weight, plf (kN/m)

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- b) For joist spans greater than 60 feet (18288 mm) in length; Bolted diagonal Erection Bridging shall be used as indicated by the **Blue and Gray shaded areas** of the Load Tables. Hoisting cables shall not be released until all rows of bolted diagonal Erection Bridging are completely installed and anchored. Where the joist spacing is less than 0.70 x joist depth, bolted horizontal bridging shall be used in addition to bolted diagonal Erection Bridging.
- c) The bolted diagonal Erection Bridging determined by Section 5.5.2.1a and Section 5.5.2.1b shall be considered a minimum. This bolted diagonal Erection Bridging shall be indicated on the placement plans.

User Note: Joists with special profiles having a higher center of gravity as compared to a parallel chord joist, joists which are canted, or joists having any condition which may create instability, may require additional bridging and/or special erection methods.

5.5.3 Quantity and Spacing of Bridging

5.5.3.1 Scope: Bridging shall be properly spaced and anchored to support the decking and the employees prior to the attachment of the deck to the top chord. The maximum spacing between lines of bridging, ℓ_{brmax} shall be the lesser of,

$$\ell_{brmax} = \left(124 + 0.67 d_j + 28 \frac{d_j}{L} \right) r_y, \text{ in.} \quad (5.5-2a)$$

$$\ell_{brmax} = \left(124 + 0.026 d_j + 0.34 \frac{d_j}{L} \right) r_y, \text{ mm} \quad (5.5-2b)$$

or,
$$\ell_{brmax} = 170 r_y \quad (5.5-3)$$

Where:

d_j is the steel joist depth, in. (mm)

L is the joist span length, ft. (m)

r_y is the radius of gyration of the top chord about the vertical axis of the joist cross section, in. (mm)

5.5.3.2 Number of Rows: The number of rows of top chord bridging shall not be less than as shown in Table 5.5-1 and the spacing shall meet the requirements of Equations 5.5-2 and 5.5-3. The number of rows of bottom chord bridging, including bridging required per Section 5.12, shall not be less than the number of top chord rows. Rows of bottom chord bridging shall be permitted to be spaced independently of rows of top chord bridging. The spacing of rows of bottom chord bridging shall meet the slenderness requirement of Section 4.3 and any specified strength requirements.

5.5.3.3 DLH Joist Section 21 and Greater: For DLH-Series joist Section Number 21 and greater, bridging shall be installed near a bottom chord panel point or an extra web member shall be furnished to brace the bottom chord for the vertical component of the bridging force equal to the horizontal bracing force.

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TABLE 5.5-1

U.S. CUSTOMARY UNITS										
NUMBER OF ROWS OF TOP CHORD BRIDGING ²										
Section Number ¹	Joist Depth	1 Row	2 Rows	3 Rows	4 Rows	5 Rows	6 Rows	7 Rows	8 Rows	9 Rows
K1	All	17	>17 to 26	>26 to 28						
K2	All	21	>21 to 30	>30 to 32						
K3	All	18	>18 to 26	>26 to 40						
K4	All	20	>20 to 30	>30 to 41	>41 to 48					
K5	12K to 24K	20	>20 to 30	>30 to 42	>42 to 48					
	26K	28	>28 to 41	> 41 to 52						
K6	14K to 24K	20	>20 to 31	>31 to 42	>42 to 48					
	26K & 28K	28	>28 to 41	>41 to 54	>54 to 56					
K7	16K to 24K	23	>23 to 34	>34 to 48						
	26K to 30K	29	>29 to 44	>44 to 60						
K8	24K	25	>25 to 39	>39 to 48						
	26K to 30K	29	>29 to 44	>44 to 60						
K9	16K to 24K	22	>22 to 34	>34 to 48						
	26K to 30K	29	>29 to 44	>44 to 60						
K10	18K to 24K	22	>22 to 38	>38 to 48						
	26K to 30K	29	>29 to 48	>48 to 60						
K11	22K	24	>24 to 39	>39 to 44						
	30K	34	>34 to 49	>49 to 60						
K12	24K	25	>25 to 43	>43 to 48						
	26K to 30K	29	>29 to 47	>47 to 60						
LH02-03	All	20	>20 to 30	>30 to 40	>40					
LH04-05	All	22	>22 to 33	>33 to 44	>44 to 55	>55				
LH06-08	All	26	>26 to 45	>45 to 60	>60 to 75	>75				
LH09	All	26	>26 to 48	>48 to 64	>64 to 80	>80				
LH/DLH10	All	28	>28 to 54	>54 to 72	>72 to 90	>90				
LH/DLH11	All	30	>30 to 54	>54 to 72	>72 to 90	>90 to 108	>108			
LH/DLH12	All	34	>34 to 55	>55 to 74	>74 to 92	>92 to 111	>111			
LH/DLH13	All	36	>36 to 63	>63 to 84	>84 to 105	>105 to 126	>126			
LH/DLH14	All	38	>38 to 64	>64 to 86	>86 to 107	>107 to 129	>129			
LH/DLH15	All	42	>42 to 73	>73 to 98	>98 to 122	>122 to 147	>147			
LH/DLH 16-17	All	44	>44 to 75	>75 to 100	>100 to 125	>125 to 150	>150 to 175	>175		
LH/DLH 18-20	All	52	>52 to 78	>78 to 104	>104 to 130	>130 to 156	>156 to 182	>182 to 208	>208 to 234	>234
LH/DLH 21-25	All	60	>60 to 90	>90 to 120	>120 to 150	>150 to 180	>180 to 210	>210		

