Concentrated Loads H Series

Steel Joist which support concentrated loads must have special consideration to insure that localized areas of the joists are not over-stressed. The following design criteria allows the designer to select standard joists which will support concentrated loads. In most cases, this design criteria will result in a joist which is somewhat heavier than is required. If a more economical joist is desired (such as when there is a large quantity), or if the concentrated load exceeds these limitations, Vulcraft can design a special joist to meet the loading requirements. In this case, the designer should specify the required uniform load in pounds per linear foot. And the location and magnitude of all concentrated loads. The joist(s) shall be labeled "Special" on the Contract Drawings.

SHORTSPANS H SERIES

1. The maximum end reaction and moment developed by the concentrated load plus the uniform load do not exceed 85% of both the allowable end reaction and resisting moment of the joist selected.
2. The attachment is in such a manner or at such a location that local bending is not introduced into the chords.
3. The concentrated load does not exceed 25% of the allowable end reaction.

ECONOMICAL

HIGH STRENGTH

DESIGN—Vulcraft H Series open web steel joists are designed in accordance with specifications of the Steel Joist Institute.

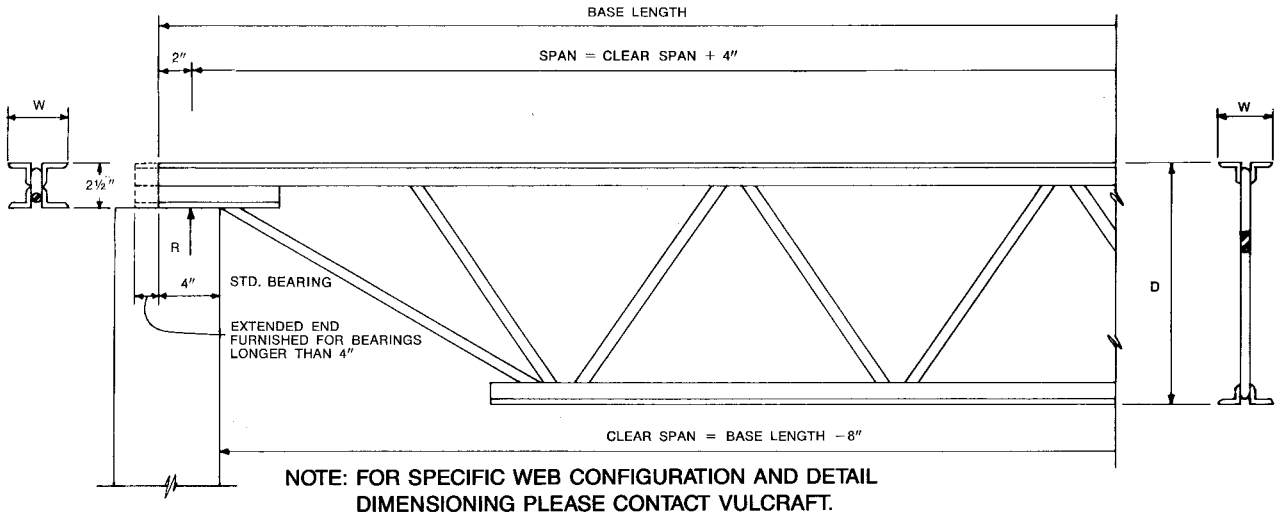
ACCESSORIES see page 27.

SJI SPANS TO 60'-0''

PAINT—Vulcraft joists receive a shop-coat of high quality rust inhibitive primer whose performance characteristics conform to those of the Steel Joist Institute specifications 3.3.

SPECIFICATIONS see page H-5.

H SERIES DETAILS



NOTE: FOR SPECIFIC WEB CONFIGURATION AND DETAIL DIMENSIONING PLEASE CONTACT VULCRAFT.

Number of Rows of Bridging
(Distances are Clear Span Dimensions)

Chord Size*	1 Row	2 Rows	3 Rows	4 Rows	5 Rows**
# 3	Up to 13'	13' to 17'	17' to 28'		
# 4	Up to 16'	16' to 21'	21' to 32'		
# 5	Up to 16'	16' to 21'	21' to 33'	33' to 38'	38' to 40'
# 6	Up to 18'	18' to 22'	22' to 36'	36' to 40'	40' to 48'
# 7	Up to 20'	20' to 25'	25' to 41'	41' to 46'	46' to 48'
# 8	Up to 21'	21' to 27'	27' to 43'	43' to 48'	48' to 60'
# 9	Up to 23'	23' to 30'	30' to 46'	46' to 52'	52' to 60'
#10	Up to 24'	24' to 30'	30' to 47'	47' to 53'	53' to 60'
#11	Up to 24'	24' to 31'	31' to 48'	48' to 55'	55' to 60'

*Last digit(s) of joist designation shown in load tables.

**Where five rows of bridging are required and spans are over 40 feet, the middle row shall be diagonal bridging with bolted connections at chords and intersection.

STANDING SEAM BRIDGING:

The bridging table at the left was developed to support the top chords against lateral movement during the construction period. It is then intended that the floor or roof deck will laterally support the top chords under a full loading condition by meeting the provisions of Section 5.8 of the specifications. Most standing seam roof systems will not adequately brace the top chords laterally with the number of rows as required by the bridging table. We therefore, recommend that when standing seam roof systems are specified, the designer employ a note to have the joist manufacturer to check the system and to provide bridging as required to adequately brace the top chords against lateral movement under a full loading condition.

UPLIFT BRIDGING:

Where uplift forces due to wind are a design requirement, these forces must be indicated on the contract drawings in terms of net uplift in pounds per square foot. When these forces are specified, they must be considered in the design of joists and/or bridging. A single line of *bottom chord* bridging must be provided near the first bottom chord panel points whenever uplift due to wind forces is a design consideration.

