	AVERAGE GRADE																					
SPEED	LEVEL	−0.05	−0.1	−0.15	−0.2	−0.25	−0.3	−0.35	−0.4	−0.45	−0.5	−0.55	−0.6	−0.65	−0.7	−0.75	−0.8	−0.85	−0.9	−0.95	−1	SPEED
10	**900**	**920**	**942**	**964**	**986**	**1009**	**1033**	**1057**	**1082**	**1108**	**1134**	**1161**	**1189**	**1217**	**1246**	**1276**	**1307**	**1338**	**1370**	**1403**	**1437**	**10**
11	1001	1024	1048	1072	1097	1123	1150	1177	1205	1233	1263	1293	1324	1356	1388	1422	1456	1491	1528	1565	1603	11
12	1104	1129	1156	1183	1210	1239	1268	1298	1329	1361	1394	1427	1461	1497	1533	1570	1608	1648	1688	1729	1772	12
13	1209	1237	1266	1295	1326	1357	1389	1422	1456	1491	1527	1564	1602	1640	1680	1721	1763	1806	1851	1896	1943	13
14	1316	1346	1378	1410	1443	1477	1512	1549	1586	1624	1663	1703	1744	1787	1830	1875	1921	1968	2017	2066	2118	14
15	**1425**	**1458**	**1492**	**1527**	**1563**	**1600**	**1638**	**1677**	**1717**	**1758**	**1801**	**1844**	**1889**	**1935**	**1982**	**2031**	**2081**	**2132**	**2185**	**2239**	**2295**	**15**
16	1536	1571	1608	1646	1684	1724	1765	1807	1851	1895	1941	1988	2036	2086	2137	2190	2244	2299	2356	2415	2475	16
17	1649	1687	1726	1767	1808	1851	1895	1940	1987	2034	2083	2134	2186	2239	2294	2351	2409	2468	2530	2593	2658	17
18	1764	1804	1846	1890	1934	1980	2027	2075	2125	2176	2228	2282	2338	2395	2454	2514	2576	2640	2706	2773	2843	18
19	1881	1924	1969	2015	2062	2110	2160	2212	2265	2319	2375	2433	2492	2553	2616	2680	2746	2815	2885	2957	3031	19
20	**2000**	**2046**	**2093**	**2142**	**2192**	**2243**	**2296**	**2351**	**2407**	**2465**	**2524**	**2586**	**2649**	**2713**	**2780**	**2848**	**2919**	**2991**	**3066**	**3143**	**3222**	**20**
21	2121	2169	2219	2271	2324	2378	2435	2492	2552	2613	2676	2741	2807	2876	2946	3019	3094	3171	3250	3331	3415	21
22	2244	2295	2348	2402	2458	2516	2575	2636	2699	2763	2830	2898	2968	3041	3115	3192	3271	3352	3436	3522	3611	22
23	2369	2422	2478	2535	2594	2655	2717	2781	2847	2915	2985	3057	3132	3208	3287	3368	3451	3537	3625	3716	3809	23
24	2496	2552	2610	2671	2732	2796	2861	2929	2998	3070	3143	3219	3297	3377	3460	3545	3633	3723	3816	3912	4010	24
25	**2625**	**2684**	**2745**	**2808**	**2873**	**2939**	**3008**	**3079**	**3151**	**3226**	**3304**	**3383**	**3465**	**3549**	**3636**	**3725**	**3817**	**3912**	**4010**	**4110**	**4213**	**25**
26	2756	2818	2881	2947	3015	3085	3157	3231	3307	3385	3466	3549	3635	3723	3814	3908	4004	4103	4206	4311	4419	26
27	2889	2953	3020	3089	3159	3232	3307	3384	3464	3546	3631	3718	3807	3899	3994	4092	4193	4297	4404	4514	4627	27
28	3024	3091	3160	3232	3306	3382	3460	3541	3624	3709	3797	3888	3981	4078	4177	4279	4384	4493	4605	4720	4838	28
29	3161	3231	3303	3378	3454	3533	3615	3699	3785	3874	3966	4061	4158	4258	4362	4468	4578	4691	4808	4928	5051	29
30	**3300**	**3372**	**3448**	**3525**	**3605**	**3687**	**3772**	**3859**	**3949**	**4042**	**4137**	**4235**	**4337**	**4441**	**4549**	**4660**	**4774**	**4892**	**5013**	**5138**	**5267**	**30**
31	3441	3516	3594	3675	3757	3843	3931	4021	4115	4211	4310	4412	4518	4626	4738	4854	4972	5095	5221	5351	5485	31
32	3584	3662	3743	3826	3912	4001	4092	4186	4283	4383	4485	4592	4701	4814	4930	5049	5173	5300	5431	5566	5705	32
33	3729	3810	3893	3980	4069	4160	4255	4352	4453	4556	4663	4773	4886	5003	5124	5248	5376	5508	5643	5784	5928	33
34	3876	3960	4046	4135	4227	4322	4420	4521	4625	4732	4842	4956	5074	5195	5319	5448	5581	5717	5858	6003	6153	34
35	**4025**	**4111**	**4201**	**4293**	**4388**	**4486**	**4587**	**4692**	**4799**	**4910**	**5024**	**5142**	**5263**	**5389**	**5518**	**5651**	**5788**	**5929**	**6075**	**6226**	**6381**	**35**
36	4176	4265	4357	4453	4551	4652	4757	4864	4975	5090	5208	5330	5455	5585	5718	5856	5997	6144	6295	6450	6610	36
37	4329	4421	4516	4614	4716	4820	4928	5039	5154	5272	5394	5520	5649	5783	5921	6063	6209	6360	6516	6677	6843	37
38	4484	4579	4677	4778	4883	4990	5102	5216	5334	5456	5582	5712	5845	5983	6125	6272	6423	6579	6740	6906	7077	38
39	4641	4739	4840	4944	5052	5163	5277	5395	5517	5642	5772	5906	6043	6186	6332	6483	6639	6800	6966	7137	7314	39
40	**4800**	**4900**	**5004**	**5112**	**5223**	**5337**	**5455**	**5576**	**5702**	**5831**	**5964**	**6102**	**6244**	**6390**	**6541**	**6697**	**6858**	**7024**	**7195**	**7371**	**7553**	**40**
41	4961	5064	5171	5282	5396	5513	5634	5759	5888	6021	6159	6300	6446	6597	6753	6913	7079	7249	7425	7607	7795	41
42	5124	5230	5340	5454	5571	5691	5816	5944	6077	6214	6355	6501	6651	6806	6966	7131	7301	7477	7658	7845	8038	42
43	5289	5398	5511	5627	5748	5872	6000	6132	6268	6409	6554	6703	6858	7017	7182	7351	7526	7707	7894	8086	8284	43
44	5456	5568	5684	5803	5927	6054	6185	6321	6461	6605	6754	6908	7067	7231	7399	7574	7754	7939	8131	8329	8533	44
45	**5625**	**5740**	**5859**	**5981**	**6108**	**6238**	**6373**	**6512**	**6656**	**6804**	**6957**	**7115**	**7278**	**7446**	**7619**	**7798**	**7983**	**8174**	**8371**	**8574**	**8783**	**45**
46	5796	5914	6035	6161	6291	6425	6563	6706	6853	7005	7162	7324	7491	7664	7842	8025	8215	8411	8613	8821	9036	46
47	5969	6089	6214	6343	6476	6613	6755	6901	7052	7208	7369	7535	7706	7883	8066	8254	8449	8649	8857	9071	9291	47
48	6144	6267	6395	6527	6663	6804	6949	7099	7254	7413	7578	7748	7924	8105	8292	8485	8685	8891	9103	9322	9549	48
49	6321	6447	6578	6713	6853	6997	7145	7299	7457	7620	7789	7964	8143	8329	8521	8719	8923	9134	9352	9576	9808	49
50	**6500**	**6629**	**6763**	**6901**	**7044**	**7191**	**7343**	**7500**	**7662**	**7830**	**8003**	**8181**	**8365**	**8555**	**8751**	**8954**	**9163**	**9379**	**9602**	**9833**	**10070**	**50**
51	6681	6813	6950	7091	7237	7388	7543	7704	7870	8041	8218	8400	8589	8783	8984	9192	9406	9627	9855	10091	10334	51
52	6864	6999	7139	7283	7433	7587	7746	7910	8079	8254	8435	8622	8815	9014	9219	9432	9651	9877	10111	10352	10601	52
53	7049	7187	7330	7477	7630	7787	7950	8118	8291	8470	8655	8846	9043	9246	9456	9673	9898	10129	10368	10615	10870	53
54	7236	7377	7523	7674	7829	7990	8156	8328	8505	8688	8876	9071	9273	9481	9696	9918	10147	10383	10628	10880	11141	54
55	**7425**	**7569**	**7718**	**7872**	**8031**	**8195**	**8364**	**8540**	**8720**	**8907**	**9100**	**9299**	**9505**	**9718**	**9937**	**10164**	**10398**	**10640**	**10889**	**11147**	**11414**	**55**
56	7616	7763	7915	8072	8234	8402	8575	8753	8938	9129	9326	9529	9739	9956	10181	10412	10651	10898	11153	11417	11689	56
57	7809	7959	8114	8274	8440	8611	8787	8970	9158	9353	9554	9761	9976	10197	10426	10663	10907	11159	11420	11689	11967	57
58	8004	8157	8315	8478	8647	8821	9002	9188	9380	9578	9784	9995	10214	10440	10674	10915	11164	11422	11688	11963	12246	58
59	8201	8357	8518	8684	8857	9034	9218	9408	9604	9806	10016	10232	10455	10686	10924	11170	11424	11687	11958	12239	12529	59
60	**8400**	**8559**	**8723**	**8893**	**9068**	**9249**	**9437**	**9630**	**9830**	**10036**	**10250**	**10470**	**10698**	**10933**	**11176**	**11427**	**11686**	**11954**	**12231**	**12517**	**12813**	**60**
61	8601	8763	8930	9103	9282	9466	9657	9854	10058	10268	10486	10710	10942	11182	11430	11686	11950	12224	12506	12798	13099	61
62	8804	8969	9139	9315	9497	9685	9880	10080	10288	10502	10724	10953	11189	11434	11686	11947	12217	12495	12783	13081	13388	62
63	9009	9176	9350	9529	9715	9906	10104	10309	10520	10739	10964	11197	11438	11687	11945	12210	12485	12769	13062	13366	13679	63
64	9216	9386	9563	9746	9934	10129	10331	10539	10754	10977	11207	11444	11689	11943	12205	12476	12756	13045	13344	13653	13972	64
65	**9425**	**9598**	**9778**	**9964**	**10156**	**10355**	**10560**	**10772**	**10991**	**11217**	**11451**	**11693**	**11943**	**12201**	**12468**	**12743**	**13029**	**13323**	**13627**	**13942**	**14267**	**65**
66	9636	9812	9995	10184	10380	10582	10790	11006	11229	11459	11697	11944	12198	12461	12732	13013	13303	13603	13913	14234	14565	66
67	9849	10028	10214	10407	10605	10811	11023	11243	11469	11704	11946	12196	12455	12723	12999	13285	13580	13886	14201	14527	14864	67
68	10064	10246	10436	10631	10833	11042	11258	11481	11712	11950	12197	12451	12715	12987	13268	13559	13859	14170	14491	14823	15166	68
69	10281	10466	10659	10857	11063	11275	11495	11722	11956	12199	12449	12708	12976	13253	13539	13835	14141	14457	14783	15121	15470	69
70	**10500**	**10689**	**10884**	**11086**	**11295**	**11511**	**11734**	**11964**	**12203**	**12449**	**12704**	**12967**	**13240**	**13521**	**13812**	**14113**	**14424**	**14746**	**15078**	**15421**	**15777**	**70**

D = DISTANCE REQUIRED FOR SAFE BRAKING
TB = TONS PER OPERATIVE BRAKE [100]
Vo = INITIAL VELOCITY AT BEGINNING OF BRAKING
G = AVERAGE GRADE IN PERCENT

FORMULA:

$$\text{DISTANCE} = 0.01\,TBV_o^2 + (80V_o)^{1-(GTB/1300)}$$

* SPEED OR VEOCITY IN MILES PER HOUR (MPH)

REV	DATE	BY	CHK	APP	DESCRIPTION	REV	DATE	BY	CHK	APP	
					01012024 FOURTH EDITION						

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:
Bin Zhang
DEPUTY DIRECTOR, ENGINEERING

Caltrain
1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SPEED CHARTS
BRAKING DISTANCE CHART
DESCENDING – 100 TPOB
SHEET 1 OF 2

CADD FILE NAME: SD–5001
REV: EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD–5001

		AVERAGE GRADE																				
SPEED	LEVEL	−1.05	−1.1	−1.15	−1.2	−1.25	−1.3	−1.35	−1.4	−1.45	−1.5	−1.55	−1.6	−1.65	−1.7	−1.75	−1.8	−1.85	−1.9	−1.95	−2	SPEED
10	**900**	**1472**	**1508**	**1545**	**1582**	**1621**	**1660**	**1701**	**1743**	**1786**	**1830**	**1875**	**1921**	**1968**	**2017**	**2067**	**2118**	**2171**	**2225**	**2280**	**2337**	**10**
11	1001	1642	1682	1724	1766	1809	1854	1900	1947	1995	2045	2095	2148	2201	2256	2313	2370	2430	2491	2554	2618	11
12	1104	1815	1860	1906	1953	2001	2051	2102	2155	2208	2264	2320	2379	2439	2500	2563	2628	2694	2763	2833	2905	12
13	1209	1991	2041	2091	2143	2197	2252	2308	2366	2426	2487	2549	2614	2680	2748	2818	2890	2963	3039	3117	3197	13
14	1316	2170	2224	2280	2337	2395	2456	2518	2581	2646	2713	2782	2853	2926	3001	3077	3156	3237	3321	3406	3494	14
15	**1425**	**2352**	**2411**	**2471**	**2533**	**2597**	**2663**	**2730**	**2800**	**2871**	**2944**	**3019**	**3096**	**3176**	**3257**	**3341**	**3427**	**3516**	**3607**	**3700**	**3796**	**15**
16	1536	2537	2600	2666	2733	2802	2873	2946	3021	3099	3178	3259	3343	3429	3518	3609	3702	3799	3898	3999	4104	16
17	1649	2724	2793	2863	2936	3010	3087	3166	3246	3330	3415	3503	3594	3687	3782	3881	3982	4086	4193	4302	4415	17
18	1764	2914	2988	3064	3141	3221	3303	3388	3475	3564	3656	3751	3848	3948	4051	4156	4265	4377	4492	4610	4732	18
19	1881	3107	3186	3267	3350	3435	3523	3613	3706	3802	3900	4001	4106	4213	4323	4436	4552	4672	4795	4922	5052	19
20	**2000**	**3303**	**3387**	**3472**	**3561**	**3652**	**3746**	**3842**	**3941**	**4043**	**4148**	**4256**	**4367**	**4481**	**4598**	**4719**	**4843**	**4971**	**5103**	**5238**	**5378**	**20**
21	2121	3501	3590	3681	3775	3872	3971	4073	4179	4287	4398	4513	4631	4752	4877	5006	5138	5274	5414	5559	5707	21
22	2244	3702	3796	3892	3992	4094	4199	4308	4419	4534	4652	4774	4899	5028	5160	5296	5437	5581	5730	5883	6040	22
23	2369	3905	4004	4106	4211	4319	4431	4545	4663	4784	4909	5038	5170	5306	5446	5590	5739	5892	6049	6211	6378	23
24	2496	4111	4216	4323	4434	4547	4665	4785	4909	5037	5169	5305	5444	5588	5736	5888	6045	6206	6372	6543	6719	24
25	**2625**	**4320**	**4429**	**4542**	**4659**	**4778**	**4901**	**5028**	**5159**	**5293**	**5432**	**5575**	**5721**	**5873**	**6028**	**6189**	**6354**	**6524**	**6699**	**6879**	**7064**	**25**
26	2756	4531	4646	4764	4886	5012	5141	5274	5411	5553	5698	5848	6002	6161	6324	6493	6666	6845	7029	7218	7414	26
27	2889	4744	4865	4989	5116	5248	5383	5523	5666	5814	5967	6124	6286	6452	6624	6800	6982	7170	7363	7562	7766	27
28	3024	4960	5086	5216	5349	5487	5628	5774	5924	6079	6239	6403	6572	6747	6926	7111	7302	7498	7700	7909	8123	28
29	3161	5179	5310	5445	5585	5728	5876	6028	6185	6347	6514	6685	6862	7044	7232	7425	7624	7830	8041	8259	8483	29
30	**3300**	**5400**	**5536**	**5677**	**5823**	**5972**	**6126**	**6285**	**6449**	**6617**	**6791**	**6970**	**7155**	**7345**	**7541**	**7742**	**7950**	**8165**	**8385**	**8613**	**8847**	**30**
31	3441	5623	5765	5912	6063	6219	6379	6545	6715	6891	7072	7258	7450	7648	7852	8063	8280	8503	8733	8970	9215	31
32	3584	5849	5997	6149	6306	6468	6635	6807	6984	7167	7355	7549	7749	7955	8167	8386	8612	8844	9084	9331	9586	32
33	3729	6077	6230	6389	6552	6720	6893	7072	7256	7445	7641	7843	8050	8265	8485	8713	8947	9189	9438	9695	9960	33
34	3876	6308	6467	6631	6800	6974	7154	7339	7530	7727	7930	8139	8355	8577	8806	9043	9286	9537	9796	10063	10338	34
35	**4025**	**6540**	**6705**	**6875**	**7050**	**7231**	**7417**	**7609**	**7807**	**8011**	**8221**	**8438**	**8662**	**8892**	**9130**	**9375**	**9628**	**9888**	**10157**	**10434**	**10719**	**35**
36	4176	6776	6946	7122	7303	7490	7683	7882	8087	8298	8516	8740	8972	9211	9457	9711	9973	10243	10521	10808	11104	36
37	4329	7014	7190	7371	7559	7752	7951	8157	8369	8587	8813	9045	9285	9532	9787	10050	10321	10600	10888	11186	11492	37
38	4484	7254	7436	7623	7817	8017	8222	8435	8654	8880	9113	9353	9601	9856	10120	10391	10672	10961	11259	11566	11883	38
39	4641	7496	7684	7878	8077	8283	8496	8715	8941	9174	9415	9663	9919	10183	10455	10736	11026	11324	11633	11950	12278	39
40	**4800**	**7741**	**7934**	**8134**	**8340**	**8553**	**8772**	**8998**	**9231**	**9472**	**9720**	**9976**	**10240**	**10513**	**10794**	**11084**	**11383**	**11691**	**12009**	**12337**	**12676**	**40**
41	4961	7988	8187	8393	8605	8824	9050	9283	9524	9772	10028	10292	10564	10845	11135	11434	11743	12061	12389	12728	13077	41
42	5124	8237	8443	8655	8873	9099	9331	9571	9819	10075	10338	10610	10891	11181	11479	11787	12105	12434	12772	13121	13481	42
43	5289	8489	8700	8918	9143	9375	9615	9862	10117	10380	10651	10931	11220	11519	11826	12144	12471	12809	13158	13518	13889	43
44	5456	8743	8960	9184	9416	9654	9901	10155	10417	10688	10967	11255	11553	11859	12176	12503	12840	13188	13547	13917	14300	44
45	**5625**	**8999**	**9223**	**9453**	**9691**	**9936**	**10189**	**10450**	**10720**	**10998**	**11285**	**11582**	**11887**	**12203**	**12529**	**12865**	**13211**	**13569**	**13939**	**14320**	**14713**	**45**
46	5796	9258	9487	9724	9968	10220	10480	10748	11025	11311	11606	11911	12225	12549	12884	13229	13586	13954	14334	14726	15130	46
47	5969	9519	9754	9997	10248	10506	10773	11049	11333	11627	11929	12242	12565	12898	13242	13597	13963	14341	14732	15135	15550	47
48	6144	9782	10024	10273	10530	10795	11069	11351	11643	11944	12255	12576	12908	13250	13603	13967	14343	14732	15133	15546	15973	48
49	6321	10048	10295	10550	10814	11086	11367	11657	11956	12265	12584	12913	13253	13604	13966	14340	14726	15125	15536	15961	16400	49
50	**6500**	**10316**	**10569**	**10831**	**11101**	**11379**	**11667**	**11964**	**12271**	**12588**	**12915**	**13253**	**13601**	**13961**	**14333**	**14716**	**15112**	**15521**	**15943**	**16379**	**16829**	**50**
51	6681	10586	10845	11113	11390	11675	11970	12275	12589	12914	13249	13595	13952	14321	14702	15095	15501	15920	16353	16800	17261	51
52	6864	10858	11124	11398	11681	11974	12275	12587	12909	13242	13585	13939	14305	14683	15073	15476	15892	16322	16765	17223	17696	52
53	7049	11133	11405	11685	11975	12274	12583	12902	13232	13572	13923	14286	14661	15048	15448	15860	16286	16726	17181	17650	18134	53
54	7236	11410	11688	11975	12271	12577	12893	13220	13557	13905	14265	14636	15019	15416	15825	16247	16683	17134	17599	18079	18575	54
55	**7425**	**11689**	**11973**	**12266**	**12569**	**12882**	**13206**	**13540**	**13884**	**14240**	**14608**	**14988**	**15380**	**15786**	**16204**	**16636**	**17083**	**17544**	**18020**	**18512**	**19019**	**55**
56	7616	11970	12260	12560	12870	13190	13520	13862	14214	14578	14954	15343	15744	16158	16586	17029	17485	17957	18444	18947	19467	56
57	7809	12254	12550	12857	13173	13500	13838	14186	14547	14919	15303	15700	16110	16534	16971	17423	17890	18372	18870	19385	19916	57
58	8004	12540	12842	13155	13478	13812	14157	14513	14881	15262	15654	16060	16479	16912	17359	17821	18298	18791	19300	19826	20369	58
59	8201	12828	13137	13456	13786	14127	14479	14843	15219	15607	16008	16422	16850	17292	17749	18221	18708	19212	19732	20270	20825	59
60	**8400**	**13118**	**13434**	**13759**	**14096**	**14444**	**14803**	**15175**	**15558**	**15954**	**16364**	**16787**	**17224**	**17675**	**18142**	**18624**	**19122**	**19636**	**20167**	**20716**	**21284**	**60**
61	8601	13411	13732	14065	14408	14763	15130	15509	15900	16305	16722	17154	17600	18061	18537	19029	19537	20063	20605	21166	21745	61
62	8804	13705	14034	14373	14723	15085	15459	15845	16244	16657	17083	17524	17979	18449	18935	19437	19956	20492	21046	21618	22210	62
63	9009	14002	14337	14683	15040	15409	15790	16184	16591	17012	17447	17896	18360	18840	19336	19848	20377	20924	21489	22073	22677	63
64	9216	14302	14643	14995	15359	15735	16124	16525	16940	17369	17813	18271	18744	19233	19739	20261	20801	21359	21935	22531	23147	64
65	**9425**	**14603**	**14950**	**15309**	**15680**	**16063**	**16459**	**16869**	**17292**	**17729**	**18181**	**18648**	**19130**	**19629**	**20144**	**20677**	**21228**	**21796**	**22384**	**22992**	**23620**	**65**
66	9636	14907	15261	15626	16004	16394	16798	17215	17646	18091	18552	19027	19519	20027	20553	21096	21657	22237	22836	23455	24095	66
67	9849	15213	15573	15945	16330	16727	17138	17563	18002	18456	18925	19409	19910	20428	20963	21517	22088	22679	23290	23921	24574	67
68	10064	15521	15887	16266	16658	17063	17481	17914	18361	18823	19300	19794	20304	20832	21377	21940	22523	23125	23747	24390	25055	68
69	10281	15831	16204	16590	16988	17400	17826	18266	18722	19192	19678	20181	20700	21237	21793	22367	22960	23573	24207	24862	25539	69
70	**10500**	**16144**	**16523**	**16915**	**17321**	**17740**	**18174**	**18622**	**19085**	**19564**	**20059**	**20570**	**21099**	**21646**	**22211**	**22795**	**23399**	**24024**	**24669**	**25336**	**26026**	**70**

D = DISTANCE REQUIRED FOR SAFE BRAKING
TB = TONS PER OPERATIVE BRAKE [100]
Vo = INITIAL VELOCITY AT BEGINNING OF BRAKING
G = AVERAGE GRADE IN PERCENT

FORMULA:

$$\text{DISTANCE} = 0.01TBV_o^2 + (80V_o)^{1-(GTB/1300)}$$

∗ SPEED OR VEOCITY IN MILES PER HOUR (MPH)

REV	DATE	BY	CHK	APP	DESCRIPTION	REV	DATE	BY	CHK	APP	
					01012024 FOURTH EDITION						

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:
Bin Zhang
DEPUTY DIRECTOR, ENGINEERING

Caltrain
1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SPEED CHARTS
BRAKING DISTANCE CHART
DESCENDING − 100 TPOB
SHEET 2 OF 2

CADD FILE NAME: SD−5002
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD−5002

	AVERAGE GRADE																					
SPEED	LEVEL	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1	SPEED
10	**900**	**879**	**859**	**840**	**821**	**803**	**785**	**768**	**751**	**734**	**718**	**702**	**687**	**672**	**658**	**644**	**630**	**616**	**603**	**590**	**578**	**10**
11	1001	978	956	934	913	893	873	854	835	816	799	781	764	747	731	716	700	685	671	657	643	11
12	1104	1078	1054	1030	1007	985	963	941	921	900	881	861	843	825	807	789	773	756	740	725	710	12
13	1209	1181	1154	1128	1103	1078	1054	1031	1008	986	965	944	923	903	884	865	847	829	811	794	778	13
14	1316	1286	1257	1228	1201	1174	1148	1123	1098	1074	1050	1028	1005	984	963	942	923	903	884	866	848	14
15	**1425**	**1392**	**1361**	**1330**	**1300**	**1272**	**1243**	**1216**	**1189**	**1163**	**1138**	**1114**	**1090**	**1066**	**1044**	**1022**	**1000**	**979**	**959**	**939**	**920**	**15**
16	1536	1501	1467	1434	1402	1371	1341	1311	1283	1255	1228	1201	1176	1151	1126	1103	1080	1057	1036	1014	994	16
17	1649	1611	1575	1540	1506	1472	1440	1408	1378	1348	1319	1291	1263	1237	1211	1185	1161	1137	1114	1091	1069	17
18	1764	1724	1685	1648	1611	1576	1541	1507	1475	1443	1412	1382	1353	1325	1297	1270	1244	1219	1194	1170	1147	18
19	1881	1838	1797	1757	1718	1681	1644	1608	1574	1540	1507	1475	1444	1414	1385	1357	1329	1302	1276	1250	1226	19
20	**2000**	**1955**	**1911**	**1869**	**1828**	**1788**	**1749**	**1711**	**1675**	**1639**	**1604**	**1571**	**1538**	**1506**	**1475**	**1445**	**1416**	**1387**	**1360**	**1333**	**1307**	**20**
21	2121	2073	2027	1983	1939	1897	1856	1816	1777	1740	1703	1668	1633	1599	1567	1535	1504	1474	1445	1417	1389	21
22	2244	2194	2145	2098	2052	2008	1965	1923	1882	1842	1804	1766	1730	1695	1660	1627	1595	1563	1533	1503	1474	22
23	2369	2316	2265	2216	2168	2121	2075	2031	1989	1947	1906	1867	1829	1792	1756	1721	1687	1654	1622	1591	1560	23
24	2496	2440	2387	2335	2285	2236	2188	2142	2097	2053	2011	1970	1930	1891	1853	1817	1781	1747	1713	1681	1649	24
25	**2625**	**2567**	**2511**	**2457**	**2404**	**2353**	**2303**	**2254**	**2207**	**2162**	**2118**	**2075**	**2033**	**1992**	**1953**	**1914**	**1877**	**1841**	**1806**	**1772**	**1739**	**25**
26	2756	2695	2637	2580	2525	2471	2419	2369	2320	2272	2226	2181	2137	2095	2054	2014	1975	1938	1901	1866	1831	26
27	2889	2826	2765	2705	2648	2592	2538	2485	2434	2384	2336	2289	2244	2200	2157	2116	2075	2036	1998	1961	1925	27
28	3024	2958	2894	2833	2773	2715	2658	2603	2550	2499	2448	2400	2352	2307	2262	2219	2177	2136	2097	2058	2021	28
29	3161	3092	3026	2962	2900	2839	2781	2724	2668	2615	2563	2512	2463	2415	2369	2324	2281	2238	2197	2157	2119	29
30	**3300**	**3229**	**3160**	**3093**	**3029**	**2966**	**2905**	**2846**	**2788**	**2733**	**2679**	**2626**	**2575**	**2526**	**2478**	**2431**	**2386**	**2342**	**2300**	**2258**	**2218**	**30**
31	3441	3367	3296	3227	3160	3094	3031	2970	2910	2853	2797	2742	2689	2638	2589	2540	2494	2448	2404	2361	2320	31
32	3584	3507	3434	3362	3292	3225	3159	3096	3034	2975	2917	2860	2806	2753	2701	2651	2603	2556	2510	2466	2423	32
33	3729	3650	3573	3499	3427	3357	3290	3224	3160	3098	3038	2980	2924	2869	2816	2764	2714	2666	2619	2573	2529	33
34	3876	3794	3715	3638	3564	3492	3422	3354	3288	3224	3162	3102	3044	2987	2932	2879	2827	2777	2729	2682	2636	34
35	**4025**	**3940**	**3859**	**3779**	**3703**	**3628**	**3556**	**3486**	**3418**	**3352**	**3288**	**3226**	**3166**	**3107**	**3051**	**2996**	**2943**	**2891**	**2841**	**2792**	**2745**	**35**
36	4176	4089	4004	3923	3843	3766	3692	3620	3549	3481	3416	3352	3290	3229	3171	3114	3060	3006	2955	2905	2856	36
37	4329	4239	4152	4068	3986	3907	3830	3755	3683	3613	3545	3479	3415	3353	3293	3235	3178	3124	3071	3019	2969	37
38	4484	4391	4302	4215	4131	4049	3970	3893	3819	3747	3677	3609	3543	3479	3417	3357	3299	3243	3188	3135	3084	38
39	4641	4545	4453	4364	4277	4193	4112	4033	3956	3882	3810	3740	3673	3607	3544	3482	3422	3364	3308	3254	3201	39
40	**4800**	**4702**	**4607**	**4515**	**4426**	**4339**	**4256**	**4175**	**4096**	**4020**	**3946**	**3874**	**3804**	**3737**	**3672**	**3608**	**3547**	**3487**	**3430**	**3374**	**3319**	**40**
41	4961	4860	4762	4668	4576	4488	4402	4318	4237	4159	4083	4009	3938	3869	3802	3737	3674	3612	3553	3496	3440	41
42	5124	5020	4920	4823	4729	4638	4549	4464	4381	4300	4222	4147	4073	4002	3933	3867	3802	3739	3679	3620	3563	42
43	5289	5182	5080	4980	4883	4790	4699	4611	4526	4444	4363	4286	4211	4138	4067	3999	3933	3868	3806	3746	3687	43
44	5456	5347	5241	5139	5040	4944	4851	4761	4673	4589	4507	4427	4350	4275	4203	4133	4065	3999	3935	3874	3814	44
45	**5625**	**5513**	**5405**	**5300**	**5198**	**5100**	**5005**	**4912**	**4823**	**4736**	**4652**	**4570**	**4491**	**4415**	**4341**	**4269**	**4199**	**4132**	**4067**	**4003**	**3942**	**45**
46	5796	5681	5570	5463	5359	5258	5160	5066	4974	4885	4799	4716	4635	4556	4481	4407	4336	4267	4200	4135	4072	46
47	5969	5851	5738	5628	5521	5418	5318	5221	5127	5036	4948	4863	4780	4700	4622	4547	4474	4403	4335	4269	4205	47
48	6144	6024	5907	5795	5686	5580	5478	5378	5282	5189	5099	5012	4927	4845	4766	4689	4614	4542	4472	4404	4339	48
49	6321	6198	6079	5964	5852	5744	5639	5538	5439	5344	5252	5163	5076	4992	4911	4833	4756	4683	4611	4542	4475	49
50	**6500**	**6374**	**6252**	**6134**	**6020**	**5910**	**5803**	**5699**	**5599**	**5501**	**5407**	**5316**	**5227**	**5142**	**5059**	**4978**	**4901**	**4825**	**4752**	**4681**	**4613**	**50**
51	6681	6552	6428	6307	6191	6078	5968	5862	5760	5660	5564	5471	5380	5293	5208	5126	5047	4970	4895	4823	4753	51
52	6864	6732	6605	6482	6363	6248	6136	6027	5923	5821	5723	5628	5535	5446	5359	5276	5195	5116	5040	4966	4895	52
53	7049	6914	6785	6659	6537	6419	6305	6195	6088	5984	5884	5786	5692	5601	5513	5427	5344	5264	5187	5111	5039	53
54	7236	7099	6966	6838	6713	6593	6477	6364	6255	6149	6046	5947	5851	5758	5668	5581	5496	5415	5335	5259	5184	54
55	**7425**	**7285**	**7150**	**7019**	**6892**	**6769**	**6650**	**6535**	**6423**	**6316**	**6211**	**6110**	**6012**	**5917**	**5825**	**5736**	**5650**	**5567**	**5486**	**5408**	**5332**	**55**
56	7616	7473	7335	7201	7072	6947	6825	6708	6594	6484	6378	6275	6175	6078	5984	5894	5806	5721	5639	5559	5482	56
57	7809	7663	7522	7386	7254	7126	7003	6883	6767	6655	6546	6441	6339	6241	6145	6053	5964	5877	5793	5712	5634	57
58	8004	7855	7712	7573	7438	7308	7182	7060	6942	6828	6717	6610	6506	6406	6309	6214	6123	6035	5950	5867	5787	58
59	8201	8049	7903	7762	7625	7492	7363	7239	7119	7002	6890	6780	6675	6573	6474	6378	6285	6195	6108	6024	5943	59
60	**8400**	**8246**	**8097**	**7952**	**7813**	**7678**	**7547**	**7420**	**7298**	**7179**	**7064**	**6953**	**6845**	**6741**	**6641**	**6543**	**6449**	**6357**	**6269**	**6183**	**6100**	**60**
61	8601	8444	8292	8145	8003	7865	7732	7603	7478	7358	7241	7127	7018	6912	6809	6710	6614	6521	6431	6344	6260	61
62	8804	8644	8489	8340	8195	8055	7919	7788	7661	7538	7419	7304	7193	7085	6980	6879	6782	6687	6595	6507	6421	62
63	9009	8846	8689	8536	8389	8246	8108	7975	7846	7721	7600	7482	7369	7259	7153	7050	6951	6855	6762	6672	6584	63
64	9216	9050	8890	8735	8585	8440	8300	8164	8032	7905	7782	7663	7548	7436	7328	7224	7122	7025	6930	6838	6750	64
65	**9425**	**9256**	**9093**	**8936**	**8783**	**8636**	**8493**	**8355**	**8221**	**8091**	**7966**	**7845**	**7728**	**7615**	**7505**	**7399**	**7296**	**7196**	**7100**	**7007**	**6917**	**65**
66	9636	9464	9299	9138	8983	8833	8688	8547	8411	8280	8153	8029	7910	7795	7684	7576	7471	7370	7272	7178	7086	66
67	9849	9674	9506	9343	9185	9033	8885	8742	8604	8470	8341	8216	8095	7978	7864	7755	7648	7546	7446	7350	7257	67
68	10064	9886	9715	9550	9389	9234	9084	8939	8799	8663	8531	8404	8281	8162	8047	7935	7828	7723	7623	7525	7431	68
69	10281	10101	9927	9758	9595	9438	9285	9138	8995	8857	8723	8594	8469	8348	8231	8118	8009	7903	7801	7701	7606	69
70	**10500**	**10317**	**10140**	**9969**	**9803**	**9643**	**9488**	**9338**	**9193**	**9053**	**8918**	**8786**	**8660**	**8537**	**8418**	**8303**	**8192**	**8085**	**7981**	**7880**	**7783**	**70**

D = DISTANCE REQUIRED FOR SAFE BRAKING
TB = TONS PER OPERATIVE BRAKE [100]
Vo = INITIAL VELOCITY AT BEGINNING OF BRAKING
G = AVERAGE GRADE IN PERCENT

FORMULA:

$$\text{DISTANCE} = 0.01TBV_o^2 + (80V_o)^{1-(GTB/1300)}$$

* SPEED OR VEOCITY IN MILES PER HOUR (MPH)

REV	DATE	BY	CHK	APP	DESCRIPTION	REV	DATE	BY	CHK	APP
					01012024 FOURTH EDITION					

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

Bin Zhang

DEPUTY DIRECTOR, ENGINEERING

Caltrain

1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SPEED CHARTS
BRAKING DISTANCE CHART
ASCENDING – 100 TPOB
SHEET 1 OF 2

CADD FILE NAME: SD-5003
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5003

	AVERAGE GRADE																				
SPEED	LEVEL	1.05	1.1	1.15	1.2	1.25	1.3	1.35	1.4	1.45	1.5	1.55	1.6	1.65	1.7	1.75	1.8	1.85	1.9	1.95	2	SPEED
10	**900**	**566**	**554**	**542**	**531**	**520**	**509**	**499**	**489**	**479**	**469**	**460**	**451**	**442**	**433**	**425**	**417**	**408**	**401**	**393**	**386**	**10**
11	1001	629	616	604	591	579	567	556	545	534	523	513	503	493	483	474	465	456	447	439	431	11
12	1104	695	680	666	653	640	627	614	602	590	578	567	556	545	535	524	514	505	495	486	477	12
13	1209	762	746	731	716	702	688	674	661	648	635	623	611	599	588	577	566	555	545	535	526	13
14	1316	831	814	797	781	766	751	736	721	707	694	680	667	655	643	631	619	608	597	586	576	14
15	**1425**	**901**	**883**	**865**	**848**	**831**	**815**	**799**	**784**	**769**	**754**	**740**	**726**	**712**	**699**	**687**	**674**	**662**	**650**	**639**	**628**	**15**
16	1536	974	954	935	917	899	881	864	848	832	816	801	786	772	758	744	731	718	705	693	681	16
17	1649	1048	1027	1007	987	968	949	931	914	897	880	864	848	833	818	803	789	776	762	749	737	17
18	1764	1124	1102	1080	1059	1039	1019	1000	982	963	946	929	912	896	880	865	850	835	821	807	794	18
19	1881	1202	1178	1156	1133	1112	1091	1071	1051	1032	1013	995	977	960	944	927	912	896	881	867	853	19
20	**2000**	**1281**	**1257**	**1233**	**1209**	**1187**	**1165**	**1143**	**1122**	**1102**	**1082**	**1063**	**1045**	**1027**	**1009**	**992**	**976**	**959**	**944**	**929**	**914**	**20**
21	2121	1363	1337	1311	1287	1263	1240	1217	1196	1174	1154	1134	1114	1095	1077	1059	1041	1024	1008	992	976	21
22	2244	1446	1419	1392	1366	1341	1317	1293	1271	1248	1227	1206	1185	1165	1146	1127	1109	1091	1074	1057	1041	22
23	2369	1531	1503	1475	1448	1422	1396	1371	1347	1324	1301	1279	1258	1237	1217	1197	1178	1160	1142	1124	1107	23
24	2496	1618	1588	1559	1531	1504	1477	1451	1426	1402	1378	1355	1333	1311	1290	1269	1250	1230	1211	1193	1176	24
25	**2625**	**1707**	**1676**	**1645**	**1616**	**1587**	**1560**	**1533**	**1507**	**1481**	**1457**	**1433**	**1409**	**1387**	**1365**	**1343**	**1323**	**1303**	**1283**	**1264**	**1246**	**25**
26	2756	1798	1765	1734	1703	1673	1644	1616	1589	1563	1537	1512	1488	1464	1441	1419	1398	1377	1356	1337	1318	26
27	2889	1890	1856	1824	1792	1761	1731	1702	1673	1646	1619	1593	1568	1544	1520	1497	1475	1453	1432	1411	1391	27
28	3024	1985	1950	1916	1882	1850	1819	1789	1760	1731	1703	1676	1650	1625	1600	1576	1553	1531	1509	1488	1467	28
29	3161	2081	2045	2009	1975	1942	1909	1878	1848	1818	1789	1761	1734	1708	1683	1658	1634	1611	1588	1566	1545	29
30	**3300**	**2179**	**2142**	**2105**	**2070**	**2035**	**2002**	**1969**	**1937**	**1907**	**1877**	**1848**	**1820**	**1793**	**1767**	**1741**	**1716**	**1692**	**1669**	**1646**	**1624**	**30**
31	3441	2280	2241	2203	2166	2130	2096	2062	2029	1998	1967	1937	1908	1880	1853	1826	1801	1776	1752	1728	1706	31
32	3584	2382	2341	2302	2264	2227	2191	2157	2123	2090	2059	2028	1998	1969	1941	1914	1887	1861	1837	1812	1789	32
33	3729	2486	2444	2403	2364	2326	2289	2253	2219	2185	2152	2120	2090	2060	2031	2003	1975	1949	1923	1898	1874	33
34	3876	2592	2549	2507	2466	2427	2389	2352	2316	2281	2248	2215	2183	2152	2123	2094	2065	2038	2012	1986	1961	34
35	**4025**	**2699**	**2655**	**2612**	**2570**	**2530**	**2491**	**2452**	**2416**	**2380**	**2345**	**2311**	**2279**	**2247**	**2216**	**2186**	**2157**	**2129**	**2102**	**2076**	**2050**	**35**
36	4176	2809	2763	2719	2676	2634	2594	2555	2517	2480	2444	2410	2376	2343	2312	2281	2251	2223	2195	2167	2141	36
37	4329	2921	2874	2828	2784	2741	2699	2659	2620	2582	2545	2510	2475	2442	2409	2378	2347	2318	2289	2261	2234	37
38	4484	3034	2986	2939	2894	2849	2807	2765	2725	2686	2649	2612	2576	2542	2509	2476	2445	2415	2385	2356	2329	38
39	4641	3150	3100	3052	3005	2960	2916	2874	2832	2792	2754	2716	2680	2644	2610	2577	2545	2513	2483	2454	2425	39
40	**4800**	**3267**	**3216**	**3167**	**3119**	**3072**	**3027**	**2984**	**2941**	**2900**	**2860**	**2822**	**2785**	**2748**	**2713**	**2679**	**2646**	**2614**	**2583**	**2553**	**2524**	**40**
41	4961	3386	3334	3283	3234	3186	3140	3096	3052	3010	2969	2930	2892	2854	2818	2784	2750	2717	2685	2654	2624	41
42	5124	3507	3454	3402	3351	3303	3255	3209	3165	3122	3080	3040	3000	2962	2925	2890	2855	2822	2789	2758	2727	42
43	5289	3631	3576	3522	3471	3421	3372	3325	3280	3236	3193	3151	3111	3072	3035	2998	2962	2928	2895	2863	2831	43
44	5456	3756	3699	3645	3592	3541	3491	3443	3396	3351	3307	3265	3224	3184	3145	3108	3072	3037	3003	2970	2938	44
45	**5625**	**3883**	**3825**	**3769**	**3715**	**3663**	**3612**	**3563**	**3515**	**3469**	**3424**	**3381**	**3339**	**3298**	**3258**	**3220**	**3183**	**3147**	**3112**	**3079**	**3046**	**45**
46	5796	4011	3953	3895	3840	3787	3735	3684	3635	3588	3542	3498	3455	3413	3373	3334	3296	3259	3224	3189	3156	46
47	5969	4142	4082	4024	3967	3912	3859	3808	3758	3710	3663	3618	3574	3531	3490	3450	3411	3374	3337	3302	3268	47
48	6144	4275	4214	4154	4096	4040	3986	3933	3882	3833	3785	3739	3694	3651	3609	3568	3528	3490	3453	3417	3382	48
49	6321	4410	4347	4286	4227	4170	4114	4061	4009	3958	3909	3862	3816	3772	3729	3687	3647	3608	3570	3534	3498	49
50	**6500**	**4547**	**4482**	**4420**	**4360**	**4301**	**4245**	**4190**	**4137**	**4085**	**4036**	**3987**	**3941**	**3895**	**3852**	**3809**	**3768**	**3728**	**3690**	**3652**	**3616**	**50**
51	6681	4685	4620	4556	4494	4435	4377	4321	4267	4215	4164	4115	4067	4021	3976	3933	3891	3850	3811	3773	3736	51
52	6864	4826	4759	4694	4631	4570	4511	4454	4399	4346	4294	4244	4195	4148	4103	4058	4016	3974	3934	3895	3858	52
53	7049	4968	4900	4834	4770	4708	4648	4590	4533	4479	4426	4375	4325	4277	4231	4186	4142	4100	4059	4020	3982	53
54	7236	5113	5043	4976	4910	4847	4786	4727	4669	4614	4560	4508	4457	4408	4361	4315	4271	4228	4186	4146	4107	54
55	**7425**	**5259**	**5188**	**5119**	**5053**	**4988**	**4926**	**4866**	**4807**	**4751**	**4696**	**4643**	**4591**	**4542**	**4493**	**4447**	**4402**	**4358**	**4316**	**4275**	**4235**	**55**
56	7616	5407	5335	5265	5197	5132	5068	5007	4947	4889	4834	4780	4727	4677	4628	4580	4534	4490	4447	4405	4364	56
57	7809	5558	5484	5413	5344	5277	5212	5150	5089	5030	4973	4918	4865	4814	4764	4715	4669	4623	4580	4537	4496	57
58	8004	5710	5635	5562	5492	5424	5358	5294	5233	5173	5115	5059	5005	4953	4902	4853	4805	4759	4714	4671	4630	58
59	8201	5864	5788	5714	5642	5573	5506	5441	5378	5318	5259	5202	5147	5093	5042	4992	4943	4897	4851	4807	4765	59
60	**8400**	**6020**	**5942**	**5867**	**5794**	**5724**	**5656**	**5590**	**5526**	**5464**	**5405**	**5347**	**5291**	**5236**	**5184**	**5133**	**5084**	**5036**	**4990**	**4946**	**4902**	**60**
61	8601	6178	6099	6023	5949	5877	5808	5741	5676	5613	5552	5493	5436	5381	5328	5276	5226	5178	5131	5086	5042	61
62	8804	6338	6258	6180	6105	6032	5962	5893	5827	5763	5702	5642	5584	5528	5474	5421	5370	5321	5274	5228	5183	62
63	9009	6500	6418	6339	6263	6189	6117	6048	5981	5916	5853	5792	5734	5677	5621	5568	5517	5467	5418	5372	5326	63
64	9216	6664	6581	6501	6423	6348	6275	6204	6136	6070	6007	5945	5885	5827	5771	5717	5665	5614	5565	5517	5471	64
65	**9425**	**6830**	**6745**	**6664**	**6585**	**6508**	**6435**	**6363**	**6294**	**6227**	**6162**	**6099**	**6039**	**5980**	**5923**	**5868**	**5815**	**5763**	**5714**	**5665**	**5619**	**65**
66	9636	6998	6912	6829	6749	6671	6596	6523	6453	6385	6319	6256	6194	6134	6077	6021	5967	5915	5864	5815	5768	66
67	9849	7167	7080	6996	6915	6836	6760	6686	6614	6545	6479	6414	6351	6291	6232	6176	6121	6068	6017	5967	5919	67
68	10064	7339	7251	7165	7083	7003	6925	6850	6778	6708	6640	6574	6511	6449	6390	6332	6277	6223	6171	6121	6072	68
69	10281	7513	7423	7336	7252	7171	7093	7017	6943	6872	6803	6736	6672	6610	6549	6491	6435	6380	6327	6276	6227	69
70	**10500**	**7689**	**7597**	**7509**	**7424**	**7342**	**7262**	**7185**	**7110**	**7038**	**6968**	**6901**	**6835**	**6772**	**6711**	**6652**	**6595**	**6539**	**6486**	**6434**	**6384**	**70**