(1) Last digit(s) of joist designation shown in Load Table.
 (2) Distances are Joist Span lengths in feet – See “Definition of Span” Figure 5.2-1. Refer to the Joist Load Table and Specification Section 6 for required bolted diagonal bridging and additional stability requirements. See Section 5.12 for additional bridging required for uplift design.



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5.5.4 Sizing of Bridging

Horizontal and diagonal bridging shall be capable of resisting the nominal unfactored horizontal compressive force, P_{br} given in Equation 5.5-4.

$$P_{br} = 0.0025 n A_t F_{\text{construction}}, \text{ kips (N)} \quad (5.5-4)$$

Where:

$n = 8$ for horizontal bridging

$n = 2$ for diagonal bridging

A_t = cross sectional area of joist top chord, in.² (mm²)

$F_{\text{construction}}$ = assumed ultimate stress in top chord to resist construction loads, determined in accordance with the following:

$$F_{\text{construction}} = \left(\frac{\pi^2 E}{\left(\frac{0.9 \ell_{brmax}}{r_y} \right)^2} \right) \geq 12.2 \text{ ksi} \quad (5.5-5a)$$

$$F_{\text{construction}} = \left(\frac{\pi^2 E}{\left(\frac{0.9 \ell_{brmax}}{r_y} \right)^2} \right) \geq 84.1 \text{ MPa} \quad (5.5-5b)$$

Where:

E = Modulus of Elasticity of steel = 29,000 ksi (200,000 MPa)

and $\frac{\ell_{brmax}}{r_y}$ is determined from Equations 5.5-2 or 5.5-3

The bridging nominal horizontal unfactored compressive forces, P_{br} , shall be in accordance with Table 5.5-2.

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TABLE 5.5-2

BRIDGING NOMINAL HORIZONTAL UNFACTORED COMPRESSIVE FORCE					
JOIST SECTION NUMBER ¹	HORIZONTAL BRIDGING P_{br} (n=8)		REQUIRED BRIDGING CONNECTION WELD ²	DIAGONAL BRIDGING P_{br} (n=2)	
	Lbs.	(N)	In.	Lbs.	(N)
K1-8	340	(1512)	1/8" x 1" (3mm x 25mm)	85	(378)
K9-10, LH02-03	450	(2002)		113	(503)
K11-12, LH04-05	560	(2491)		140	(623)
LH06-08	750	(3336)		188	(836)
LH09	850	(3781)		213	(945)
LH/DLH10	900	(4003)		225	(1001)
LH/DLH11	950	(4226)		238	(1056)
LH/DLH12	1100	(4893)		275	(1223)
LH/DLH13	1200	(5338)		300	(1334)
LH/DLH14	1300	(5783)		325	(1446)
LH/DLH15	1450	(6450)		363	(1612)
LH/DLH16-17	1850	(8229)	1/8" x 1 1/2" (3mm x 38mm)	463	(2057)
LH/DLH18-20	2350	(10453)		585	(2602)
LH/DLH21-22	3150	(14012)	1/8" x 2" (3mm x 51mm)	790	(3514)
LH/DLH23-24	4130	(18371)	1/8" x 3" (3mm x 76mm)	1035	(4604)
LH/DLH25	4770	(21218)		1195	(5316)

(¹) Last digit(s) of joist designation shown in Load Table.
(²) Or other connection type designed for the required force.