STANDARD LOAD TABLE
OPEN WEB STEEL JOISTS, H SERIES

Based on a Maximum Allowable Tensile Stress of 30,000 PSI††

Adopted by the Steel Joist Institute October 1, 1974, Revised to November 7, 1983.

The black figures in the following table give the TOTAL safe uniformly distributed load-carrying capacities, in pounds per linear foot, of H Series Steel Joists. The weight of DEAD loads, including the joists, must be deducted to determine the LIVE load carrying capacities of the joists. The load table may be used for parallel chord joists installed to a maximum slope of ½ inch per foot.

The figures shown in blue in this load table are the LIVE loads per linear foot of joist which will produce an approximate deflection of 1/360 of the span. LIVE loads which will produce a deflection of 1/240 of the span may be obtained by multiplying the figures in blue by 1.5. In no case shall the total load capacity of the joists be exceeded.**

Tests on steel joists designed in accordance with the Standard Specifications have demonstrated that the Standard Load Tables are applicable for concentrated top chord loadings (such as are developed in bulb-tee roof construction) when the sum of the equal concentrated top chord loadings does not exceed the allowable uniform loading for the joist type and span and the loads are placed at spacings not exceeding 33″ along the top chord.

Allowable total safe loads in pounds per linear foot of H Series Steel Joists — for joist depths 8″ to 16″

JOIST TYPE	8H3	10H3	10H4	12H3	12H4	12H5	12H6	14H3	14H4	14H5	14H6	14H7	16H4	16H5	16H6	16H7	16H8
OVERALL DEPTH (inches)	8	10	10	12	12	12	12	14	14	14	14	14	16	16	16	16	16
RESISTING MOM. (inch-kips)	91	116	148	140	180	222	260	165	212	259	307	369	221	289	344	413	478
MAX. END REAC. (pounds)	2400	2500	2800	2800	3200	3600	3900	3200	3500	3800	4200	4600	3800	4300	4600	4900	5200
MOM. OF INERTIA (inches⁴)	12.3	19.8	24.5	28.9	37.8	44.3	52.6	40.1	52.4	61.4	73.2	86.2	64.5	79.3	93.5	112.6	129.5
†APPROX. WEIGHT (lbs./ft.)	5.0	5.0	6.1	5.2	6.2	7.1	8.2	5.5	6.5	7.4	8.6	10.0	6.6	7.8	8.6	10.3	11.4
SPAN (ft.)																	
8	600	500	560	467	533	600	650	457	500	543	600	657	475	538	575	613	650
9	533	500	560	467	533	600	650	457	500	543	600	657	475	538	575	613	650
10	480	500	560	467	533	600	650	457	500	543	600	657	475	538	575	613	650
	460																
11	436	455	509	467	533	600	650	457	500	543	600	657	475	538	575	613	650
	345																
12	400	417	467	467	533	600	650	457	500	543	600	657	475	538	575	613	650
	266																
13	359	385	431	431	492	554	600	457	500	543	600	657	475	538	575	613	650
	209	337	417														
14	310	357	400	400	457	514	557	457	500	543	600	657	475	538	575	613	650
	167	270	334	393													
15	270	333	373	373	427	480	520	427	467	507	560	613	475	538	575	613	650
	136	219	271	320	418												
16	232	302	350	350	400	450	488	400	438	475	525	575	475	538	575	613	650
	112	181	223	264	345	404	480	366									
17		268	329	323	376	424	459	376	412	447	494	541	447	506	541	576	612
		151	186	220	287	337	400	305	398								
18		239	305	288	356	400	433	340	389	422	467	511	422	478	511	544	578
		127	157	185	242	284	337	257	336	393			413				
19		214	273	259	332	379	411	305	368	400	442	484	400	453	484	516	547
		108	133	157	206	241	286	218	285	334	399	470	351	432			
20		193	247	233	300	360	390	275	350	380	420	460	368	430	460	490	520
		92	114	135	177	207	246	187	245	287	342	403	301	370	437		
21				212	272	336	371	249	320	362	400	438	334	410	438	467	495
				117	152	179	212	162	212	248	295	348	260	320	377	454	
22				193	248	306	355	227	292	345	382	418	304	391	418	445	473
				101	133	155	185	141	184	215	257	302	226	278	328	395	454
23				176	227	280	328	208	267	326	365	400	279	364	400	426	452
				89	116	136	162	123	161	189	225	265	198	243	287	346	398
24				162	208	257	301	191	245	300	350	383	256	334	383	408	433
				78	102	120	142	108	142	166	198	233	174	214	253	304	350
25								176	226	276	327	368	236	308	367	392	416
								96	125	147	175	206	154	190	224	269	310
26								163	209	255	303	354	218	285	339	377	400
								85	111	131	156	183	137	169	199	239	275
27								151	194	237	281	337	202	264	315	363	385
								76	99	117	139	164	122	151	177	214	246
28								140	180	220	261	314	188	246	293	350	371
								68	89	104	125	147	110	135	159	192	220
29													175	229	273	327	359
													99	121	143	172	198
30													164	214	255	306	347
													89	110	129	156	179
31													153	200	239	287	332
													81	99	117	141	162
32													144	188	224	269	311
													74	90	107	128	148

† Approximate Weights per Linear Foot of steel joists only. Accessories not included.

†† For an approximate total load carrying capacity at a maximum allowable tensile stress of 22,000 psi, the total load carrying capacity shown in the load table should be multiplied by the ratio 22/30.