D = DISTANCE REQUIRED FOR SAFE BRAKING
TB = TONS PER OPERATIVE BRAKE [100]
Vo = INITIAL VELOCITY AT BEGINNING OF BRAKING
G = AVERAGE GRADE IN PERCENT

FORMULA:

$$\text{DISTANCE} = 0.01TBV_o^2 + (80V_o)^{1-(GTB/1300)}$$

* SPEED OR VEOCITY IN MILES PER HOUR (MPH)

REV	DATE	BY	CHK	APP	DESCRIPTION	REV	DATE	BY	CHK	APP	
					01012024 FOURTH EDITION						

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

Bin Zhang

DEPUTY DIRECTOR, ENGINEERING

Caltrain

1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SPEED CHARTS
BRAKING DISTANCE CHART
ASCENDING – 100 TPOB
SHEET 2 OF 2

CADD FILE NAME: SD-5004
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5004

FREIGHT—TRAIN REDUCING DISTANCES

GRADE	VELOCITY AT ORIGIN (Vo) — REDUCTION TO 15 M.P.H.									REDUCTION TO 25 M.P.H.							REDUCTION TO 40 M.P.H.				GRADE
GRADE	20	25	30	35	40	45	50	55	60	30	35	40	45	50	55	60	45	50	55	60	GRADE
2	**787**	**1119**	**1498**	**1923**	**2397**	**2919**	**3489**	**4108**	**4776**	**1307**	**1733**	**2207**	**2729**	**3299**	**3918**	**4585**	**2310**	**2881**	**3499**	**4167**	**2**
1.9	813	1153	1539	1972	2453	2982	3559	4185	4860	1341	1774	2255	2784	3362	3988	4662	2348	2925	3551	4226	1.9
1.8	841	1188	1582	2023	2512	3049	3634	4267	4950	1377	1818	2307	2844	3429	4062	4745	2388	2973	3607	4289	1.8
1.7	871	1227	1629	2078	2575	3120	3714	4355	5046	1416	1865	2362	2907	3501	4143	4833	2432	3025	3667	4357	1.7
1.6	903	1267	1678	2137	2642	3196	3799	4449	5148	1457	1916	2422	2976	3578	4228	4928	2479	3082	3732	4431	1.6
1.5	**936**	**1310**	**1731**	**2199**	**2714**	**3278**	**3889**	**4550**	**5258**	**1502**	**1970**	**2485**	**3048**	**3660**	**4320**	**5029**	**2531**	**3143**	**3803**	**4511**	**1.5**
1.4	972	1356	1787	2265	2791	3364	3986	4657	5376	1549	2027	2553	3127	3748	4419	5138	2586	3208	3879	4598	1.4
1.3	1010	1405	1847	2336	2872	3457	4090	4771	5501	1600	2089	2625	3210	3843	4524	5254	2647	3279	3961	4691	1.3
1.2	1050	1457	1910	2411	2959	3556	4200	4893	5635	1654	2155	2703	3299	3944	4637	5379	2712	3356	4049	4791	1.2
1.1	1093	1512	1978	2491	3052	3661	4318	5024	5778	1712	2225	2786	3395	4052	4758	5512	2782	3439	4145	4899	1.1
1	**1138**	**1570**	**2050**	**2576**	**3151**	**3773**	**4444**	**5164**	**5932**	**1773**	**2300**	**2875**	**3497**	**4168**	**4887**	**5655**	**2857**	**3528**	**4248**	**5016**	**1**
0.9	1186	1633	2126	2667	3256	3893	4579	5312	6095	1839	2381	2969	3606	4292	5026	5809	2939	3625	4358	5141	0.9
0.8	1237	1699	2207	2764	3368	4021	4722	5472	6270	1910	2466	3071	3723	4424	5174	5972	3027	3728	4478	5276	0.8
0.7	1291	1769	2294	2867	3488	4157	4875	5641	6457	1985	2558	3179	3848	4566	5333	6148	3122	3840	4607	5422	0.7
0.6	1349	1844	2386	2977	3615	4302	5038	5823	6656	2066	2656	3295	3982	4718	5502	6336	3225	3960	4745	5578	0.6
0.5	**1410**	**1923**	**2484**	**3093**	**3751**	**4457**	**5212**	**6016**	**6870**	**2152**	**2761**	**3418**	**4125**	**4880**	**5684**	**6537**	**3335**	**4090**	**4894**	**5747**	**0.5**
0.4	1474	2007	2588	3218	3896	4622	5398	6223	7097	2243	2872	3551	4277	5053	5878	6752	3453	4229	5054	5928	0.4
0.3	1543	2097	2699	3350	4050	4799	5597	6444	7341	2341	2992	3692	4441	5239	6086	6983	3581	4379	5226	6123	0.3
0.2	1616	2192	2817	3491	4214	4986	5808	6680	7601	2445	3119	3842	4615	5437	6308	7229	3718	4540	5412	6333	0.2
0.1	1693	2293	2942	3640	4389	5187	6034	6931	7878	2556	3255	4003	4801	5649	6546	7493	3866	4714	5611	6558	0.1
0	**1775**	**2400**	**3075**	**3800**	**4575**	**5400**	**6275**	**7200**	**8175**	**2675**	**3400**	**4175**	**5000**	**5875**	**6800**	**7775**	**4025**	**4900**	**5825**	**6800**	**0**
−0.1	1862	2514	3217	3970	4773	5628	6532	7487	8492	2802	3555	4358	5213	6117	7072	8077	4196	5100	6055	7060	−0.1
−0.2	1954	2635	3367	4150	4985	5870	6806	7793	8830	2936	3720	4554	5440	6376	7362	8400	4379	5315	6302	7339	−0.2
−0.3	2052	2763	3527	4343	5210	6129	7099	8120	9192	3080	3896	4763	5682	6652	7673	8745	4576	5546	6567	7639	−0.3
−0.4	2156	2900	3697	4547	5450	6404	7411	8469	9578	3234	4084	4986	5941	6947	8005	9115	4788	5794	6852	7961	−0.4
−0.5	**2266**	**3045**	**3878**	**4765**	**5705**	**6698**	**7744**	**8841**	**9991**	**3397**	**4284**	**5224**	**6217**	**7263**	**8360**	**9510**	**5015**	**6060**	**7158**	**8307**	**−0.5**
−0.6	2382	3198	4070	4997	5977	7011	8099	9239	10431	3571	4498	5478	6512	7600	8740	9932	5259	6346	7486	8678	−0.6
−0.7	2506	3362	4275	5243	6267	7345	8477	9663	10902	3757	4726	5750	6828	7960	9145	10384	5520	6652	7838	9077	−0.7
−0.8	2637	3535	4492	5506	6576	7701	8881	10116	11404	3955	4969	6039	7164	8344	9579	10867	5801	6981	8215	9504	−0.8
−0.9	2776	3719	4723	5785	6904	8080	9312	10599	11941	4166	5228	6347	7523	8755	10042	11384	6102	7334	8621	9962	−0.9
−1	**2923**	**3915**	**4968**	**6082**	**7254**	**8485**	**9772**	**11115**	**12514**	**4390**	**5504**	**6676**	**7907**	**9194**	**10537**	**11936**	**6425**	**7712**	**9055**	**10454**	**−1**
−1.1	3079	4122	5229	6398	7627	8915	10262	11666	13126	4630	5798	7028	8316	9662	11066	12527	6771	8117	9521	10981	−1.1
−1.2	3245	4342	5506	6734	8024	9374	10784	12253	13780	4884	6112	7402	8753	10162	11631	13158	7141	8551	10020	11547	−1.2
−1.3	3420	4576	5801	7092	8446	9864	11342	12880	14478	5156	6447	7802	9219	10697	12235	13833	7539	9017	10556	12153	−1.3
−1.4	3606	4824	6114	7472	8896	10385	11936	13550	15223	5445	6803	8227	9716	11267	12881	14554	7965	9516	11129	12803	−1.4
−1.5	**3803**	**5087**	**6447**	**7877**	**9376**	**10941**	**12571**	**14264**	**16019**	**5753**	**7183**	**8682**	**10247**	**11877**	**13570**	**15325**	**8421**	**10051**	**11744**	**13500**	**−1.5**
−1.6	4012	5367	6800	8307	9886	11533	13247	15026	16869	6080	7588	9166	10813	12527	14306	16150	8910	10624	12403	14246	−1.6
−1.7	4233	5664	7176	8765	10429	12164	13968	15839	17777	6429	8019	9682	11417	13221	15093	17031	9433	11237	13109	15046	−1.7
−1.8	4468	5978	7575	9253	11007	12836	14737	16707	18746	6801	8478	10233	12062	13963	15933	17972	9993	11894	13865	15904	−1.8
−1.9	4717	6312	7999	9771	11623	13553	15557	17634	19781	7196	8968	10820	12750	14754	16831	18978	10593	12598	14674	16822	−1.9
−2	**4980**	**6667**	**8450**	**10322**	**12279**	**14316**	**16431**	**18622**	**20886**	**7617**	**9489**	**11446**	**13483**	**15598**	**17789**	**20053**	**11235**	**13351**	**15541**	**17806**	**−2**

ASCENDING

DESCENDING

D = DISTANCE REQUIRED FOR SAFE BRAKING
TB = TONS PER OPERATIVE BRAKE [100]
Vo = INITIAL VELOCITY AT BEGINNING OF BRAKING
Vf = FINAL VELOCITY AT END OF BRAKING [40]
G = AVERAGE GRADE IN PERCENT

FORMULA:

$$\text{DISTANCE} = 0.01TBV_o^2 + (80V_o)^{1-(GTB/1300)} - (0.01TBV_f^2)^{1-(GTB/1900)}$$

REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

Bin Zhang

DEPUTY DIRECTOR, ENGINEERING

1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SPEED CHARTS
REDUCING DISTANCE CHART
FOR 100 TPOB FREIGHT TRAIN

CADD FILE NAME: SD−5005
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD−5005

PASSENGER TRAIN DISTANCE IN FEET vs. SPEED IN M.P.H.

SPEED MPH	DISTANCE IN FEET ⑤ STOP	⑥ IRED	⑦ FRED	⑧ APER
0	0	0	0	0
1	13	12	1	1
2	27	26	3	3
3	43	42	7	6
4	60	59	12	11
5	79	77	19	17
6	100	97	27	24
7	123	119	37	33
8	147	142	48	43
9	173	166	61	54
10	201	192	75	67
11	230	220	91	81
12	261	249	108	96
13	293	279	127	113
14	328	311	147	131
15	363	345	169	150
16	401	380	192	171
17	440	416	217	193
18	481	454	243	216
19	524	494	271	241
20	568	535	300	267
21	614	577	331	294
22	661	621	363	323
23	711	667	397	353
24	762	714	432	384
25	814	762	469	417
26	868	812	507	451
27	924	863	547	486
28	982	916	588	523
29	1041	971	631	561
30	1102	1027	675	600
31	1164	1084	721	641
32	1229	1143	768	683
33	1295	1204	817	726
34	1362	1266	867	771
35	1431	1329	919	817
36	1502	1394	972	864
37	1575	1461	1027	913
38	1649	1529	1083	963
39	1725	1598	1141	1014
40	1802	1669	1200	1067
41	1882	1742	1261	1121
42	1963	1816	1323	1176
43	2045	1891	1387	1233
44	2129	1968	1452	1291
45	2215	2047	1519	1350
46	2303	2127	1587	1411
47	2392	2208	1657	1473
48	2483	2291	1728	1536
49	2576	2376	1801	1601
50	2670	2462	1875	1666

SPEED MPH	DISTANCE IN FEET ⑤ STOP	⑥ IRED	⑦ FRED	⑧ APER
51	2766	2549	1951	1734
52	2863	2638	2028	1802
53	2962	2728	2107	1872
54	3063	2820	2187	1944
55	3166	2914	2269	2016
56	3270	3009	2352	2090
57	3376	3105	2437	2166
58	3484	3203	2523	2242
59	3593	3303	2611	2320
60	3704	3404	2700	2400
61	3816	3506	2791	2480
62	3930	3610	2883	2562
63	4046	3716	2977	2646
64	4164	3823	3072	2730
65	4283	3931	3169	2816
66	4404	4041	3267	2904
67	4527	4153	3367	2992
68	4651	4266	3468	3082
69	4777	4380	3571	3174
70	4904	4496	3675	3266
71	5033	4614	3781	3360
72	5164	4733	3888	3456
73	5297	4853	3997	3552
74	5431	4975	4107	3650
75	5567	5098	4219	3750
76	5705	5223	4332	3850
77	5844	5350	4447	3952
78	5985	5478	4563	4056
79	6127	5607	4681	4160
80	6272	5738	4800	4266
81	6417	5871	4921	4374
82	6565	6005	5043	4482
83	6714	6140	5167	4592
84	6865	6277	5292	4704
85	7018	6416	5419	4816
86	7172	6556	5547	4930
87	7328	6697	5677	5045
88	7485	6840	5808	5162
89	7654	6985	5941	5280
90	7805	7131	6075	5399
91	7968	7278	6211	5520
92	8132	7427	6348	5642
93	8298	7578	6487	5765
94	8466	7730	6627	5890
95	8635	7883	6769	6016
96	8806	8038	6912	6143
97	8978	8195	7057	6272
98	9153	8353	7203	6402
99	9328	8512	7351	6533
100	9506	8673	7500	6666

SPEED MPH	DISTANCE IN FEET ⑤ STOP	⑥ IRED	⑦ FRED	⑧ APER
101	9685	8835	7651	6800
102	9866	8999	7803	6935
103	10049	9165	7957	7072
104	10233	9332	8112	7210
105	10419	9500	8269	7349
106	10606	9670	8427	7490
107	10796	9842	8587	7632
108	10986	10015	8748	7775
109	11179	10189	8911	7920
110	11373	10365	9075	8066
111	11569	10543	9241	8213
112	11767	10722	9408	8362
113	11966	10902	9577	8512
114	12167	11084	9747	8663
115	12369	11268	9919	8816
116	12574	11453	10092	8970
117	12779	11639	10267	9125
118	12987	11827	10443	9282
119	13196	12017	10621	9440
120	13407	12208	10800	9599
121	13620	12400	10981	9760
122	13834	12594	11163	9922
123	14050	12790	11347	10085
124	14267	12987	11532	10250
125	14487	13185	11719	10416
126	14707	13385	11907	10583
127	14930	13586	12097	10752
128	15154	13789	12288	10922
129	15380	13994	12481	11093
130	15608	14200	12675	11266
131	15837	14407	12871	11440
132	16068	14616	13068	11615
133	16300	14827	13267	11791
134	16535	15039	13467	11969
135	16770	15252	13669	12149
136	17008	15467	13872	12329
137	17247	15684	14077	12511
138	17488	15902	14283	12695
139	17731	16121	14491	12879
140	17975	16342	14700	13065
141	18221	16565	14911	13253
142	18468	16789	15123	13441
143	18718	17014	15337	13631
144	18968	17241	15552	13823
145	19221	17470	15769	14015
146	19475	17700	15987	14209
147	19731	17931	16207	14405
148	19989	18164	16428	14601
149	20248	18399	16651	14799
150	20509	18634	16875	14998

FOR STOPPING DISTANCES:

A) SELECT MAXIMUM AUTHORIZED SPEED (OR INITIAL SPEED) IN MPH COLUMN.

B) READ DISTANCE TO STOP ON SAME LINE IN COLUMN 5.

FOR REDUCING DISTANCES:

A) SELECT MAXIMUM AUTHORIZED SPEED (OR INITIAL SPEED) IN MPH COLUMN.

B) READ DISTANCE ON SAME LINE IN COLUMN 6 & 7.

C) SUBTRACT DISTANCE DERIVED FROM COLUMN 7 FROM DISTANCE DERIVED FROM COLUMN 6 ; THIS IS THE REDUCING DISTANCE.*

NOTES:

1) "*" INDICATES THAT ACTUAL BRAKING TESTS WERE NOT PERFORMED ON THIS DATA* FOR INFORMATION ONLY*

2) EQUATIONS FOR CALCULATIONS:

⑤ STOPPING DISTANCE:

$$D_{STOP} = 0{*}83333V_1^2 + 11{*}73V_1$$

⑥–⑦ REDUCING DISTANCE:

$$D_{RED} = D_{IRED} - D_{FRED}$$

$$= 0{*}7500(V_1^2 - V_F^2) + 11{*}73V_1$$

REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

Bin Zhang

DEPUTY DIRECTOR, ENGINEERING

Caltrain

1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SPEED CHARTS
PASSENGER TRAIN
BRAKING DISTANCE CALCULATIONS

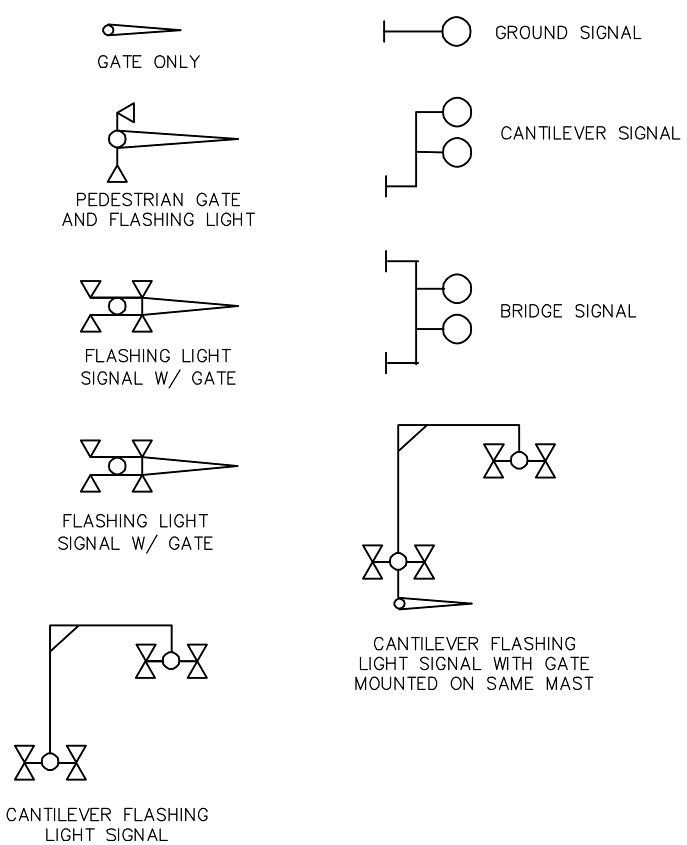
CADD FILE NAME: SD-5006

REV: EDITION: FOURTH

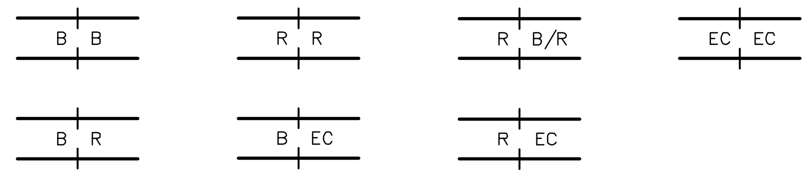
SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5006

GATES AND SIGNALS

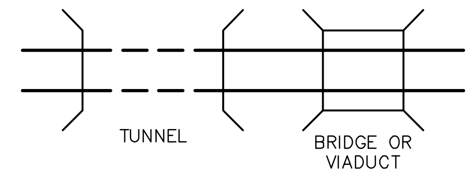


TRACK CIRCUITS

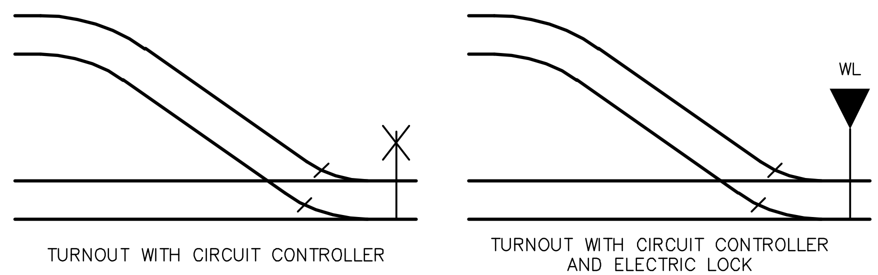


B/R – TRACK BATTERY WITH FLOATER RELAY LOCATION
EC – ELECTRONICALLY CODED
R – TRACK RELAY LOCATION
B – TRACK BATTERY LOCATION
(L) – BATTERY CHOKE

TUNNELS AND BRIDGES



HAND–OPERATED TURNOUTS



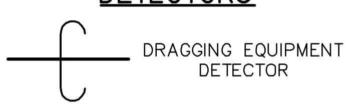
CALTRAIN SIGNAL SYSTEM NOMENCLATURE

NWS – NORMAL SWITCH REQUEST
RWS – REVERSE SWITCH REQUEST
SGHS – SOUTHWARD SIGNAL REQUEST
NGHS – NORTHWARD SIGNAL REQUEST
FLT – SIGNAL FLEETING
NWK – NORMAL SWITCH INDICATION
RWK – REVERSE SWITCH INDICATION
SGK – SOUTHWARD SIGNAL CLEAR INDICATION
NGK – NORTHWARD SIGNAL CLEAR INDICATION
TEK – SIGNAL IN TIME INDICATION
TK – OS TRACK INDICATION
AK – APPROACH TRACK INDICATION
NWP – NORMAL SWITCH POINT POSITION
RWP – REVERSE SWITCH POINT POSITION
NWR – NORMAL SWITCH CONTROL RELAY
RWR – REVERSE SWITCH CONTROL RELAY
NJSP – DUAL SELECTOR LEVER
WBC – SWITCH CONTROL RELAY BACK CHECK
GE – GREEN SIGNAL LAMP
YE – YELLOW SIGNAL LAMP
RE – RED SIGNAL LAMP
UAX – UPSTREAM ADJACENT CROSSING
DAX – DOWNSTREAM ADJACENT CROSSING
XR – CROSSING CONTROL RELAY
GCR – GATE CONTROL RELAY
GPR – GATE REPEATER RELAY (GATE IN UP POSITION)
GD – GATE DOWN
FR – FLASHER RELAY
EMS – EMERGENCY ALARM CONTROL CIRCUITS
LOS – LOSS OF SHUNT

CALTRAIN SIGNAL SYSTEM NOMENCLATURE TRAFFIC CONTROL/SUPERVISORY CIRCUITS

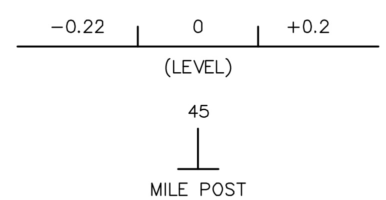
IVPMT – PREEMPTION RELAY POSITIVE
NIVPMT – PREEMPTION RELAY NEGATIVE
2VPMT – GATE DOWN RELAY POSITIVE
N2VPMT – PREEMPTION RELAY NEGATIVE
BVSUP – SUPERVISORY RELAY POSITIVE
NBVSUP – SUPERVISORY RELAY NEGATIVE
BX – SOURCE ENERGY POSITIVE
CX – SOURCE ENERGY NEGATIVE
HEALTH – TRAFFIC SIGNAL HEALTH POSITIVE
NHEALTH – TRAFFIC SIGNAL HEALTH NEGATIVE

DETECTORS

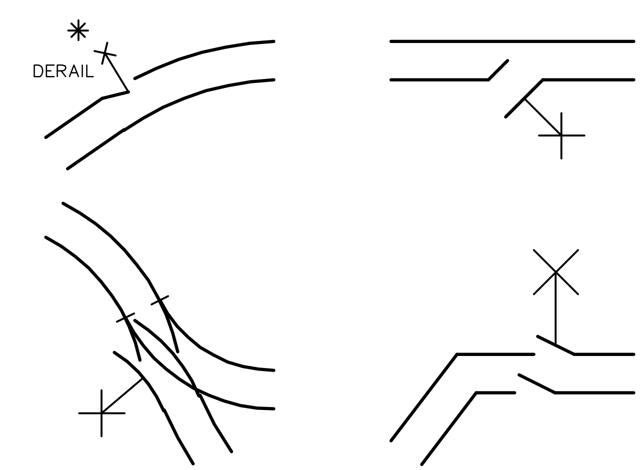


PROFILE (GRADE)

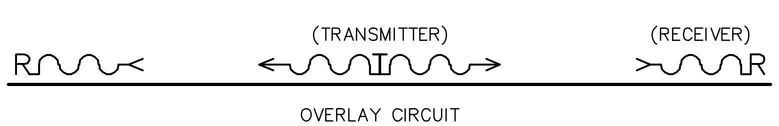
(FOR SOUTHBOUND MOVEMENT LEFT TO RIGHT)

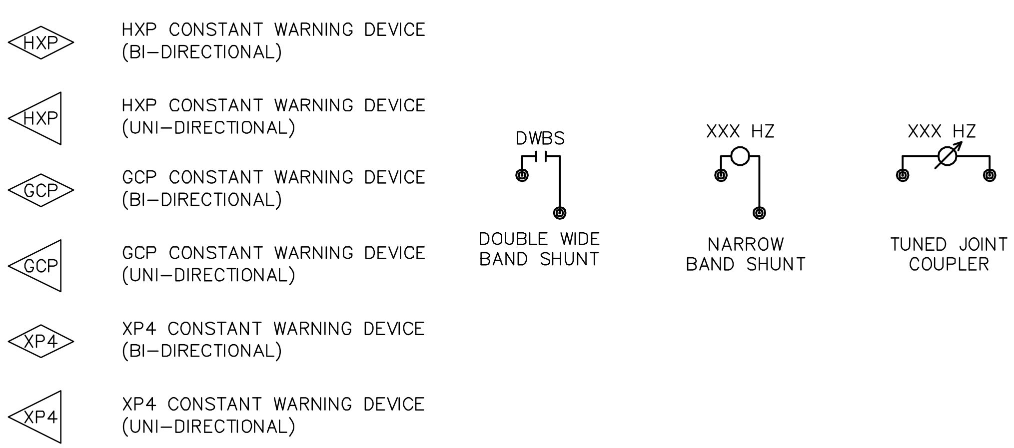


DERAILS

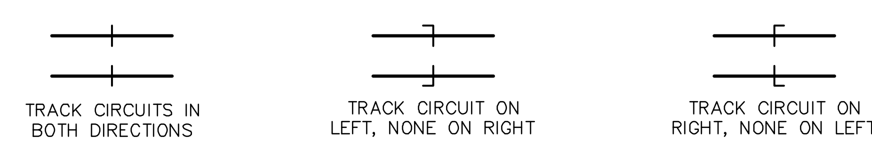


TRACK INSTRUMENT





INSULATED RAIL JOINTS



REV	DATE	BY	CHK	APP	DESCRIPTION	REV	DATE	BY	CHK	APP
					01012024 FOURTH EDITION					

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY: Bin Zhang
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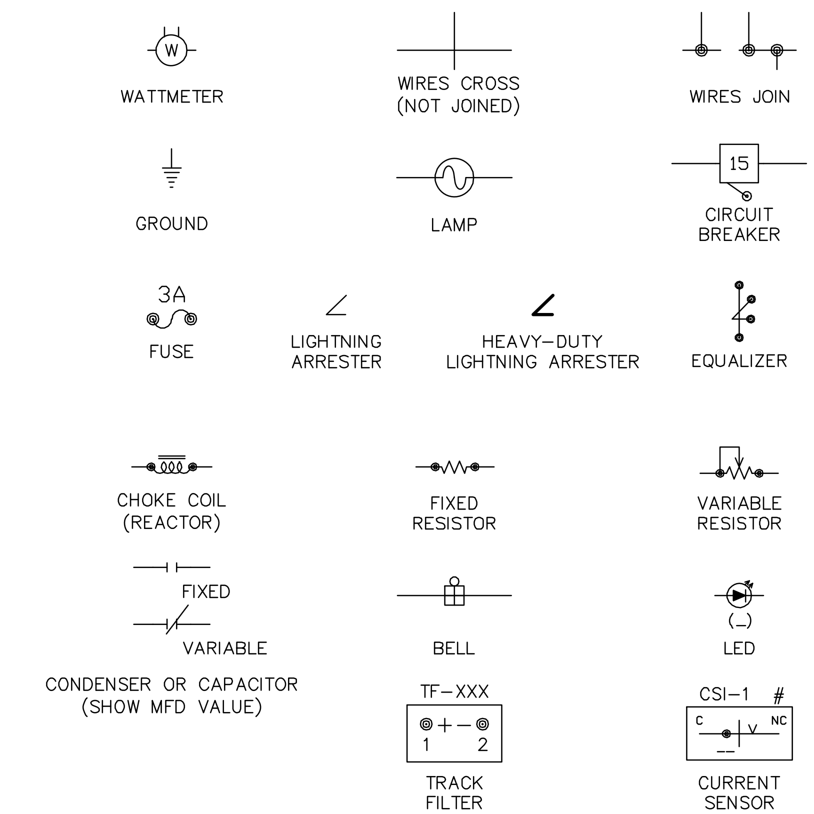
Caltrain
1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

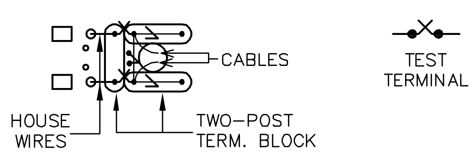
SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL

CIRCUIT PLAN SYMBOLS

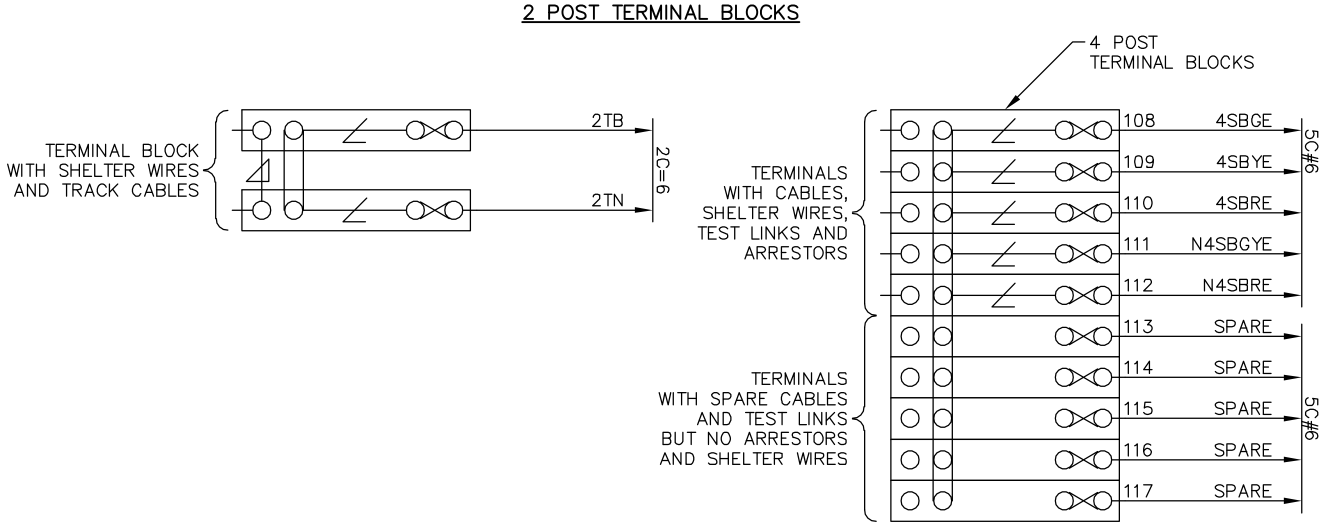
CADD FILE NAME: SD–5101
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD–5101



VARIOUS SYMBOLS

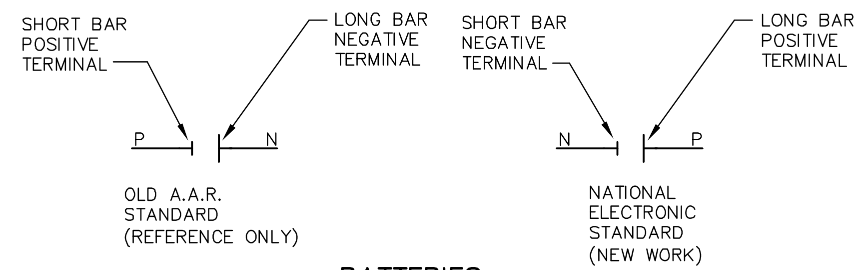


2 POST TERMINAL BLOCKS



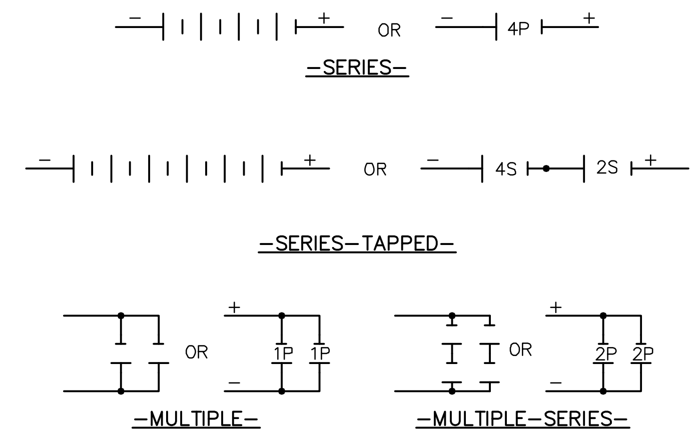
4 POST TERMINAL BLOCKS

DETAILS FOR TERMINAL BOARDS



BATTERIES

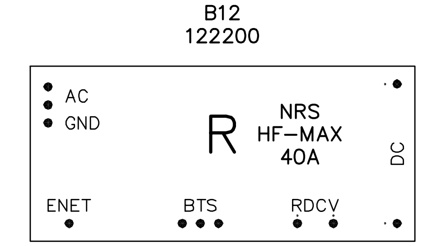
NOTE:
THE NATIONAL ELECTRONIC STANDARD IS SHOWN HERE TO ACQUAINT OUR PERSONNEL WITH THE SYMBOL USED BY OTHER INDUSTRIES AND IS NOT FOR USE ON SIGNAL CIRCUIT PLANS.



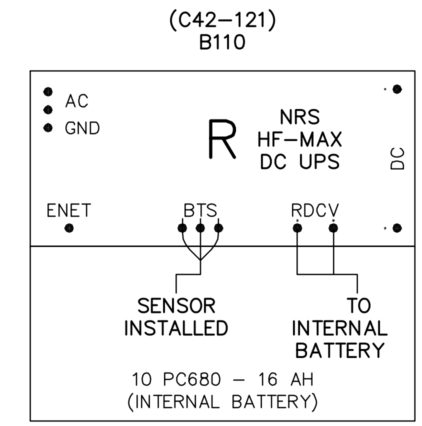
SPECIFY NUMBER OF CELLS USED AND, USING SYMBOLS BELOW, SHOW THE TYPE.

D-DRY CELLS
N-NICKEL-IRON OR NICKEL-CADMIUM STORAGE CELLS

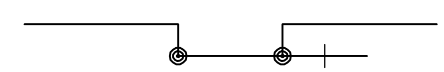
CIRCUIT ARRANGEMENTS



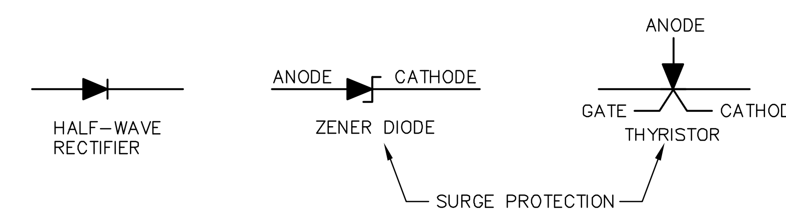
HF-MAX CHARGER



HF-MAX CHARGER 110 V DC



KNIFE SWITCH



DEVICES USED WITH RECTIFIERS

REV	DATE	BY	CHK	APP	DESCRIPTION
	01012024				FOURTH EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

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San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
COMPONENT SYMBOLS
AND CIRCUIT PLAN SYMBOLS

CADD FILE NAME: SD-5102
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5102

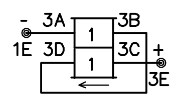
ACCEPTABLE PLUG-IN RELAYS FOR USE ON CALTRAIN PROJECTS

RELAY DESCRIPTION	BASE TYPE	BASE DWG #	CONTACT CONFIGURATION	ASO	OLD SPTC TAB	SIEMENS	OLD SPTC TAB
RELAY, 2 OHM BIASED NEUTRAL TRACK	B1	1	4FB–2F–1B	A62–120	RTM	400510	RTN
RELAY, 0.5 OHM BIASED NEUTRAL TRACK	B1	2	4FB–2F–1B	A62–120	RTM	400510	RTN
RELAY 500 OHM BIASED NEUTRAL REGULAR RELEASE	B1	3	6FB	A62–125	RBM	400500	RBN
RELAY, 60 OHM NEUTRAL FLASHER	B1	4	4FB	A62–195	REF	400700–X	RFH
RELAY, 100/100 OHM NEUTRAL POWER TRANSFER	B1	5	6FB HD	A62–579	RXR	400801–X	RXT
RELAY, 450/.069 OHM NEUTRAL LIGHT OUT	B1	7	4FB	A62–217	RXS	400302	RXU
RELAY, 500 OHM BIASED NEUTRAL SWITCH CONTROL	B1	9	2F–2B EHD	A62–429	RWN	400520	RWT
RELAY, MICROCHRON TIMING 1 SEC TO 19 MIN 59 SEC	B2	10	2FB–3F–2B	A62–627	RUK	NONE	
RELAY, .064/135 OHM NEUTRAL SWITCH OVERLOAD	B1	11	2CBO	A62–430	RWO	400601	RWU
RELAY, 24 OHM NEUTRAL SLOW RELEASE	B1	13	2FB	A62–365	RLY	400221	
RELAY, 500 OHM NEUTRAL REGULAR RELEASE	B1	14	6FB	A62–262	RLT	400000	RLT1
RELAY, 500 OHM NEUTRAL REGULAR RELEASE	B1	15	6FB HD	A62–580	RLV	400023	RLV1

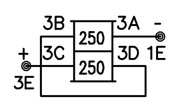
NOTE: SEE SD–5104 FOR CONTACT ARRANGEMENT

VITAL PLUG–IN RELAYS

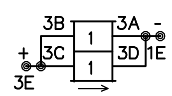
D.C. BIASED NEUTRAL RELAY



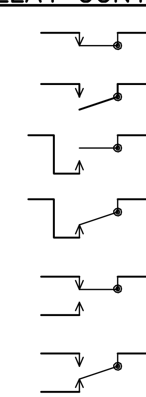
D.C. NEUTRAL RELAY



D.C. BIASED NEUTRAL RELAY– COILS IN PARALLEL



RELAY CONTACTS – TWO POSITION RELAYS



FRONT CONTACT–RELAY NORMALLY ENERGIZED

FRONT CONTACT–RELAY NORMALLY DE–ENERGIZED

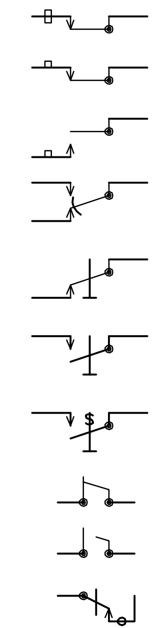
BACK CONTACT–RELAY NORMALLY ENERGIZED

BACK CONTACT–RELAY NORMALLY DE–ENERGIZED

FRONT AND BACK CONTACT–RELAY NORMALLY ENERGIZED

FRONT AND BACK CONTACT–RELAY NORMALLY DE–ENERGIZED

RELAY CONTACTS WITH SPECIAL CHARACTERISTICS



MAGNETIC BLOW–OUT

HIGH CURRENT (HEAVY DUTY) FRONT CONTACT

HIGH CURRENT (HEAVY DUTY) BACK CONTACT

CLOSE BEFORE OPEN CONTACT

PUSH BUTTON–PUSH TO OPEN

PUSH BUTTON–PUSH TO CLOSE

SPRING RETURN PUSH BUTTON

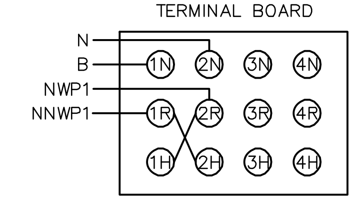
SWITCH LOCK CONTACT–CLOSED

SWITCH LOCK CONTACT–OPEN

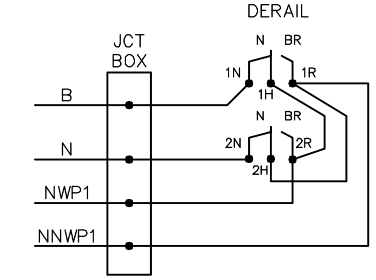
CHECKING CONTACT OF TIME ELEMENT RELAY USED TO CHECK THE RELAY NORMAL

SWITCH CIRCUIT CONTROLLER WIRING

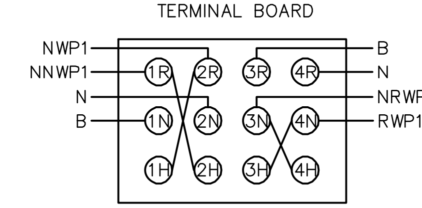
DERAIL OR SWITCH CIRCUIT CONTROLLER TERMINAL BOARD



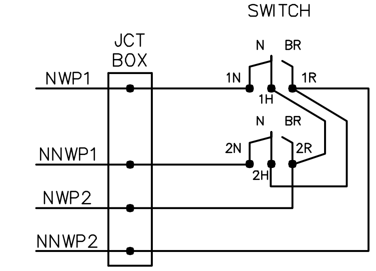
DERAIL

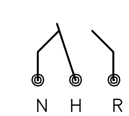


SECOND SWITCH IN SWITCH AND DERAIL COMBINATION OR CROSSOVER CIRCUIT CONTROLLER TERMINAL BOARD



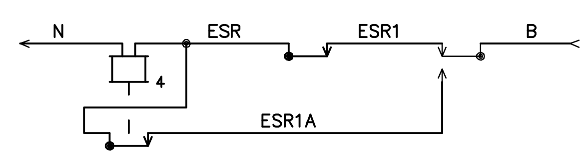
SWITCH





SWITCH CIRCUIT CONTROLLER CONTACT

TYPICAL CIRCUIT



REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

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1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
RELAYS AND RELAY CONTACTS
SHELF AND VITAL RELAYS

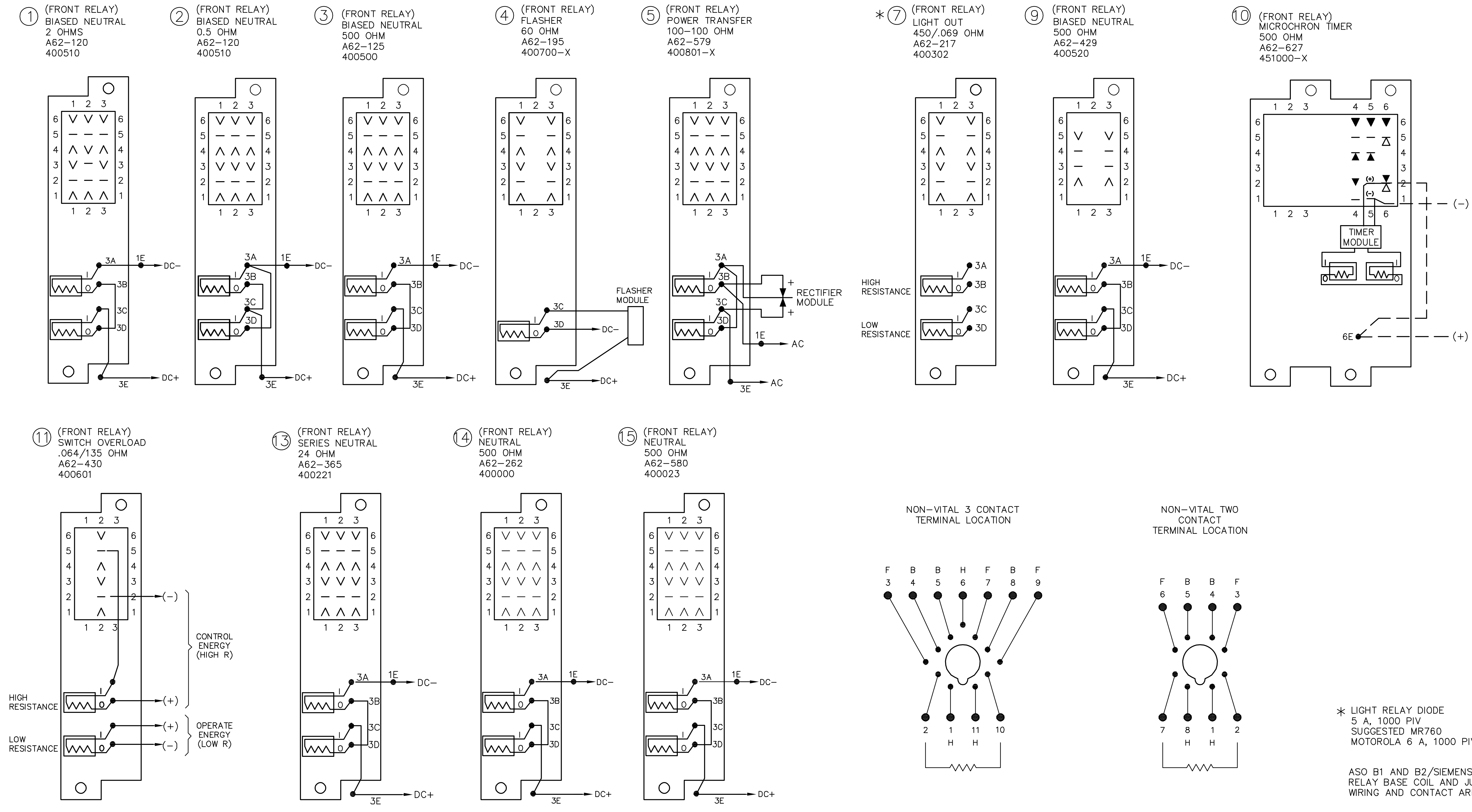
CADD FILE NAME: SD–5103

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD–5103



* LIGHT RELAY DIODE
5 A, 1000 PIV
SUGGESTED MR760
MOTOROLA 6 A, 1000 PIV

ASO B1 AND B2/SIEMENS ST1 AND ST2 RELAY BASE COIL AND JUMPER WIRING AND CONTACT ARRANGEMENT.