5.5.5 Connections

Connections to the joist chords shall be made by welding or mechanical means and shall be capable of resisting the unfactored or nominal horizontal force, P_{br} , of Equation 5.5-4 but not less than 700 pounds (3114 N).

5.5.6 Bottom Chord Bearing Joists

Where bottom chord bearing joists are utilized, a row of diagonal bridging shall be provided near the support(s). This bridging shall be installed and anchored before the hoisting cable(s) is released.

5.6 INSTALLATION OF BRIDGING

Bridging shall support the top and bottom chords against lateral movement during the construction period and shall hold the steel joists in the approximate position as shown on the joist placement plans.

The ends of all bridging lines terminating at walls or beams shall be anchored thereto.

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5.7 BEARING SEAT ATTACHMENTS

5.7.1 Masonry and Concrete

Ends of K-Series, LH-Series, and DLH-Series Joists and Joist Girders resting on steel bearing plates on masonry or structural concrete shall be attached thereto, as shown in Table 5.7-1, with a minimum of two fillet welds, or with two bolts, or the equivalent.

5.7.2 Steel

Ends of K-Series, LH-Series, and DLH-Series Joists and Joist Girders resting on steel supports shall be attached thereto, as shown in Table 5.7-1, with a minimum of two fillet welds, or with two bolts, or the equivalent. Where K-Series, LH-Series and DLH-Series Joists and Joist Girders are used to provide lateral stability to the supporting member, the final connection shall be made by welding or as designated by the specifying professional.

TABLE 5.7-1

JOIST SECTION NUMBER ¹	MINIMUM FILLET WELD	MINIMUM BEARING SEAT BOLTS FOR ERECTION
K1-12	2– 1/8" x 2 1/2" (3 x 64 mm)	2– 1/2" (13 mm) A307
LH02-06	2– 3/16" x 2 1/2" (5 x 64 mm)	
LH07-17, DLH10-17, JG	2– 1/4" x 2 1/2" (6 x 64 mm)	2– 3/4" (19 mm) A307
LH/ DLH18-25, JG ²	2– 1/4" x 4" (6 x 102 mm)	2– 3/4" (19 mm) A325
⁽¹⁾ Last digit(s) of joist designation shown in load table.		
⁽²⁾ Joist Girders with a self weight greater than 50 plf (0.73 kN/m).		

5.7.3 Uplift

Where uplift forces are a design consideration, roof joists shall be anchored to resist such forces and shall meet the requirements of Section 5.12.

5.8 JOIST SPACING

Joists shall be spaced so that the loading on each joist does not exceed the design load (LRFD or ASD) for the particular joist designation and span as shown in the applicable load tables.

5.9 FLOOR AND ROOF DECKS

5.9.1 Material

Floor and roof decks shall be permitted to consist of cast-in-place or pre-cast concrete or gypsum, cold-formed steel, wood, or other suitable material capable of supporting the required load at the specified joist spacing.

5.9.2 Thickness

Cast-in-place slabs shall be not less than 2 inches (51 mm) thick.

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5.9.3 Centering

Centering for cast-in-place slabs shall be permitted to be ribbed metal lath, corrugated steel sheets, paper-backed welded wire fabric, removable centering or any other suitable material capable of supporting the slab at the designated joist spacing.

Centering shall not cause lateral displacement or damage to the top chord of joists during installation or removal of the centering or placing of the concrete.

5.9.4 Bearing

Slabs or decks shall bear uniformly along the top chords of the joists.

5.9.5 Attachments

The spacing of attachments along the joist top chord shall not exceed 36 inches (914 mm). Such attachments of the slab or deck to the top chords of joists shall be capable of resisting the forces given in Table 5.9-1.