** Section 5.9 of the "Standard Specifications for Open Web Steel Joists, H Series" limits the design LIVE load deflection.

LOADS ABOVE THE COLORED LINES ARE GOVERNED BY SHEAR.

STANDARD LOAD TABLE / OPEN WEB STEEL JOISTS, H SERIES

Based on a Maximum Allowable Tensile Stress of 30,000 PSI††

Allowable total safe loads in pounds per linear foot of H Series Steel Joists — for joist depths 18″ to 22″

JOIST TYPE	18H5	18H6	18H7	18H8	18H9	18H10	18H11	20H5	20H6	20H7	20H8	20H9	20H10	20H11	22H6	22H7	22H8	22H9	22H10	22H11
OVERALL DEPTH (inches)	18	18	18	18	18	18	18	20	20	20	20	20	20	20	22	22	22	22	22	22
RESISTING MOM. (inch-kips)	325	383	466	540	627	705	814	365	406	499	602	701	789	912	422	526	653	776	873	1009
MAX. END. REAC. (pounds)	4500	4800	5200	5400	5900	6600	7600	4800	5100	5400	5600	6400	7000	7900	5400	5600	5800	6700	7200	8100
MOM. OF INERTIA (inches⁴)	101.5	119.8	143.5	164.3	179.0	202.0	229.0	123.9	141.2	171.7	206.5	224.0	253.0	287.0	165.1	200.4	247.6	275.0	309.0	352.0
†APPROX. WEIGHT (lbs./ft.)	8.0	9.2	10.4	11.6	12.6	14.0	15.8	8.4	9.6	10.7	12.2	13.2	14.6	16.4	9.7	10.7	12.0	13.8	15.2	16.9
SPAN (ft.)																				
18	500	533	578	600	621	629	633	480	510	540	560	640	636	632	491	509	527	609	626	648
19	474	505	547	568	621	629	633	480	510	540	560	640	636	632	491	509	527	609	626	648
20	450	480	520	540	590	629	633	480	510	540	560	640	636	632	491	509	527	609	626	648
21	429	457	495	514	562	629	633	457	486	514	533	610	636	632	491	509	527	609	626	648
	409																			
22	409	436	473	491	536	600	633	436	464	491	509	582	636	632	491	509	527	609	626	648
	356	420																		
23	391	417	452	470	513	574	633	417	443	470	487	557	609	632	470	487	504	583	626	648
	312	368	441					380	434											
24	375	400	433	450	492	550	633	400	425	450	467	533	583	632	450	467	483	558	600	648
	274	324	388	444	484	546	619	335	382						446					
25	347	384	416	432	472	528	608	384	408	432	448	512	560	632	432	448	464	536	576	648
	243	286	343	393	428	483	548	296	338	411					395					
26	321	369	400	415	454	508	585	360	392	415	431	492	538	608	415	431	446	515	554	623
	216	255	305	349	380	429	487	263	300	365		476			351	426				
27	297	350	385	400	437	489	563	334	371	400	415	474	519	585	386	415	430	496	533	600
	193	227	272	312	340	383	435	235	268	326	392	425	480	545	313	380				
28	276	326	371	386	421	471	543	310	345	386	400	457	500	564	359	400	414	479	514	579
	173	204	244	280	305	344	390	211	240	292	352	381	431	488	281	341		468		
29	258	304	359	372	407	455	524	289	322	372	386	441	483	545	335	386	400	462	497	559
	155	184	220	252	274	309	351	190	216	263	317	343	388	440	253	307	379	421	473	539
30	241	284	345	360	393	440	507	270	301	360	373	427	467	527	313	373	387	447	480	540
	140	166	199	227	248	280	317	171	195	238	286	310	350	397	228	277	343	381	428	487
31	225	266	323	348	381	426	490	253	282	346	361	413	452	510	293	361	374	432	465	523
	127	150	180	206	224	253	287	155	177	215	259	281	317	360	207	251	311	345	387	441
32	212	249	303	338	369	413	475	238	264	325	350	400	438	494	275	342	363	419	450	506
	116	137	164	187	204	230	261	141	161	196	236	255	288	327	188	228	282	314	352	401
33	199	234	285	327	358	400	461	223	249	305	339	388	424	479	258	322	352	406	436	491
	106	125	149	171	186	210	238	129	147	178	215	233	263	298	172	208	257	286	321	366
34	187	221	269	311	347	388	447	210	234	288	329	376	412	465	243	303	341	394	424	476
	96	114	136	156	170	192	218	118	134	163	196	213	240	273	157	190	235	261	294	335
35	177	208	254	294	337	377	434	199	221	272	320	366	400	451	230	286	331	383	411	463
	88	104	125	143	156	176	200	108	123	150	180	195	220	250	144	175	216	240	269	307
36	167	197	240	278	323	363	419	188	209	257	310	356	389	439	217	271	322	372	400	450
	81	96	115	132	143	162	183	99	113	137	166	179	203	230	132	160	198	220	247	282
37								178	198	243	293	341	378	427	206	256	314	362	389	438
								91	104	127	152	165	187	212	122	148	183	203	228	260
38								169	187	230	278	324	364	416	195	243	301	353	379	426
								84	96	117	141	153	172	195	112	136	169	187	210	240
39								160	178	219	264	307	346	400	185	231	286	340	369	415
								78	89	108	130	141	159	181	104	126	156	173	195	222
40								152	169	208	251	292	329	380	176	219	272	323	360	405
								72	82	100	121	131	148	168	96	117	145	161	180	205
41															167	209	259	308	346	395
															89	109	134	149	167	191
42															159	199	247	293	330	381
															83	101	125	139	156	177
43															152	190	235	280	315	364
															78	94	116	129	145	165
44															145	181	225	267	301	347
															72	88	109	121	136	154

† Approximate Weights per Linear Foot of steel joists only. Accessories not included.