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PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:
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DEPUTY DIRECTOR, ENGINEERING

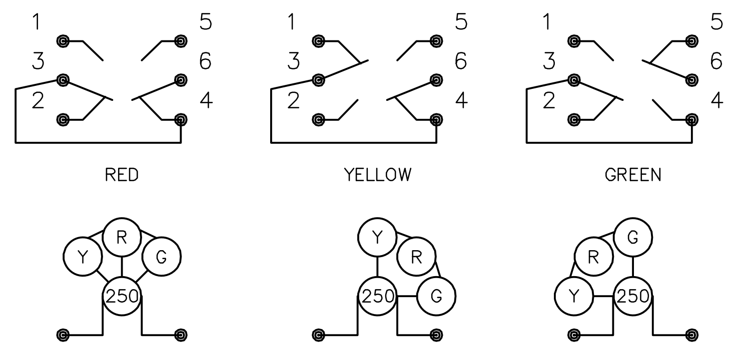
Caltrain
1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
PLUG-IN RELAY
TYPICAL CONTACT ARRANGEMENT

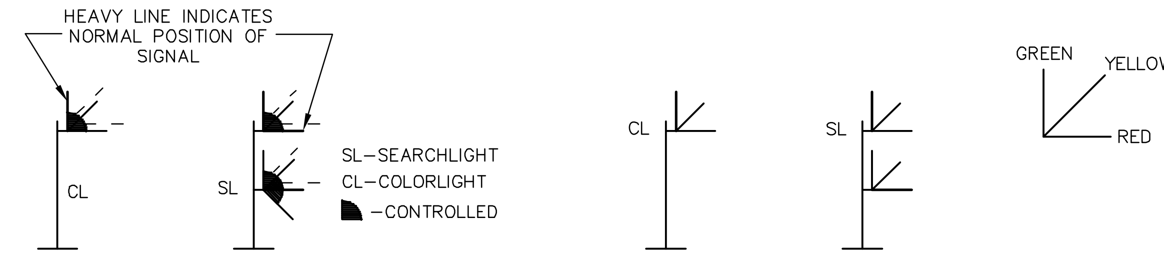
CADD FILE NAME: SD-5104
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5104

SEARCHLIGHT SIGNAL CONTACTS AND TERMINAL POST NUMBERING



TYPE H AND H2

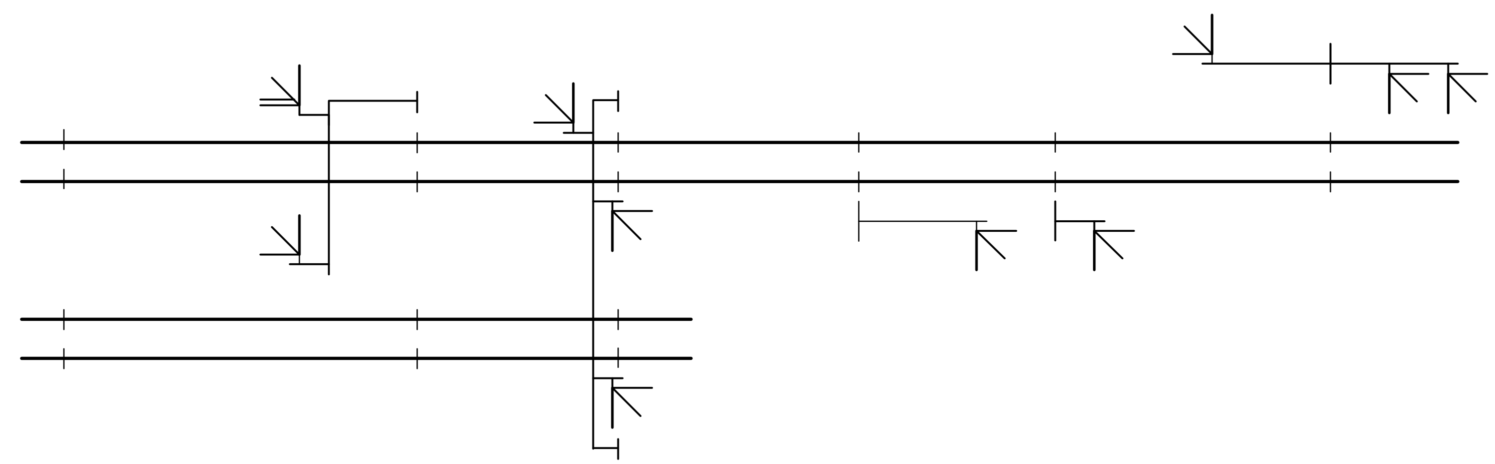
WAYSIDE SIGNAL SYMBOLS



CONTROLLED SIGNAL

AUTOMATIC SIGNAL

DASHED LINE DENOTES FLASHING ASPECT
THICKENED LINE DENOTES NORMAL ASPECT



CANTILEVER SIGNAL

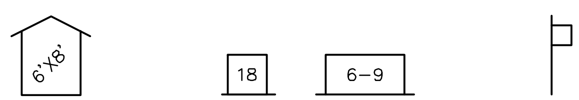
BRIDGE SIGNAL

GROUND SIGNAL

DWARF SIGNAL

BI–DIRECTIONAL SIGNALS (SINGLE MAST)

SIGNAL HOUSINGS



SIGNAL HOUSE

SIGNAL CASES

CASE ON POST

NUMERALS IN HOUSINGS INDICATE SIZE OR CAPACITY OF UNIT.

NOTE:

TYPES OF SIGNALS:
- CL = COLORLIGHT
- SL = SEARCHLIGHT
- UL = UNILENS
- LED = LIGHT EMITTING DIODE
- TL = TRICOLOR LED

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
SIGNALS AND HOUSING
GRAPHIC SYMBOLS

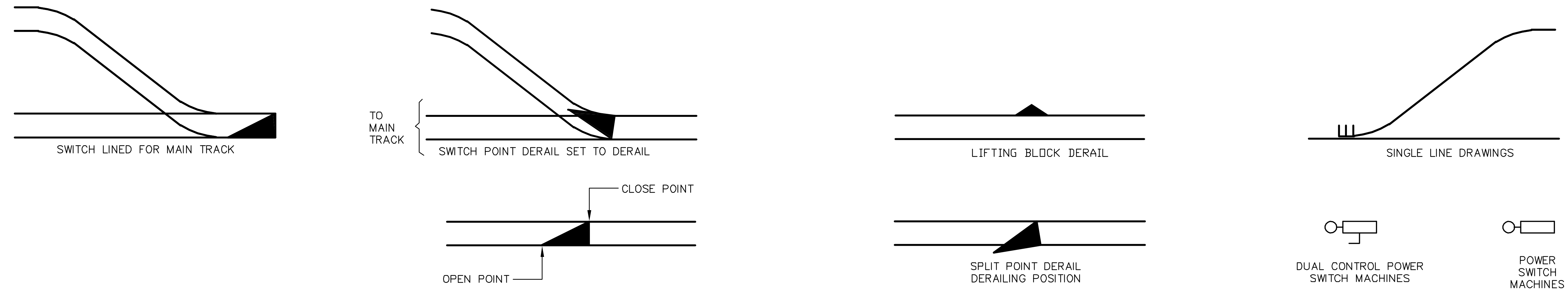
CADD FILE NAME: SD–5105

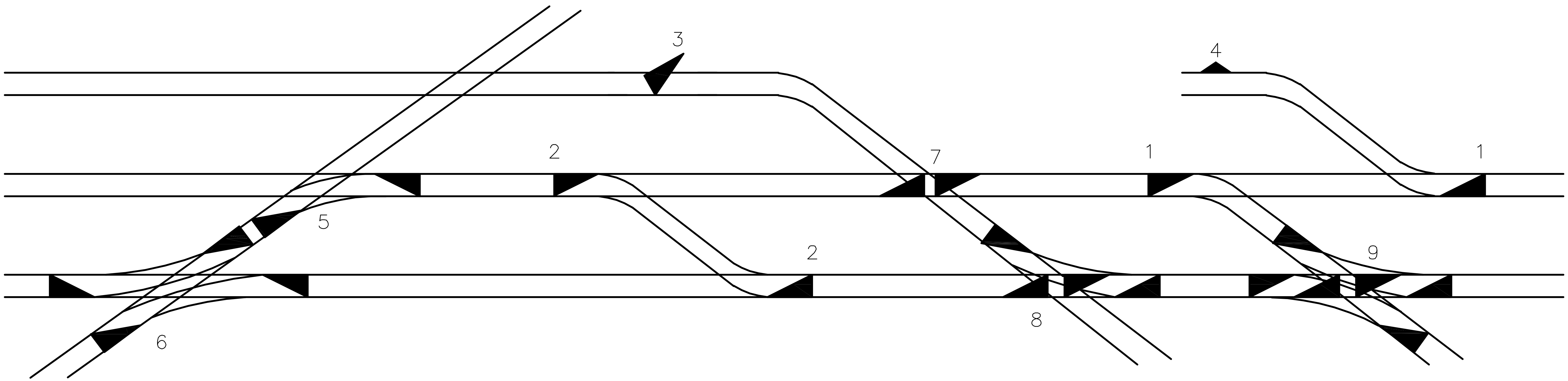
REV: EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD–5105

INTERLOCKED SWITCHES AND DERAILS





LINE PLAN

NOTES:

1. SINGLE TURNOUT
2. SINGLE CROSSOVER
3. DERAIL POINT TYPE (OLD)
4. DERAIL LIFT TYPE
5. SINGLE SLIP SWITCH WITH RIGID FROG
6. DOUBLE SLIP SWITCH WITH RIGID FROG
7. MOVEABLE POINT CROSSING FROG (M.P.F.)
8. SINGLE SLIP SWITCH WITH M.P.F.
9. DOUBLE SLIP SWITCH WITH M.P.F.

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL

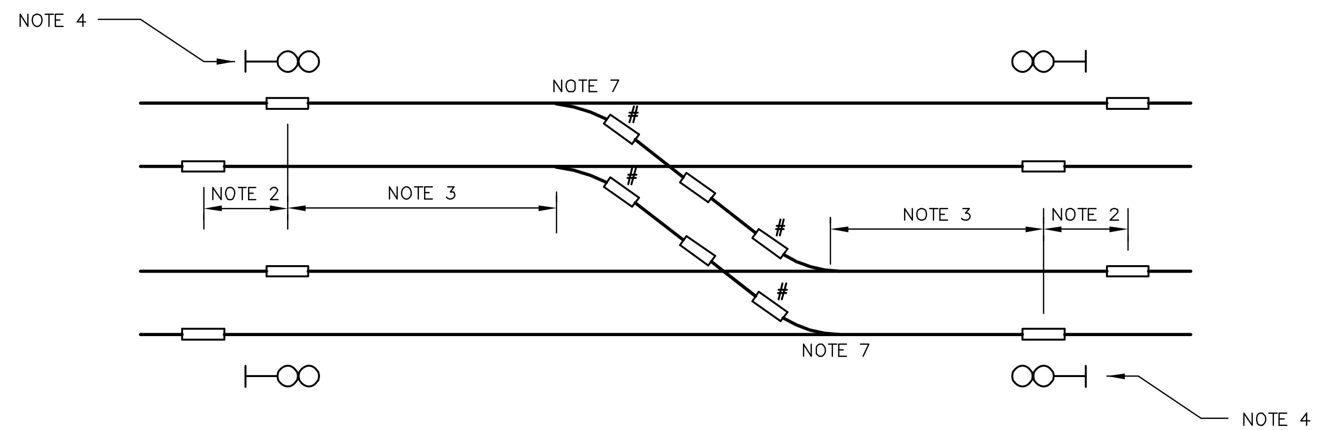
SWITCH AND DERAIL SYMBOLS

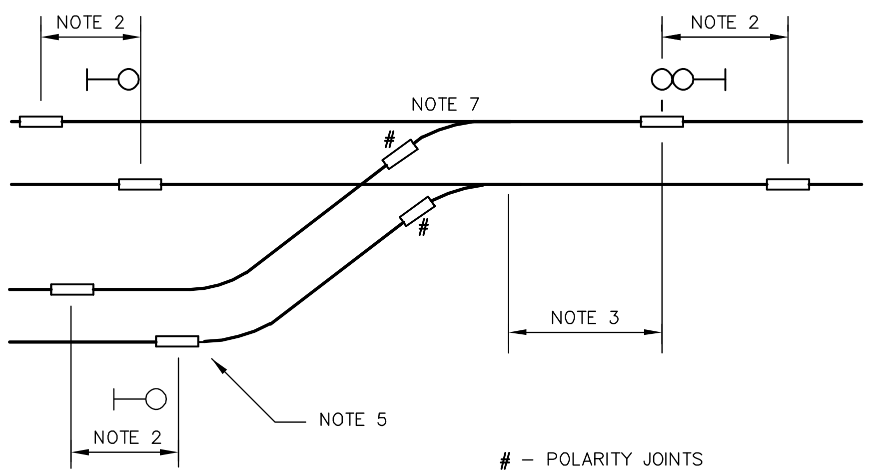
CADD FILE NAME: SD-5106

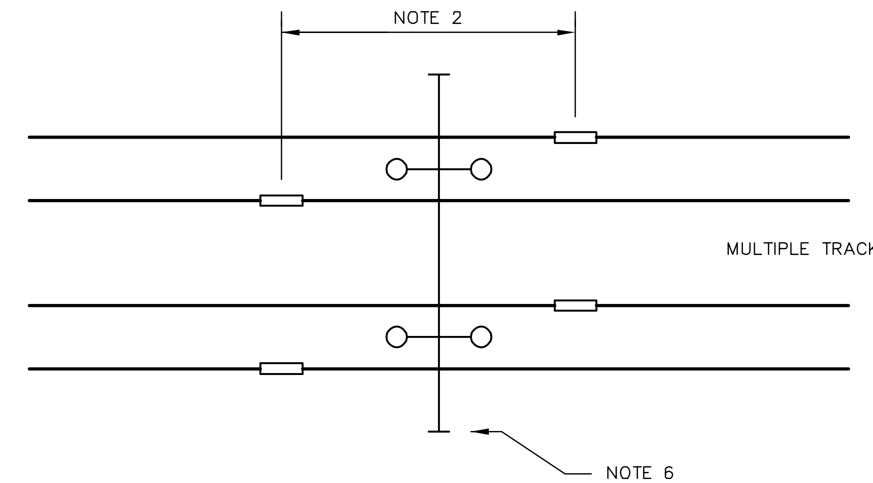
REV: EDITION: FOURTH

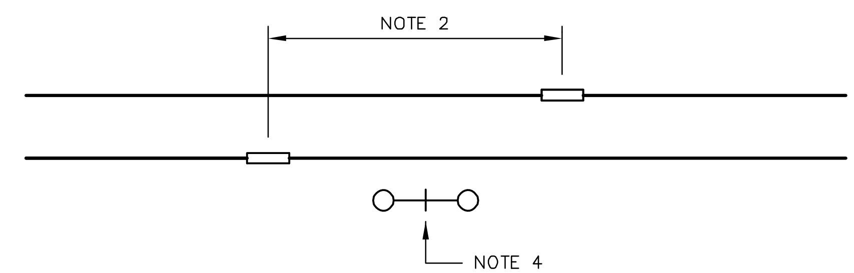
SIGNAL AND COMMUNICATIONS

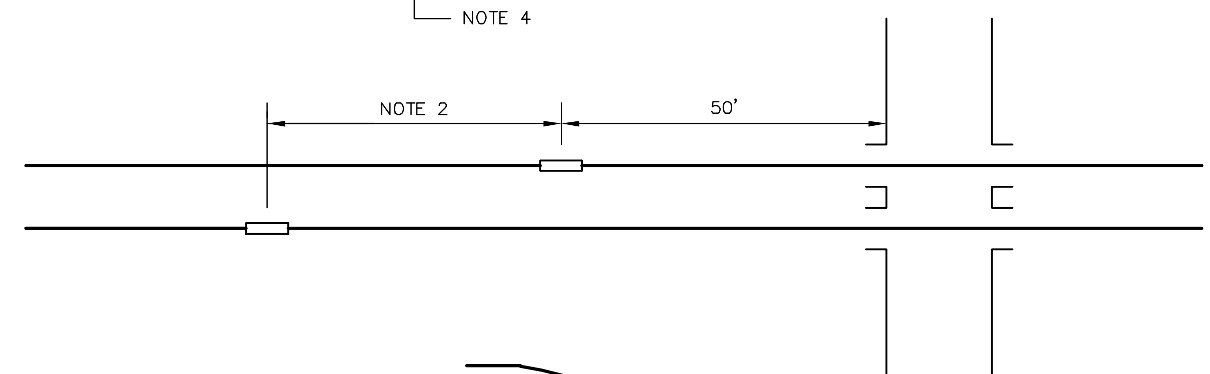
STANDARD DRAWING NO.: SD-5106

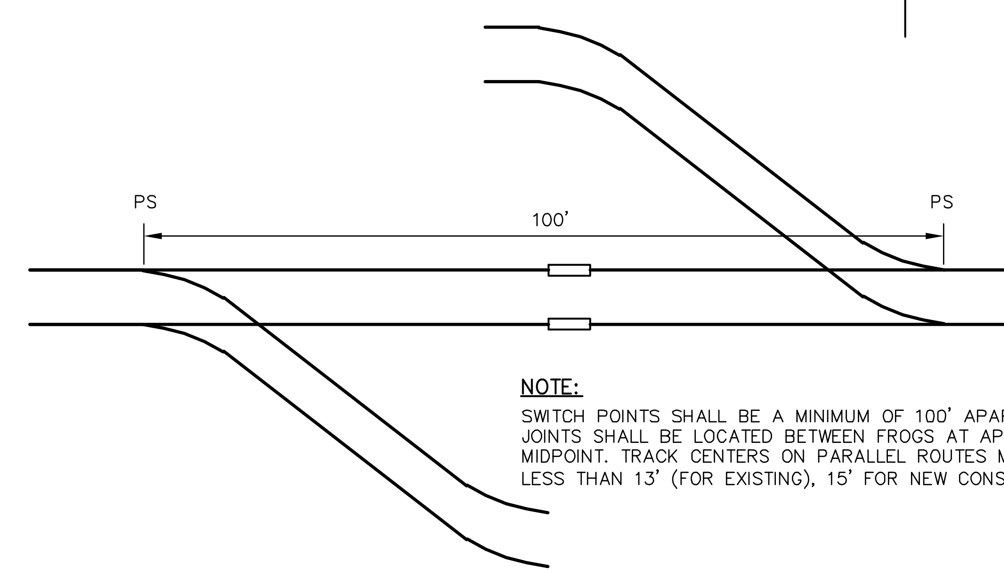












NOTE:
SWITCH POINTS SHALL BE A MINIMUM OF 100' APART. INSULATED JOINTS SHALL BE LOCATED BETWEEN FROGS AT APPROXIMATE MIDPOINT. TRACK CENTERS ON PARALLEL ROUTES MUST BE NO LESS THAN 13' (FOR EXISTING), 15' FOR NEW CONSTRUCTION

NOTES:

1. POLARITY JOINTS SHALL HAVE A MAXIMUM STAGGER OF 4'–6".
2. DISTANCE MEASURED BETWEEN END POSTS OF INSULATED JOINTS, EXCEPT POLARITY JOINTS, SHALL BE 4'–8" MIN AND 10' MAX.
3. DISTANCE FROM POINT OF SWITCH TO FIRST INSULATED JOINT SHALL BE APPROXIMATELY 50'. IN NO CASE SHALL THIS DISTANCE BE LESS THAN 20'. INSTALLATIONS LESS THAN 50' MUST BE APPROVED BY CALTRAIN DEPUTY DIRECTOR OF ENGINEERING.
4. SIGNAL SHALL BE CENTERED BETWEEN INSULATED JOINTS.
5. INSULATED JOINT SHALL BE PLACED APPROXIMATELY 50' BEYOND CLEARANCE POINT (13' CENTERS), EXCEPT WHERE THE CLEAR POINT IS ON TANGENT TRACK PARALLEL TO THE MAIN TRACK, IN WHICH CASE INSULATED JOINTS MAY BE PLACED AT CLEARANCE POINT PLUS 15'.
6. SIGNALS ON CANTILEVERS AND BRIDGES SHALL BE LOCATED DIRECTLY ABOVE CENTERLINE OF TRACK. CANTILEVER AND BRIDGE MOUNTED SIGNALS SHALL BE CENTERED BETWEEN INSULATING JOINTS.
7. TIE PLATES UNDER POLARITY JOINTS SHALL HAVE A MINIMUM 1" CLEARANCE FROM TIE PLATE OF OPPOSITE POLARITY.
8. ALL NEW INSULATED JOINTS SHALL COMPLY WITH PTC REQUIREMENTS.

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PENINSULA CORRIDOR JOINT POWERS BOARD

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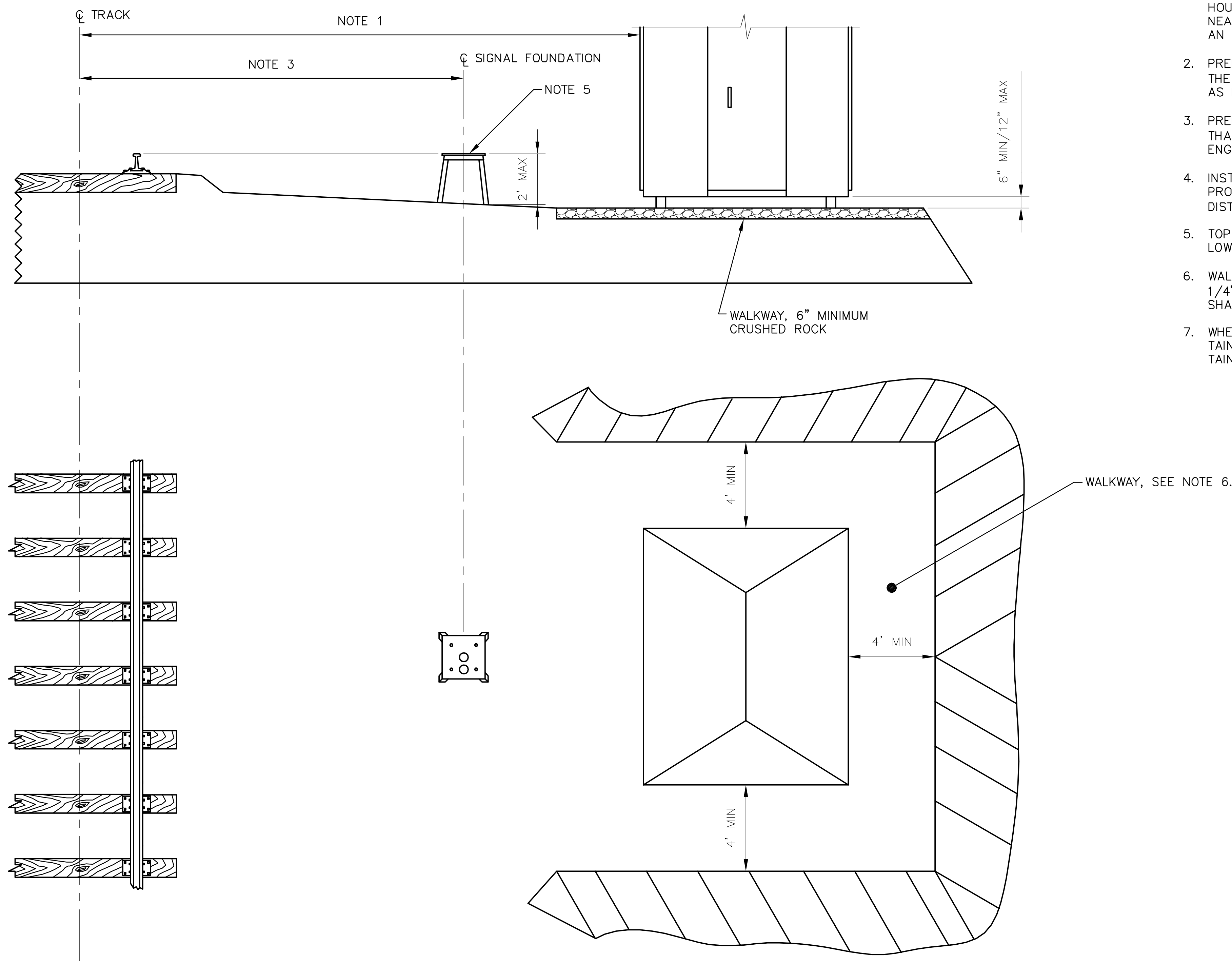
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
STANDARD PLACEMENT
INSULATED JOINTS
AT SIGNAL LOCATIONS

CADD FILE NAME: SD–5107
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD–5107



NOTES:

1. PREFERRED LOCATION FOR WAYSIDE SIGNAL HOUSES SHALL BE AS CLOSE AS POSSIBLE TO CALTRAIN'S RIGHT–OF–WAY LINE WHILE ALLOWING FOR THE 4' MINIMUM CLEARANCE REQUIRED AROUND THE HOUSE. WAYSIDE SIGNAL HOUSES SHALL BE NO LESS THAN 25' FROM THE CENTERLINE OF THE NEAREST TRACK. ANY DEVIATION FROM STANDARD DISTANCE SHALL REQUIRE AN APPROVED VARIANCE REQUEST.
2. PREFERRED LOCATION FOR CROSSING SIGNAL HOUSES SHALL BE 25' FROM THE CENTERLINE OF THE NEAREST TRACK AND 30' FROM FACE OF CURB OR AS DIRECTED BY THE ENGINEER.
3. PREFERRED DISTANCE SHALL BE 15'. SIGNALS SHALL NOT BE PLACED LESS THAN 15' FROM CENTERLINE OF NEAREST TRACK WITHOUT APPROVAL OF THE ENGINEER.
4. INSTALLERS SHALL ENSURE EQUIPMENT IS PLACED ENTIRELY ON CALTRAIN'S PROPERTY AND THAT SIGNAL IS EASILY VIEWED FROM A PREFERRED DISTANCE OF 2000'.
5. TOP OF SIGNAL FOUNDATION SHALL NOT BE HIGHER THAN TOP OF RAIL NOR LOWER THAN BASE OF RAIL.
6. WALKWAY SHALL CONSIST OF A 6" THICK MINIMUM LAYER OF CRUSHED ROCK, 1/4" TO 3/4" IN SIZE. WALKWAY SURFACE SHALL BE LEVEL. IN NO CASE SHALL THE WALKWAY SURFACE HAVE A SLOPE GREATER THAN 2%.
7. WHERE A SLOPE EQUAL TO THE MAIN LINE EMBANKMENT CANNOT BE MAIN–TAINED, A RETAINING WALL SHALL BE NECESSARY AND DESIGNED TO MAIN–TAIN THE REQUIRED WALKWAY AROUND SIGNAL HOUSE.

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL

TYPICAL SIGNAL/CROSSING LOCATION

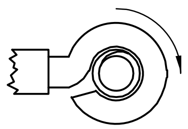
CADD FILE NAME: SD–5108

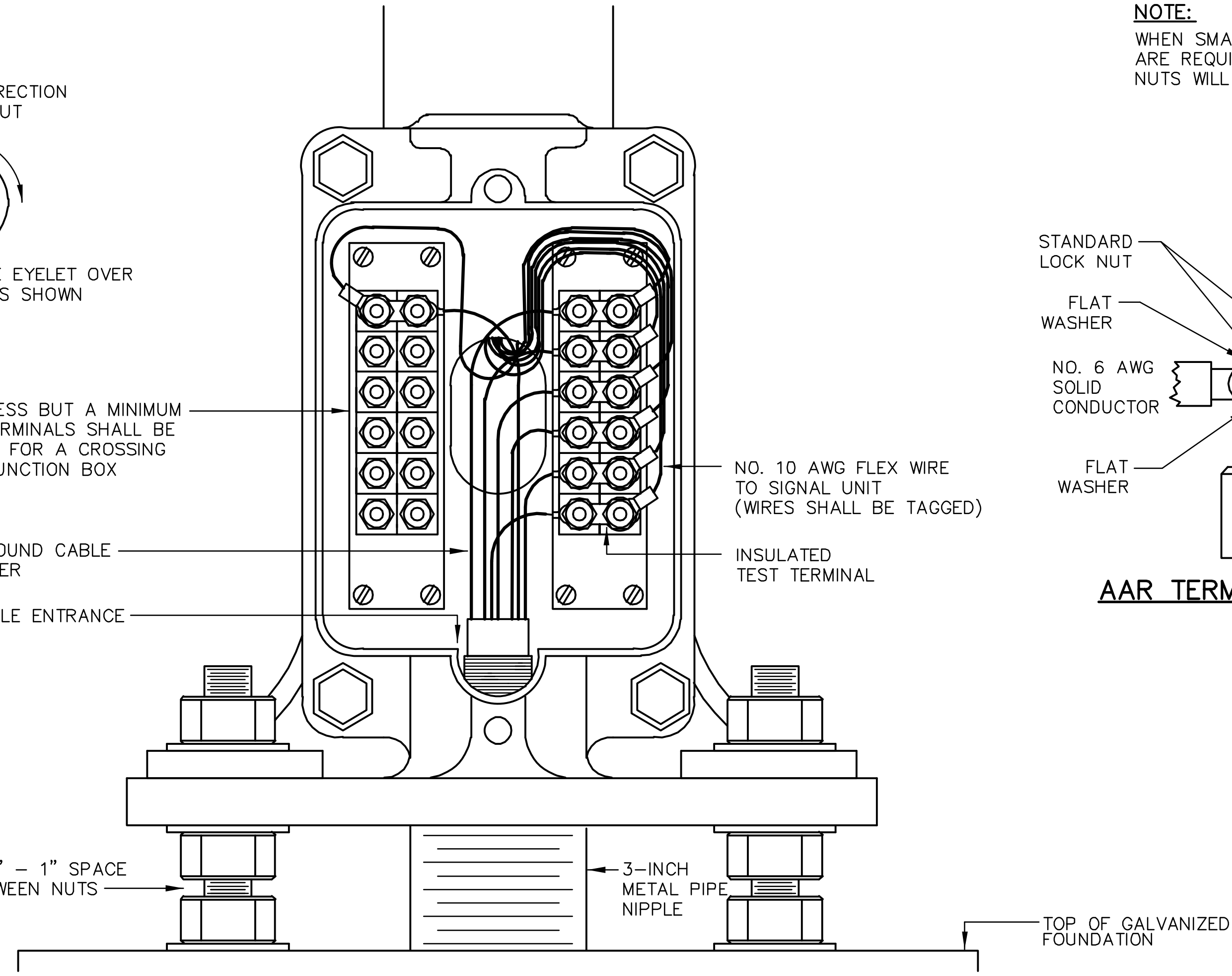
REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

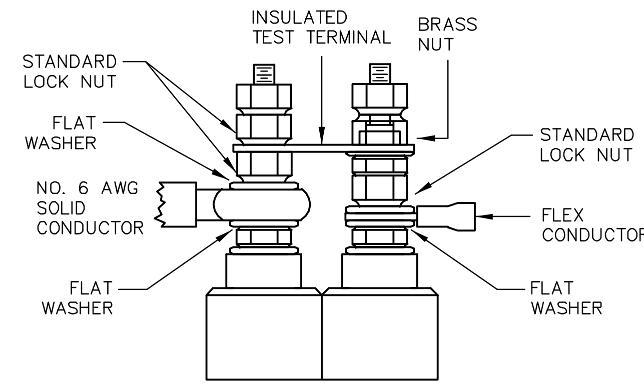
STANDARD DRAWING NO.: SD–5108



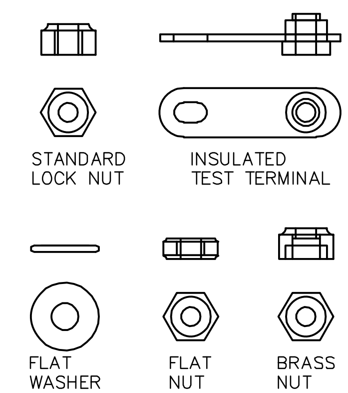


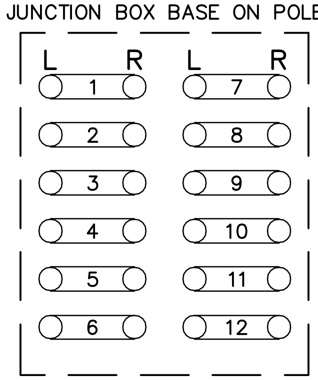
JUNCTION BOX BASE ON POLE

NOTE:
WHEN SMALLER SIZED SOLID CONDUCTORS ARE REQUIRED, FLAT NUT AND STANDARD NUTS WILL EXCHANGE POSITIONS.



AAR TERMINAL WITH 1 5/8" STUDS





TERMINAL NUMBERING DIAGRAM

NOTES:

1. ALL CABLES SHALL BE POTHEADED. METAL SHIELDING SHALL BE ATTACHED TO GROUNDING BOLT IN SIGNAL HOUSE.
2. INSULATION ON SOLID CONDUCTORS SHALL BE REMOVED AND THE EXPOSED BARE WIRE THOROUGHLY CLEANED TO PROVIDE HIGH CONDUCTIVITY, TAKING CARE NOT TO NICK OR DAMAGE WIRE.
3. THE BARE WIRE SHALL BE FORMED TO PRODUCE AN EYELET, WHICH SHALL BE PLACED OVER THE BINDING POST. THE EYELET SHALL BE SIZED TO PROVIDE A TIGHT FITTING LOOP AROUND THE POST BUT LOOSE ENOUGH TO EASILY SLIDE ON AND OFF.
4. A FLAT WASHER SHALL BE PLACED ON THE BINDING POST. THE EYELET SHALL THEN BE PLACED ON THE POST FOLLOWED BY ANOTHER FLAT WASHER. A NUT SHALL BE APPLIED AND SECURELY TIGHTENED WITH A TERMINAL WRENCH.
5. INSULATION ON FLEX CONDUCTORS SHALL BE REMOVED USING A SPRING LOADED STRIPPING TOOL RECOMMENDED BY THE MANUFACTURER OF THE WIRE AND THE EXPOSED BARE WIRE THOROUGHLY CLEANED TO PROVIDE HIGH CONDUCTIVITY.
6. EYELET SHALL BE ATTACHED TO FLEX CONDUCTORS. ONLY CALTRAIN APPROVED EYELET SHALL BE UTILIZED. A COMPRESSION TOOL RECOMMENDED BY THE MANUFACTURER OF THE EYELET SHALL BE USED TO ATTACH THE EYELET.
7. A FLAT WASHER SHALL BE PLACED ON THE BINDING POST. THE EYELET SHALL THEN BE PLACED ON THE POST FOLLOWED BY ANOTHER FLAT WASHER. IF APPLICABLE, THE SECOND EYELET SHALL BE PLACED ON THE POST FOLLOWED BY A FLAT WASHER. A NUT SHALL BE APPLIED AND SECURELY TIGHTENED WITH A TERMINAL WRENCH.
8. AN INSULATED TEST LINK SHALL BE INSTALLED ONCE THE SOLID CONDUCTORS AND EYELETS ARE ATTACHED. THE TEST LINK SHALL BE SECURED USING ONE FLAT AND ONE CROWN NUT AND THE CIRCUIT "CLOSED" BY APPLYING THE BRASS NUT.
9. FLEX CONDUCTORS SHALL BE TAGGED USING PCJPB APPROVED TAGS.
10. WHERE POSSIBLE, SPARE SOLID CABLE CONDUCTORS SHALL BE ATTACHED TO SPARE BINDING POSTS. NO MORE THAN ONE SOLID CONDUCTOR SHALL BE SECURED TO A POST.
11. DRAWING DEPICTS TERMINATION OF CABLE CONDUCTORS AND EQUIPMENT WIRING. THIS METHOD SHALL BE USED IN JUNCTION BOXES USED FOR SWITCHES, SIGNALS, CROSSING GATES, CANTILEVERS, ETC. INSULATED TEST TERMINALS SHALL BE INSTALLED ON EACH END OF ANY CABLE TERMINATED SO THAT CABLE CONDUCTORS MAY BE ISOLATED WITHOUT REMOVING CONDUCTOR FROM TERMINAL.

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PENINSULA CORRIDOR JOINT POWERS BOARD

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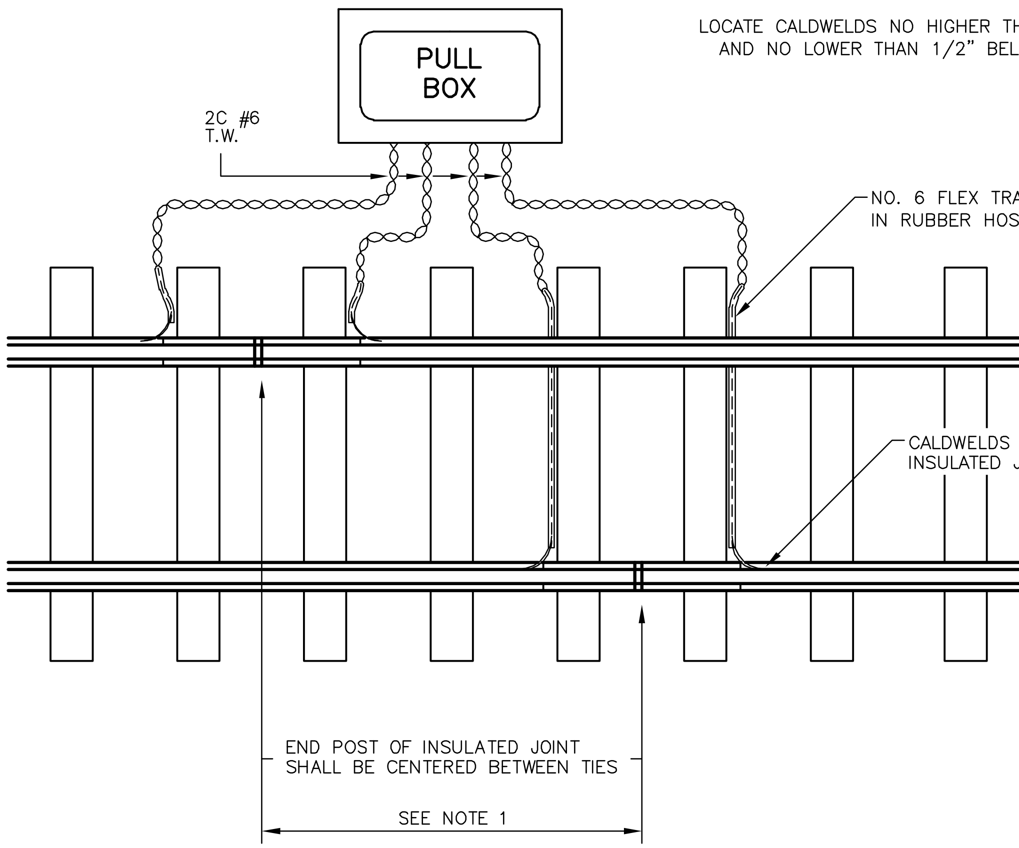
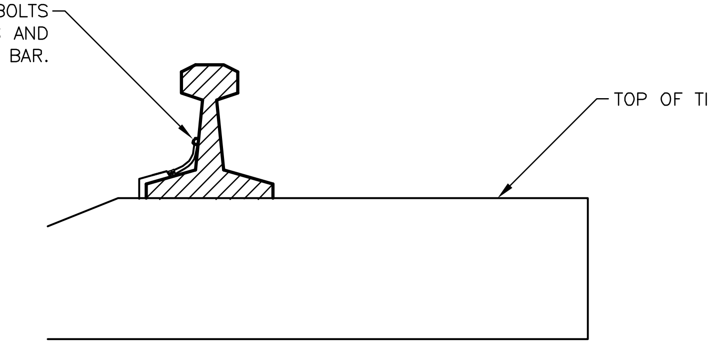
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
TERMINATION
TYPICAL CABLE TERMINATION

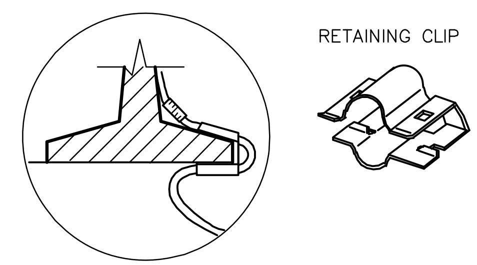
CADD FILE NAME: SD–5109
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD–5109



PLAN



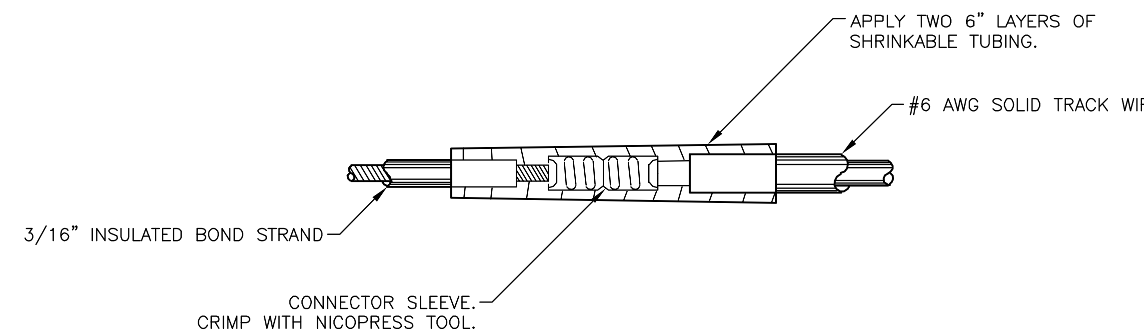
ENLARGED DETAIL OF CALDWELD



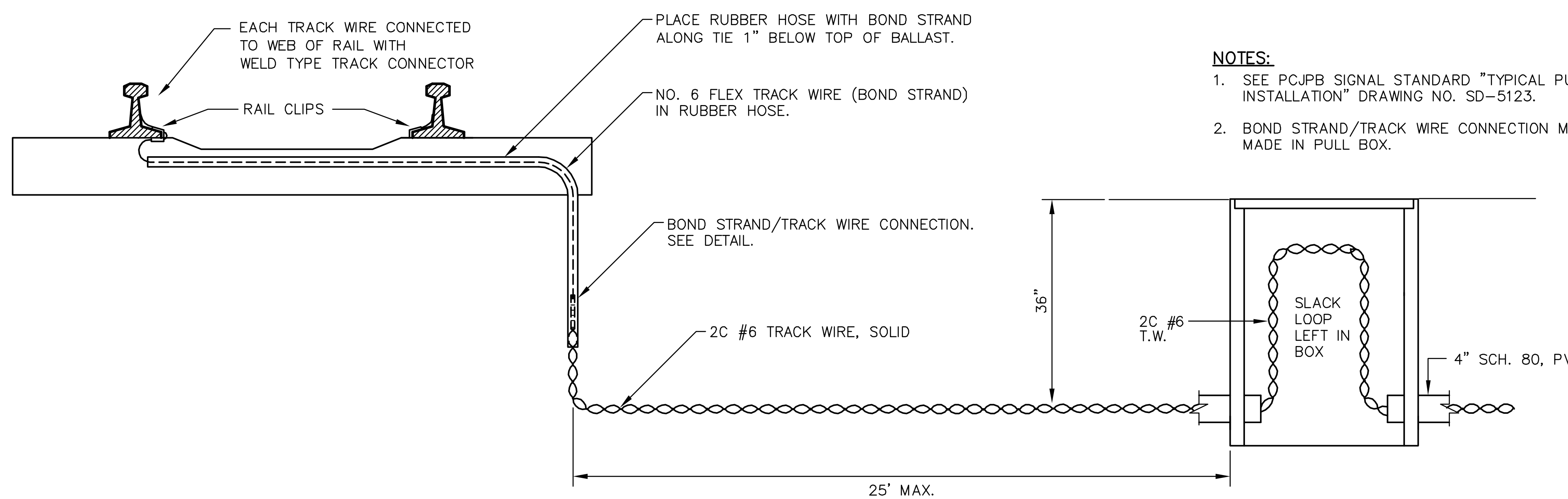
TRACK WIRE RETAINER CLIP APPLICATION

NOTES:

1. INSULATED JOINTS SHALL BE STAGGERED A MINIMUM OF 4 FEET 8 INCHES AND A MAXIMUM OF 10 FEET, MEASURED FROM END POST TO END POST.
2. SPLICE FLEX TRACK WIRE TO SOLID TRACK WIRE USING COMPRESSION SLEEVE. MATERIALS USED TO SEAL SPLICE SHALL PROVIDE, AT MINIMUM, THE SAME INSULATING QUALITIES AS THE TRACK WIRE COVERING.
3. TRACK WIRE RETAINING CLIPS SHALL BE USED TO SECURE TRACK WIRE TO RAIL.
4. WIRES SHALL FOLLOW CONTOUR OF TIE AND RAIL WITH NO EXCESS SLACK.
5. TRACK CIRCUIT RAIL CONNECTORS SHALL BE 3/16 INCH STRANDED BRONZE CONDUCTORS WITH 1 INCH TAP FOR WELD CONNECTION ON ONE END AND COMPRESSION SLEEVE ON THE OTHER END FOR A DIRECT CRIMP TYPE CONNECTION TO THE TRACK WIRE. TRACK CIRCUIT RAIL CONNECTORS SHALL HAVE A NOMINAL LENGTH OF 4 INCHES.
6. BOND SIGNAL TRACK WIRES CLOSEST TO INSULATED JOINT IN ORDER TO MAXIMIZE BROKEN RAIL DETECTION.