TABLE 5.9-1

JOIST SECTION NUMBER ¹	NOMINAL FORCE REQUIRED ²
K1-12	100 lbs/ft. (1.46 kN/m)
LH02-04	120 lbs/ft. (1.75 kN/m)
LH05-09	150 lbs/ft. (2.19 kN/m)
LH/DLH10-17	200 lbs/ft. (2.92 kN/m)
LH/DLH18-19	250 lbs/ft. (3.65 kN/m)
LH/DLH20-21	300 lbs/ft. (4.38 kN/m)
LH/DLH22-24	420 lbs/ft. (6.13 kN/m)
LH/DLH25	520 lbs/ft. (7.59 kN/m)
⁽¹⁾ Last digit(s) of joist designation shown in Load Table.	
⁽²⁾ Nominal bracing force is unfactored.	

5.9.6 Wood Nailers

Where wood nailers are used, such nailers in conjunction with deck or slab shall be firmly attached to the top chords of the joists in conformance with Section 5.9.5.

5.9.7 Joist With Standing Seam Roofing or Laterally Unbraced Top Chords

Where the roof systems do not provide lateral stability for the steel joists in accordance with Section 5.9.5 sufficient stability shall be provided to brace the steel joists laterally under the full design load. For this condition, the compression chord design shall include the effects of both the in-plane and out-of-plane buckling of the steel joist (e.g., buckling about the vertical axis of the steel joist cross section). In any case where the attachment requirement of Section 5.9.5 is not achieved, out-of-plane strength shall be achieved by adjusting the bridging spacing and/or increasing the compression chord area and the y-axis radius of gyration. The effective slenderness ratio about the vertical axis equals $0.94 L/r_y$; where L is the bridging spacing in inches (millimeters) and r_y is the radius of gyration of the top chord in inches (millimeters). The maximum bridging spacing shall not exceed that specified in Section 5.5.3.

User Note: Some examples of roof systems which may not provide adequate top chord lateral stability may be standing seam roofs, skylights, or other openings which do not provide top chord attachments per Section 5.9.5.

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Horizontal bridging members attached to the compression chords and their anchorages shall be designed for a compressive axial force, P_{br} , given in Equation 5.9-1.

$$P_{br} = 0.001nP + 0.004P\sqrt{n} \geq 0.0025nP, \text{ kips (N)} \quad (5.9-1)$$

Where n is the number of joists between end anchors and P is the chord design force in kips (N)

The attachment force between the horizontal bridging member and the compression chord shall be $0.01P$. Horizontal bridging attached to the tension chords shall be proportioned so that the slenderness ratio between attachments does not exceed 300. Diagonal bridging shall be proportioned so that the slenderness ratio between attachments does not exceed 200.

5.10 DEFLECTION

The deflection due to the design live load shall not exceed the following:

Floors: 1/360 of span.

Roofs: 1/360 of span where a plaster ceiling is attached or suspended, or
1/240 of span for all other cases.

The specifying professional shall give consideration to the effects of deflection and vibration in the selection of joists.

User Note: For further information on vibration, refer to Steel Joist Institute Technical Digest 5, "Vibration of Steel Joist-Concrete Slab Floors".

5.11 PONDING

The ponding investigation shall be performed by the specifying professional.

User Note: For further reference, refer to Steel Joist Institute Technical Digest 3, "Structural Design of Steel Joist Roofs to Resist Ponding Loads" and AISC 360.

5.12 UPLIFT

Where uplift forces due to wind are a design requirement, these forces shall be indicated on the structural drawings in terms of NET uplift in pounds per square foot (Pascals). The structural drawings shall indicate if the net uplift is based upon an LRFD or ASD load combination. When these forces are specified, they shall be considered in the design of joists, Joist Girders, and required bridging or bracing. Wherever uplift due to wind forces is a design consideration, the following shall be required:

- For joists, a single line of **bottom chord** bridging shall be provided near the first bottom chord panel points.
- For **Joist Girders**, if the ends of the bottom chord are not strutted and extended to column stabilizer plates, bracing shall be provided near the first bottom chord panel points.

User Note: For further reference, refer to Steel Joist Institute Technical Digest 6, "Structural Design of Steel Joist Roofs to Resist Uplift Loads".