†† For an approximate total load carrying capacity at a maximum allowable tensile stress of 22,000 psi, the total load carrying capacity shown in the load table should be multiplied by the ratio 22/30.

** Section 5.9 of the "Standard Specifications for Open Web Steel Joists, H Series" limits the design LIVE load deflection.

LOADS ABOVE THE COLORED LINES ARE GOVERNED BY SHEAR.

STANDARD LOAD TABLE / OPEN WEB STEEL JOISTS, H SERIES

Based on a Maximum Allowable Tensile Stress of 30,000 PSI††

Allowable total safe loads in pounds per linear foot of H Series Steel Joists — for joist depths 24″ to 30″

JOIST TYPE	24H6	24H7	24H8	24H9	24H10	24H11	26H8	26H9	26H10	26H11	28H8	28H9	28H10	28H11	30H8	30H9	30H10	30H11
OVERALL DEPTH (inches)	24	24	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30
RESISTING MOM. (inch-kips)	462	576	716	851	957	1106	784	925	1040	1203	846	1000	1124	1300	909	1075	1207	1397
MAX. END REAC. (pounds)	5600	5800	6000	7000	7500	8200	6700	7200	7600	8300	6700	7200	7700	8400	6800	7500	8100	8700
MOM. OF INERTIA (inches)	197.6	238.6	297.3	330.0	371.0	423.0	333.0	390.0	439.0	501.0	389.0	455.0	512.0	586.0	448.0	525.0	591.0	677.0
†APPROX. WEIGHT (lbs./ft.)	10.3	11.5	12.7	14.0	15.5	17.5	12.8	14.8	16.2	17.9	13.5	15.2	16.8	18.3	14.2	15.4	17.3	18.8
SPAN (ft.)																		
24	467	483	500	583	625	631	515	554	585	638	479	514	550	600	453	500	540	580
25	448	464	480	560	600	631	515	554	585	638	479	514	550	600	453	500	540	580
26	431	446	462	538	577	631	515	554	585	638	479	514	550	600	453	500	540	580
27	415 375	430	444	519	556	607	496	533	563	615	479	514	550	600	453	500	540	580
28	393 336	414 406	429	500	536	586	479	514	543	593	479	514	550	600	453	500	540	580
29	366 303	400 365	414	483	517	566	462	497	524	572	462	497	531	579	453	500	540	580
30	342 273	387 330	400	467 457	500	547	447	480	507	553	447	480	513	560	453	500	540	580
31	320 248	374 299	387 373	452 414	484 465	529	432 418	465	490	535	432	465	497	542	439	484	523	561
32	301 225	363 272	375 339	438 376	469 423	513 482	419 380	450 445	475	519	419	450	481	525	425	469	506	544
33	283 205	352 248	364 309	424 343	455 386	497 440	406 346	436 405	461 456	503	406 404	436	467	509	412	455	491	527
34	266 188	332 227	353 283	412 314	441 353	482 402	394 317	424 371	447 417	488 476	394 370	424	453	494	400	441	476	512
35	251 172	313 208	343 259	400 288	429 323	469 369	383 290	411 340	434 383	474 437	383 339	411 396	440	480	389	429	463	497
36	238 158	296 191	333 238	389 264	417 297	456 339	372 267	400 312	422 352	461 401	372 311	400 364	428 410	467	378 359	417	450	483
37	225 146	280 176	324 219	378 243	405 274	443 312	362 246	389 288	411 324	449 370	362 287	389 336	416 378	454 432	368 330	405 387	438 436	470
38	213 135	266 162	316 202	368 225	395 253	432 288	353 227	379 266	400 299	437 341	353 265	379 310	405 349	442 399	358 305	395 357	426 402	458
39	202 124	252 150	308 187	359 208	385 234	421 266	344 210	369 246	390 276	426 316	344 245	369 287	395 322	431 369	349 282	385 331	415 372	446 426
40	193 115	240 139	298 174	350 193	375 217	410 247	327 194	360 228	380 256	415 292	335 227	360 266	385 299	420 342	340 262	375 306	405 345	435 395
41	183 107	228 129	284 161	337 179	366 201	400 229	311 181	351 211	371 238	405 272	327 211	351 247	376 278	410 318	332 243	366 285	395 320	424 367
42	175 100	218 120	271 150	322 166	357 187	390 213	296 168	343 197	362 221	395 253	319 196	343 229	367 258	400 295	324 226	357 265	386 298	414 341
43	167 93	208 112	258 140	307 155	345 174	381 199	283 156	334 183	353 206	386 235	305 183	335 214	358 241	391 275	316 211	349 247	377 278	405 318
44	159 87	198 105	247 130	293 145	330 163	373 186	270 146	319 171	345 193	377 220	291 171	327 200	350 225	382 257	309 196	341 230	368 259	395 297
45	152 81	190 98	236 122	280 135	315 152	364 173	258 137	305 160	338 180	369 205	279 159	320 187	342 210	373 240	299 184	333 215	360 242	387 278
46	146 76	181 92	226 114	268 127	302 142	348 162	247 128	291 150	328 168	361 192	267 149	313 175	335 197	365 225	286 172	326 202	352 227	378 260
47	139 71	174 86	216 107	257 119	289 133	334 152	237 120	279 140	314 158	353 180	255 140	302 164	328 184	357 211	274 161	319 189	345 213	370 244
48	134 67	167 81	207 100	246 111	277 125	320 143	227 112	268 132	301 148	346 169	245 131	289 154	321 173	350 198	263 151	311 177	338 200	363 229
49							218 106	257 124	289 139	334 159	235 124	278 144	312 163	343 186	252 142	298 167	331 188	355 215
50							209 100	247 117	277 131	321 150	226 116	267 136	300 153	336 175	242 134	287 157	322 177	348 202
51							201 94	237 110	267 124	308 141	217 110	256 128	288 144	329 165	233 126	276 148	309 166	341 191
52							193 88	228 104	256 117	297 133	209 103	247 121	277 136	321 156	224 119	265 139	298 157	335 180
53											201 98	237 114	267 128	309 147	216 112	255 132	286 148	328 170
54											193 92	229 108	257 121	297 139	208 106	246 125	276 140	319 161
55											186 87	220 102	248 115	287 132	200 101	237 118	266 133	308 152
56											180 83	213 97	239 109	276 125	193 95	229 112	257 126	297 144
57															187 90	221 106	248 119	287 137
58															180 86	213 101	239 113	277 130
59															174 81	206 95	231 108	268 123
60															168 77	199 91	224 102	259 117