ENLARGED DETAIL OF WIRE CONNECTION



ELEVATION

NOTES:

1. SEE PCJPB SIGNAL STANDARD "TYPICAL PULL BOX INSTALLATION" DRAWING NO. SD-5123.
2. BOND STRAND/TRACK WIRE CONNECTION MAY BE MADE IN PULL BOX.

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
TRACK WIRES
TYPICAL TRACK WIRES LAYOUT

CADD FILE NAME: SD-5110

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5110

NOT USED.

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
TYPICAL GROUNDING
FOR SIGNAL LOCATIONS

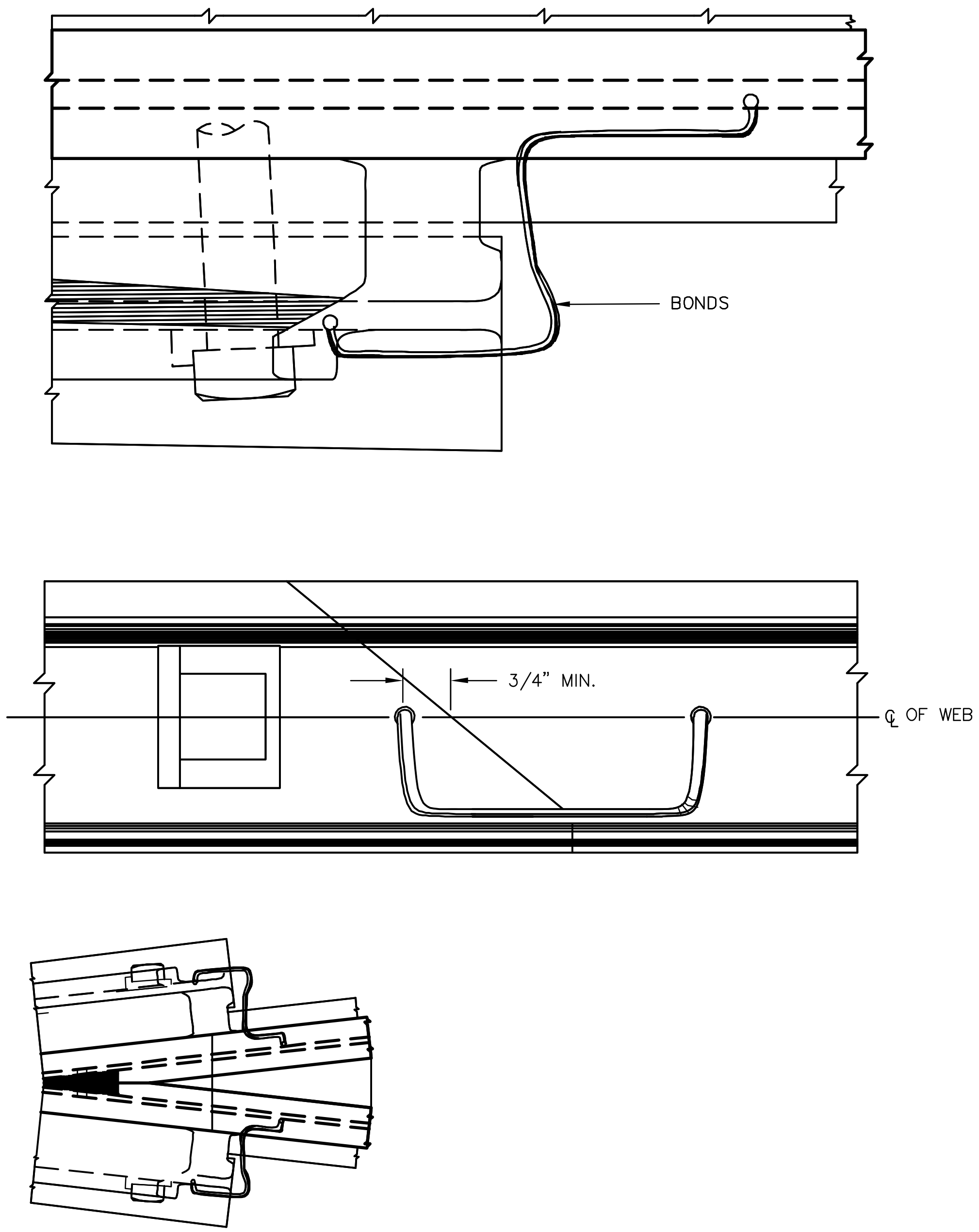
CADD FILE NAME: SD-5111

REV:

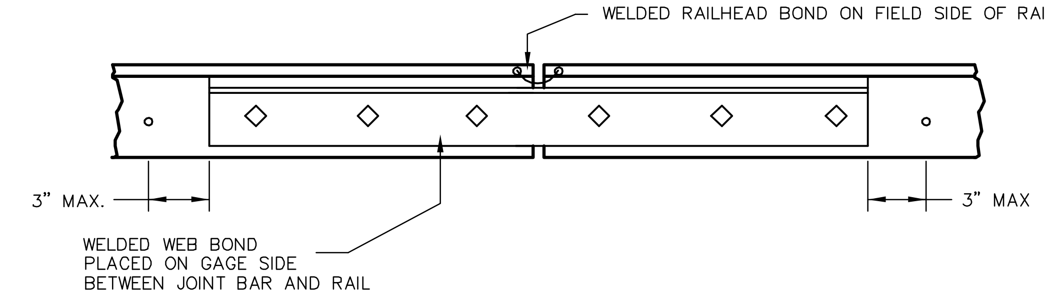
EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

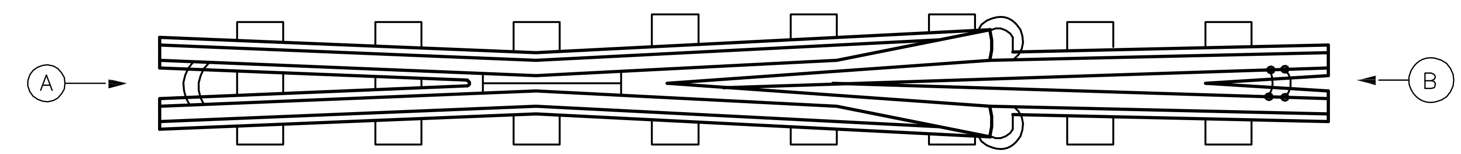
STANDARD DRAWING NO.: SD-5111



TURNOUT FROG BONDING

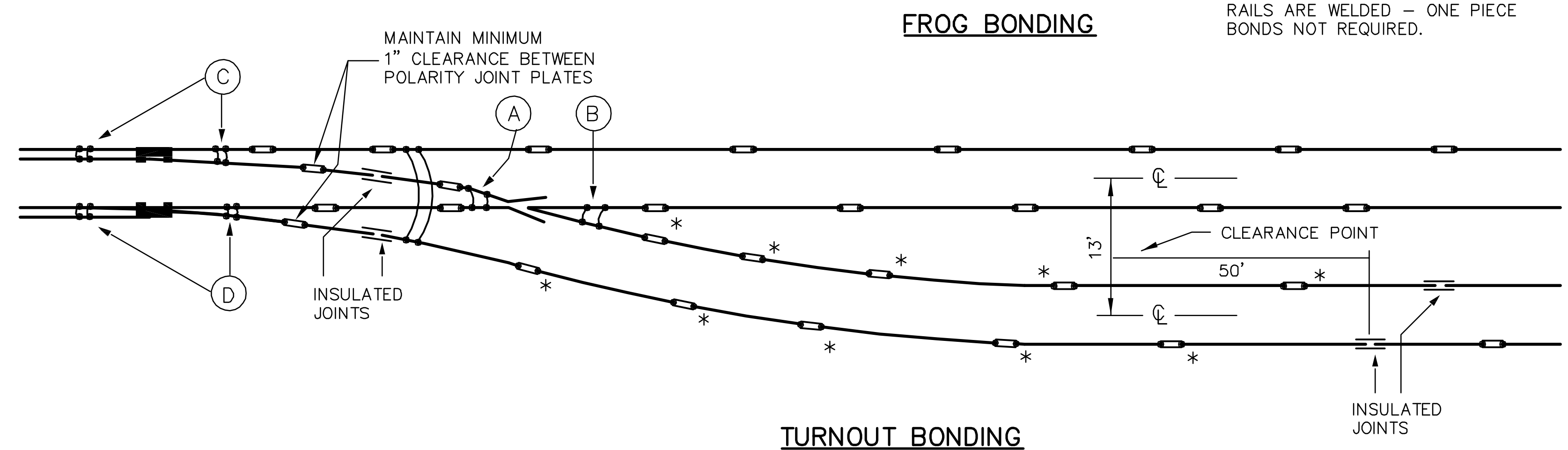


JOINT BONDING



FROG BONDING

NOTE: IN PLACE OF WHERE 2 WING RAILS ARE WELDED – ONE PIECE BONDS NOT REQUIRED.



TURNOUT BONDING

NOTES:

1. BONDS BETWEEN RAILS AT A, B, C AND D SHALL BE APPLIED TO RAIL WEB
2. TURNOUTS SHALL BE DOUBLE BONDED USING ONE WEB TYPE BOND AND ONE RAILHEAD BOND, WITH EXCEPTION TO JOINTS MARKED WITH AN (*), THOSE JOINTS ONLY REQUIRE RAILHEAD BOND WHEN TURNOUT TERMINATES IN A TRACK RELAY
3. ALL WEB BONDS SHALL BE 3/16" IN DIAMETER, 12" LONG WITH STEEL TERMINALS WELDED TO THE WEB OF THE WELDED TYPE
4. ALL RAILHEAD BONDS SHALL BE 3/16" IN DIAMETER WITH STEEL TERMINALS WELDED TO CONDUCTORS OF THE WELDED TYPE. THEY SHALL HAVE A NOMINAL LENGTH OF 6 1/2"
5. LOCATION OF THE INSULATED JOINTS MAY BE MODIFIED ONLY WITH THE ENGINEER'S APPROVAL
6. PLACEMENT OF BOND WIRES SHALL MAXIMIZE BROKEN RAIL DETECTION
7. WIRES TO FOLLOW CONTOUR OF RAIL AND TIE WITH NO EXCESS SLACK
8. ALL BONDS AND TRACK CONNECTIONS UTILIZING 3/16" BOND STRAND SHALL BE WITH STEEL TERMINALS WELDED TO THE RAIL
9. WHERE THE 2 WING RAILS ARE WELDED AS ONE PIECE BONDS ARE NOT REQUIRED
10. ON RIGID FROG, BONDS SHALL BE INSTALLED ON THE SIDE OF THE FROG ON WHICH THE HEADS OF BOLTS ARE LOCATED. ON SPRING RAIL FROG, BONDS ARE NOT REQUIRED ON MOVEABLE SIDE
11. DISTANCE BETWEEN TERMINALS IS SHOWN AS 1". THIS DIMENSION MAY DECREASE, WHEN NECESSARY, DUE TO LIMITED DISTANCE FROM BOLT TO THE END OF THE RAIL
12. WHEN A PLATE CLIP (ON SPRING RAIL FROGS) INTERFERES WITH APPLICATION OF BONDS AS SHOWN HEREON, THE PLATE CLIP SHALL BE ARRANGED TO PERMIT PROPER INSTALLATION OF THE BONDS

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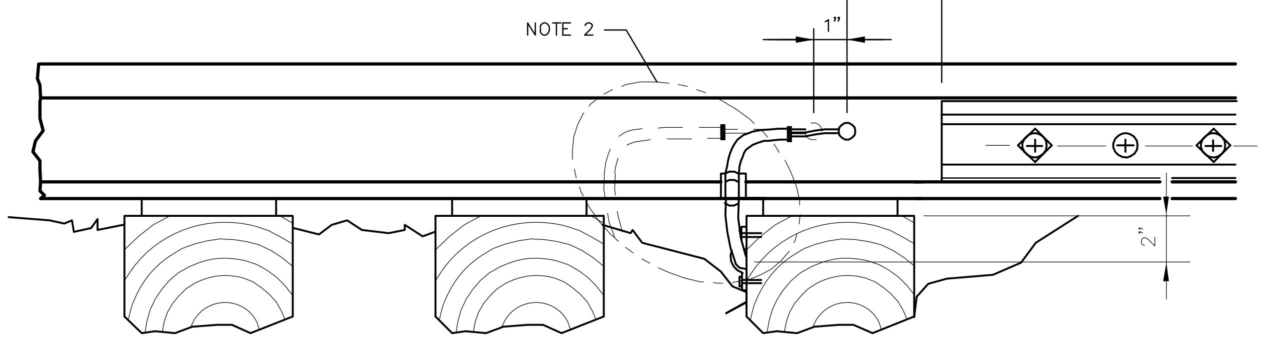
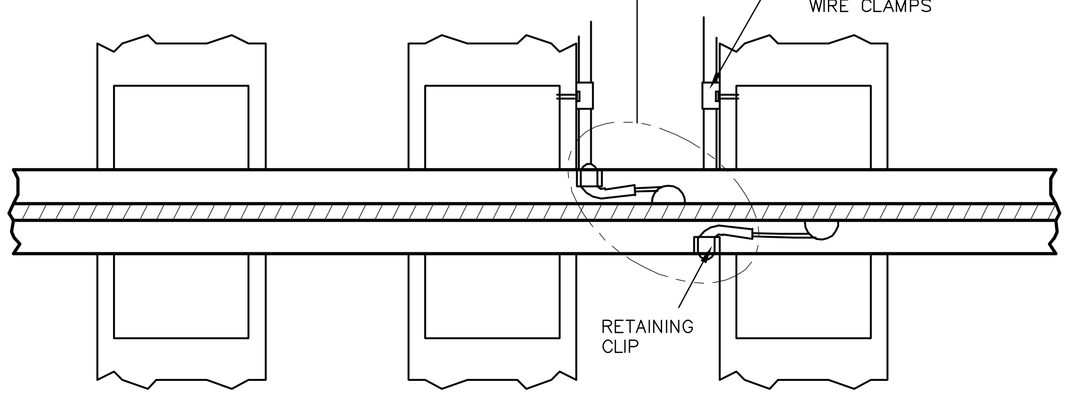
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL

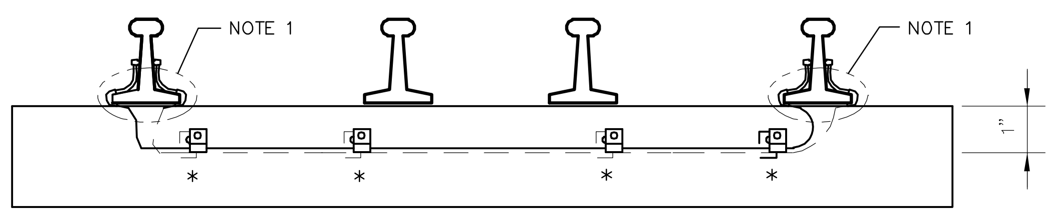
RAIL BONDING DETAILS

CADD FILE NAME: SD-5112
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5112





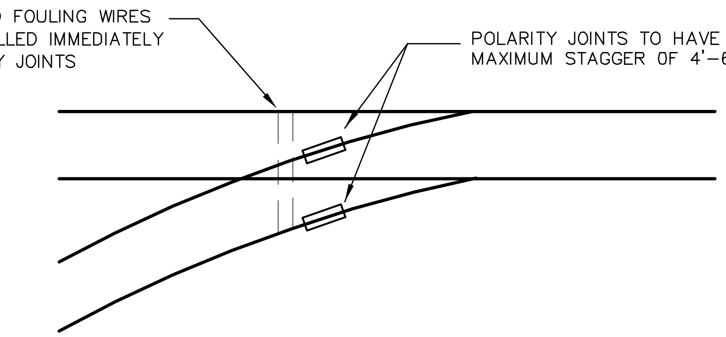
AVOID DRIVING NAILS WHERE CONTACT MIGHT BE MADE WITH TRACK SPIKES OR ANCHORS

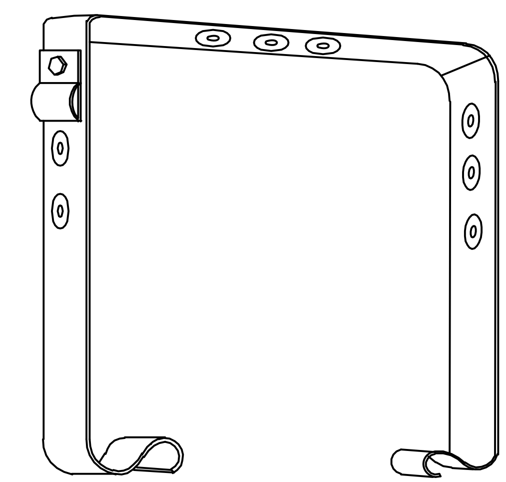


NOTES:

1. USE TWO STRANDED INSULATED TRACK WIRES INSTALLED WITH WEB WELD ATTACHED FROM OPPOSITE SIDES
2. FOULING WIRES SHALL BE INSTALLED ON SIDE OF ADJACENT TIES
3. FOULING WIRES SHALL BE MAINTAINED FREE OF SPLICES AND BE EXPOSED FOR VISUAL INSPECTION
4. AVOID PLACING FOULING WIRES WHERE THEY MAY COME IN CONTACT WITH RAIL ANCHORS
5. BOND STRAND FOR FOULING WIRES SHALL BE 3/16" SINGLE STRAND WITH 1/16" BLACK PVC INSULATION

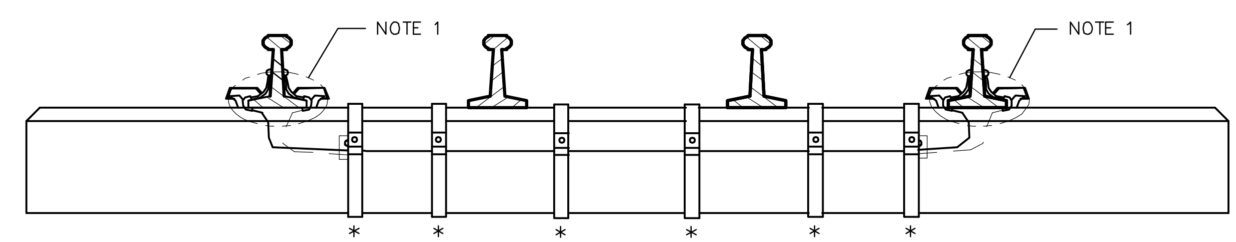
*6. STRAPS TO BE USED ON CONCRETE TIES. USE INSULATED WIRE CLAMPS, AS SHOWN IN SD-5110, ON WOOD TIES – STRAPS SHALL BE EVENLY SPACED

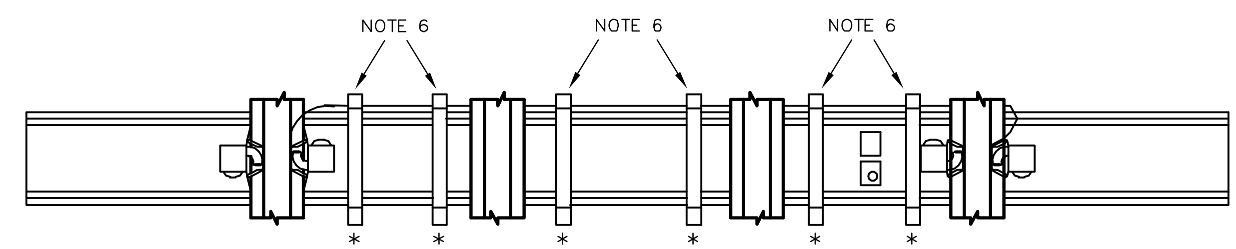




CLAMP SHALL BE SIZED FOR SNUG FIT TO TIE. SEE SHEET SD-5110 FOR SIZING DETAILS

CONCRETE TIE STRAP





FOULING WIRES ON NEW WORK SHALL ONLY BE INSTALLED WITH APPROVAL OF THE ENGINEER

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PENINSULA CORRIDOR JOINT POWERS BOARD

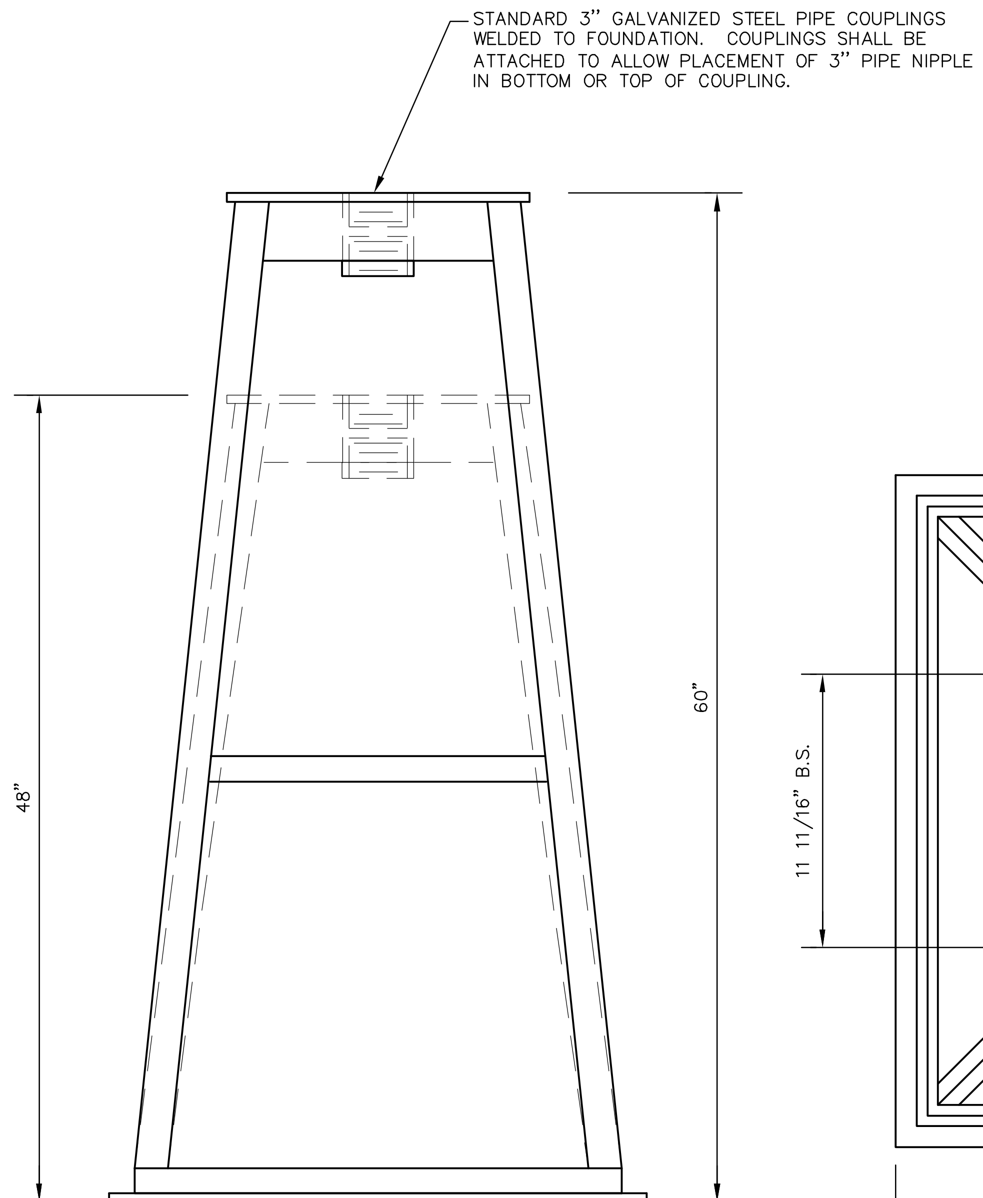
APPROVED BY:
Bin Zhang
DEPUTY DIRECTOR, ENGINEERING

Caltrain
1250 San Carlos Avenue
San Carlos, CA 94070

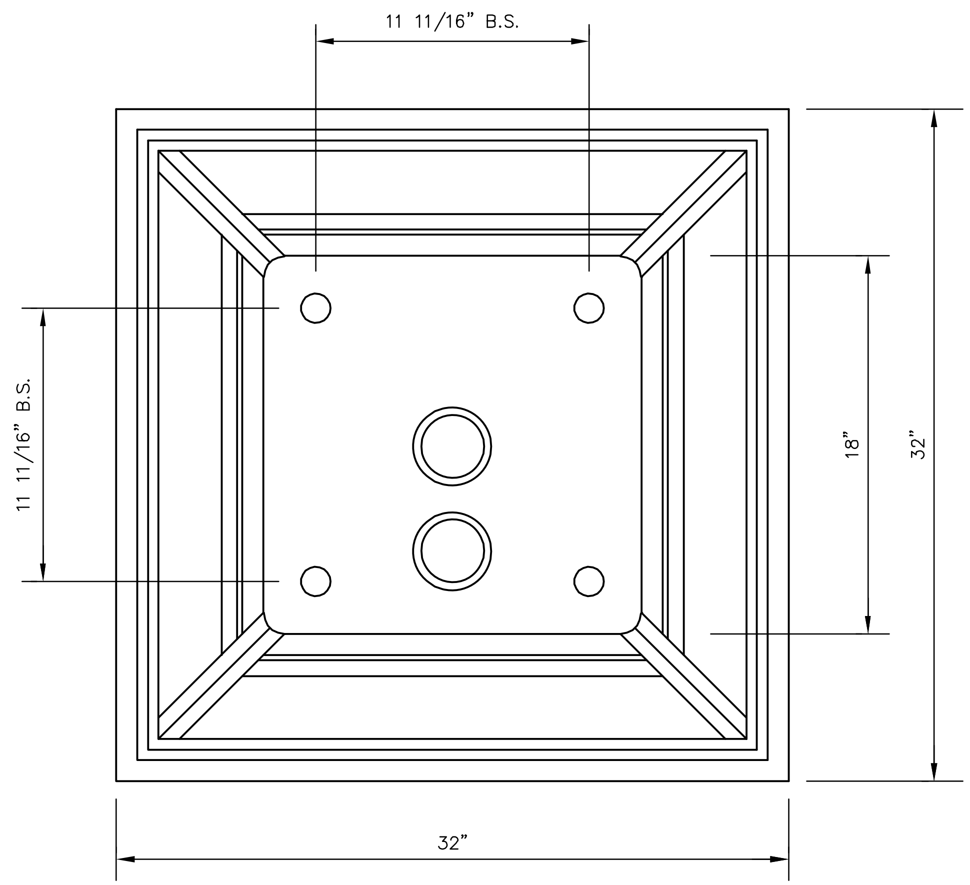
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
STANDARD PLACEMENT
OF FOULING WIRES

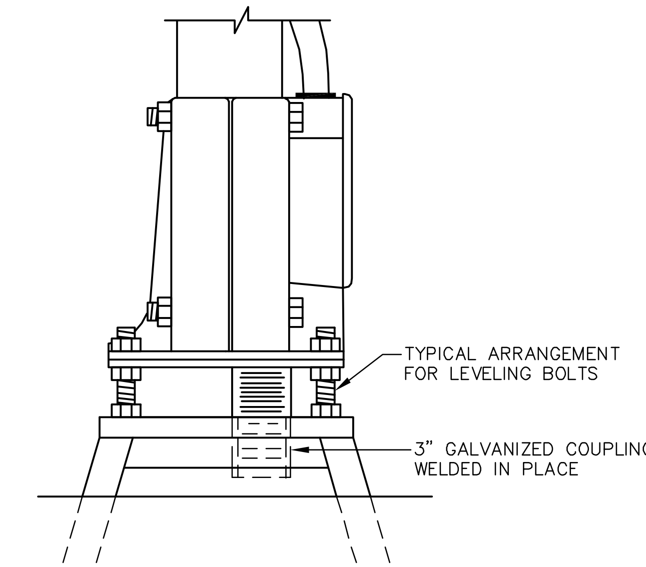
CADD FILE NAME: SD-5113
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5113



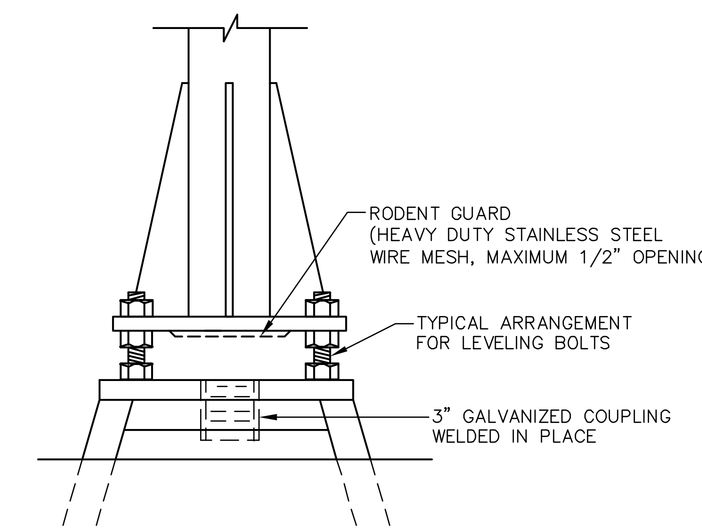
GROUND SIGNAL FOUNDATION



TOP VIEW



GATE FOUNDATION



FLASHER MAST FOUNDATION

NOTES:

1. FOUNDATIONS SHALL BE HOT DIPPED GALVANIZED
2. FURNISHED WITH 4 EA 1" X 8" BOLTS WITH HEX HEADS, 12 NUTS AND 16 FLAT WASHERS
3. BOLTS SHALL BE THREADED TO ALLOW FOR LEVELING
4. BOLTS, WASHERS AND NUTS SHALL BE CADMIUM STEEL AND SHALL BE PACKAGED SEPARATELY IN A WATER TIGHT CONTAINER SECURELY ATTACHED TO THE FOUNDATION

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REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

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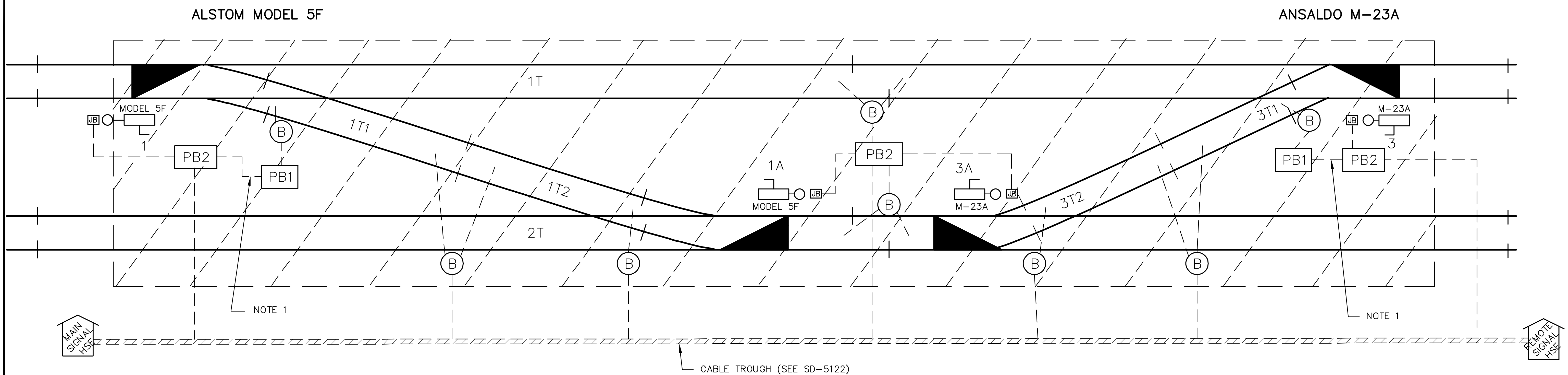
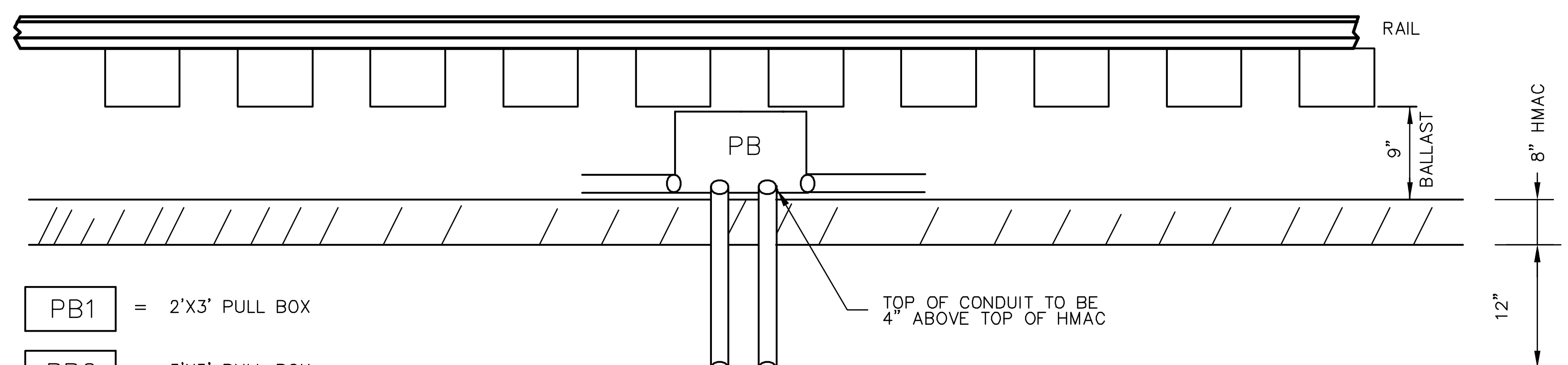
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
FOUNDATION FOR GROUND SIGNAL, GATE AND FLASHER MAST

CADD FILE NAME: SD-5114
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5114





TYPICAL CROSS SECTION

NOTES:

1. INSTALL ON TOP OF HMAC IN SCHEDULE 80 PVC CONDUIT OR GRS CONDUIT.
2. WHERE HMAC UNDERLAY IS INSTALLED, ALL SIGNAL CABLES AND TRACK WIRES SHALL BE INSTALLED IN 4" SCHEDULE 80 PVC MIDWAY BETWEEN TRACK CENTERS ABOVE HMAC PAD. SIGNAL AND TRACK CONSTRUCTION CREWS MUST COORDINATE INSTALLATION OF CONDUITS UNDER TRACKS PRIOR TO INSTALLATION OF HMAC. FINAL GRADE SHALL BE IDENTIFIED, INCLUDING ANY DRAINAGE DITCHES WHICH SIGNAL CABLES TRAVERSE. SIGNAL CABLES SHALL BE 36" BELOW BOTTOM OF THE DRAINAGE DITCH UNLESS DITCH IS LINED OR VARIANCE APPROVED BY THE ENGINEER
3. WHEN FIELD CONDITIONS PERMIT, POLARITY TRACK WIRES MAY BE INSTALLED AS SHOWN INSTEAD OF ON TOP OF HMAC.
4. REFER TO SD-5123 FOR CONDUIT ENTRANCE-EXIT REQUIREMENTS FOR PULL-BOXES.
5. ALSTOM (FORMERLY GRS). ANSALDO (FORMERLY US&S).

PB1 = 2'X3' PULL BOX

PB2 = 3'X5' PULL BOX

JB = JUNCTION BOX

B = TRACK WIRE BOOTLEG (SEE SD-5111)

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PENINSULA CORRIDOR JOINT POWERS BOARD

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San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
CROSSOVER WITH HMAC UNDERLAY
TYPICAL CROSSOVER LAYOUT

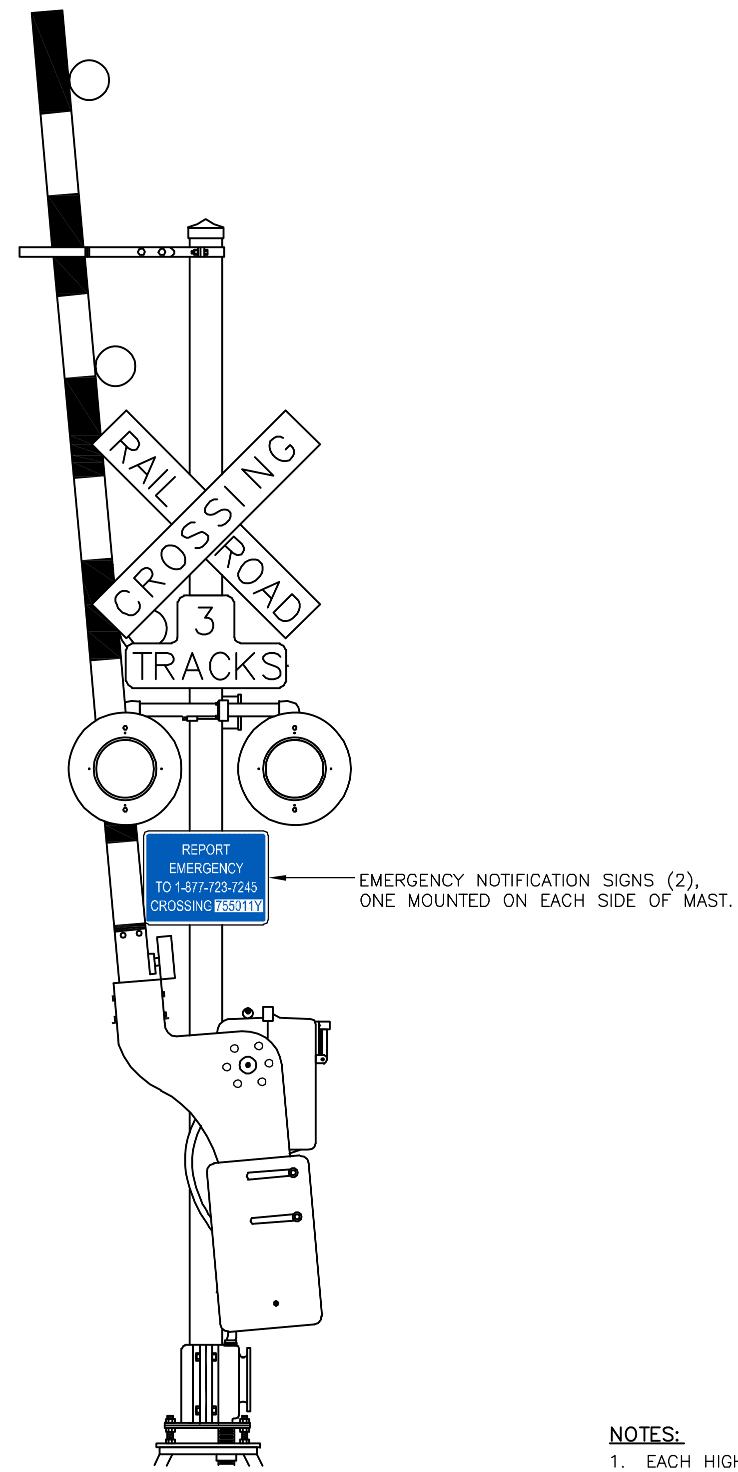
CADD FILE NAME: SD-5115

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5115



FLS WITH GATE

ELEVATION

SCALE: NTS

NOTES:

1. EACH HIGHWAY GRADE CROSSING SHALL COMPLY WITH THE MUTCD.
2. EACH HIGHWAY GRADE CROSSING SHALL BE EQUIPPED WITH A SIGN IDENTIFYING THE CROSSING BY ITS NAME AND DOT NUMBER. IT SHALL ALSO BE EQUIPPED WITH A SIGN HAVING AN 800 NUMBER THAT WILL CONNECT A CALLER TO THE PROPER AUTHORITIES IN THE EVENT OF AN EMERGENCY AT THE CROSSING.
3. FOR HIGHWAY GRADE CROSSING EMERGENCY NOTIFICATION SIGN DETAILS SEE SD-5117.

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PENINSULA CORRIDOR JOINT POWERS BOARD

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San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATION
GENERAL SIGNAL
TYPICAL CROSSING GATE
WITH EMERGENCY NOTIFICATION SIGNS

CADD FILE NAME: SD-5116

REV:

EDITION: FOURTH

SIGNAL

STANDARD DRAWING NO.: SD-5116

EMERGENCY NOTIFICATION SIGN
DETAIL
SCALE: NTS

NOTES:

1. EMERGENCY NOTIFICATION SIGN SHALL COMPLY WITH THE REQUIREMENTS OF CALIFORNIA MUTCD CHAPTER 8B, SIGNS AND MARKINGS.
2. SIGN PANEL SHALL BE MADE OF 1/8" THICK ALUMINUM.
3. BACKGROUND COLOR: RETRO-REFLECTIVE BLUE (FEDERAL STANDARD FS 15080).
4. LETTERS AND NUMBERS: RETRO-REFLECTIVE WHITE. 1" HIGH ARIAL.
5. CROSSING NUMBER ON SIGN: RETRO-REFLECTIVE BLUE (FEDERAL STANDARD FS 15080) LETTERS AND NUMBERS OVERPRINTED ON RETRO-REFLECTIVE WHITE FIELD. 1" HIGH ARIAL. IF NECESSARY, CONDENSE BOTTOMMOST TEXT STRING SO THAT IT FITS IN THE BLUE FIELD.
6. BORDERS: RETRO-REFLECTIVE WHITE, 3/8" WIDE.
7. MOUNTING HARDWARE SHALL BE OF TAMPER PROOF STAINLESS STEEL SS316.
8. EMERGENCY NOTIFICATION SIGN PLACEMENT SHALL COMPLY WITH THE REQUIREMENTS OF TITLE 49, PART 234, SUBPART E, SECTION 234.311, ENS SIGNS PLACEMENT AND MAINTENANCE.

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PENINSULA CORRIDOR JOINT POWERS BOARD

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DEPUTY DIRECTOR, ENGINEERING

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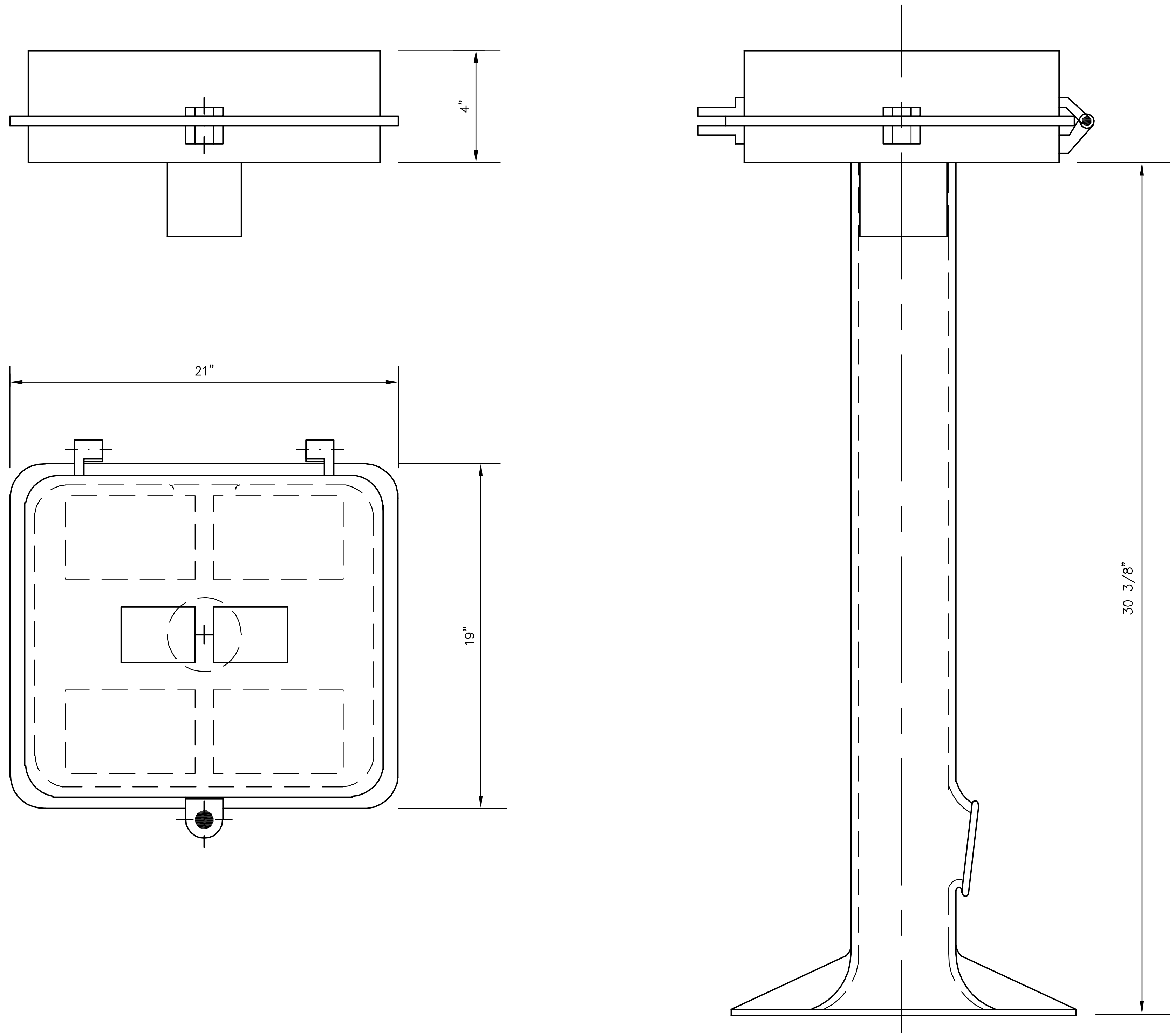
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
GRADE CROSSINGS
EMERGENCY NOTIFICATION SIGN

CADD FILE NAME: SD-5117
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5117



NOTE:

TUNED JOINT COUPLER (TJC) SHALL BE INSTALLED 8'–6" FROM TRACK CENTER. TOP OF BOX SHALL OPEN AWAY FROM TRACK AND SHALL BE LEVEL WITH TOP OF TIE. ADD BALLAST AND GRADE AS NEEDED TO EXTEND TRACK SHOULDER 3' BEYOND BOX.