5.13 DIAPHRAGMS AND COLLECTORS

Where diaphragm collector forces due to wind or seismic forces are a design requirement, these forces shall be indicated on the structural drawings. The structural drawings shall indicate the nominal (unfactored) forces. The structural drawings shall also indicate the Seismic Design Category, and the Seismic Force Resisting System type, and applicable seismic design coefficients. When this data is specified, joist collectors or chords in horizontal diaphragm systems, shall be designed in conformance with the provisions of Section 4 through Section 6. End connections and splices in joists incorporated into Seismic Force Resisting System (SFRS) as horizontal diaphragms as collectors or chords shall adhere to the requirements stipulated by the applicable building code.

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5.14 INSPECTION

Joists shall be inspected by the manufacturer before shipment to verify compliance of materials and workmanship with the requirements of this Specification.

User Note: If the purchaser requires an inspection of the steel joists or Joist Girders by someone other than the manufacturer's own inspectors, they shall be permitted to reserve the right to do so in their "Invitation to Bid" or the accompanying "Job Specifications". Arrangements shall be made with the manufacturer for such inspection of the joists or Joist Girders at the manufacturing shop by the purchaser's inspectors at purchaser's expense.

5.15 PARALLEL CHORD SLOPED JOISTS AND JOIST GIRDERS

The span of a parallel chord sloped joist or Joist Girder shall be defined by the length along the slope. Minimum depth, load-carrying capacity, and bridging requirements shall be determined by the sloped definition of span. The Load Table capacity shall be the component normal to the joist.

SECTION 6**ERECTION STABILITY
AND HANDLING**

As a minimum, erection stability and handling of joists and Joist Girders shall meet the requirements of this Section 6.

User Note: Additional requirements for erection of steel joists and Joist Girders can be found in Steel Joist Institute Technical Digest No. 9, "Handling and Erection of Steel Joists and Joist Girders".

6.1 STABILITY REQUIREMENTS

User Note: It is not recommended that an erector climb on unbridged joists, extreme caution shall be exercised since unbridged joists exhibit some degree of instability under the erector's weight.

- a) In steel framing, where joists/Joist Girders are utilized at column lines, the joist/Joist Girder shall be field-bolted at the column. Before hoisting cables are released and before an employee is allowed on the joists/Joist Girder the following conditions shall be met:
 - 1) The seat at each end of the joist/Joist Girder is attached in accordance with Section 5.7. Where a bolted seat connection is used for erection purposes, as a minimum, the bolts shall be snug tightened. The snug tight condition shall be defined as the tightness that exists where all plies of a joint are in firm contact. This shall be attained by a few impacts of an impact wrench or the full effort of an employee using an ordinary spud wrench.
 - 2) Where stabilizer plates are required the joist/Joist Girder bottom chord shall engage the stabilizer plate.

During the construction period, the contractor shall provide means for the adequate distribution of loads so that the carrying capacity of any joist or Joist Girder is not exceeded.

- b) Before an employee is allowed on the steel joist: BOTH ends of joists at columns (or joists designated as column joists) shall be attached to its supports. For all other joists a minimum of one end shall be attached before the employee is allowed on the joist. The attachment shall be in accordance with Section 5.7.

Where a bolted seat connection is used for erection purposes, as a minimum, the bolts shall be snug tightened. The snug tight condition shall be defined as the tightness that exists where all plies of a joint are in firm contact. This shall be attained by a few impacts of an impact wrench or the full effort of an employee using an ordinary spud wrench.