† Approximate Weights per Linear Foot of steel joists only. Accessories not included.
†† For an approximate total load carrying capacity at a maximum allowable tensile stress of 22,000 psi, the total load carrying capacity shown in the load table should be multiplied by the ratio 22/30.
** Section 5.9 of the "Standard Specifications for Open Web Steel Joists, H Series" limits the design LIVE load deflection.

LOADS ABOVE THE COLORED LINES ARE GOVERNED BY SHEAR.

STANDARD SPECIFICATIONS
FOR OPEN WEB STEEL JOISTS, H SERIES

Adopted by Steel Joist Institute February 15, 1978, Revised to November 7, 1983.

SECTION 1.
SCOPE

SPECIFICATIONS
H SERIES

These specifications cover the design, manufacture and use of Open Web Steel Joists, **H** Series.

SECTION 2.
DEFINITION

The term "Open Web Steel Joists **H** Series," as used herein, refers to open web parallel chord load-carrying members suitable for the direct support of floors and roof decks in buildings, utilizing hot-rolled or cold-formed steel, including cold-formed steel whose yield strength* has been attained by cold working. They are designed in accordance with these specifications to develop the resisting moments and maximum end reactions shown in the Standard Load Tables for Open Web Steel Joists, **H** Series attached hereto.

The design of chord sections for **H** Series joists shall be based on a yield strength of 50,000 psi. The design of web sections for **H** Series joists shall be based on a yield strength of either 36,000 psi or 50,000 psi. Steel used for **H** Series joist chord or web sections shall have a minimum yield strength determined in accordance with one of the procedures specified in Section 3.2, which is equal to the yield strength assumed in the design.

* The term "Yield Strength" as used herein shall designate the yield level of a material as determined by the applicable method outlined in paragraph 13 — "Yield Strength," or paragraph 12 — "Yield Point," of ASTM Standard A370, "Mechanical Testing of Steel Products," or as specified in Section 3.2 of this specification.

SECTION 3.
MATERIALS

3.1 STEEL

The steel used in the manufacture of chord and web sections shall conform to one of the following ASTM Specifications of latest adoption:

- Structural Steel, ASTM A36.
- High-Strength Low-Alloy Structural Steel, ASTM A242.
- High-Strength Low-Alloy Structural Manganese Vanadium Steel, ASTM A441.
- Hot Rolled Carbon Steel Sheets and Strip, Structural Quality, ASTM A570.
- High-Strength Low-Alloy Columbium-Vanadium Steel of Structural Quality, ASTM A572, Grade 50.
- High-Strength Low-Alloy Structural Steel with 50,000 psi Minimum Yield Point to 4" thick, ASTM A588.
- Steel Sheet and Strip, Hot Rolled or Cold-Rolled Sheet, High-Strength Low-Alloy, with Improved Corrosion Resistance, ASTM A606.
- Steel Sheet and Strip, Hot-Rolled or Cold-Rolled, High-Strength Low-Alloy, with Improved Corrosion Resistance, Columbium and/or Vanadium ASTM A607, Grade 50.
- Steel, Cold Rolled Sheet, Carbon Structural, ASTM A611, Grade D.

or shall be of suitable quality ordered or produced to other than the listed specifications, provided that such material in the state used for final assembly and fabrication is weldable and is proved by tests performed by the producer or fabricator to have the properties specified in Section 3.2.

3.2 MECHANICAL PROPERTIES

The Yield strength used as a basis for the design stresses prescribed in Section 4 shall be either 36,000 psi or 50,000 psi. Evidence that the steel furnished meets or exceeds the design yield strength shall 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 material, the mechanical properties of which conform to the requirements of one of the listed specifications, test specimens and procedure shall conform to those of such specifications and to ASTM A370. In the case of material, the mechanical properties of which do not conform to the requirements of one of the listed specifications, the test specimens and procedures shall conform to the applicable requirements of ASTM A370 and the specimens shall exhibit a yield strength equal to or exceeding the design yield strength and an elongation of not less than (a) 20 percent in 2 inches for sheet and strip, or (b) 18 percent in 8 inches for plates, shapes and bars with adjustments for thickness for plates, shapes and bars as prescribed in ASTM A36, A242, A441, A572, and A588 whichever specification is applicable on the basis of design yield strength. The number of tests shall be as prescribed in ASTM A6 for plates, shapes and bars; and ASTM A570, A606, A607, and A611 for sheet and strip.

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 Sections 3.1.1 and 6.3 of the AISI Specifications for the Design of Cold Formed Steel Structural Members and shall indicate compliance with these provisions and with the following additional requirements:

(a) The yield strength measured in the tests 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 6 percent greater than the yield strength of the section.