STANDARD TYPE PEDESTAL

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REV	DATE	BY	CHK	APP	

PENINSULA CORRIDOR JOINT POWERS BOARD

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Caltrain

1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
JUNCTION BOX
TUNED JOINT COUPLER

CADD FILE NAME: SD–5118

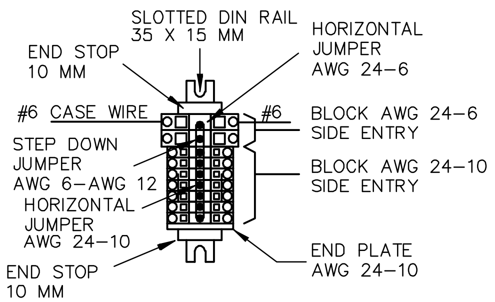
REV:

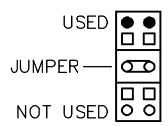
EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD–5118

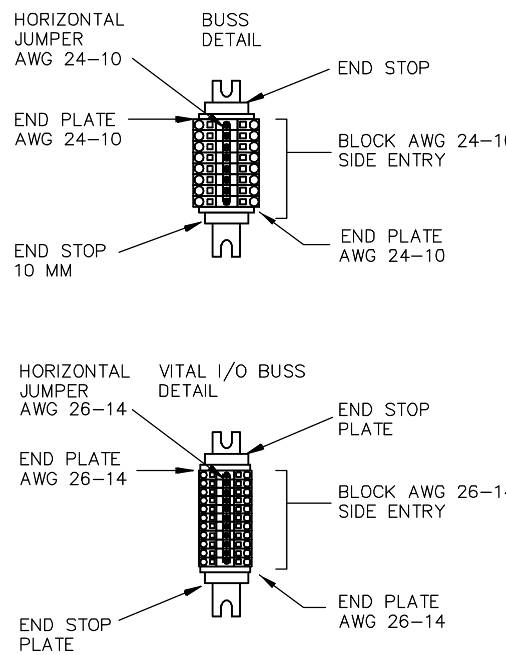
SCREWLESS CAGE CLAMP TERMINAL DETAIL



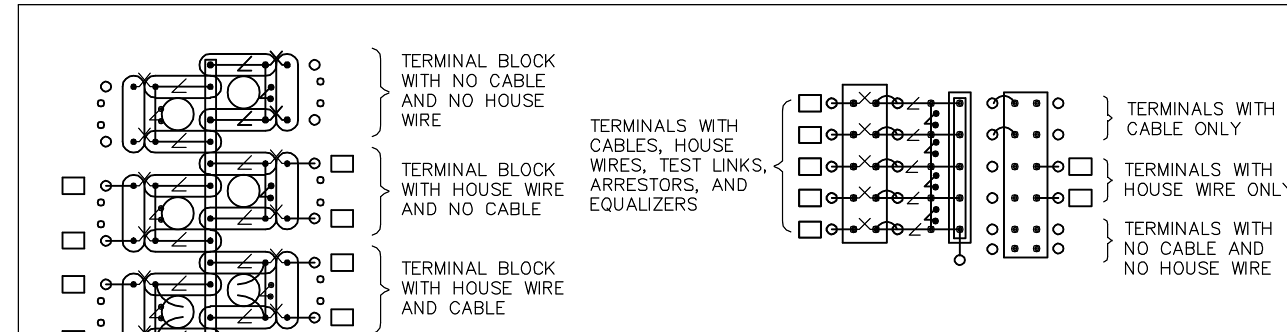


NOTE:

WIRES SHALL BE STRIPPED USING WIRE MANUFACTURER APPROVED SPRING LOADED STRIPPER TO THE FOLLOWING LENGTHS:
AWG 24–6 = 0.7 IN.
AWG 24–10 = 0.5 IN.
AWG 26–14 = 0.4 IN.



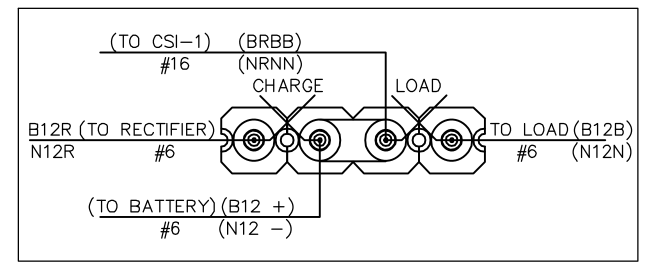
TERMINAL BOARD DETAIL



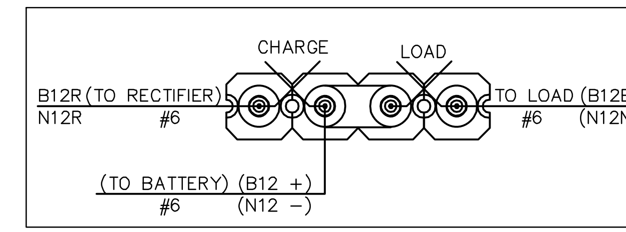
NOTE:

CABLE TAGS TO BE ATTACHED TO TERMINAL BOARD WITH STAPLES OR NAILS.

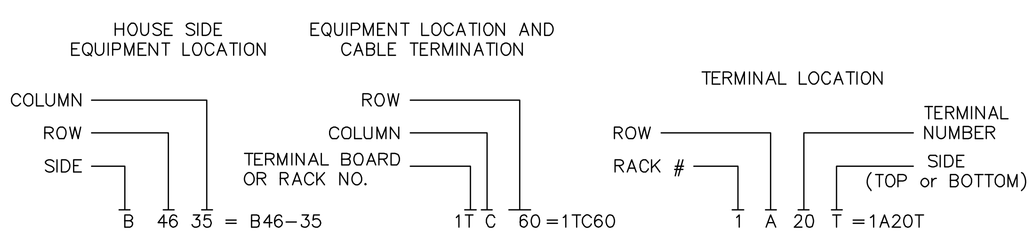
DETAIL A



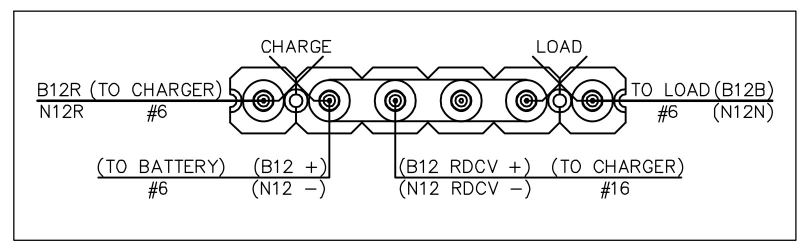
DETAIL B

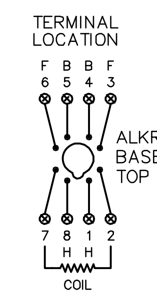


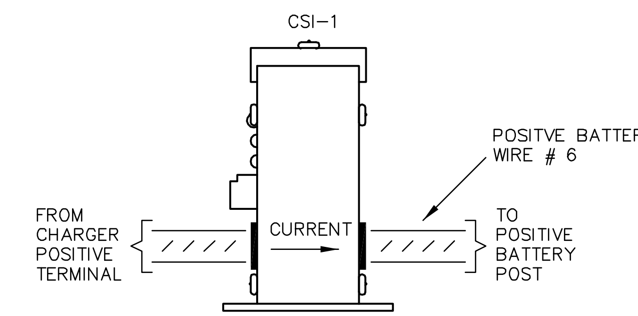
LOCATION LEGENDS



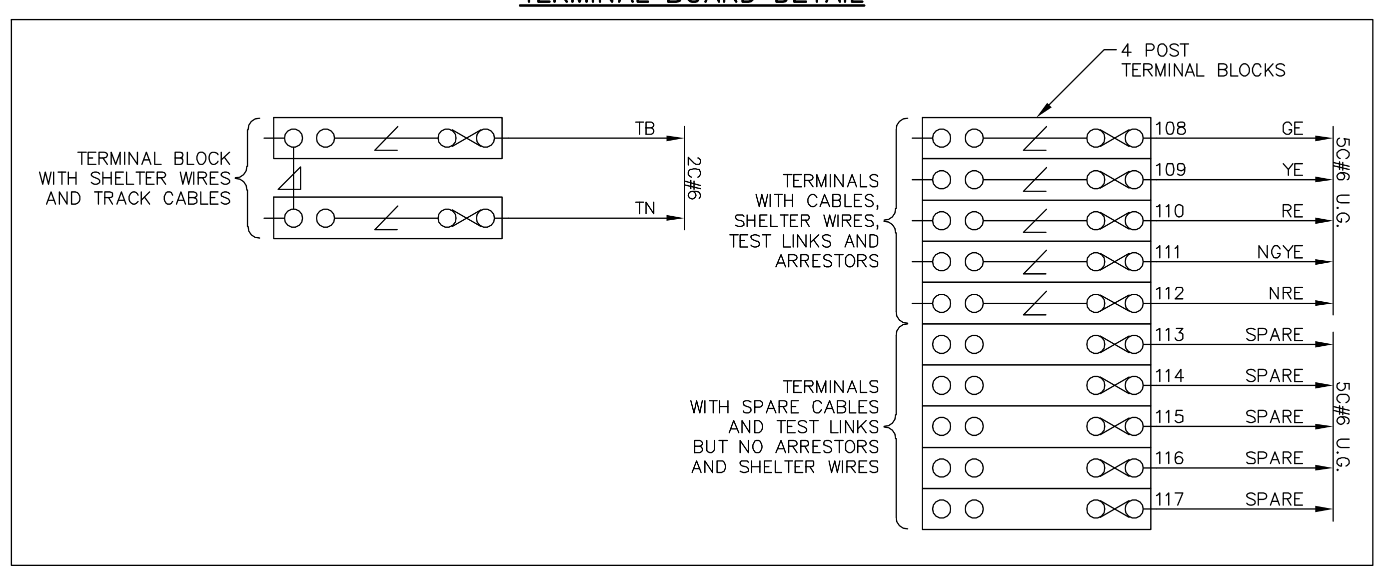
NRS HF–MAX DETAIL A







TERMINAL BOARD DETAIL



NOTES:

- = CLEARVIEW ARRESTOR
- = HEAVY DUTY EQUALIZER
- = INSULATED TEST TERMINAL
- = TERMINAL BLOCK
- = TERMINAL BLOCK
- = DRILL 1/2–INCH HOLE AND FINISH EDGES FOR CASE WIRE AND CABLE CONDUCTORS
- = DRILL 1–1/4 INCH HOLE AND FINISH EDGES FOR TRACK WIRE
- = ADJUSTABLE RESISTANCE
- = TWISTED WIRE
- = TEST POINTS FOR XGNDS.
- = COIL PER I–324
- = DV4 OR EQUAL

NOTE:

UNLESS NOTED OTHERWISE ON SIGNAL DRAWINGS, WIRES SHALL BE #14 AWG FLEX. ALL GROUND WIRES SHALL BE #6 AWG SOFT DRAWN COPPER. WIRES TO BATTERIES SHALL BE #6 AWG FLEX CASE WIRE.

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PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY: Bin Zhang

DEPUTY DIRECTOR, ENGINEERING

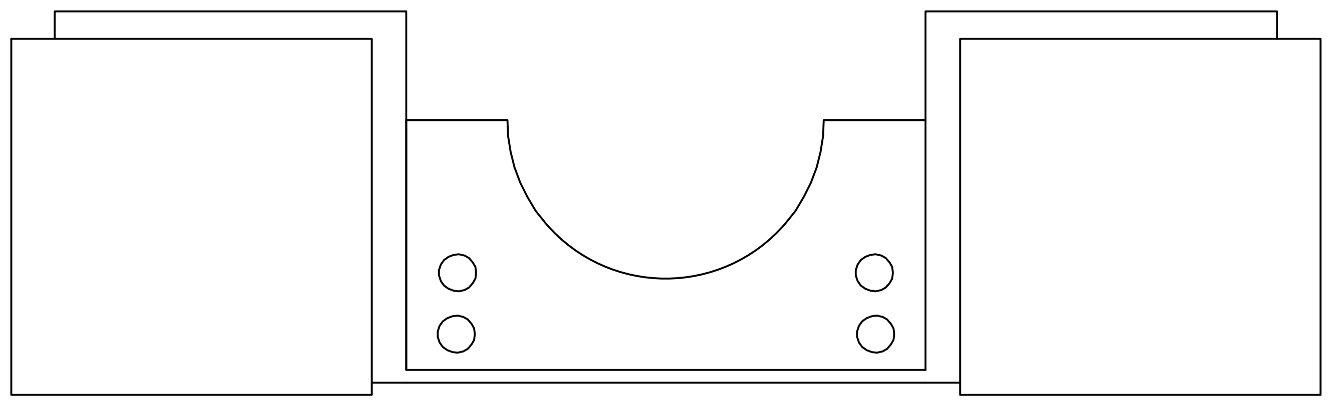
Caltrain
1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
WAGO SCREWLESS CAGE CLAMP
BOARD WIRING DETAILS

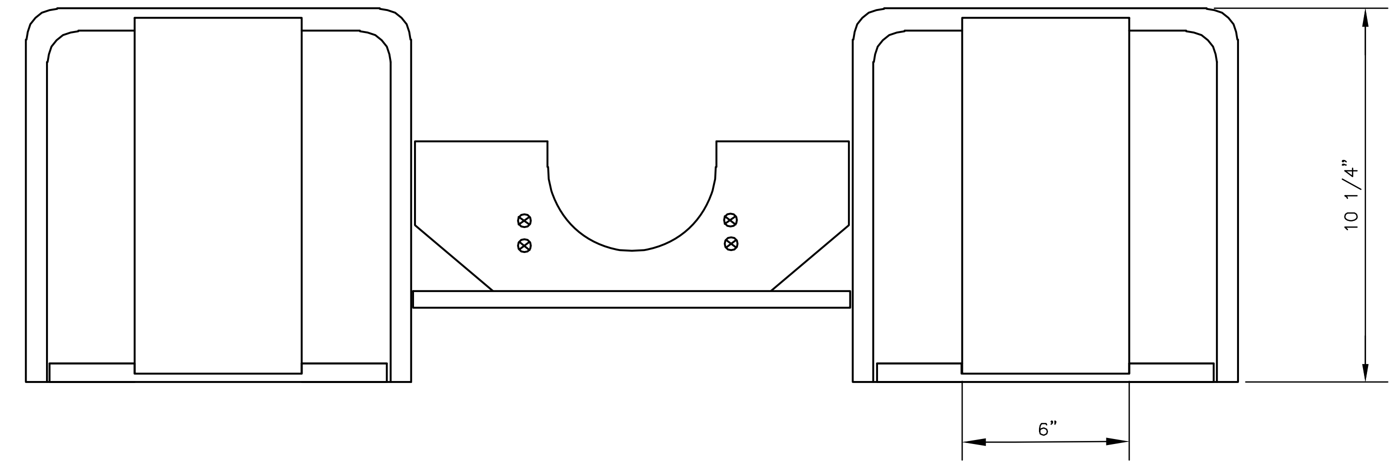
CADD FILE NAME: SD–5119
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD–5119

WOOD

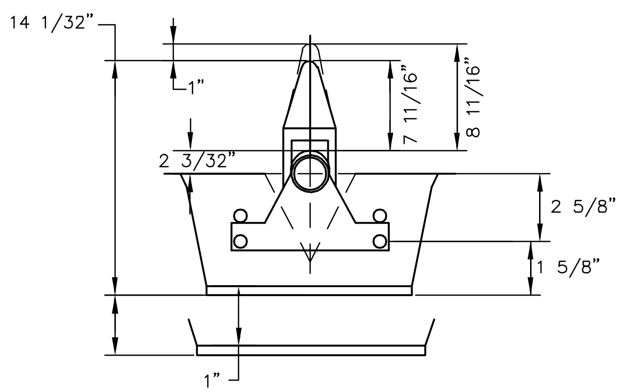


SIDE VIEW

CONCRETE

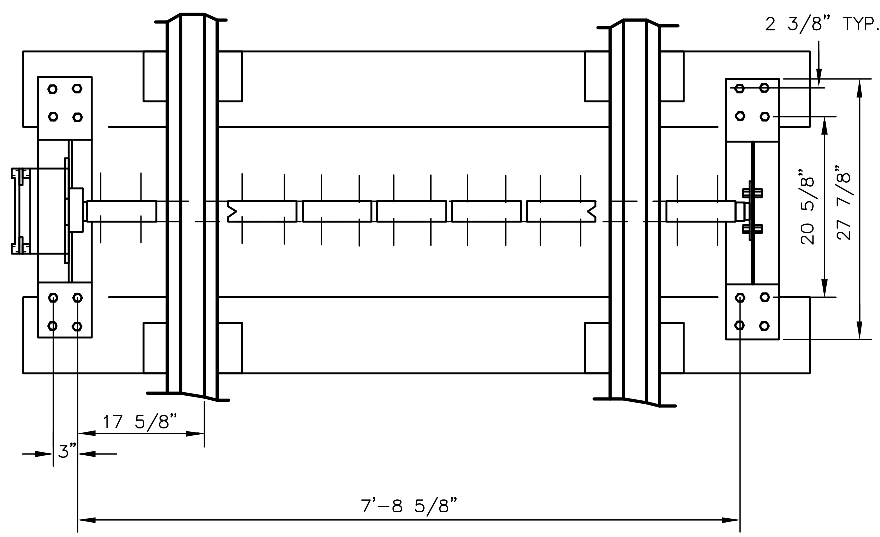


SIDE VIEW



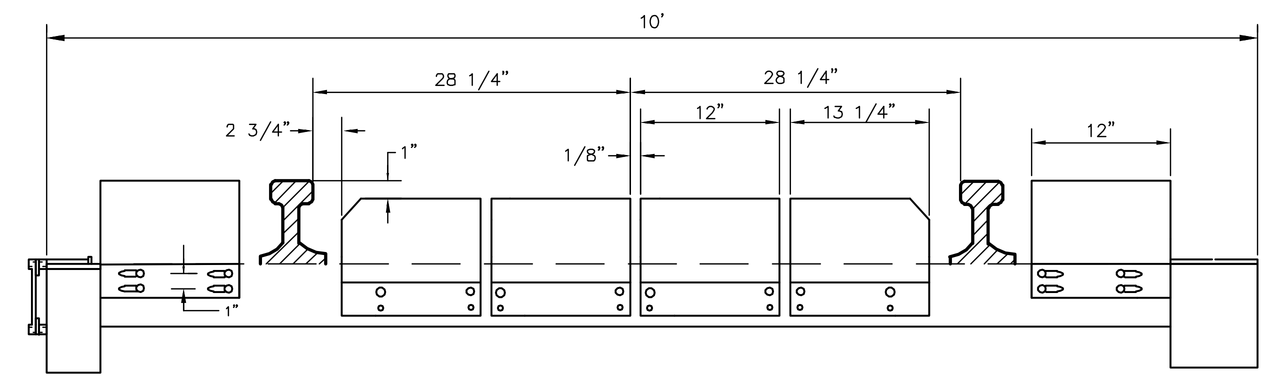
SIDE VIEW

WOOD

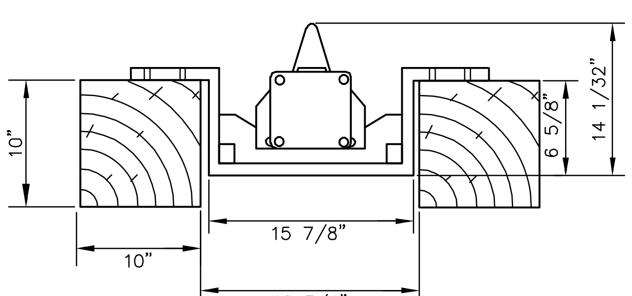


TOP VIEW

CONCRETE



FRONT VIEW



SIDE VIEW

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REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

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San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
DRAGGING EQUIPMENT DETECTION
TIE BRACKET
AND MOUNT ARRANGEMENT

CADD FILE NAME: SD-5120

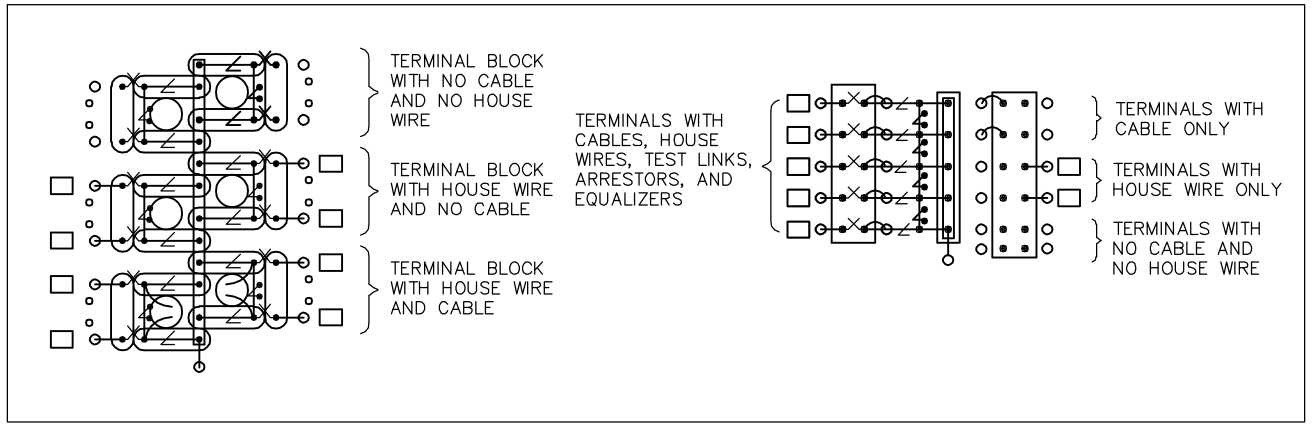
REV:

EDITION: FOURTH

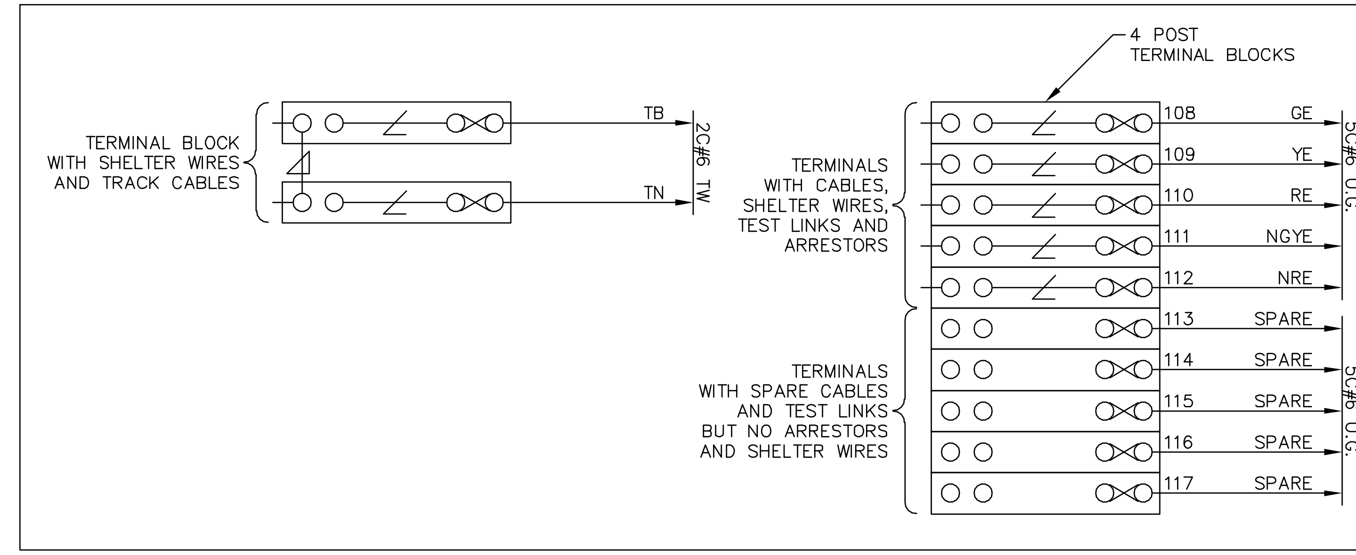
SIGNAL AND COMMUNICATIONS

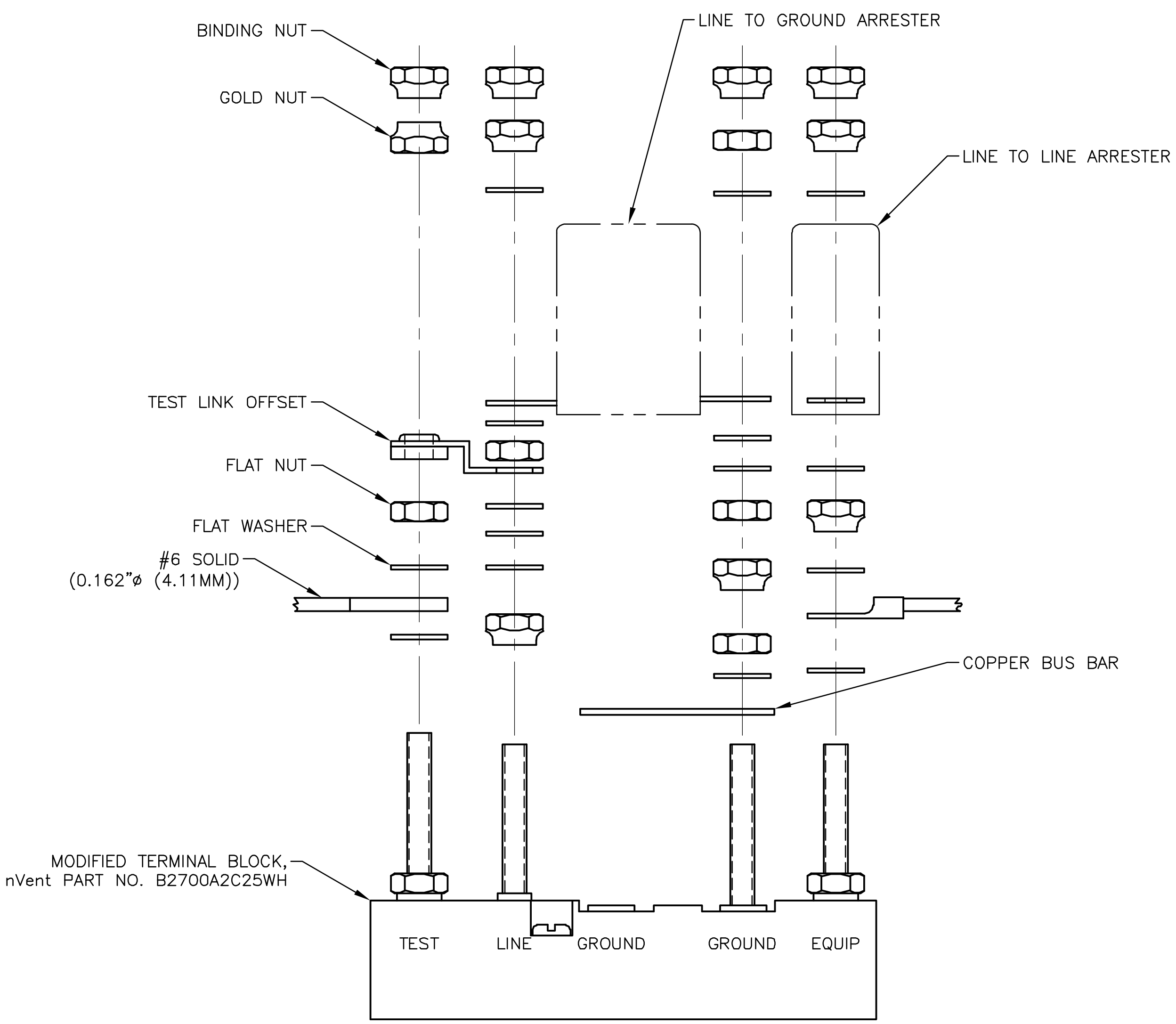
STANDARD DRAWING NO.: SD-5120

TERMINAL BOARD DETAIL



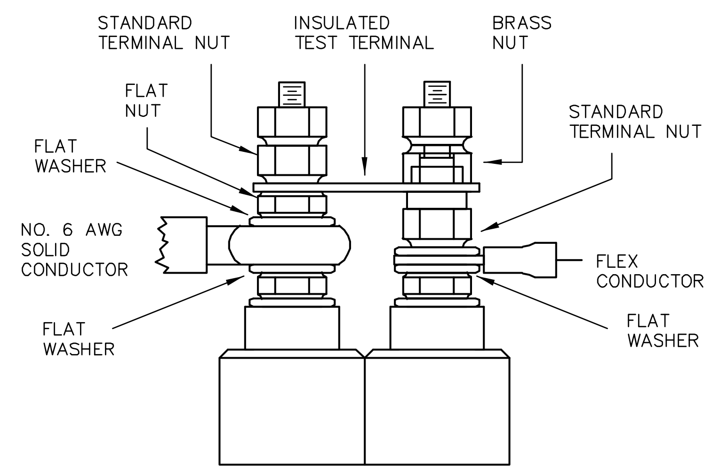
TERMINAL BOARD DETAIL



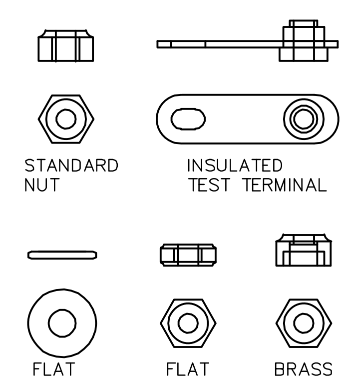


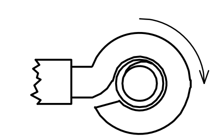
TERMINAL BLOCK WITH HARDWARE

NOTE:
WHEN SMALLER SIZED SOLID CONDUCTORS ARE REQUIRED, FLAT NUT AND STANDARD NUTS WILL EXCHANGE POSITIONS.



AAR TERMINAL





PLACE SOLID WIRE EYELET OVER TERMINAL POST AS SHOWN

NOTES:

1. CASE OPTION SIZE SHALL BE DETERMINED BY THE ENGINEER. CASE SHALL BE EQUIPPED WITH A PLYWOOD BACKBOARD SETUP WITH A MINIMUM OF 48 – 2 POST TERMINALS ARRANGED AS OUTLINED IN THE TERMINAL BOARD DETAIL ABOVE AND DISPLAYED IN THE CASE.
2. INSULATION ON SOLID CONDUCTORS SHALL BE REMOVED AND THE EXPOSED BARE WIRE THOROUGHLY CLEANED TO PROVIDE HIGH CONDUCTIVITY, TAKING CARE NOT TO NICK OR DAMAGE WIRE.
3. THE BARE WIRE SHALL BE FORMED TO PRODUCE AN EYELET WHICH SHALL BE PLACED OVER THE BINDING POST. THE EYELET SHALL BE SIZED TO PROVIDE A TIGHT FITTING LOOP AROUND THE POST BUT LOOSE ENOUGH TO EASILY SLIDE ON AND OFF.
4. A FLAT WASHER SHALL BE PLACED ON THE BINDING POST. THE EYELET SHALL THEN BE PLACED ON THE POST FOLLOWED BY ANOTHER FLAT WASHER. A NUT SHALL BE APPLIED AND SECURELY TIGHTENED WITH A TERMINAL WRENCH.
5. INSULATION ON FLEX CONDUCTORS SHALL BE REMOVED USING A SPRING LOADED STRIPPING TOOL RECOMMENDED BY THE MANUFACTURER OF THE WIRE AND THE EXPOSED BARE WIRE THOROUGHLY CLEANED TO PROVIDE HIGH CONDUCTIVITY.
6. EYELET SHALL BE ATTACHED TO FLEX CONDUCTORS. ONLY CALTRAIN APPROVED EYELET SHALL BE UTILIZED. A COMPRESSION TOOL RECOMMENDED BY THE MANUFACTURER OF THE EYELET SHALL BE USED TO ATTACH THE EYELET.
7. A FLAT WASHER SHALL BE PLACED ON THE BINDING POST. THE EYELET SHALL THEN BE PLACED ON THE POST FOLLOWED BY ANOTHER FLAT WASHER. IF APPLICABLE, THE SECOND EYELET SHALL BE PLACED ON THE POST FOLLOWED BY A FLAT WASHER. A NUT SHALL BE APPLIED AND SECURELY TIGHTENED WITH A TERMINAL WRENCH.
8. AN INSULATED TEST LINK SHALL BE INSTALLED ONCE THE SOLID CONDUCTORS AND EYELETS ARE ATTACHED. THE TEST LINK SHALL BE SECURED USING ONE FLAT AND ONE CROWN NUT AND THE CIRCUIT "CLOSED" BY APPLYING THE BRASS NUT.
9. FLEX CONDUCTORS SHALL BE TAGGED USING CALTRAIN APPROVED TAGS.
10. WHERE POSSIBLE, SPARE SOLID CABLE CONDUCTORS SHALL BE ATTACHED TO SPARE BINDING POSTS. NO MORE THAN ONE SOLID CONDUCTOR SHALL BE SECURED TO A POST.

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PENINSULA CORRIDOR JOINT POWERS BOARD

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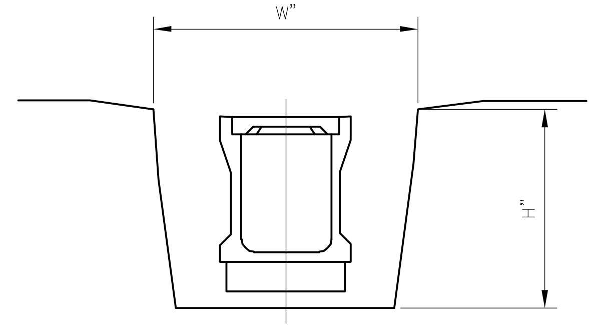
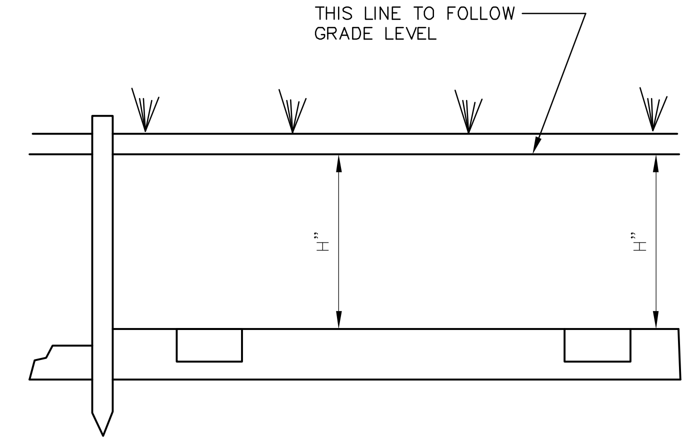
STANDARD DRAWINGS
SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
CABLE JUNCTION CASE

CADD FILE NAME: SD-5121
REV: EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5121

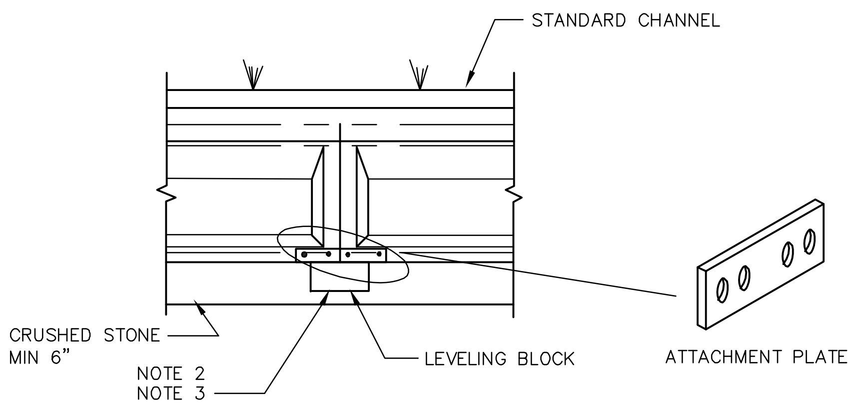
EXCAVATION SIZE CHART		
MODEL	WIDTH	HEIGHT
68	36"	18"
128	45"	18"
1216	45"	27"
2012	50"	24"
2016	50"	27"
3012	60"	24"



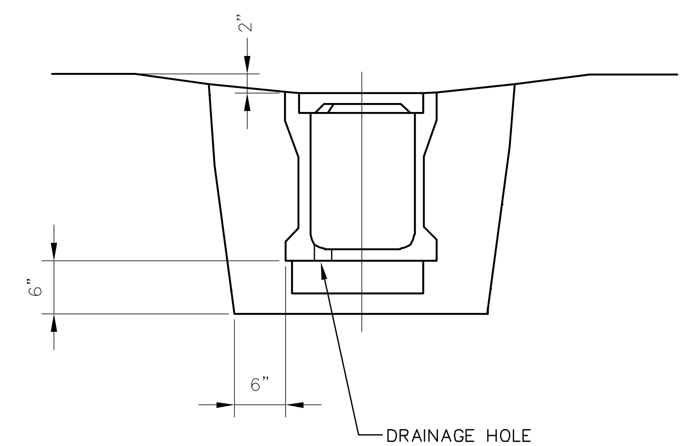
CROSS SECTION



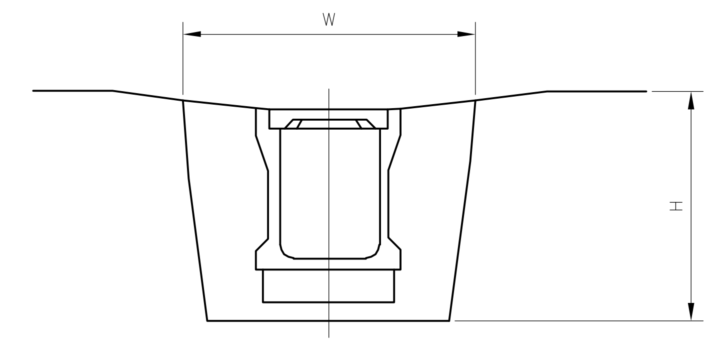
SECTION



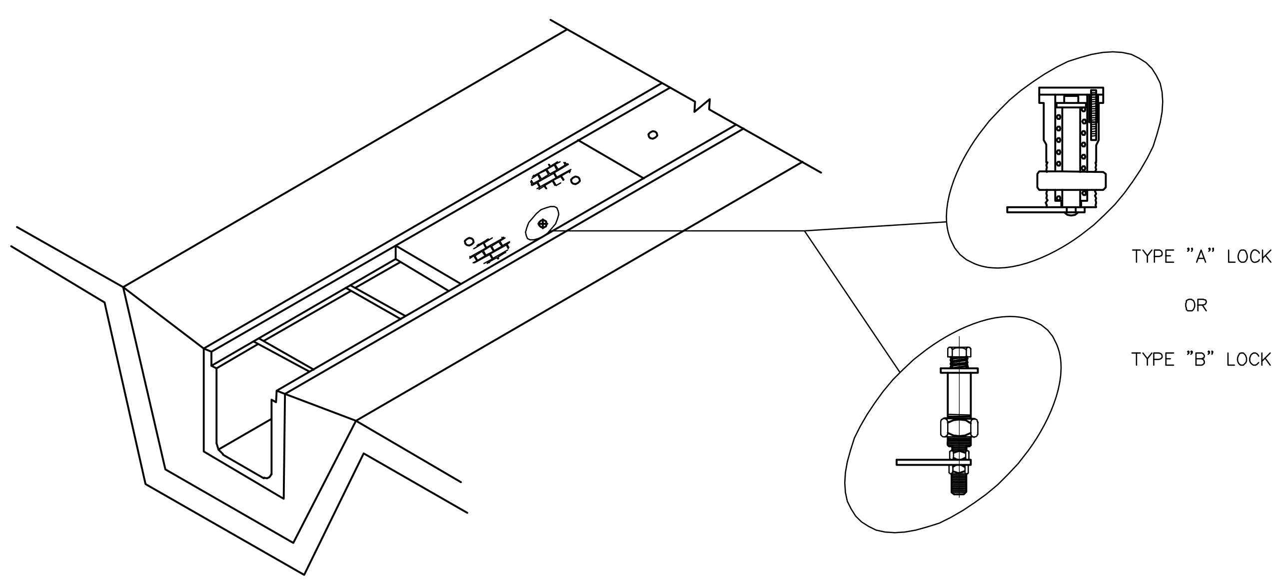
ELEVATION



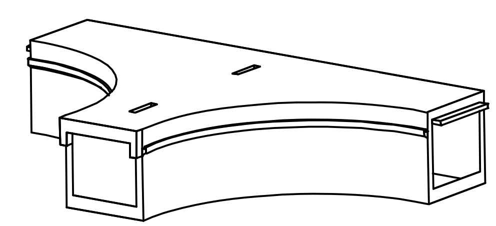
CROSS SECTION



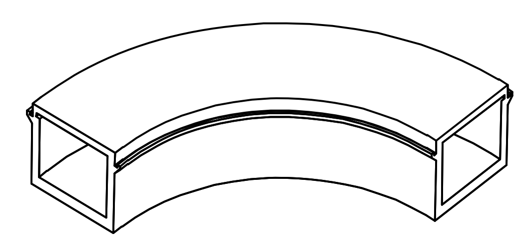
CROSS SECTION



TYPICAL CABLE TROUGH



T-INTERSECTION CABLE TROUGH



90° SWEEP CABLE TROUGH

NOTES:

1. PREPARE A LINE GRADE TO SET THE LEVELING BLOCKS USING A TRANSIT OR CORD LINE WITH LINE LEVEL
2. INSTALL AND COMPACT A LAYER OF SMALL AGGREGATE ROCK, MINIMUM 6" DEEP
3. LOCATE LEVELING BLOCKS TO ALLOW FOR EVEN DISTRIBUTION OF WEIGHT WITH BLOCK SPACING NOT TO EXCEED 48". BLOCK REQUIRED WHEREVER JOINTS LAY. FILL AND COMPACT THE TOP OF LEVELING BLOCKS WITH STONE. USING GRANULAR STONE BACK FILL AGAINST THE SIDES OF THE CHANNELS IN 8" COMPACTED LIFTS TO WITHIN 2" OF FINISHED GRADE
4. CHANNEL TOP SET AT 2" BELOW FINAL GRADE LEVEL AND BUTT-JOINED TO EACH OTHER ON THE LEVELING BLOCKS; EACH CHANNEL SHOULD BE SUPPORTED FOR 4" ON THE LEVELING BLOCKS AT JOINTS
5. THE DETAILS OF CABLE TROUGH INTERSECTION ARE FOR ILLUSTRATION ONLY. ACTUAL INTERSECTIONS MAY BE DIFFERENT THAN SHOWN

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PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

Bin Zhang

DEPUTY DIRECTOR, ENGINEERING

Caltrain

1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

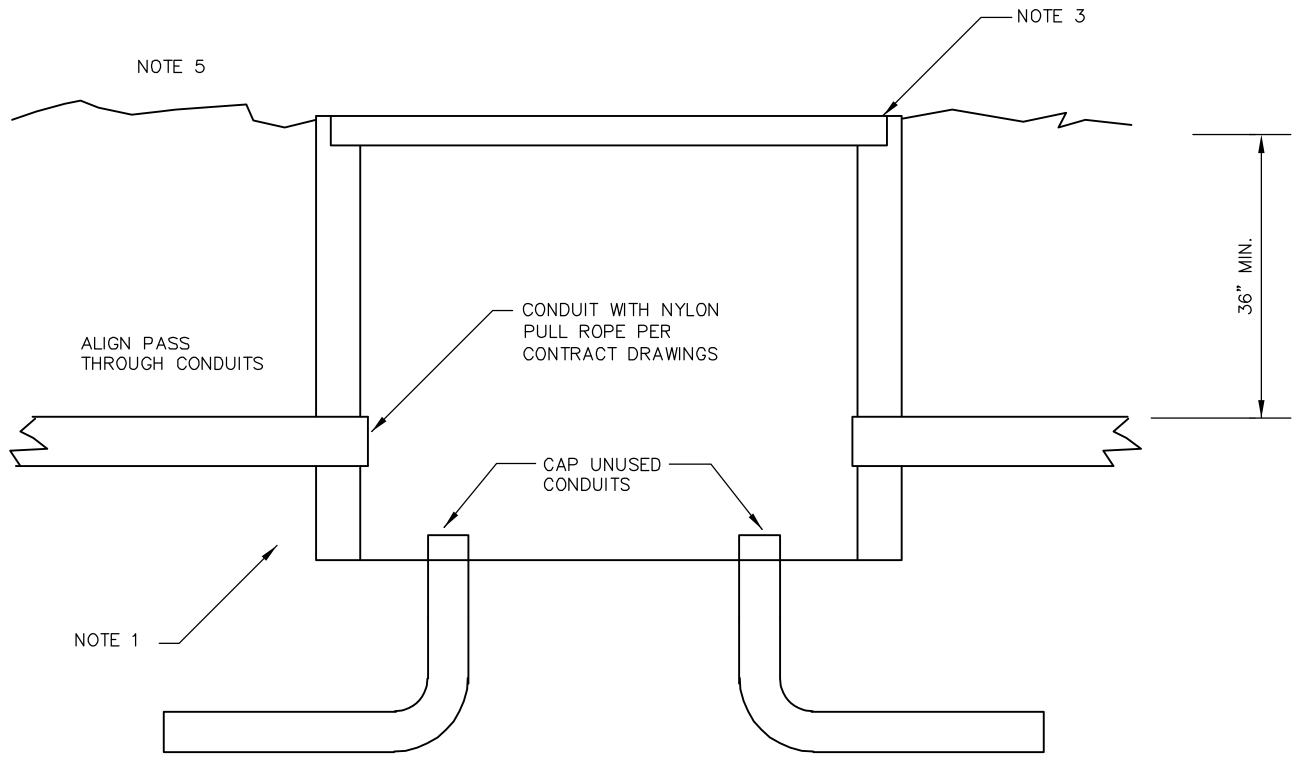
SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
TYPICAL SIGNAL/CROSSING LOCATION
CABLE TROUGH