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- c) On steel joists that do not require erection bridging as shown by either the unshaded area of the Load Tables or as determined by Section 5.5.2.1, only one employee shall be allowed on the steel joist until all bridging is installed and anchored.
- d) Where the span of the steel joist is within the Red shaded area of the Load Table, or in the absence of a standard SJI Section Number designation and Erection Bridging is required in accordance with Section 5.5.2.1, the following shall apply:
 - 1) The row of bridging nearest the midspan of the steel joist shall be bolted diagonal Erection Bridging; and
 - 2) Hoisting cables shall not be released until this bolted diagonal Erection Bridging is installed and anchored, unless an alternate method of stabilizing the joist has been provided; and
 - 3) No more than one employee shall be allowed on these spans until all other bridging is installed and anchored.
- e) Where the span of the steel joist is within the Blue shaded area of the Load Table, the following shall apply:
 - 1) All rows of bridging shall be bolted diagonal bridging; and
 - 2) Hoisting cables shall not be released until the two rows of bolted diagonal Erection Bridging nearest the third points of the steel joist are installed and anchored; and
 - 3) No more than two employees shall be allowed on these spans until all bridging is installed and anchored.
- f) Where the span of the steel joist is in the Gray shaded area of the Load Table, the following shall apply:
 - 1) All rows of bridging shall be bolted diagonal bridging; and
 - 2) Hoisting cables shall not be released until all bridging is installed and anchored; and
 - 3) No more than two employees shall be allowed on these spans until all other bridging is installed and anchored.
- g) Where permanent bridging terminus points cannot be used during erection, additional temporary bridging terminus points shall be required to provide lateral stability.
- h) In the case of bottom chord bearing joists, the ends of the joist shall be restrained laterally per Section 5.5.6 before releasing the hoisting cables.
- i) After the joist is straightened and plumbed, and all bridging is completely installed and anchored, the ends of the joists shall be fully connected to the supports in accordance with Section 5.7.

6.2 LANDING AND PLACING LOADS

- a) Except as stated in Section 6.2(d), no "construction loads" shall be allowed on the steel joists until all bridging is installed and anchored, and all joist bearing ends are attached.

User Note: For definition of "construction load" see Code of Federal Regulations (CFR), Occupational Safety and Health Administration (OSHA), 29 CFR Part 1926, Safety Standards for Steel Erection; Subpart R - Steel Erection, §1926.751 Definitions; January 18, 2001, Washington, D.C.

- b) During the construction period, loads placed on the steel joists shall be distributed so as not to exceed the capacity of the steel joists.
- c) The weight of a bundle of joist bridging shall not exceed a total of 1000 pounds (454 kilograms). The 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 (0.30 m) of the secured end.
- d) No bundle of deck shall be placed on steel joists until all bridging has been installed and anchored and all joist bearing ends attached, unless the following conditions are met:
 - 1) The contractor 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;
 - 2) The bundle of decking is placed on a minimum of three steel joists;

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- 3) The joists supporting the bundle of decking are attached at both ends;
- 4) At least one row of bridging is installed and anchored;
- 5) The total weight of the decking does not exceed 4000 pounds (1816 kilograms); and
- 6) The edge of the bundle of decking is placed within 1 foot (0.30 meters) of the bearing surface of the joist end.

User Note: For definition of “qualified person” see Code of Federal Regulations (CFR), Occupational Safety and Health Administration (OSHA), 29 CFR Part 1926, Safety Standards for Steel Erection; Subpart R - Steel Erection, §1926.751 Definitions; January 18, 2001, Washington, D.C.

- e) The edge of the construction load shall be placed within 1 foot (0.30 meters) of the bearing surface of the joist end.

6.3 FIELD WELDING

All field welding shall be performed in accordance with the structural drawings. Field welding shall not damage the joists or Joist Girders.

On cold-formed steel members whose yield strength has been attained by cold working, and whose as-formed strength is used in the design, the total length of weld at any one point shall not exceed 50 percent of the overall developed width of the cold-formed section.

6.4 HANDLING

Particular attention shall be considered for the handling and erection of K-Series, LH-Series, DLH-Series steel joists and Joist Girders. Damage to the joists and accessories shall be avoided. Hoisting cables shall be attached at panel point locations and those locations shall be selected to minimize erection stresses.

Each joist shall be adequately braced laterally before any loads are applied. If lateral support is provided by bridging, the bridging lines as defined in Section 6.1(c), 6.1(d), 6.1(e), and 6.1(f) shall be anchored to prevent lateral movement.

6.5 FALL ARREST SYSTEMS

Steel joists and Joist Girders shall not be used as anchorage points for a fall arrest system unless written direction to do so is obtained from a “qualified person”.

User Note: For definition of “qualified person” see Code of Federal Regulations (CFR), Occupational Safety and Health Administration (OSHA), 29 CFR Part 1926, Safety Standards for Steel Erection; Subpart R - Steel Erection, §1926.751 Definitions; January 18, 2001, Washington, D.C.