(c) Where compression tests are used for acceptance and control purposes the specimens shall withstand a gross shortening of 2 percent of its original length without cracking. The length of specimen shall not be greater than 20 times its least radius of gyration.

(d) If any test specimen fails to pass the requirements of 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.

3.3 PAINT

The standard shop paint shall conform to one of the following:

(a) Steel Structures Painting Council Specifications 15-68T, Type I (red oxide).

(b) Federal Specification TT-P-636 (red oxide).

(c) Or, shall be a shop paint which meets the minimum performance requirements of one of the above listed specifications.

SECTION 4.
DESIGN AND MANUFACTURE

4.1 METHOD

Joists shall be designed in accordance with these specifications as simply supported uniformly loaded trusses supporting a floor or roof deck so constructed as to brace the top chord of the joists against lateral buckling. Where any applicable design feature is not specifically covered herein, the design shall be in accordance with the following specifications of latest adoption:

(a) American Institute of Steel Construction Specification for Design, Fabrication and Erection of Structural Steel for Buildings, where the material used consists of plates, shapes or bars.

(b) American Iron and Steel Institute Specification for the Design of Cold Formed Steel Structural Members, for members which are formed from sheet or strip material.

4.2 UNIT STRESSES

Joists shall have their components so proportioned that the unit stresses in pounds per square inch shall not exceed the following, where F_y is the yield strength defined in Section 3.2:

(a) Tension:

Chords

F_y = 50,000 psi ..... F_t = 30,000 psi

Webs

F_y = 50,000 psi ..... F_t = 30,000 psi

F_y = 36,000 psi ..... F_t = 22,000 psi

(b) Compression:

For members with l/r less than C_c:

$$F_a = \frac{\left[1 - \frac{(l/r)^2}{2C_c^2}\right] Q\, F_y}{\frac{5}{3} + \frac{3}{8}\left(\frac{l/r}{C_c}\right) - \frac{1}{8}\left(\frac{l/r}{C_c}\right)^3} \quad \text{where } C_c = \sqrt{\frac{2\pi^2 E}{Q\, F_y}} \text{ and}$$

where Q is a form factor equal to unity except when the width-thickness ratio of one or more elements of the profile exceeds the limits specified in the AISC Specifications, Section 1.9 for hot rolled sections and in the AISI Specifications, Section 3, for cold formed sections.

For members with l/r greater than C_c:

In the above formulas l is taken as the distance between panel points for the chord members and the unbraced length clear of attachments for web members, and r is the corresponding least radius of gyration of the member or any component thereof. E is equal to 29,000,000 psi.

(c) Bending:

For chords

F_y = 50,000 psi ..... F_b = 30,000 psi

For web members other than solid rounds

F_y = 50,000 psi ..... F_b = 30,000 psi

F_y = 36,000 psi ..... F_b = 22,000 psi

For web members of solid round cross-section

F_y = 50,000 psi ..... F_b = 45,000 psi

F_y = 36,000 psi ..... F_b = 32,500 psi

For bearing plates

F_y = 50,000 psi ..... F_b = 37,500 psi

F_y = 36,000 psi ..... F_b = 27,000 psi

4.3 MAXIMUM SLENDERNESS RATIOS

The slenderness ratio, l/r, where l is as used in Section 4.2 (b) and r is the corresponding least radius of gyration shall not exceed the following:

Top chord interior panels 90

Top chord end panels 120

Compression members other than top chord 200

Tension members 240

4.4 MEMBERS

(a) Chords:

The bottom chord shall be designed as an axially loaded tension member.

The top chord shall be designed for only axial compressive stress when the panel length, l, does not exceed 24 inches. When the panel length exceeds 24 inches, the top chord shall be designed as a continuous member subject to combined axial and bending stresses and shall be so proportioned that

$$\frac{f_a}{F_a} + \frac{C_m f_b}{\left(1 - \frac{f_a}{F'_e}\right) Q F_b} \leq 1.0, \text{ at mid-panel;}$$

in which

$C_m = 1\text{-}0.3f_a/F'_e$ for end panels
$C_m = 1\text{-}0.4f_a/F'_e$ for interior panels
f_a = Computed axial unit compressive stress
f_b = Computed bending unit compressive stress at the point under consideration
F_a = Permissible axial unit compressive stress based on l/r as defined in Section 4.2 (b)
F_b = Permissible bending unit stress
F_y = Specified minimum yield strength
$F'_e = \frac{12\pi^2 E}{23\,(l/r_x)^2}$ where l is the panel length as defined in Section 4.2(b) and r_x is the radius of gyration about the axis of bending.
Q = Form factor as defined in Section 4.2(b).

The top chord shall be considered as stayed laterally by the floor slab or roof deck when attachments are in accordance with the requirements of Section 5.8 (e) of these specifications.

Lateral stability during erection shall be provided by bridging and the chord properties shall be such that $\frac{}{} \geq 10{,}000$ psi where

$$F_a = \frac{14.15 \times 10^6 C_1 C_2}{hS^2 A_t} \times \frac{}{\sqrt{(I_t + I_b)\,(J_t + J_b)S^2 + 25.6 I_t I_b h^2}}$$

and S = Spacing of bridging (in.)
h = Effective joist depth (in.)
A_t = Area of top chord (in.^{2})
I_t = Moment of Inertia of top chord about the vertical axis (in.^{4})
I_b = Moment of Inertia of bottom chord about vertical axis (in.^{4})
J_t, J_b = Torsion constant of top and bottom chord respectively (in.^{4})

The torsion constant of angles or hat-shaped sections is determined from the formula*

$$J = \frac{At^2}{3}$$

where A is the cross-sectional area of the member being considered and t is its thickness.