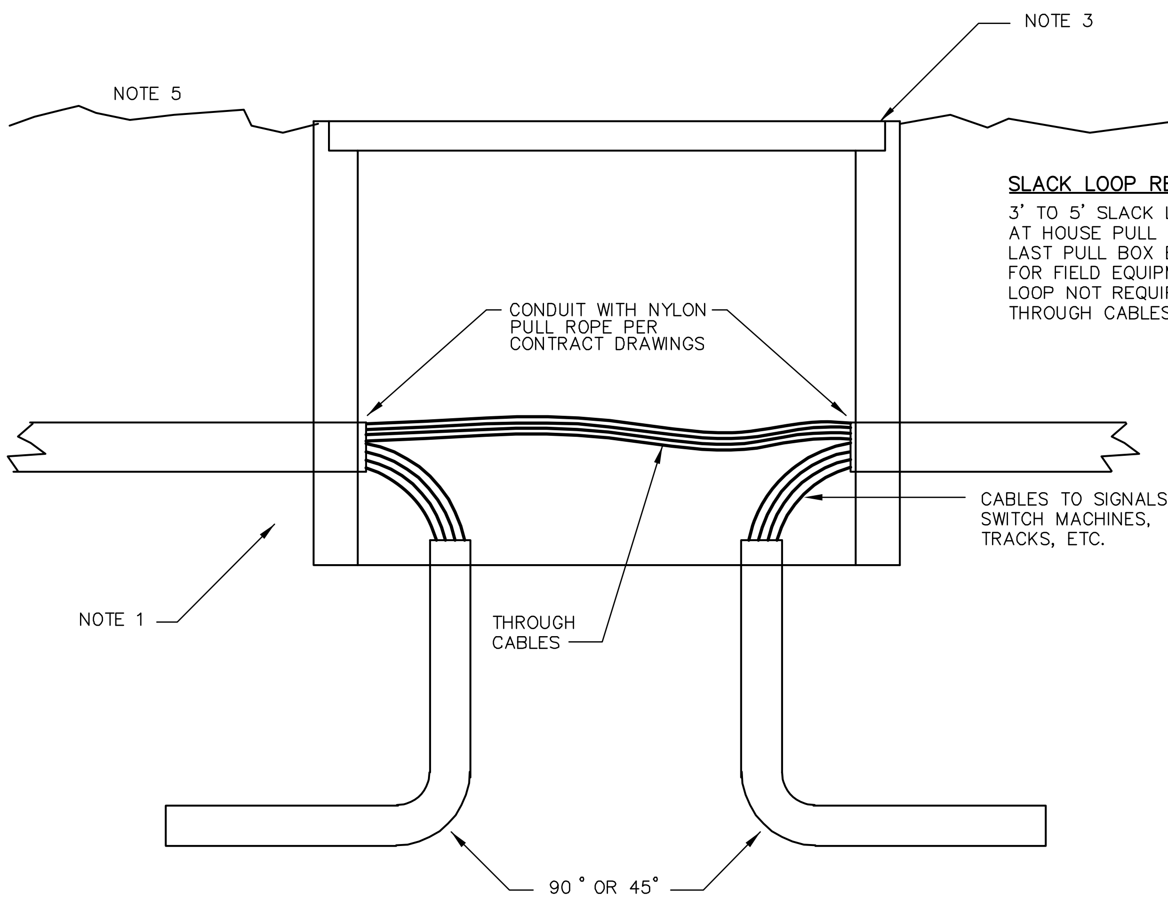
CADD FILE NAME: SD-5122

REV: EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

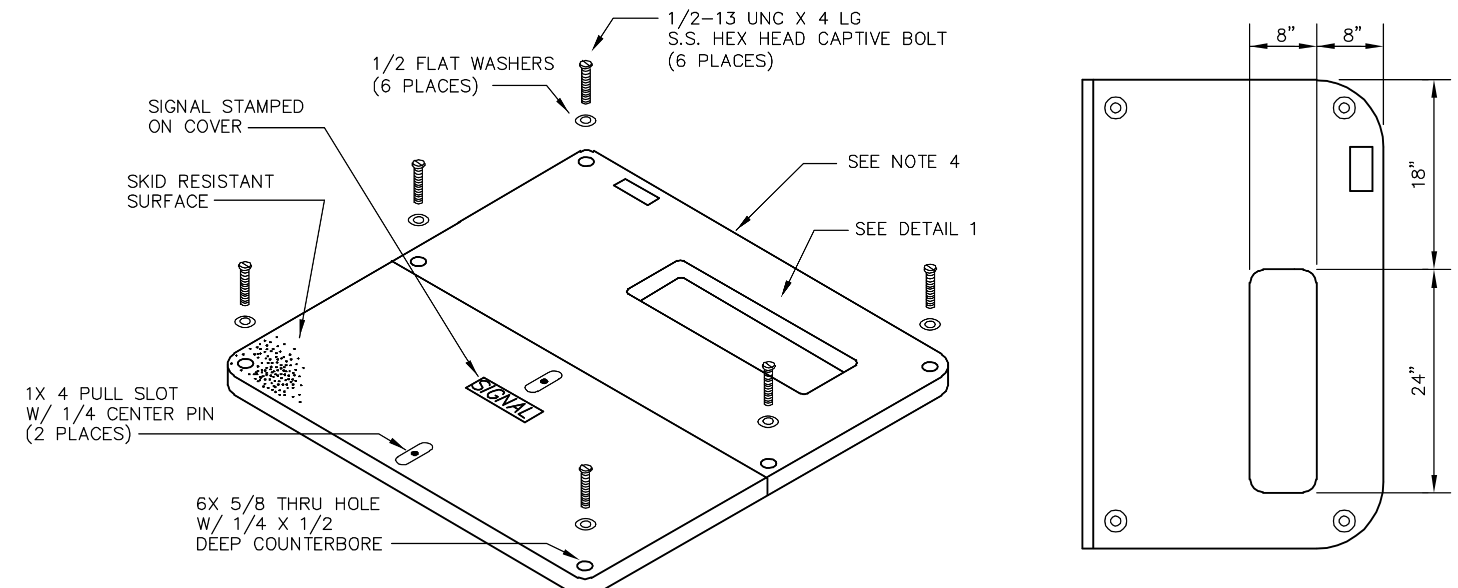
STANDARD DRAWING NO.: SD-5122



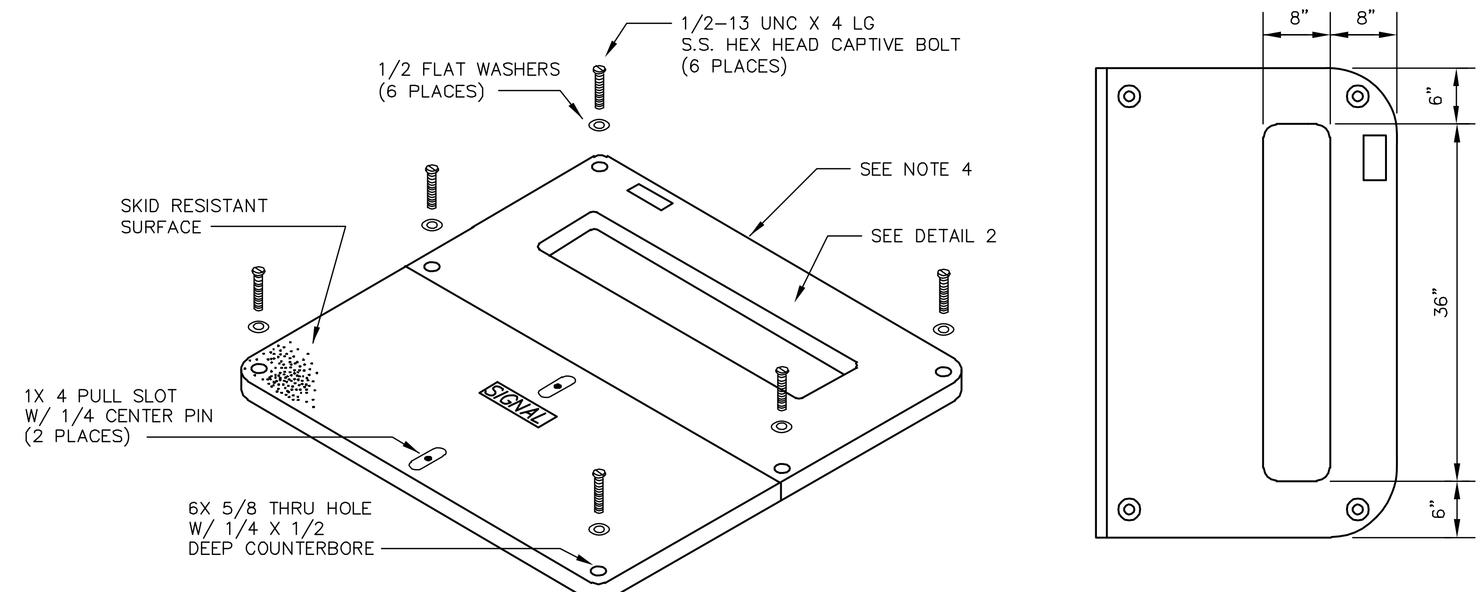


SLACK LOOP REQUIREMENTS:

3' TO 5' SLACK LOOP REQUIRED AT HOUSE PULL BOX AND AT LAST PULL BOX BEFORE EXITING FOR FIELD EQUIPMENT, SLACK LOOP NOT REQUIRED FOR THROUGH CABLES



DETAIL 1 FOR 8' X 14' SIGNAL HOUSE



DETAIL 2 FOR 6' X 6' SIGNAL HOUSE

NOTES:

1. PLACE A LAYER OF DRAINAGE ROCKS AT A MINIMUM OF 6" BELOW AND EXTENDING 12" FROM EACH SIDE OF THE PULL BOX. ROCKS SHALL BE COMPACTED PRIOR TO PLACEMENT OF PULL BOX
2. NATIVE MATERIAL SHALL BE USED FOR BACKFILLING CONDUIT. ROCK AND DEBRIS LARGER THAN 3 INCHES IN DIAMETER SHALL BE REMOVED. BACK FILL COMPACTION SHALL BE 95-PERCENT IN 8" LIFTS
3. PULL BOX SHALL BE DESIGNED FOR H-20-44 BRIDGE LOADING AND EQUIPPED WITH COVER DESIGNED FOR VEHICULAR TRAFFIC. MINIMUM NOMINAL SIZE OF PULL BOX SHALL BE 2' X 3' LARGER PULLS BOXES SHALL BE FURNISHED WHERE MINIMUM BEND RADIUS OF CABLE IS A FACTOR. TOP OF PULL BOX SHALL BE LEVEL WITH FINAL GRADE
4. FOR CONTROL POINT, OR CROSSING SIGNAL HOUSE THIS COVER ASSEMBLY SHALL BE USED WITH A 4' X 4' PULL BOX WITH "NOTE 3" DESIGN SPECS. COVER IS DESIGNED WITH AN OPENING FOR THE SIGNAL HOUSE CABLE CHUTE. THE SIDE OF THE COVER WITH THE CABLE CHUTE OPENING IS RATED FOR PEDESTRIAN TRAFFIC ONLY
5. ALL PULL BOXES SHALL BE PROTECTED FROM DAMAGE UNTIL FINAL PLACEMENT IN SERVICE
6. SEAL CONDUIT / CABLE WELLS WITH PLASTER OF PARIS OR OTHER SUITABLE MATERIAL

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PENINSULA CORRIDOR JOINT POWERS BOARD

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1250 San Carlos Avenue
San Carlos, CA 94070

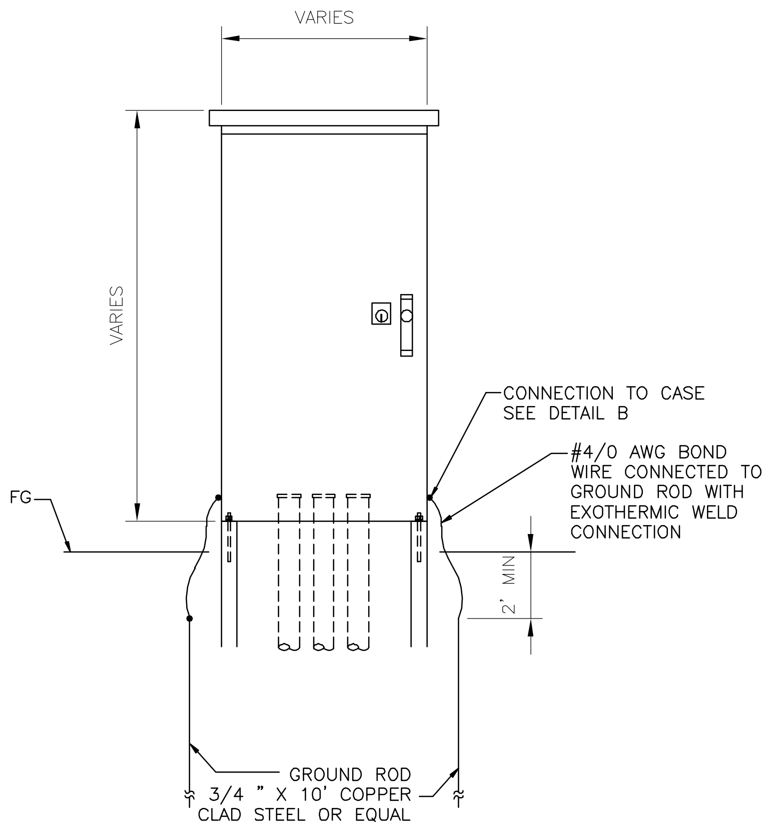
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
PULL BOX
TYPICAL PULL BOX INSTALLATION

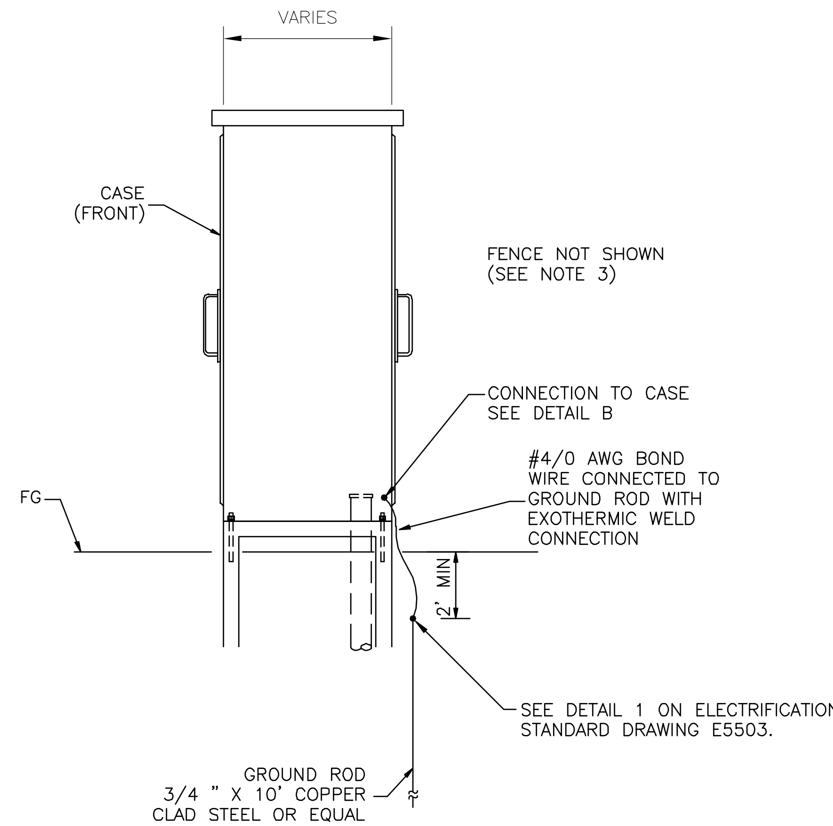
CADD FILE NAME: SD-5123
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5123

NOTES:

1. CONNECT ALL GROUND WIRES TO FACTORY INSTALLED GROUND STUD ON CASE.
2. CONTRACTOR TO MEASURE GROUND RESISTANCE AFTER INSTALLATION. IF GROUND RESISTANCE IS GREATER THAN 15Ω, ADDITIONAL GROUND RODS AND A GROUND LOOP TO BE INSTALLED TO MEET 15Ω. IF NECESSARY USE CHEMICAL TREATMENT OF SOIL TO LOWER THE RESISTIVITY OF GROUND AS REQUIRED.
3. FOR GROUNDING TO SIGNAL EQUIPMENT CASE WITHIN FENCING PERIMETER, SEE SD-5512. REFER TO SIGNALS AND COMMUNICATIONS DUCT BANK DRAWINGS.

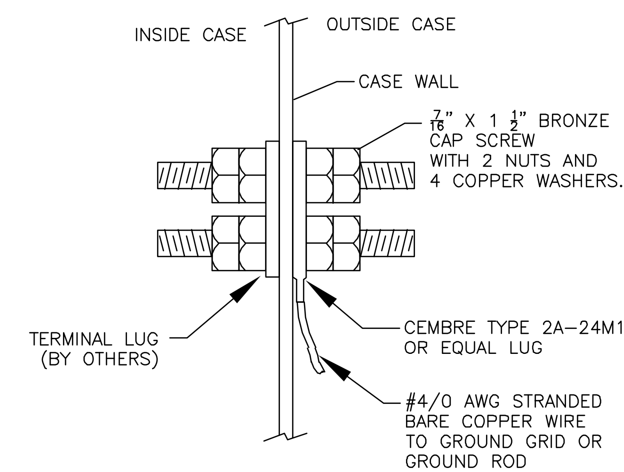


FRONT VIEW



SIDE VIEW

TYPICAL EQUIPMENT CASE
VIEWS
SCALE: NOT TO SCALE



B
–
CASE GROUND
CONNECTION DETAIL
NOT TO SCALE

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					01012024 FOURTH EDITION						

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:
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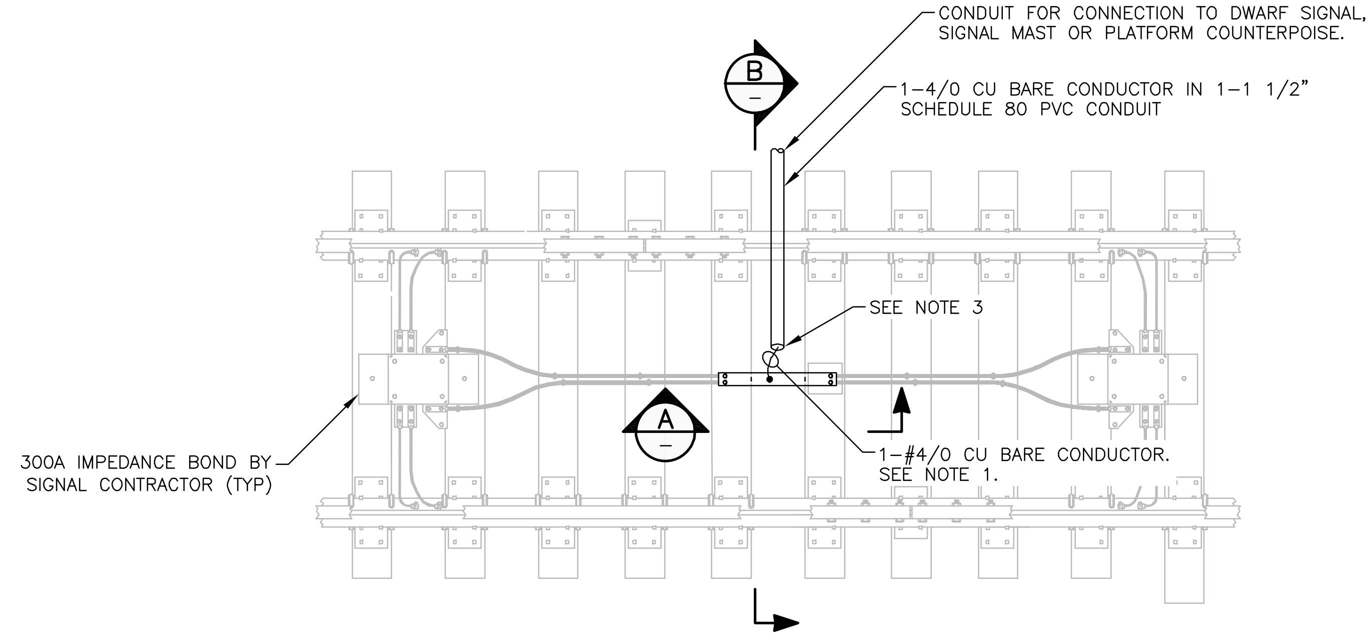
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
TYPICAL SIGNAL EQUIPMENT
CASE GROUNDING

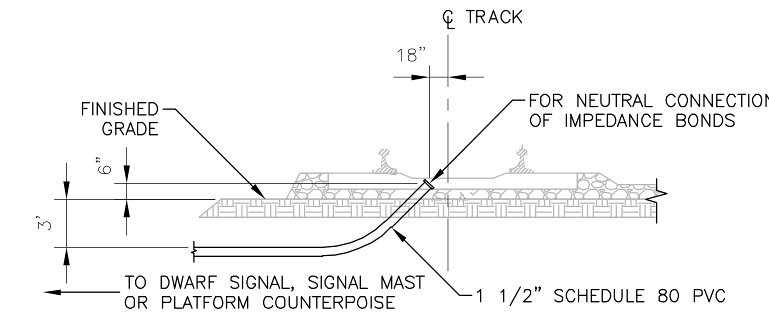
CADD FILE NAME: SD-5124
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5124



300A IMPEDANCE BOND CIRCUIT DETAIL
CONNECTION TO DWARF SIGNAL, SIGNAL MAST
OR PLATFORM COUNTERPOISE

PLAN

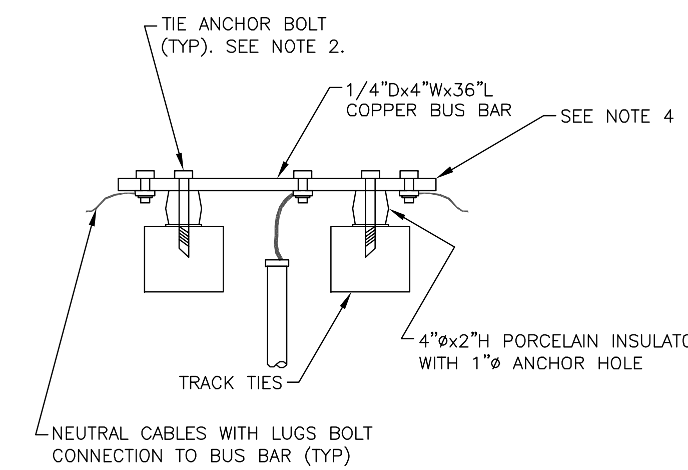
SCALE: NOT TO SCALE



IMPEDANCE BOND CONDUIT
SECTION AND DETAIL

B – SECTION

SCALE: NOT TO SCALE



A – SECTION

SCALE: NOT TO SCALE

NOTES:

1. FOR CONDUCTOR TYPE, SEE NOTE 7 ON ELECTRIFICATION STANDARD DRAWING E5002.
2. FOR WOOD TIES, USE 3/4"x6" LAG SCREW TO SECURE COPPER BUS. FOR CONCRETE TIES, MAKE THE ATTACHMENTS USING 3/4" MIN. WIDE STAINLESS STEEL STRAPS WRAPPED AROUND THE TIE OR OTHER METHOD AS APPROVED BY ENGINEER.
3. PROVIDE WATERTIGHT BUSHING AT CONDUCTOR EXIT, RATED FOR CONDUCTOR TYPE.
4. PROVIDE COVER/SHIELD FOR BUSBAR. SUBMIT BUSBAR/SHIELD COVER TO CALTRAIN FOR APPROVAL PRIOR TO PROCUREMENT.

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PENINSULA CORRIDOR JOINT POWERS BOARD

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San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
IMPEDANCE BOND DETAILS

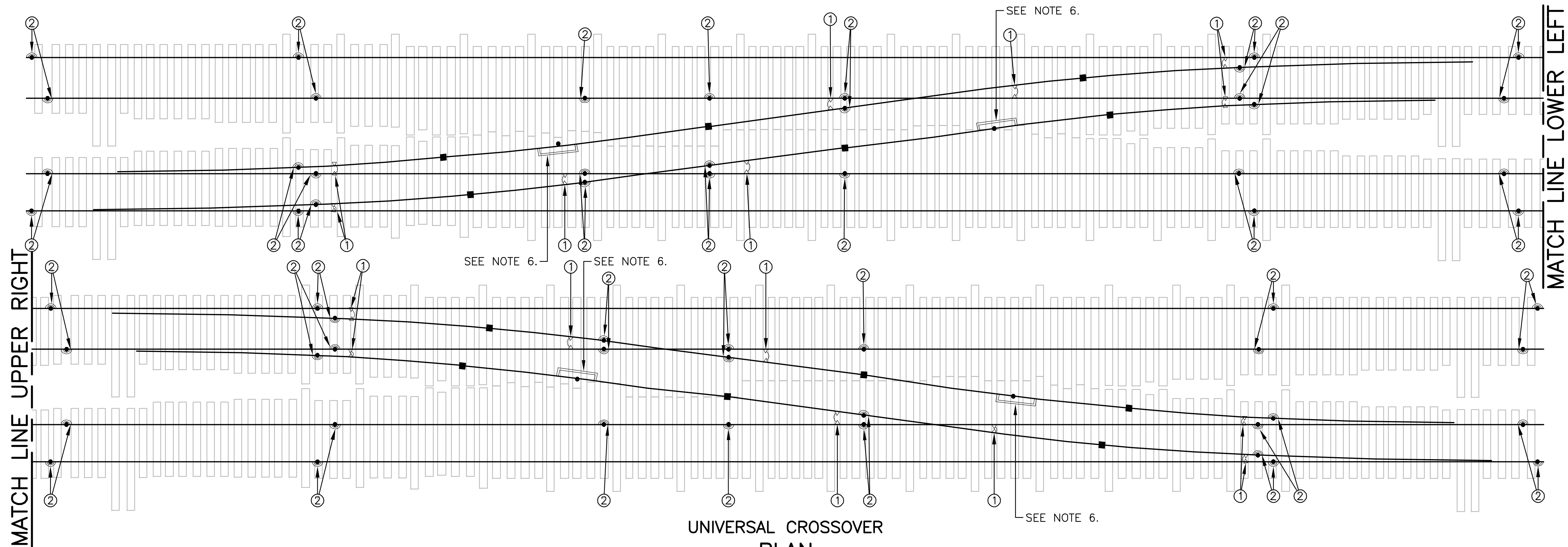
CADD FILE NAME: SD-5125

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

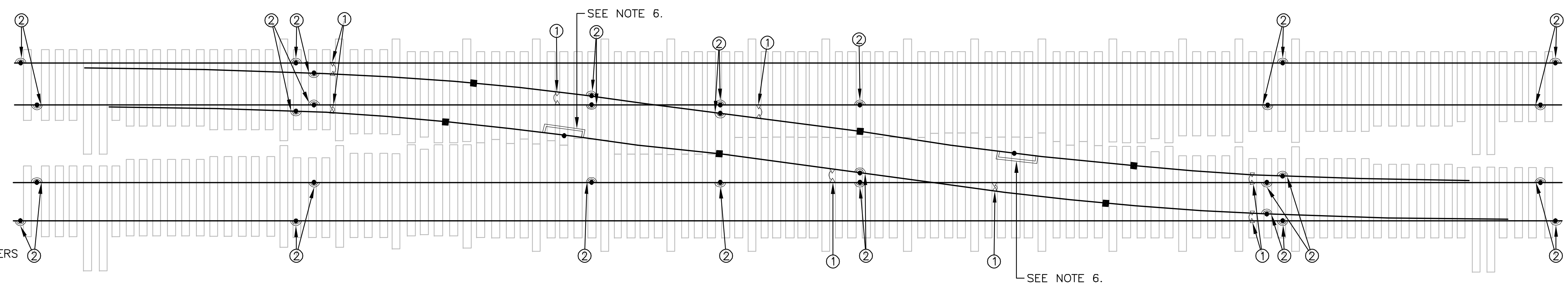
STANDARD DRAWING NO.: SD-5125



UNIVERSAL CROSSOVER

PLAN

SCALE: NOT TO SCALE



SINGLE CROSSOVER

PLAN

SCALE: NOT TO SCALE

LEGEND:

RAIL JOINT, BY OTHERS

INSULATED JOINT, BY OTHERS

BONDED SIGNAL RAIL JOINT (2 BONDS PER RAIL JOINT)

EQUIPMENT:

① TWO #4/0 AWG INSULATED CABLE FROG OR CROSSBOND AT EACH LOCATION.

② TWO #4/0 AWG BONDS, ONE ON EACH SIDE OF THE RAILS, SHALL BE COMPRESSION BOLTED TO THE WEB OF THE RAILS AT THE CENTERLINE OF THE WEB, 7 INCHES BEYOND THE JOINT BARS, AS SHOWN IN THE RAIL JOINT DETAIL ON DWG SD-5127, EXCEPT THAT ONLY ONE #4/0 AWG BOND SHALL BE USED WHEN BONDING TO THE HEELS OF SWITCH POINT RAILS.

NOTES:

1. EQUIVALENT CONFIGURATION REQUIRED FOR DIRECT FIXATION AND BALLASTED TRACK.
2. SIGNAL BONDS: ERICO TYPE SBPAJB-"A", OR APPROVED EQUAL. (16 EXTRA GALVANIZED STEEL WIRES AND 3 COPPER WIRES).
3. THE CONTRACTOR SHALL ASSEMBLE INSULATED SIGNAL RAIL BONDS OF THE APPROPRIATE LENGTH USING 2 TRACK CONNECTORS AND THE APPROPRIATE LENGTH OF INSULATED WIRE.
4. THE INSULATED SIGNAL RAIL BONDS SHALL CLOSELY MATCH (AS PRACTICABLE) THE SIZE, COMPOSITION, AND GAUGE OF THE NON-INSULATED SIGNAL RAIL BOND.
5. THE TRACKAGE DIAGRAM SHOWN REPRESENTS A TYPICAL UNIVERSAL CROSSOVER AND SINGLE CROSSOVER AND THEREFORE ILLUSTRATES ONLY THE MINIMUM AMOUNT OF SIGNAL RAIL BONDING REQUIRED. THE CONTRACTOR SHALL PROVIDE THE SIGNAL RAIL BONDING SHOWN. PLUS ANY ADDITIONAL SIGNAL RAIL BONDING NECESSARY TO BOND AROUND ADDITIONAL RAIL JOINTS INCLUDED IN CROSSOVERS OF LARGER SIZE OR ON WIDER TRACK.
6. THE CONTRACTOR SHALL USE PIN-TYPE SIGNAL RAIL BONDS OF THE TYPE SHOWN WHEREVER POSSIBLE, WHERE CLOSE CLEARANCES OR LACK OF SPACE PRECLUDES THE USE OF PIN-TYPE BONDS, CADWELDED RAILHEAD BONDS OF A TYPE PREVIOUSLY APPROVED BY THE ENGINEER MAY BE USED.
7. CEMBRE TYPE CONNECTIONS ARE AN ACCEPTABLE ALTERNATIVE TO OTHER CABLE TO RAIL CONNECTIONS.

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PENINSULA CORRIDOR JOINT POWERS BOARD

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DEPUTY DIRECTOR, ENGINEERING

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1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

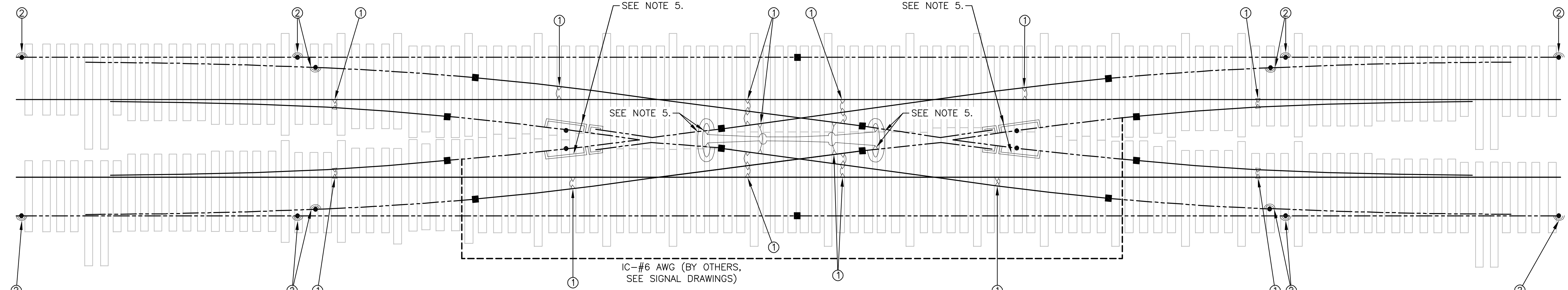
SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
TYPICAL BONDING UNIVERSAL AND SINGLE CROSSOVER LAYOUT

CADD FILE NAME: SD-5126

REV: | EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5126



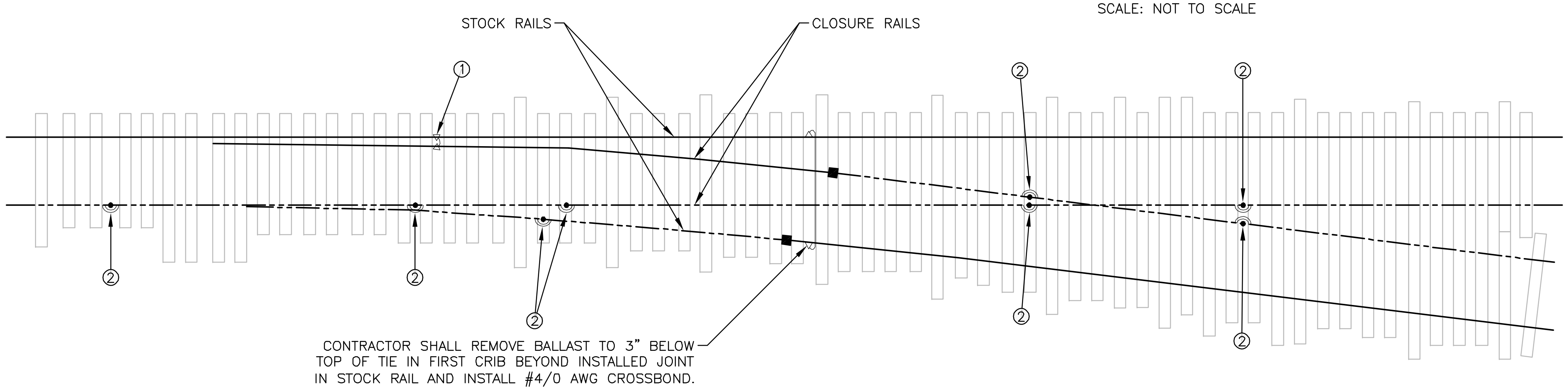
DIAMOND CROSSOVER (SINGLE SIGNAL RAIL)

PLAN

SCALE: NOT TO SCALE

LEGEND

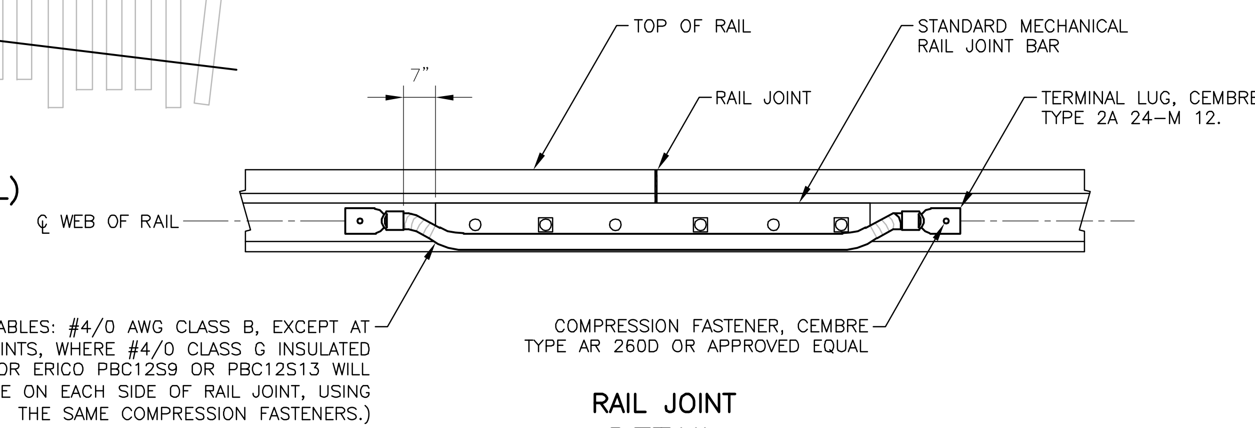
- RAIL JOINT, BY OTHERS
- INSULATED JOINT, BY OTHERS
- BONDED SIGNAL RAIL JOINT (2 BONDS PER RAIL JOINT)
- BONDED SIGNAL RAIL TO SIGNAL WING RAIL AT SIGNAL RAIL FROG (4 SIGNAL BONDS PER FROG)
- NO. 6 AWG FLEX CABLE
- POWER RAIL
- SIGNAL RAIL



SINGLE TURNOUT (SINGLE SIGNAL RAIL)

PLAN

SCALE: NOT TO SCALE



RAIL JOINT

DETAIL

SCALE: NOT TO SCALE

NOTES:

1. EQUIVALENT CONFIGURATION REQUIRED FOR DIRECT FIXATION AND BALLASTED TRACK.
2. SIGNAL BONDS: ERICO TYPE SBPAJB-"A", OR APPROVED EQUAL. (16 EXTRA GALVANIZED STEEL WIRES AND 3 COPPER WIRES).
3. THE CONTRACTOR SHALL ASSEMBLE INSULATED SIGNAL RAIL BONDS OF THE APPROPRIATE LENGTH USING 2 TRACK CONNECTORS AND THE APPROPRIATE LENGTH OF INSULATED WIRE. THE INSULATED SIGNAL RAIL BONDS SHALL CLOSELY MATCH (AS PRACTICABLE) THE SIZE, COMPOSITION AND GAUGE OF THE NON-INSULATED SIGNAL RAIL BOND.
4. THE TRACKAGE DIAGRAM SHOWN REPRESENTS A TYPICAL NO. 8 DIAMOND CROSSOVER AND SINGLE TURNOUT AND THEREFORE ILLUSTRATES ONLY THE MINIMUM AMOUNT OF SIGNAL RAIL BONDING REQUIRED. THE CONTRACTOR SHALL PROVIDE THE SIGNAL RAIL BONDING SHOWN PLUS ANY ADDITIONAL SIGNAL RAIL BONDING NECESSARY TO BOND AROUND ADDITIONAL RAIL JOINTS INCLUDED IN CROSSOVERS OF LARGER SIZE OR ON WIDER TRACK CENTERS.
5. THE CONTRACTOR SHALL USE PIN-TYPE SIGNAL RAIL BONDS OF THE TYPE SHOWN WHEREVER POSSIBLE. WHERE CLOSE CLEARANCES OR LACK OF SPACE PRECLUDES THE USE OF PIN-TYPE BONDS, CADWELDED RAILHEAD BONDS OF A TYPE PREVIOUSLY APPROVED BY THE ENGINEER MAY BE USED.
6. CEMBRE TYPE CONNECTIONS ARE AN ACCEPTABLE ALTERNATIVE TO OTHER CABLE TO RAIL CONNECTIONS.

EQUIPMENT:

1. TWO #4/0 AWG INSULATED CABLE FROG OR CROSSBOND AT EACH LOCATION.
2. TWO 4/0 AWG SIGNAL BONDS, ONE ON EACH SIDE OF THE RAILS, SHALL BE COMPRESSION BOLTED TO THE WEB OF THE RAILS AT THE CENTERLINE OF THE WEB, 7 INCHES BEYOND THE JOINT BARS, AS SHOWN IN THE RAIL JOINT DETAIL, EXCEPT THAT ONLY ONE 4/0 AWG BOND SHALL BE USED WHEN BONDING TO THE HEELS OF SWITCH POINT RAILS.

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REV	DATE	BY	CHK	APP	

PENINSULA CORRIDOR JOINT POWERS BOARD

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San Carlos, CA 94070

STANDARD DRAWINGS

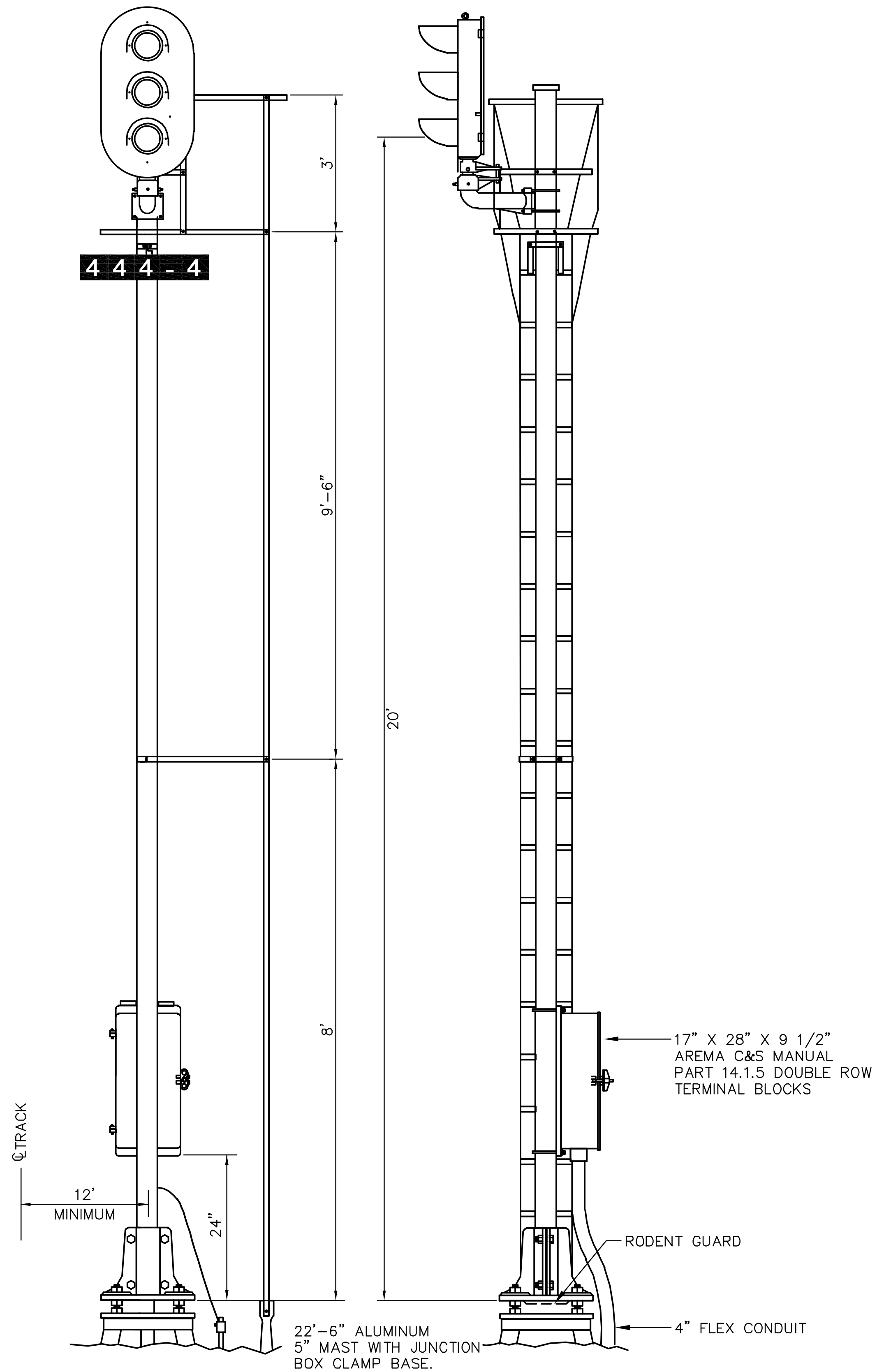
SIGNAL AND COMMUNICATIONS
GENERAL SIGNAL
TYPICAL DIAMOND AND SINGLE
TURNOUT LAYOUT

CADD FILE NAME: SD-5127

REV: | EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5127



FRONT VIEW

SIDE VIEW

NOTES:

1. WHERE CLEARANCES ARE NOT A FACTOR, SIGNALS SHALL BE SET 12' MINIMUM TO 15' MAXIMUM FROM CENTER LINE OF TRACKS.
2. FOR SIGNAL UNIT REFERENCE SEE SD-5205. NUMBER PLATE TO BE OMITTED ON CONTROLLED SIGNALS.
3. FOR FOUNDATION SEE SD-5114.
4. ALL IN-LINE SIGNAL LIGHT UNITS SHALL BE LED, INCANDESCENT LIGHTS ARE NOT ACCEPTABLE.
5. SIGNAL SHALL BE EQUIPPED WITH LADDER GUARD AND LOCKING BRACKET. LADDER AND PLATFORM SHALL MEET CURRENT OSHA REQUIREMENTS AND SHALL BE MOUNTED ON FIELD SIDE OF MAST.
6. PROVIDE A MINIMUM DISTANCE OF 4' FOR WALKWAY AROUND SIGNAL AND LADDER.
7. A LAYER OF CRUSHED ROCK, 3/4" X 1/4" SHALL BE PLACED AROUND STRUCTURE A MINIMUM DISTANCE OF 4'.
8. SIGNAL ASPECT SIGNALS SHALL HAVE THE BACK SIDE PAINTED SILVER.