*It should be noted that this equation applies only for open-section chords (angles, hat-shapes).

The coefficient $C_1 = 0.85$ for two-piece chord joists and $C_1 = 1.0$ for one-piece chord joists. The coefficient C_2 is given in the following table:

Number of Rows of Bridging	C_2
1	4.00
2	3.00
3	4.00
4	3.33
5	4.00

(b) Web

The vertical shears to be used in the design of the web members shall be determined from full uniform loading but such vertical shear shall be not less than 50% of the maximum end reaction. Due consideration shall be given to the effect of eccentricity. The effect of combined axial compression and bending may be investigated using the provisions of Section 4.4 (a), letting $C_m = 0.4$ when bending due to eccentricity produces reversed curvature.

(c) Bearings

The bearing area shall be proportioned so that unit bearing pressure in pounds per square inch does not exceed the following values:

On masonry laid in cement mortar ..... 250 psi
On structural concrete ..... 750 psi

(d) Extended Ends

Extended ends shall be designed as cantilever beams with their reactions carried back at least to the first interior panel point of the joist.

4.5 CONNECTIONS

(a) Methods

Joint connections and splices shall be made by attaching the members to one another by arc or resistance welding or other approved method.

(b) Strength

Joint connections shall be capable of withstanding forces due to an ultimate load equal to at least two times the design load shown in the applicable Standard Load Table.

(c) Splices

Splices may occur at any point in chord or web members. Members containing a butt weld splice shall develop an ultimate tensile force of at least 57,000 psi times the full design area of the chord or web. The term "member" shall be defined as all component parts, comprising the chord or web, at the point of splice.

(d) Eccentricity

Members connected at a joint shall have their centroidal axes meet at a point if practical. Otherwise, due consideration shall be given to

the effect of eccentricity. In no case shall eccentricity of any web member at a joint exceed ¾ of the overall dimension, measured in the plane of the web, of the largest member connected. Such eccentricity shall be the perpendicular distance from a point at the centroid of the joint located on the centroidal axis of the chord, to the centroidal axis of the web member. Ends of joists shall be proportioned to resist bending produced by eccentricity at the support.

4.6 DESIGN VERIFICATION TESTS

(a) Chord and Web Members

Each manufacturer shall, at the time of design review by the Steel Joist Institute or other independent agency, verify by tests that his design, in accordance with Sections 4.1 through 4.5 of this specification, will provide a minimum factor of safety of 1.65 on the theoretical design capacity 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 may be conducted on full sections.

(b) Joints and Connections

Each manufacturer shall verify by shear tests on representative joints of typical joists that connections will meet the provisions of Section 4.5 (b). Chord and web members may be reinforced for such tests.

4.7 CAMBER

Camber is optional with the manufacturer but when provided, recommended approximate camber is as follows:

Top Chord Length	Approximate Camber
20 feet	¼ inches
30 feet	⅜ inches
40 feet	⅝ inches
50 feet	1 inch
60 feet	1½ inches

In no case will joists be manufactured with negative camber.

4.8 SHOP PAINT

Joists and accessories shall receive one shop coat of paint as specified in Section 3.3.

SECTION 5.
APPLICATION

5.1 USAGE

These specifications shall apply to any type of structure where floors and roofs are to be supported directly by steel joists installed as hereinafter specified. Where joists are used other than on simple spans under uniformly distributed loading as prescribed in Section 4.1, they shall be investigated and modified if necessary to limit the unit stresses to those listed in Section 4.2.

5.2 SPAN

The clear span of a joist shall not exceed 24 times its depth.

5.3 END SUPPORTS

(a) Steel

Due consideration of the end reactions shall be taken in the design of supporting steel.

The ends of joists shall extend a distance of not less than 2½ inches over steel supports.

Where it is deemed necessary to butt opposite joists over a narrow steel support with bearing less than noted above, special ends must be specified, and such ends shall have positive attachment to the support, either by bolting or welding.

(b) Masonry and Concrete

The following minimum bearing lengths, parallel to the length of joists, shall be provided for bearing on masonry and concrete:

		Minimum Bearing Length	
Chord Size	Joist Depth	On Masonry	On Concrete
#3 thru #8	8″ thru 24″	4 inches	4 inches
#8	26″ thru 30″	5 inches	4 inches
#9	18″ thru 30″	5 inches	4 inches
#10 and #11	18″ thru 30″	6 inches	4 inches

5.4 BRIDGING

Bridging is required and shall consist of one of the following types:

(a) Horizontal

Horizontal bridging shall consist of two continuous horizontal steel members, one attached to the top chord and the other attached to the bottom chord. Each attachment to the joists shall be made by welding or mechanical means and shall be capable of resisting a horizontal force of not less than 700 pounds.

The ratio of unbraced length to least radius of gyration (l/r) of the bridging member shall not exceed 300, where l is the distance in inches between attachments and r is the least radius of gyration of the bridging member. If the bridging member is a round bar, the diameter shall be at least ½ inch.

(b) Diagonal

Diagonal bridging shall consist of cross-bracing with l/r ratio of not more than 200, where l is the distance in inches 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 between connections at the point of intersection of the bracing members and the connections to the chord of the joists. Connections to the chords of steel joists shall be made by positive mechanical means or by welding.

(c) Quantity

In no case shall the number of rows of bridging be less than shown in the following table. Spaces between rows shall be approximately uniform.