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REV	DATE	BY	CHK	APP	

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Caltrain

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San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SIGNAL APPARATUS
GROUND SIGNAL
SINGLE UNIT COLORLIGHT

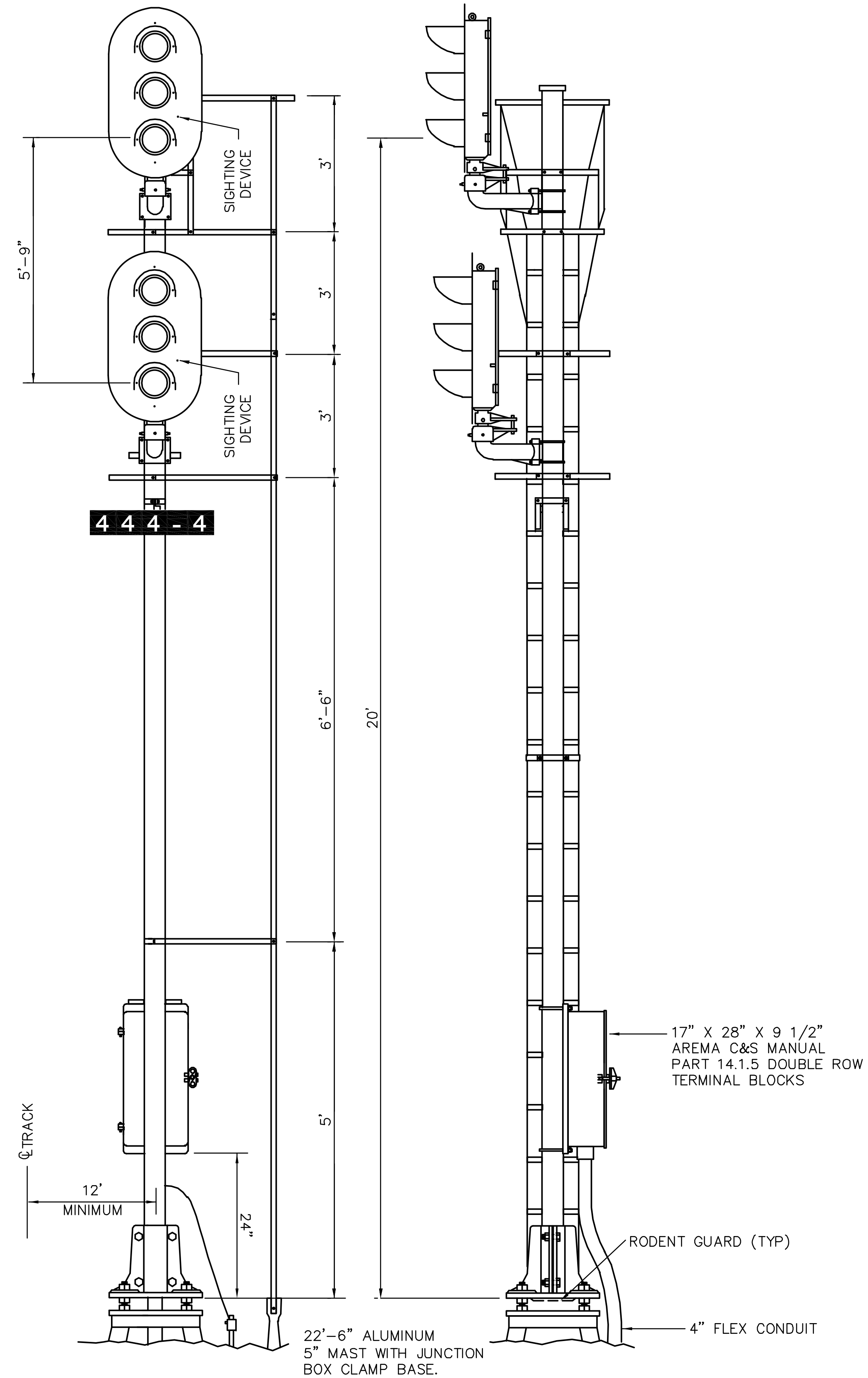
CADD FILE NAME: SD-5201

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5201



FRONT VIEW

SIDE VIEW

NOTES:

1. WHERE CLEARANCES ARE NOT A FACTOR, SIGNALS SHALL BE SET 12' MINIMUM TO 15' MAXIMUM FROM CENTER LINE OF TRACKS.
2. FOR SIGNAL UNIT REFERENCE SEE SD-5205. NUMBER PLATE TO BE OMITTED ON CONTROLLED SIGNALS.
3. FOR FOUNDATION SEE SD-5114.
4. ALL IN-LINE SIGNAL LIGHT UNITS SHALL BE LED, INCANDESCENT LIGHTS ARE NOT ACCEPTABLE.
5. SIGNAL SHALL BE EQUIPPED WITH LADDER GUARD AND LOCKING BRACKET. LADDER AND PLATFORM SHALL MEET CURRENT OSHA REQUIREMENTS AND SHALL BE MOUNTED ON FIELD SIDE OF MAST.
6. PROVIDE A MINIMUM DISTANCE OF 4' FOR WALKWAY AROUND SIGNAL AND LADDER.
7. A LAYER OF CRUSHED ROCK, 3/4" X 1/4" SHALL BE PLACED AROUND STRUCTURE A MINIMUM DISTANCE OF 4'.

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	01012024				FOURTH EDITION

REV	DATE	BY	CHK	APP	

PENINSULA CORRIDOR JOINT POWERS BOARD

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Caltrain

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San Carlos, CA 94070

STANDARD DRAWINGS

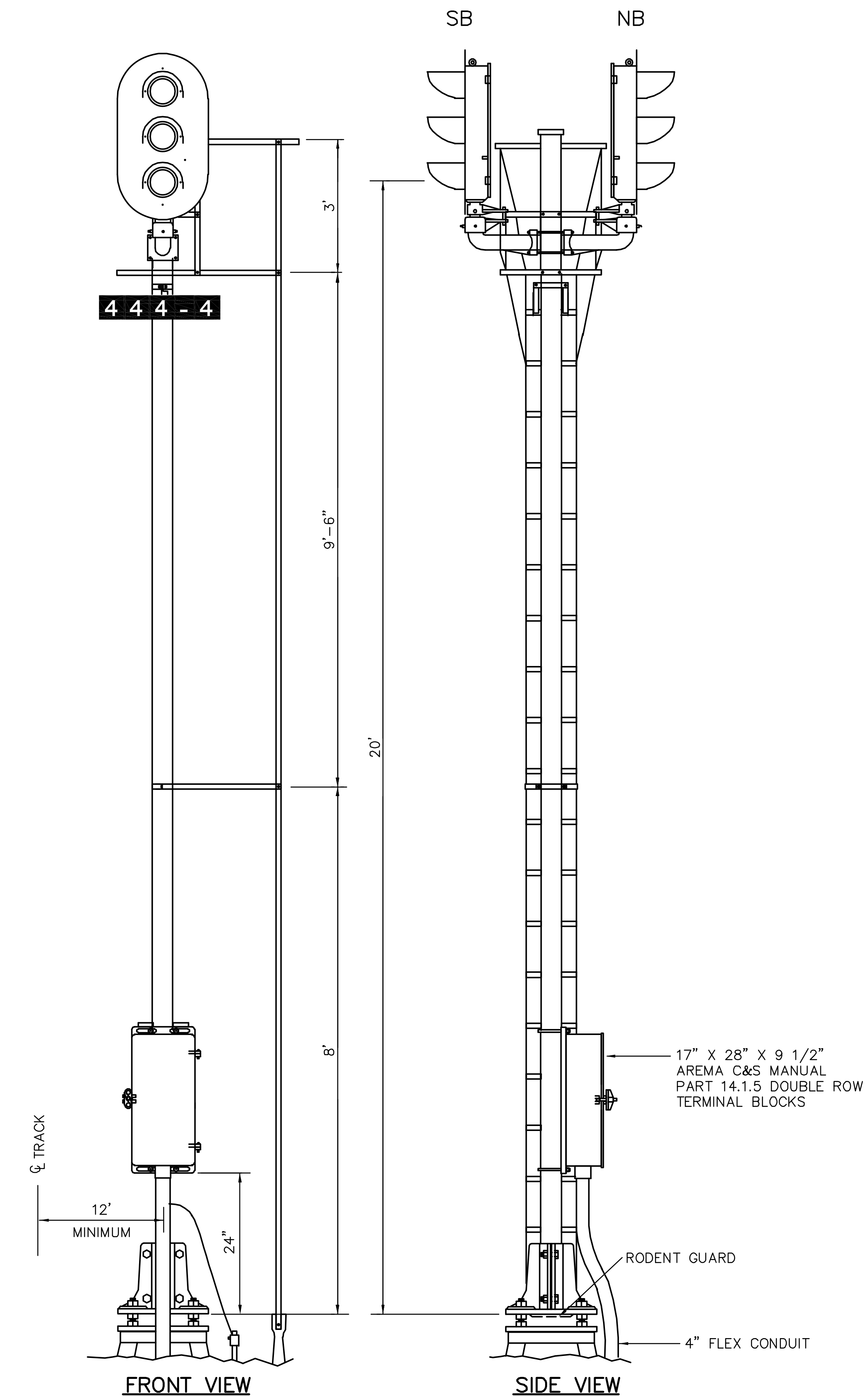
SIGNAL AND COMMUNICATIONS
SIGNAL APPARATUS
GROUND SIGNAL (22 FEET)
DOUBLE UNIT COLORLIGHT

CADD FILE NAME: SD-5202

REV: | EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5202



NOTES:

1. WHERE CLEARANCES ARE NOT A FACTOR, SIGNALS SHALL BE SET 12' MINIMUM TO 15' MAXIMUM FROM CENTER LINE OF TRACKS.
2. FOR SIGNAL UNIT REFERENCE SEE SD–5205. NUMBER PLATE TO BE OMITTED ON CONTROLLED SIGNALS.
3. FOR FOUNDATION SEE SD–5114.
4. ALL IN–LINE SIGNAL LIGHT UNITS SHALL BE LED, INCANDESCENT LIGHTS ARE NOT ACCEPTABLE.
5. SIGNAL SHALL BE EQUIPPED WITH LADDER GUARD AND LOCKING BRACKET. LADDER AND PLATFORM SHALL MEET CURRENT OSHA REQUIREMENTS AND SHALL BE MOUNTED ON FIELD SIDE OF MAST.
6. PROVIDE A MINIMUM DISTANCE OF 4' FOR WALKWAY AROUND SIGNAL AND LADDER.
7. A LAYER OF CRUSHED ROCK, 3/4" X 1/4" SHALL BE PLACED AROUND STRUCTURE A MINIMUM DISTANCE OF 4'.

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San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SIGNAL APPARATUS
GROUND SIGNAL (22 FEET)
BI–DIRECTIONAL COLORLIGHT

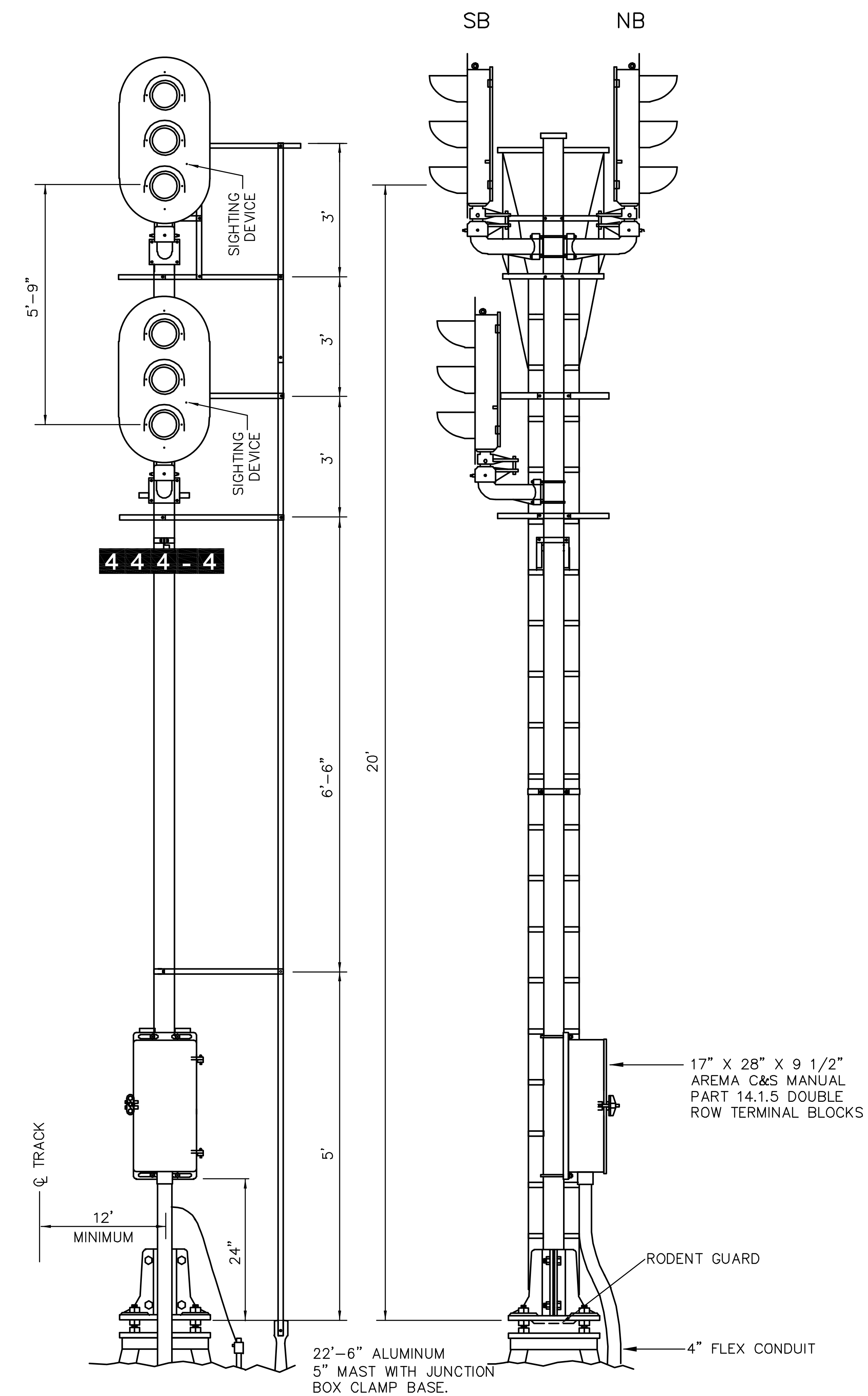
CADD FILE NAME: SD–5203

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD–5203



FRONT VIEW

SIDE VIEW

NOTES:

1. WHERE CLEARANCES ARE NOT A FACTOR, SIGNALS SHALL BE SET 12' MINIMUM TO 15' MAXIMUM FROM CENTER LINE OF TRACKS.
2. FOR SIGNAL UNIT REFERENCE SEE SD-5205. NUMBER PLATE TO BE OMITTED ON CONTROLLED SIGNALS.
3. FOR FOUNDATION SEE SD-5114.
4. ALL IN-LINE SIGNAL LIGHT UNITS SHALL BE LED, INCANDESCENT LIGHTS ARE NOT ACCEPTABLE.
5. SIGNAL SHALL BE EQUIPPED WITH LADDER GUARD AND LOCKING BRACKET. LADDER AND PLATFORM SHALL MEET CURRENT OSHA REQUIREMENTS AND SHALL BE MOUNTED ON FIELD SIDE OF MAST.
6. PROVIDE A MINIMUM DISTANCE OF 4' FOR WALKWAY AROUND SIGNAL AND LADDER.
7. A LAYER OF CRUSHED ROCK, 3/4" X 1/4" SHALL BE PLACED AROUND STRUCTURE A MINIMUM DISTANCE OF 4'.

REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP	

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

Bin Zhang

DEPUTY DIRECTOR, ENGINEERING

Caltrain

1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SIGNAL APPARATUS
GROUND SIGNAL (22 FEET)
WITH 2ND UNIT
BI-DIRECTIONAL COLORLIGHT

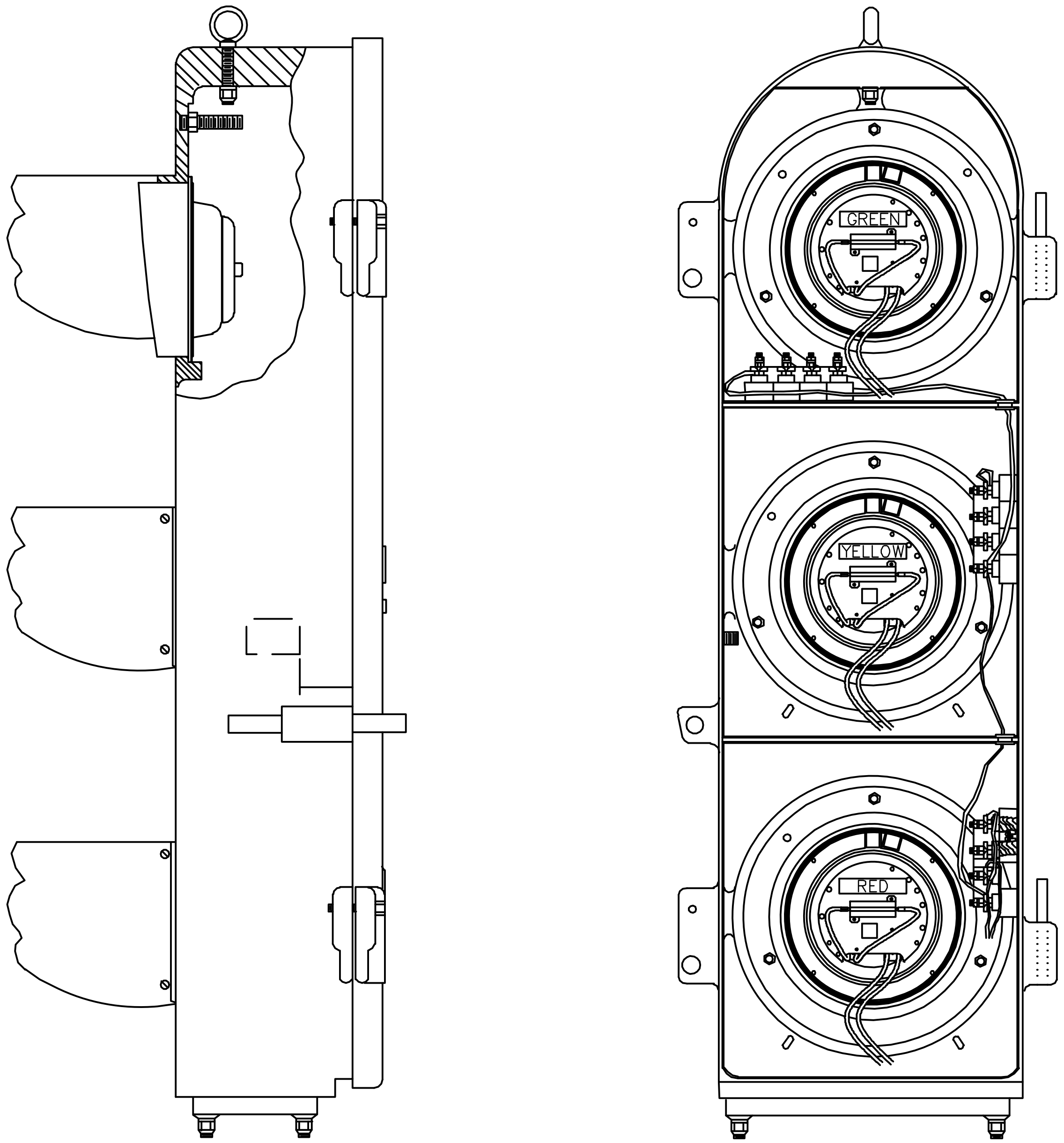
CADD FILE NAME: SD-5204

REV:

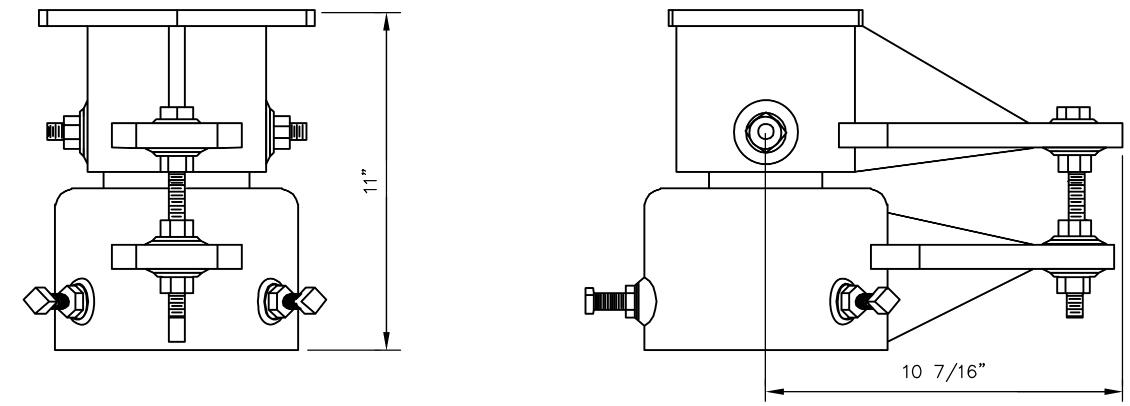
EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

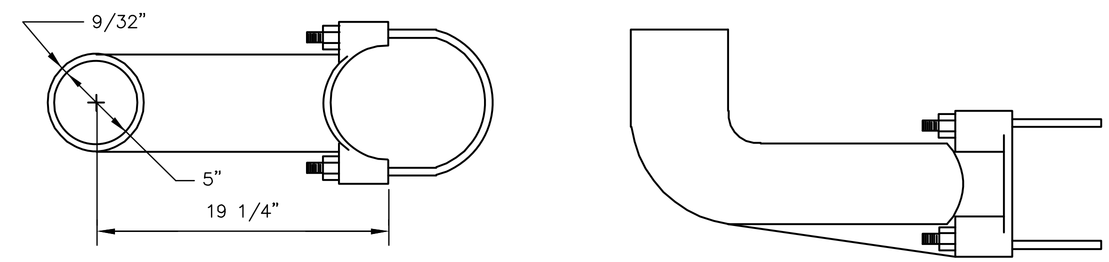
STANDARD DRAWING NO.: SD-5204



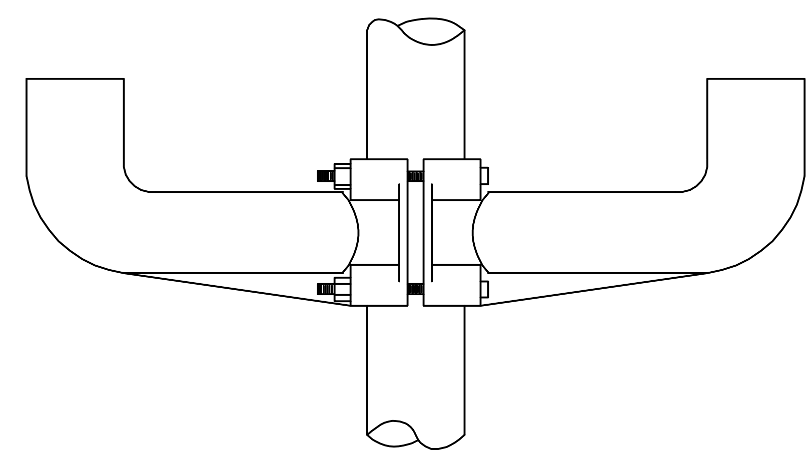
SIGNAL UNIT



BRACKET ADJUSTABLE



TUBE TYPE–SINGLE BRACKET



TUBE TYPE–DOUBLE BRACKET

NOTE:
ALL IN–LINE SIGNAL LIGHT UNITS SHALL BE LED. INCANDESCENT LIGHTS ARE NOT ACCEPTABLE.

REV	DATE	BY	CHK	APP	DESCRIPTION
	01012024				FOURTH EDITION

REV	DATE	BY	CHK	APP

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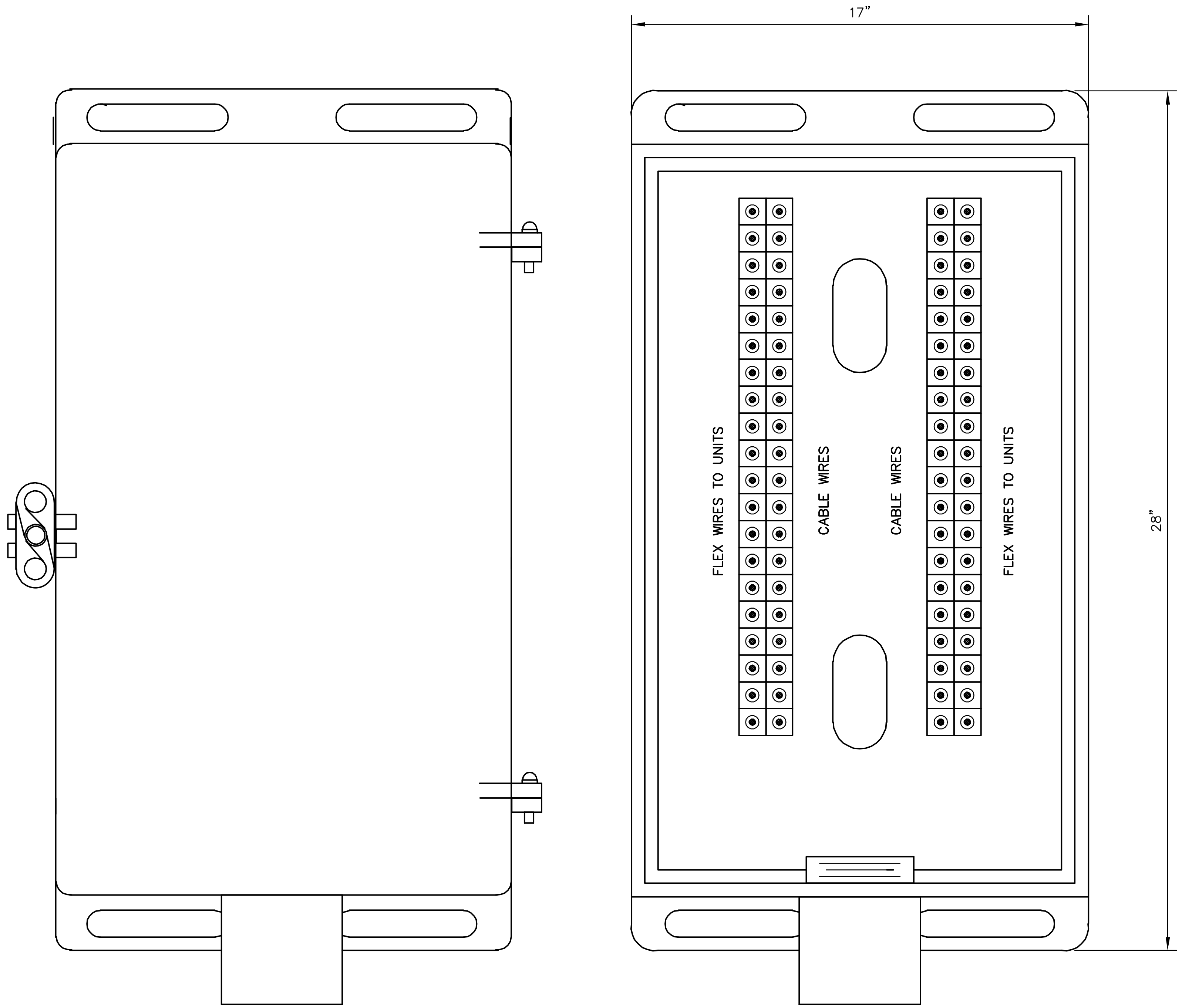
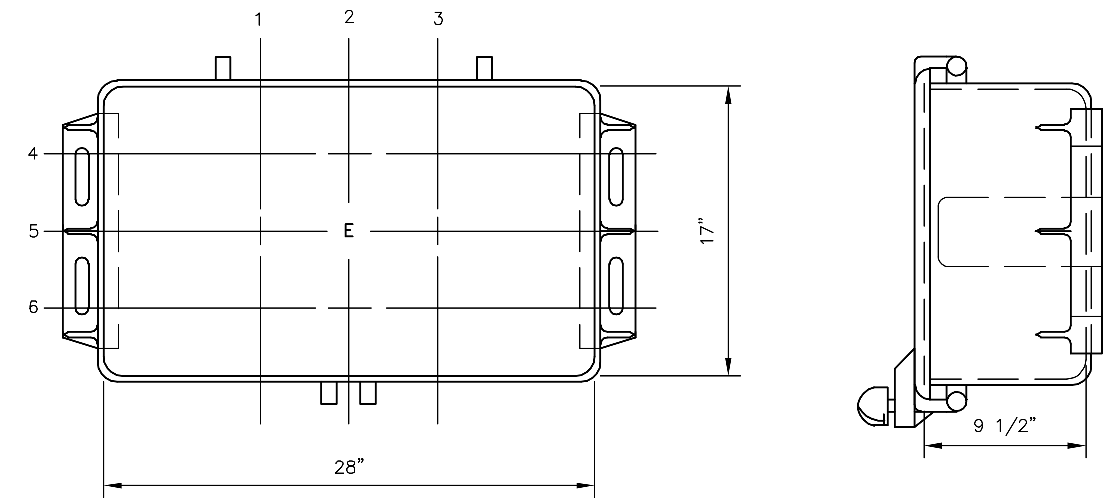
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SIGNAL APPARATUS
SIGNAL UNIT DETAILS
TYPICAL COLORLIGHT

CADD FILE NAME: SD–5205
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD–5205





NOTES:

1. TERMINAL BOX SHALL BE ALUMINUM MEASURING 17"W X 28"L 9 1/2"D.
2. INSULATED TEST TERMINALS, AS SHOWN IN SD-5109 SHALL BE INSTALLED BETWEEN FLEX CONDUCTOR AND CABLE CONDUCTOR.
3. ALL CONDUCTORS SHALL BE IDENTIFIED WITH SLEEVE TYPE TAGS. TAGS SHALL DISPLAY NOMENCLATURE AS SHOWN ON CIRCUIT DRAWING.
4. EACH SPARE CABLE CONDUCTOR SHALL BE TERMINATED ON AN AREMA C&S MANUAL PART 14.1.5 TERMINAL AND LOCKED DOWN TIGHTLY WITH TWO TERMINAL NUTS.
5. TERMINALS NOT USED SHALL BE EQUIPPED WITH TWO WASHERS AND TWO CROWN NUTS.
6. CABLE ENTRANCE SHALL BE SEALED TO PREVENT ACCESS BY RODENTS AND OTHER PESTS.
7. PROTECT WIRE FROM SHARP EDGES WITH RUBBER GROMMET/MATTING.
8. AN ADDITIONAL JUNCTION BOX MAY BE REQUIRED IF AMOUNT OF CONDUCTORS EXCEED THE AMOUNT OF TERMINALS.

REV	DATE	BY	CHK	APP	DESCRIPTION
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REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

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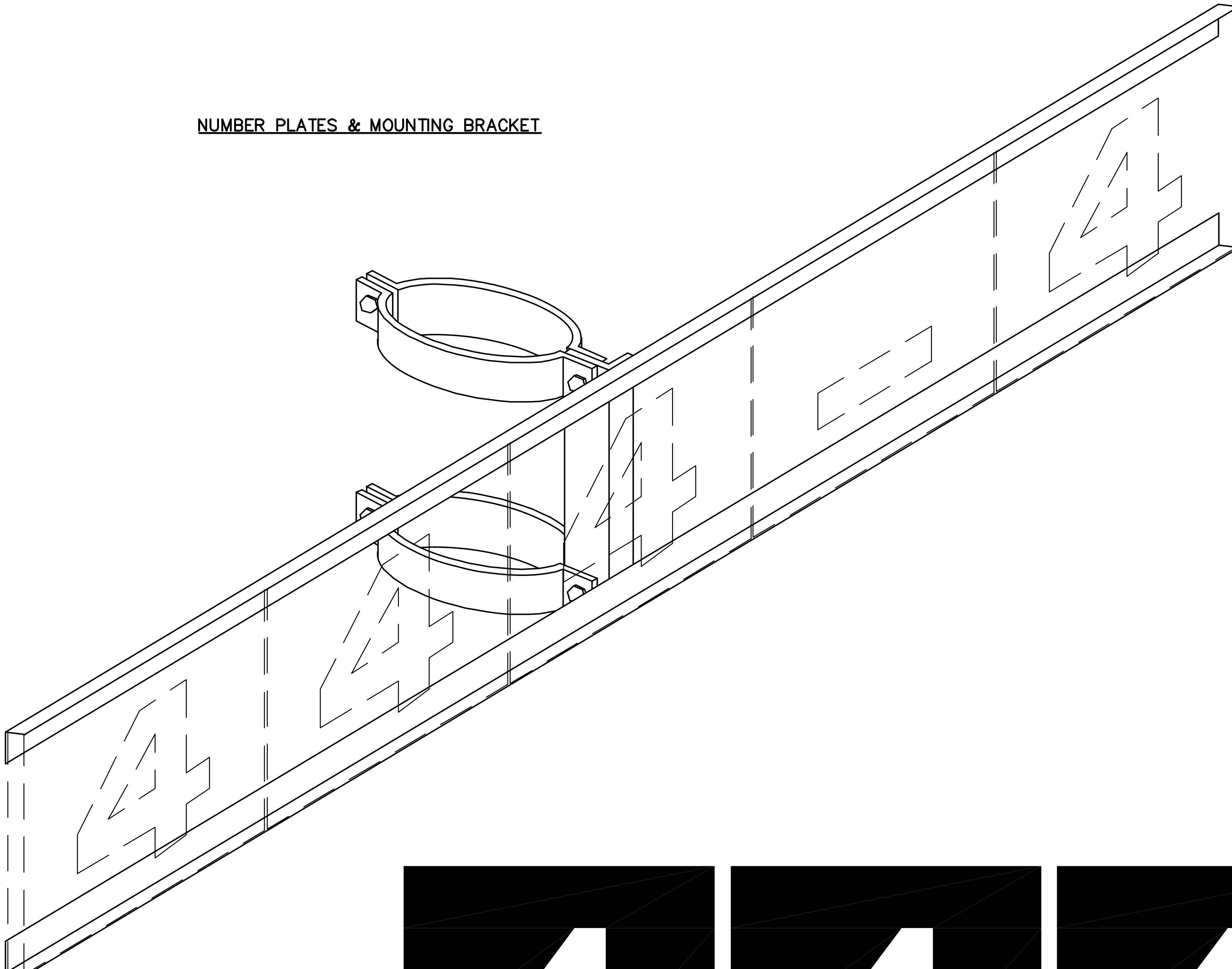
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SIGNAL APPARATUS
TERMINAL BOX
TYPICAL SIGNAL TERMINAL BOX

CADD FILE NAME: SD-5206
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5206

NUMBER PLATES & MOUNTING BRACKET



NOTES:

1. UNITYPE FRAMES SHALL BE MADE OF ALUMINUM OR STEEL AND BE COMPLETE WITH ALL HARDWARE REQUIRED FOR MOUNTING TO ALMOST ANY SIZE MAST.
2. ALL NUMBER AND LETTER PLATES SHALL HAVE WHITE IMAGES ON BLACK BACKGROUNDS.
3. MOUNTING BRACKETS SHALL BE FOR 5" PIPE MAST MOUNTING UNLESS OTHERWISE SPECIFIED.
4. BEND TABS ON CORNERS OF PLATES WHEN COTTER KEYS ARE NOT PROVIDED TO PREVENT PLATES FROM SLIDING OUT.

REV	DATE	BY	CHK	APP	DESCRIPTION	REV	DATE	BY	CHK	APP
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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SIGNAL APPARATUS
SIGNAL NUMBER PLATE DETAILS

CADD FILE NAME: SD–5207

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD–5207

NOT USED

REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP	DESCRIPTION

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SIGNAL APPARATUS

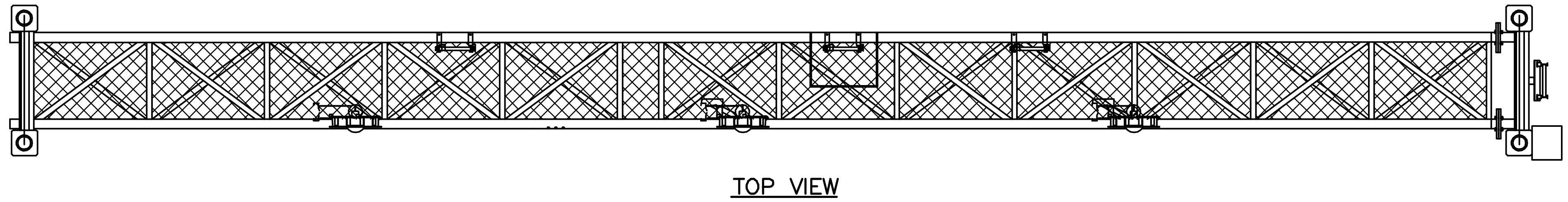
CADD FILE NAME: SD-5208

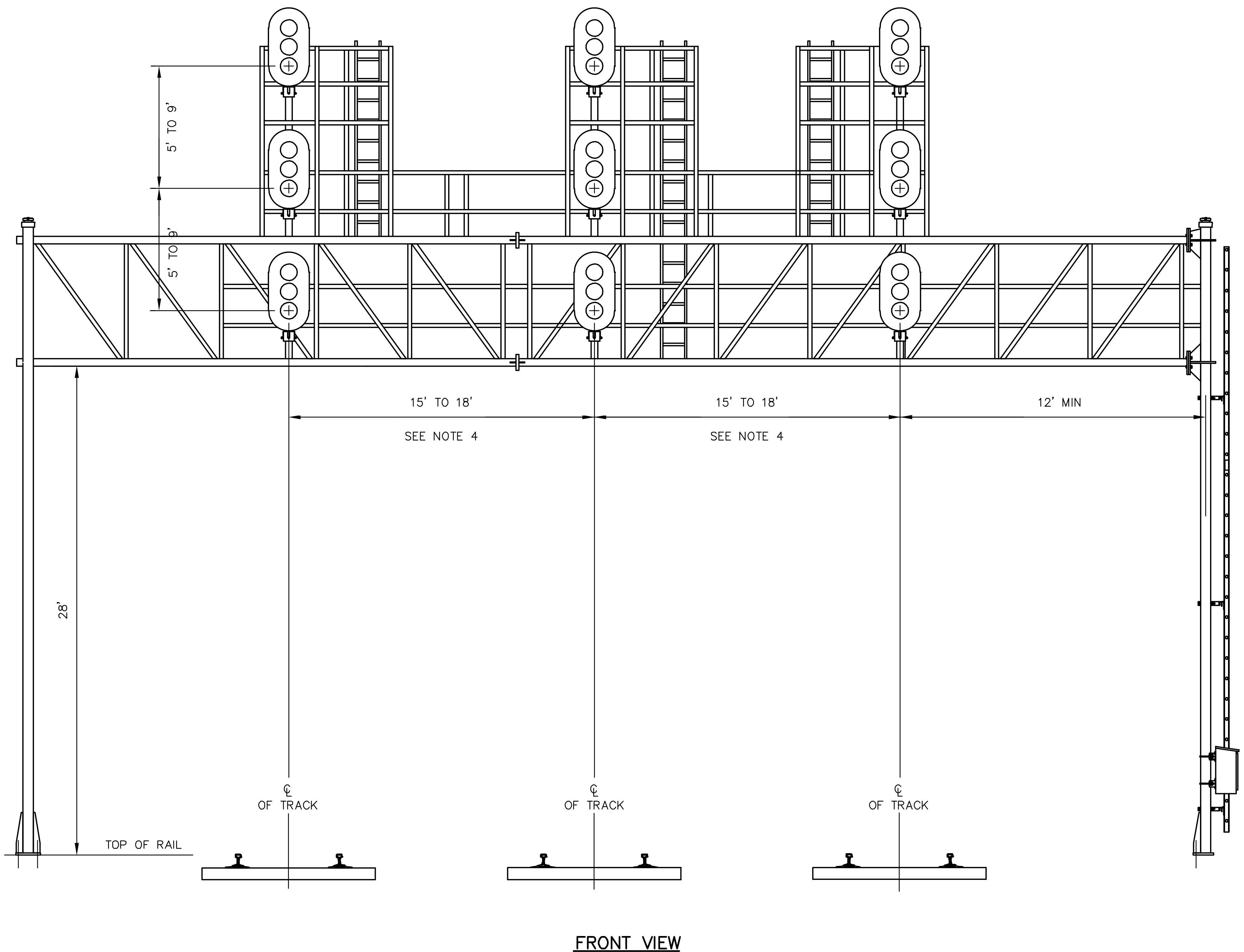
REV:

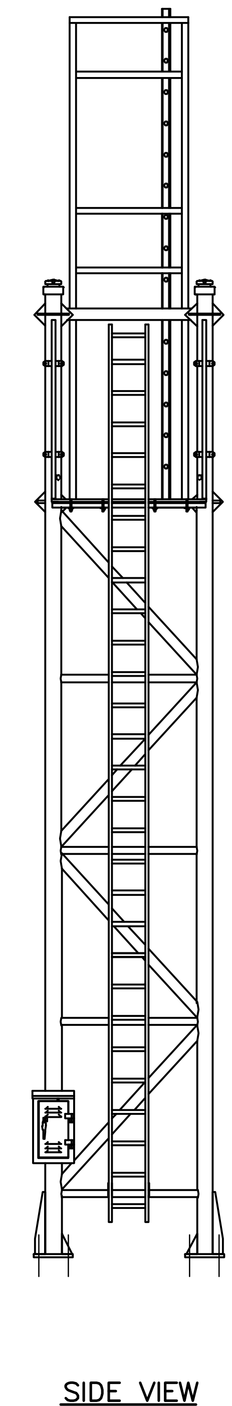
EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5208







NOTES:

1. BASE OF BRIDGE MAST SHALL BE LEVEL WITH TOP OF HIGHEST RAIL.
2. 41" X 73 3/4" X 24" FREE STANDING POWDER COATED STEEL JUNCTION CASE REQUIRED WHERE MAST MOUNTED JUNCTION CASE DOES NOT HAVE SUFFICIENT CAPACITY.
3. FIXED LADDER SHALL INCLUDE A FALL ARREST SYSTEM MEETING ALL OSHA REQUIREMENTS.
4. SPACING OF BRIDGE MOUNTED SIGNALS VARIES PER LOCATION AND WILL BE DETERMINED DURING DESIGN.

FOOTING REQUIREMENTS:

A LAYER OF CRUSHED ROCK, 3/4" X 1/4", SHALL BE PLACED AROUND STRUCTURE A MINIMUM DISTANCE OF 4' OUT FROM FOOTING. PROVIDE RETAINING WALL IF REQUIRED.

REV	DATE	BY	CHK	APP	DESCRIPTION
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REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

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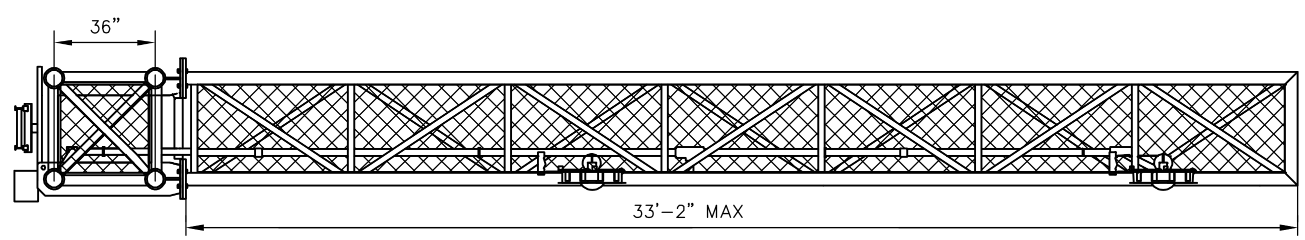
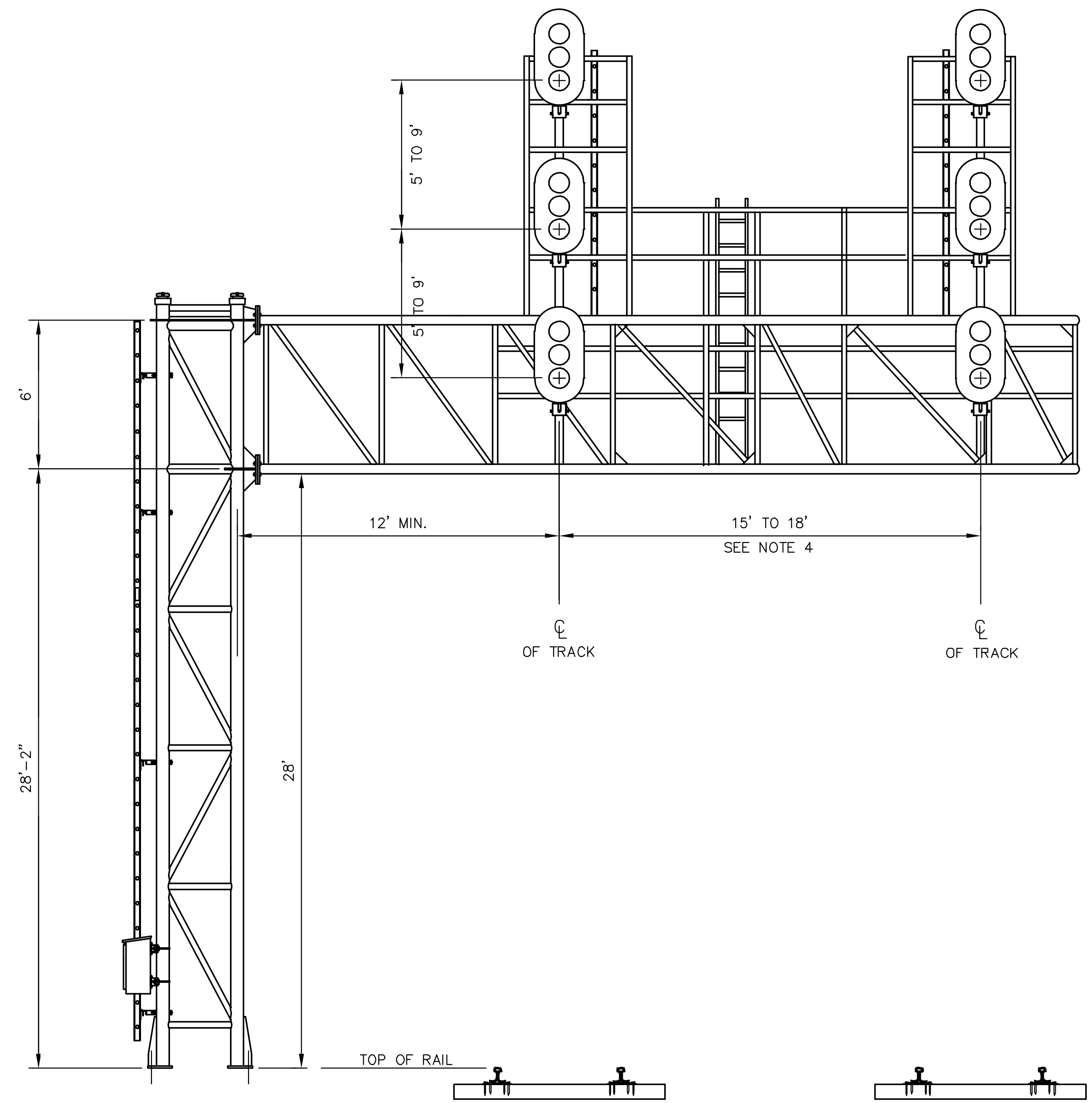
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SIGNAL APPARATUS
SIGNAL BRIDGE
TYPICAL SIGNAL BRIDGE

CADD FILE NAME: SD-5209
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5209



TOP VIEW



FRONT VIEW

NOTE:

4" FLEX CONDUIT(S) MAY BE RUN OUTSIDE OF FOUNDATION TO ENTER BOTTOM OF JUNCTION BOX. REFER TO SD-5206.