Number of Rows of Bridging

(Distances are Clear Span Dimensions)

Chord Size*	1 Row	2 Rows	3 Rows	4 Rows	5 Rows**
# 3	Up to 13′	13′ to 17′	17′ to 28′		
# 4	Up to 16′	16′ to 21′	21′ to 32′		
# 5	Up to 16′	16′ to 21′	21′ to 33′	33′ to 38′	38′ to 40′
# 6	Up to 18′	18′ to 22′	22′ to 36′	36′ to 40′	40′ to 48′
# 7	Up to 20′	20′ to 25′	25′ to 41′	41′ to 46′	46′ to 48′
# 8	Up to 21′	21′ to 27′	27′ to 43′	43′ to 48′	48′ to 60′
# 9	Up to 23′	23′ to 30′	30′ to 46′	46′ to 52′	52′ to 60′
#10	Up to 24′	24′ to 30′	30′ to 47′	47′ to 53′	53′ to 60′
#11	Up to 24′	24′ to 31′	31′ to 48′	48′ to 55′	55′ to 60′

*Last digit(s) of joist designation shown in load tables.

** Where five rows of bridging are required and spans are over 40 feet, the middle row shall be diagonal bridging with bolted connections at chords and intersections.

5.5 INSTALLATION OF BRIDGING

All bridging and bridging anchors shall be completely installed before construction loads are placed on the joists.

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

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

5.6 END ANCHORAGE

(a) Masonry Supports

Joists resting on masonry supports shall be bedded in mortar and anchored thereto with an anchor equivalent to a ⅜ inch round steel bar not less than 8 inches long. Every third joist in floors and every joist in roofs shall be anchored. In roofs where parapet walls are not present, two ½ inch anchor bolts or other equal means shall be used in lieu of the steel bar.

(b) Steel Supports

Ends of joists resting on steel supports shall be connected thereto with the equivalent of two ⅛ inch fillet welds 1 inch long, or a ½ inch bolt.

In steel framing, where columns are not framed in at least two directions with structural steel members, joists at column lines shall be field bolted at the columns to add lateral stability during construction.

(c) Uplift

Where uplift forces are a design consideration, roof joists shall be anchored to resist such forces.

5.7 JOIST SPACING

Joists shall be spaced so that the loading on each joist does not exceed the allowable load for the particular joist design.

5.8 FLOOR AND ROOF DECKS

(a) Material

Floors and roof decks may consist of cast-in-place or pre-cast concrete or gypsum, formed steel, wood, or other suitable material capable of supporting the required load at the specified joist spacing.

(b) Thickness

Cast-in-place slabs shall not be less than 2 inches thick.

(c) Centering

Centering for cast-in-place slabs may 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.

(d) Bearing

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

(e) Attachments

Each attachment for slab or deck to top chords of joists shall be capable of resisting a lateral force of not less than 300 pounds. The spacing shall not exceed 36 inches along the top chord.

(f) Wood Nailers

Where wood nailers are used, such nailers in conjunction with deck or slab shall be attached to the top chords of the joists in conformance with Section 5.8 (e).

5.9 DEFLECTION

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

Floors

$1/360$ of clear span where a plaster ceiling is attached or where a structural concrete slab is supported

$1/240$ of clear span for all other cases.

Roofs

$1/360$ of clear span where a plaster ceiling is attached

$1/240$ of clear span for all other cases.

The Specifying Authority shall give due consideration to the effects of deflection in selection of joists.

5.10 PONDING

Unless a roof surface is provided with sufficient slope toward points of free drainage or adequate individual drains to prevent the accumulation of rain water, the roof system shall be investigated to assure stability under ponding conditions in accordance with Section 1.13.3 of the AISC Specifications.* The ponding investigation shall be performed by the specifying engineer or architect.

*For further reference, refer to Steel Joist Institute Technical Digest No. 3, "Structural Design of Steel Joist Roofs to Resist Ponding Loads."

5.11 UPLIFT

Where uplift forces due to wind are a design requirement, these forces must be indicated on the contract drawings in terms of net uplift in pounds per square foot. These forces must be considered in the design of joists and/or bridging.*

5.12 INSPECTION

Joists shall be inspected by the manufacturer before shipment to insure compliance of materials and workmanship with the requirements of these specifications. If the purchaser wishes an inspection of the steel joists by someone other than the manufacturer's own inspectors, he may reserve the right to do so in his "Invitation to Bid" or the accompanying "Job Specifications."

Arrangements shall be made with the manufacturer for such inspection of the joists at the manufacturing shop by the purchaser's inspectors at purchaser's expense.

SECTION 6
HANDLING AND ERECTION

Care shall be exercised at all times to avoid damage through careless handling during unloading, storing and erecting.

As soon as joists are erected, all bridging shall be completely installed and the joists permanently fastened into place before the application of any loads except the weight of the erectors. Many joists exhibit some degree of lateral instability under the weight of an erector until bridging is installed. Therefore, where three or more rows of bridging are required by the table in Section 5.4 (c), caution shall be exercised by the erectors until all bridging is completely and properly installed.

Where five rows of bridging are required in spans of over 40 feet, each joist shall be adequately braced laterally before the next joist is erected and before any loads are applied. Hoisting cables shall not be released until support has been provided by the center row of diagonal bridging and the bridging line has been anchored to prevent lateral movement, and where joists are bottom bearing, their ends have been restrained laterally.

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

Field welding shall not damage the joists. The total length of weld at any one point on cold-formed members whose yield strength has been attained by cold working and whose as-formed strength is used in the design shall not exceed 50 percent of the over-all developed width of the cold-formed section.

*For further reference, refer to Steel Joist Institute Technical Digest No. 6, "Structural Design of Steel Joist Roofs to Resist Uplift Loads."