NOTES:

1. BASE OF BRIDGE MAST SHALL BE LEVEL WITH TOP OF HIGHEST RAIL.
2. 41" X 73 3/4" X 24" FREE STANDING POWDER COATED STEEL JUNCTION CASE REQUIRED WHERE MAST MOUNTED JUNCTION CASE DOES NOT HAVE SUFFICIENT CAPACITY.
3. FIXED LADDER SHALL INCLUDE A FALL ARREST SYSTEM MEETING ALL OSHA REQUIREMENTS.
4. SPACING OF BRIDGE MOUNTED SIGNALS VARIES PER LOCATION AND WILL BE DETERMINED DURING DESIGN.

FOOTING REQUIREMENTS:

A LAYER OF CRUSHED ROCK, 3/4" X 1/4", SHALL BE PLACED AROUND STRUCTURE A MINIMUM DISTANCE OF 4' OUT FROM FOOTING. PROVIDE RETAINING WALL IF REQUIRED.

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REV	DATE	BY	CHK	APP	DESCRIPTION

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STANDARD DRAWINGS

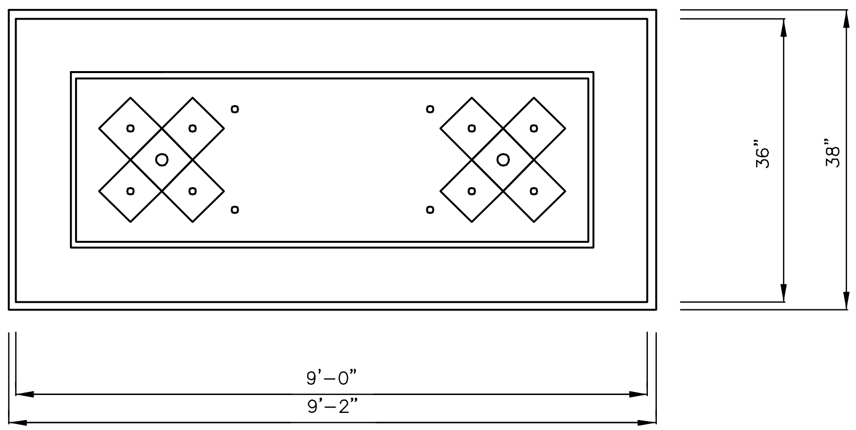
SIGNAL AND COMMUNICATIONS
SIGNAL APPARATUS
SIGNAL CANTILEVER
TYPICAL SIGNAL CANTILEVER

CADD FILE NAME: SD-5210

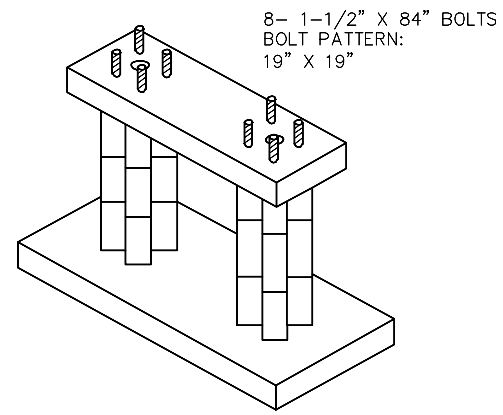
REV: | EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

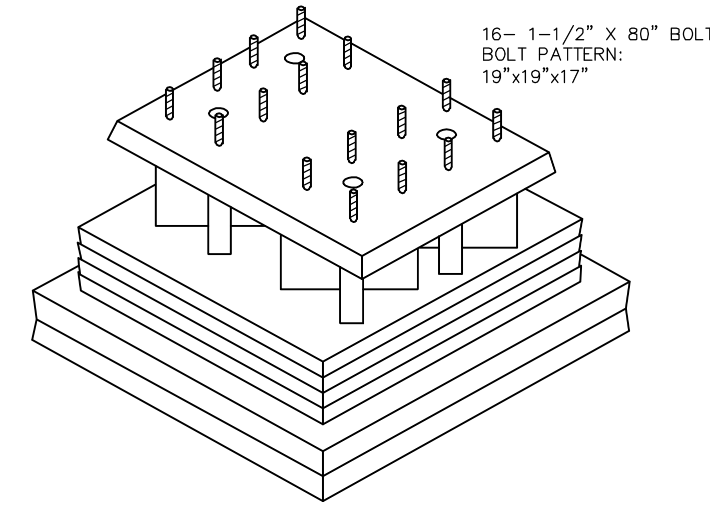
STANDARD DRAWING NO.: SD-5210



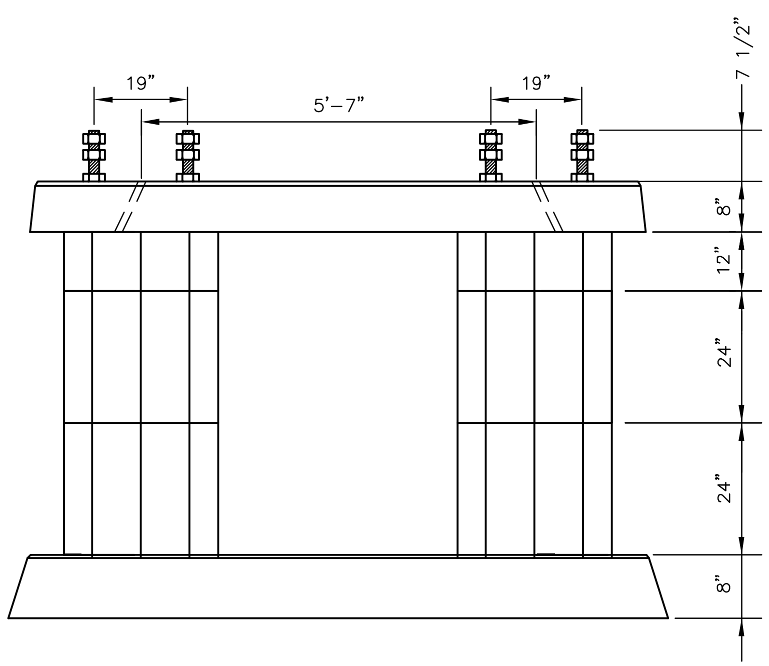
TOP VIEW



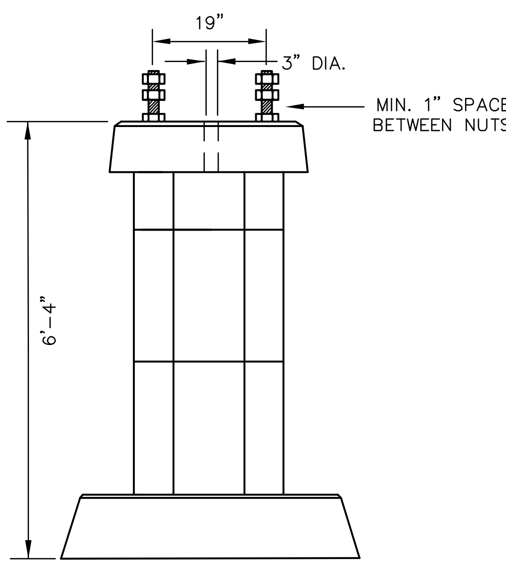
ISOMETRIC VIEW



ISOMETRIC VIEW



FRONT VIEW

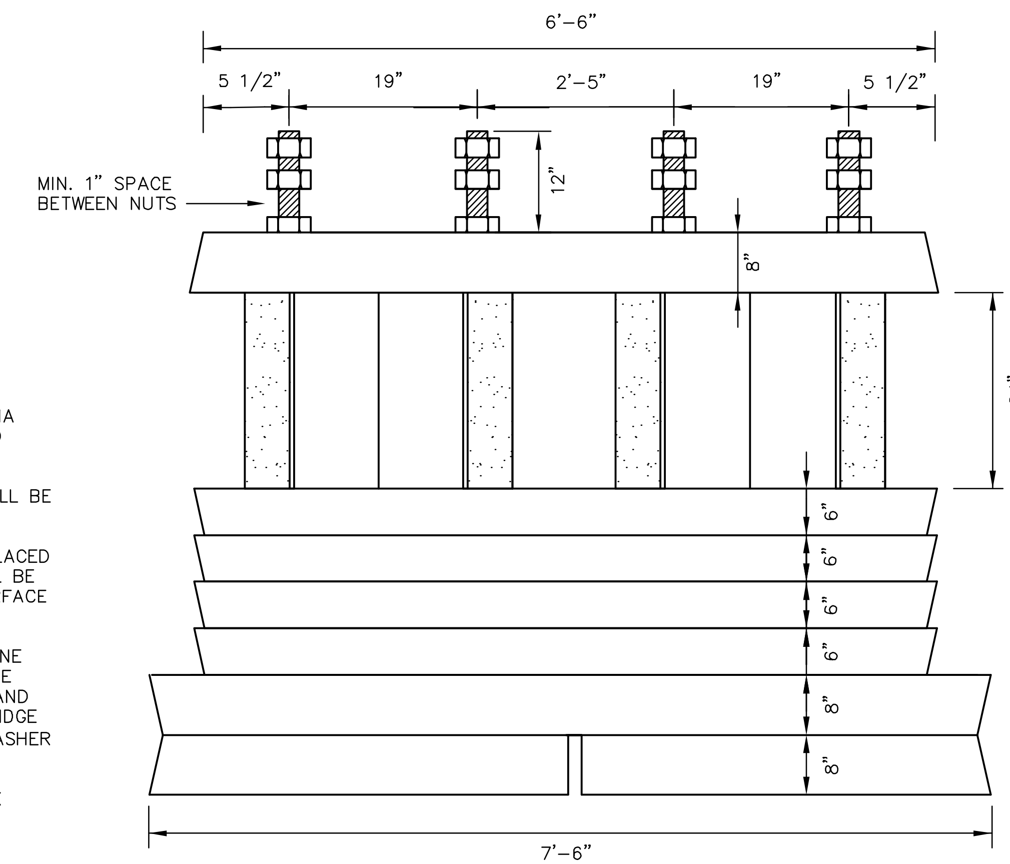


SIDE VIEW

SIGNAL BRIDGE FOUNDATION

NOTES:

1. CONCRETE SHALL BE IN ACCORDANCE WITH AREMA SPECIFICATIONS FOR CONCRETE STRUCTURES AND FOUNDATIONS.
2. TOP AND BOTTOM SURFACES OF ALL PARTS SHALL BE FLAT AND PARALLEL.
3. STEEL PLATE AND NUT ASSEMBLIES SHALL BE PLACED SUCH THAT WHEN ASSEMBLED. THE BOLTS SHALL BE PERPENDICULAR TO THE BASE PLATE UPPER SURFACE WITHIN ONE DEGREE OF PERPENDICULAR
4. NUT ASSEMBLY SHALL BE ARRANGED SO THAT ONE NUT AND FLAT WASHER WILL BE USED TO SECURE ANCHOR BOLTS TO FOUNDATION. ANOTHER NUT AND FLAT WASHER SHALL BE USED TO LEVEL THE BRIDGE AND OR CANTILEVER MAST AND A THIRD NUT/WASHER COMBINATION TO SECURE MAST IN PLACE.
5. TAMP EXCAVATED HOLE, PROVIDE CURSHED ROCK PRIOR TO SETTING FOUNDATION.



4–MAST WAYSIDE CANTILEVER 4'X4'

REV	DATE	BY	CHK	APP	DESCRIPTION
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PENINSULA CORRIDOR JOINT POWERS BOARD

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SIGNAL APPARATUS
TYPICAL BRIDGE AND CANTILEVER FOUNDATION

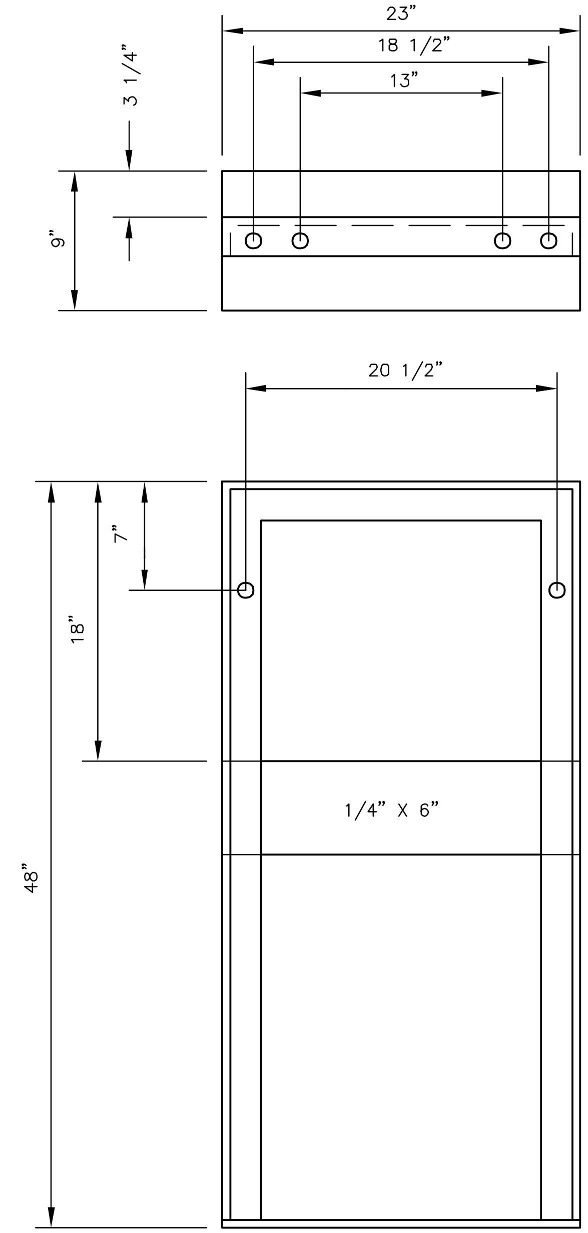
CADD FILE NAME: SD–5211

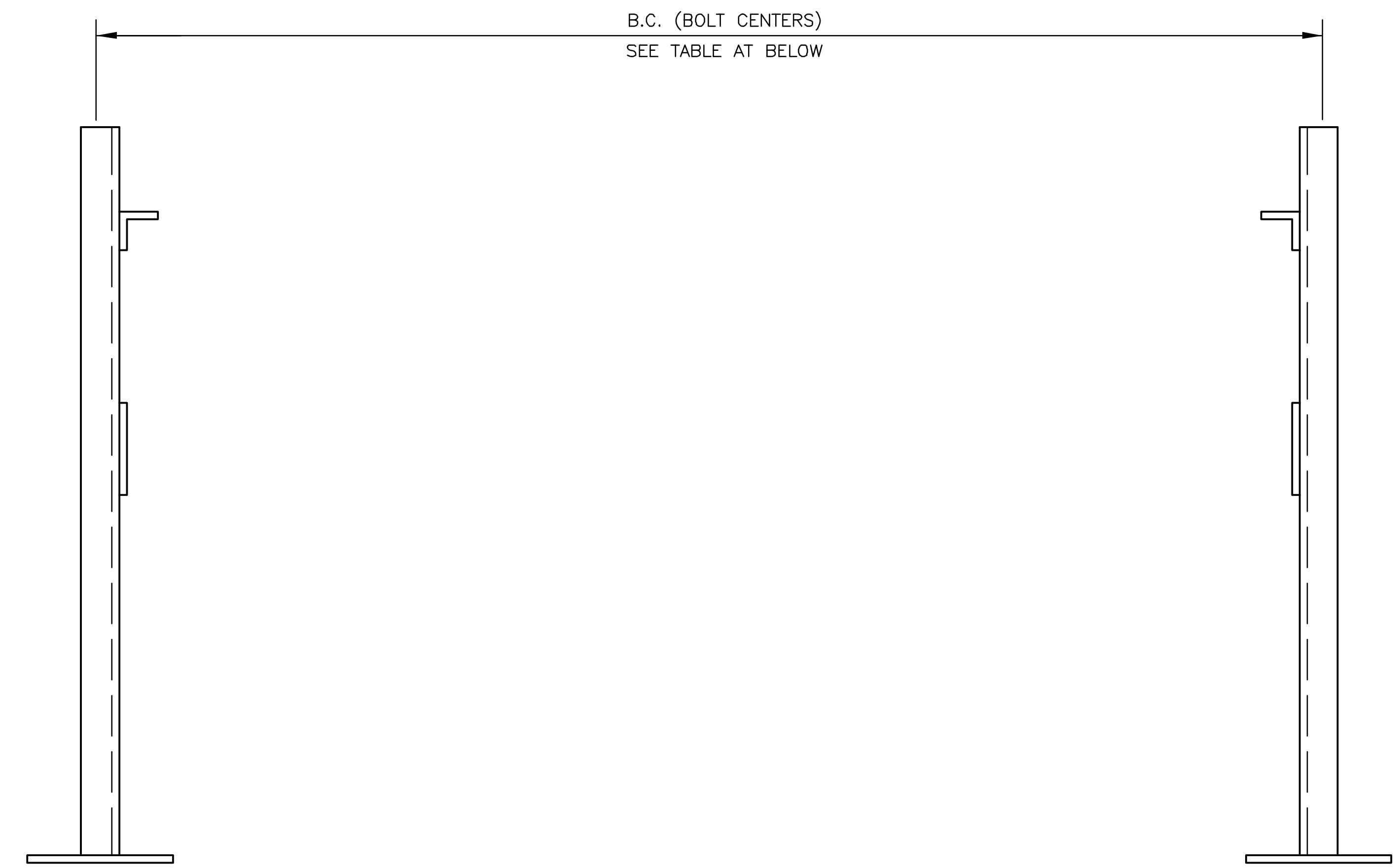
REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD–5211





INSTALLATION SET-UP	
(B. C.) BOLT CENTERS	USE WITH CASE
18 1/2" X 34"	2' X 7"
18 1/2" X 43 3/4"	3' X 5"
18 1/2" X 61 1/4"	4' X 11"
18 1/2" X 83 1/4"	6' X 9"
18 1/2" X 118 1/4"	9' X 8"

NOTES:

1. FOUNDATION SHALL BE HOT DIPPED GALVANIZED AND IN ACCORDANCE WITH ASTM SPEC A123
2. ALL ANGLE IRON SHALL BE ASTM 1020 STRUCTURAL STEEL 2 1/2" X 2 1/2" X 1/4" THICK AND ALL PLATE STEEL TO BE ASTM 1020 AND AT LEAST 1/4" THICK
3. EACH ASSEMBLY SHALL CONSIST OF 4 (FOUR) GALVANIZED 3/4" X 10" X 1 1/2" LONG HEX HEAD BOLTS, 4 HEX NUTS AND 8 PLAIN WASHERS FOR ATTACHING PIERS TO STRUTS AND CASE
4. TAMP FOUNDATION HOLE, AND PROVIDE CRUSHED ROCK PRIOR TO SETTING FOUNDATION

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REV	DATE	BY	CHK	APP	

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SIGNAL APPARATUS

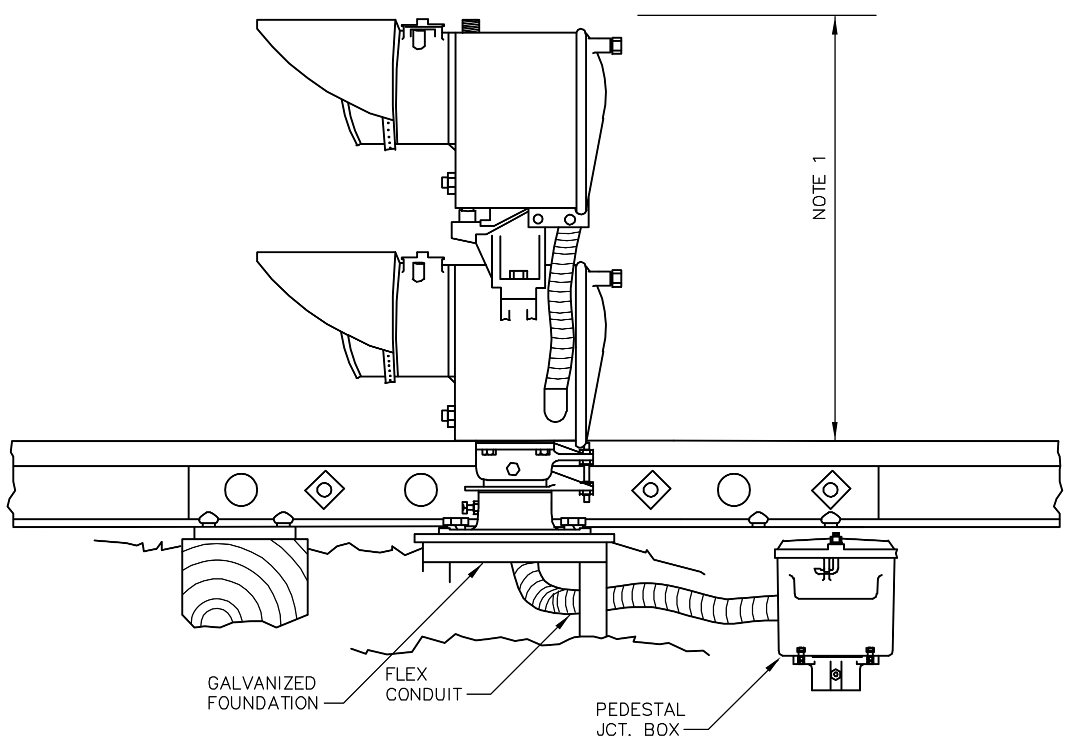
RELAY CASE FOUNDATION

CADD FILE NAME: SD-5212

REV: EDITION: FOURTH

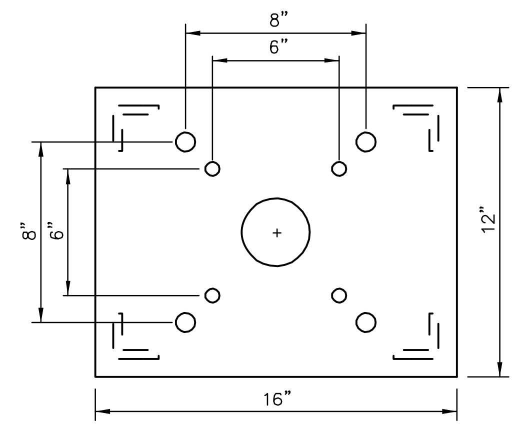
SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5212

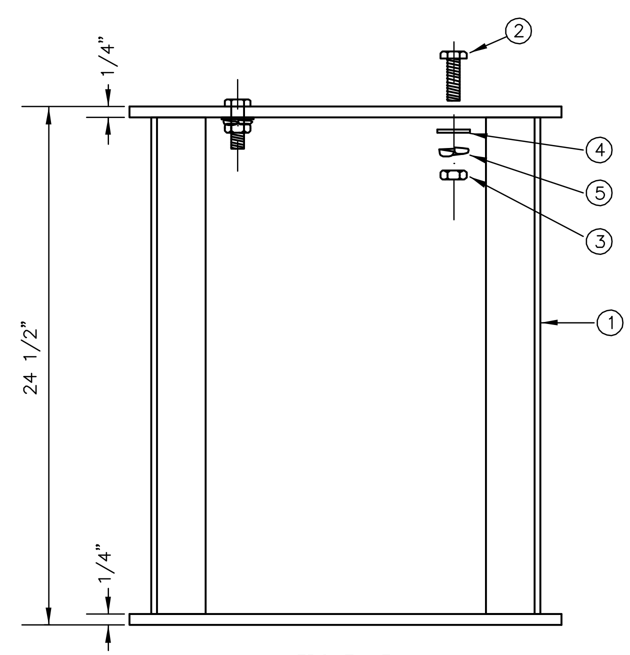


TYPICAL DOUBLE UNIT
DWARF SIGNAL

ITEM	PART #	QTY	DESCRIPTION
1	8B20133	1	DWARF FOUNDATION WELDMENT
2	KA95491	4	3/4–10 x 2 1/2 HEX HEAD BOLT Z/Y
3	KD96182	4	3/4–10 HEX NUT Z/Y
4	KE97431	4	3/4" FLAT WASHER Z/Y
5	KF97146	4	3/4" SPLIT LOCK WASHER Z/Y

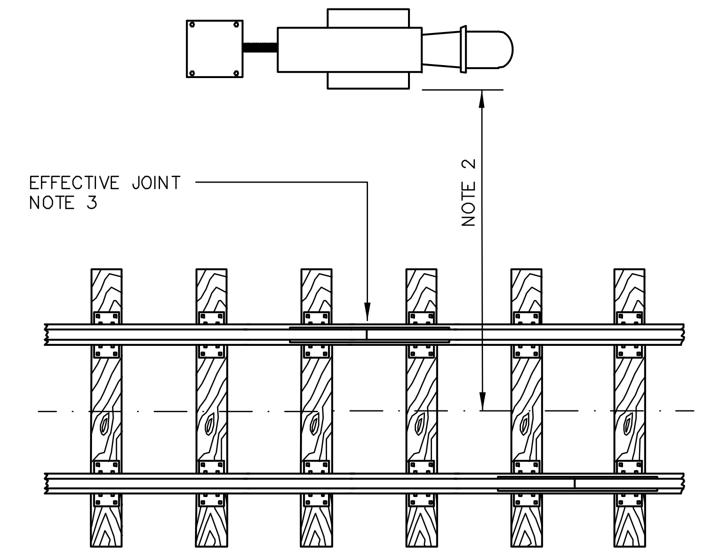


TOP VIEW

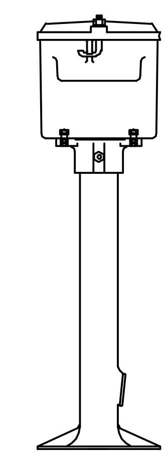


FRONT VIEW

SIGNAL FOUNDATION

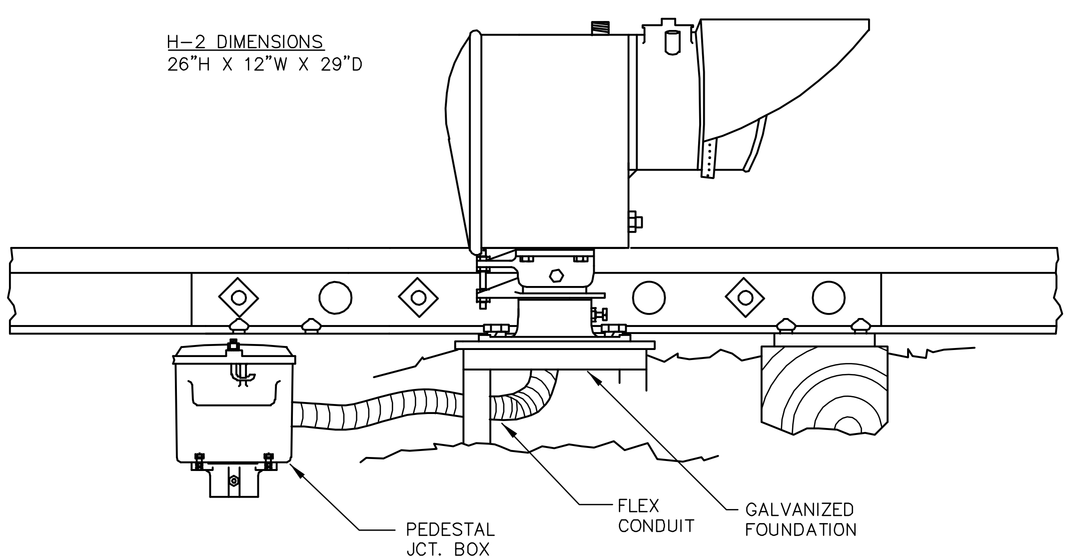


TYPICAL DWARF SIGNAL
PLACEMENT



JUNCTION BOX PEDESTAL

H–2 DIMENSIONS
26"H X 12"W X 29"D



TYPICAL SINGLE UNIT
DWARF SIGNAL

NOTES:

1. THE VERTICAL HEIGHT OF A DWARF SIGNAL SHALL NOT BE GREATER THAN 34" ABOVE TOP OF ANY ADJACENT RAIL.
2. NO PORTION OF THE DWARF SIGNAL SHALL BE WITHIN 6' OF THE CENTERLINE OF ANY TRACK.
3. SIGNAL FOUNDATION SHALL BE CENTERED ON END POST OF EFFECTIVE INSULATED JOINT.
4. TOP OF JUNCTION BOX LID/COVER SHALL BE LEVEL WITH TOP OF TIE.
5. DESIGNER SHALL SPECIFY MINIMUM AND MAXIMUM ALLOWABLE DISTANCES FROM SIGNAL TO JUNCTION BOX.

REV	DATE	BY	CHK	APP	DESCRIPTION
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REV	DATE	BY	CHK	APP	

PENINSULA CORRIDOR JOINT POWERS BOARD

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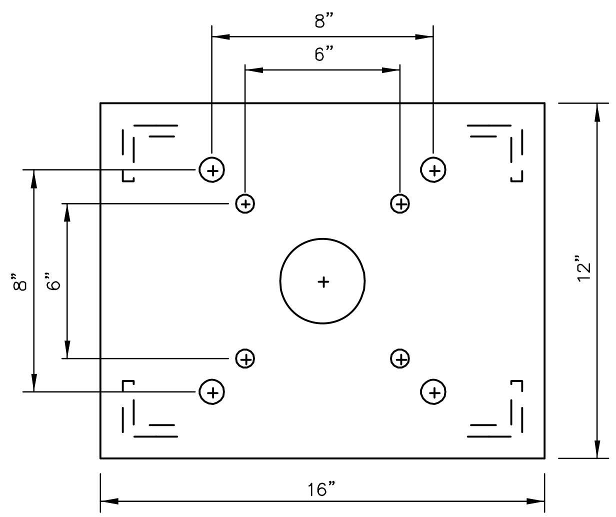
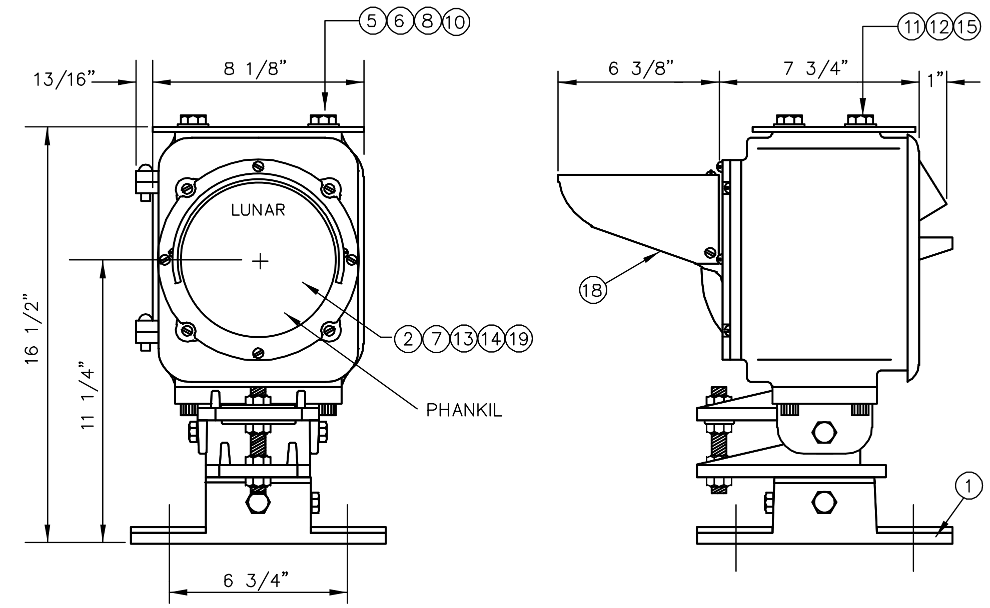
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SIGNAL APPARATUS
H–2 DWARF SIGNAL
PLACEMENT AND FOUNDATION

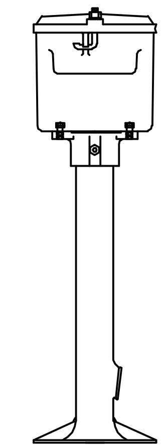
CADD FILE NAME: SD–5213
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD–5213



TOP VIEW



SIEMENS CLS-10D DWARF SIGNAL
OR EQUIVALENT

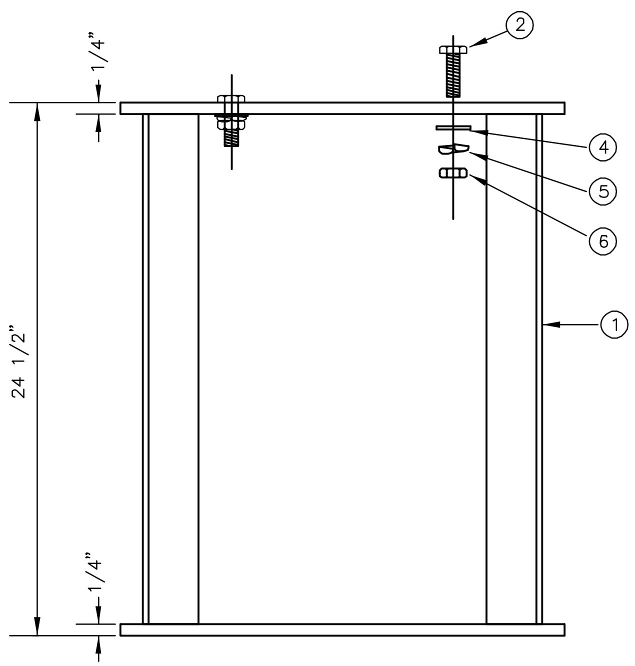


JUNCTION BOX PEDESTAL

ITEM NO:	COMPONENT	DESCRIPTION	USAGE
1	042275-1X	BASE ASSY, DWARF	1
2	042609-X	HEAD CLS-10D 12VDC	1
5	042255-2	CAP, HOUSING	1
6	042268-3	GASKET	2
7	042365-3	BULB, 10V-25W	1
8	042268-2	WASHER 1/2-13	4
10	2108-SC	N HX 1/2-13	4
11	1812-MSC	W LKS M 1/2	8
12	1730-SC	W FA 1/2 X 1-1/16	4
13	044075-	LENS 6-3/8 CLEAR	1
14	042257-4L	LENS 6-3/8 LUNAR	1
15	4169-SSC	CS SH 1/2-13 X 1.75	4
18	042005-X1	VISOR, STEEL 6-3/8	1
19		PHANKIL	

NOTES:

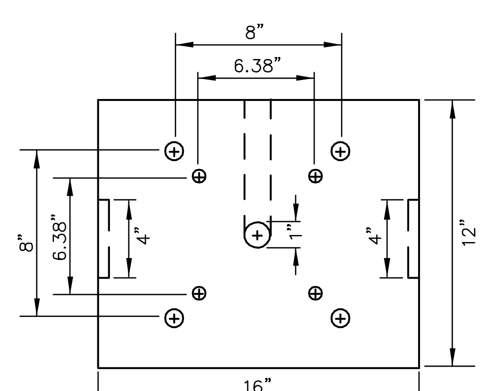
1. THE VERTICAL HEIGHT OF SIGNAL MARKER LIGHT SHALL NOT BE GREATER THAN 34 INCHES ABOVE TOP OF RAIL.
2. THE VERTICAL HEIGHT OF A DWARF SIGNAL SHALL NOT BE GREATER THAN 34" ABOVE TOP OF ANY ADJACENT RAIL.



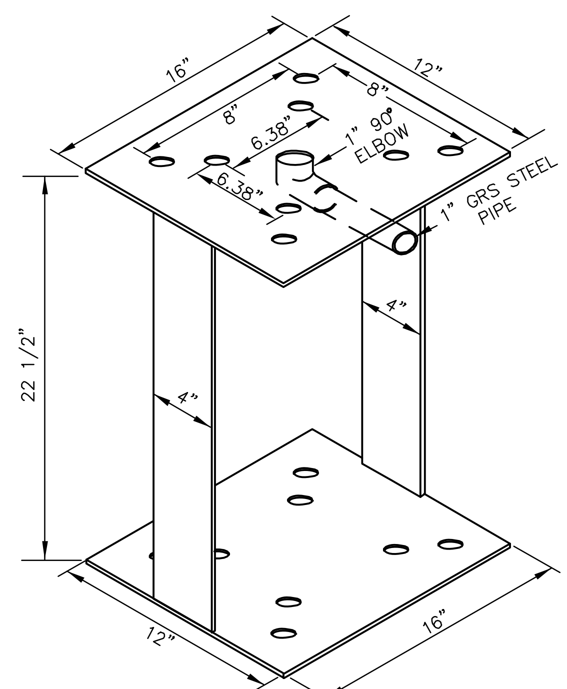
SIDE VIEW

SIGNAL FOUNDATION

ITEM	PART #	QTY	DESCRIPTION
1	8B20133	1	DWARF FOUNDATION WELDMENT
2	KA95491	4	3/4-10 x 2 1/2 HEX HEAD BOLT Z/Y
3	KD96182	4	3/4-10 HEX NUT Z/Y
4	KE97431	4	3/4" FLAT WASHER Z/Y
5	KF97146	4	3/4" SPLIT LOCK WASHER Z/Y

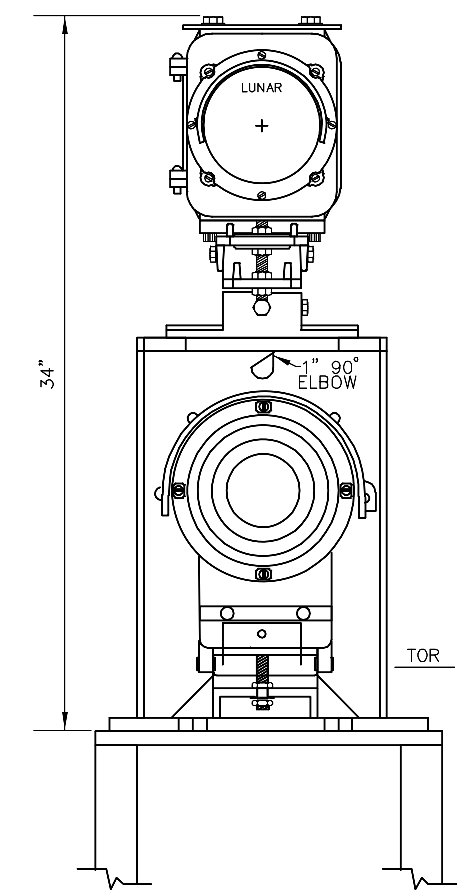


TOP & BOTTOM VIEW

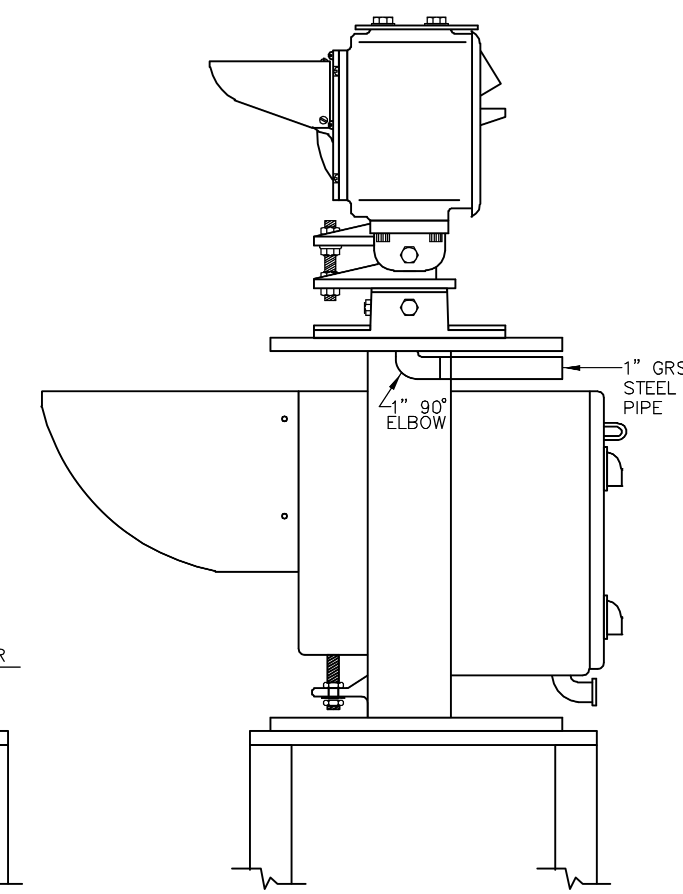


ISOMETRIC VIEW

CLS-10D SIGNAL BRACKET
OR EQUIVALENT



FRONT VIEW



SIDE VIEW

SIEMENS CLS-10D DWARF SIGNAL

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					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP	DESCRIPTION

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APPROVED BY:

Bin Zhang

DEPUTY DIRECTOR, ENGINEERING

Caltrain

1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

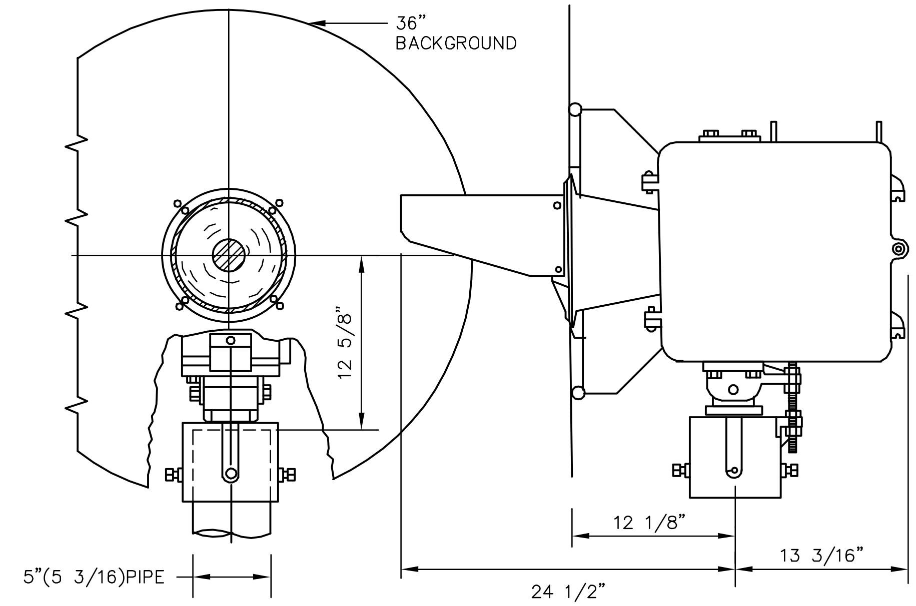
SIGNAL AND COMMUNICATIONS
SIGNAL APPARATUS
TYPICAL DWARF SIGNAL
SIGNAL MARKER LIGHT

CADD FILE NAME: SD-5214

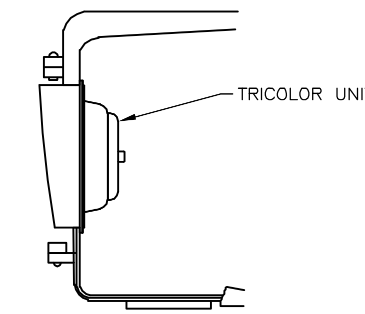
REV: EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

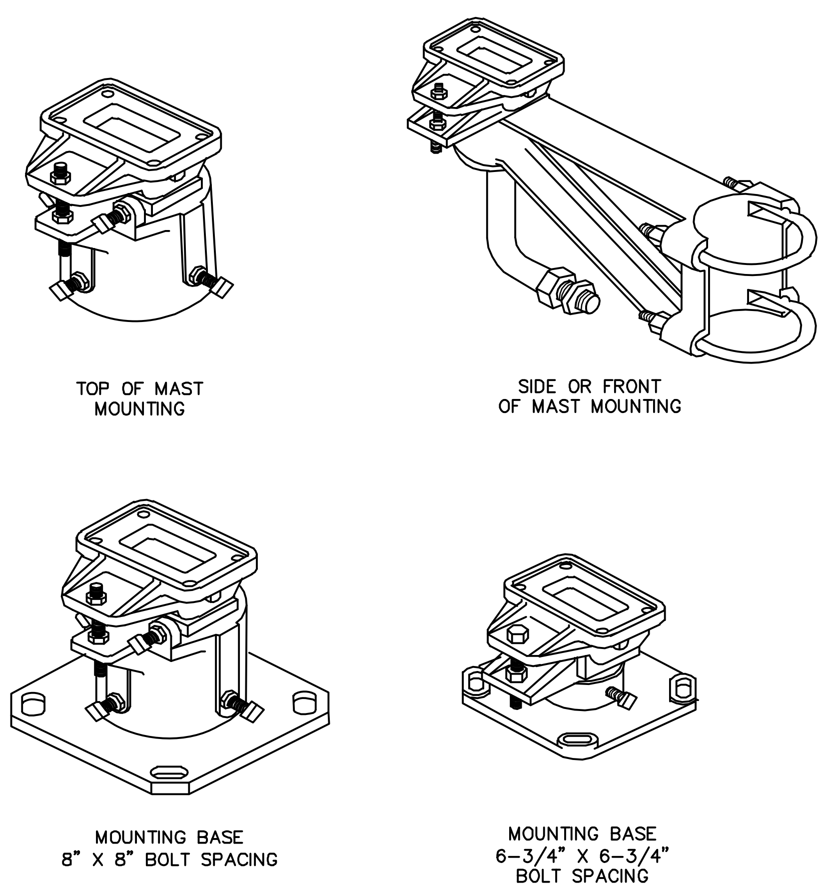
STANDARD DRAWING NO.: SD-5214



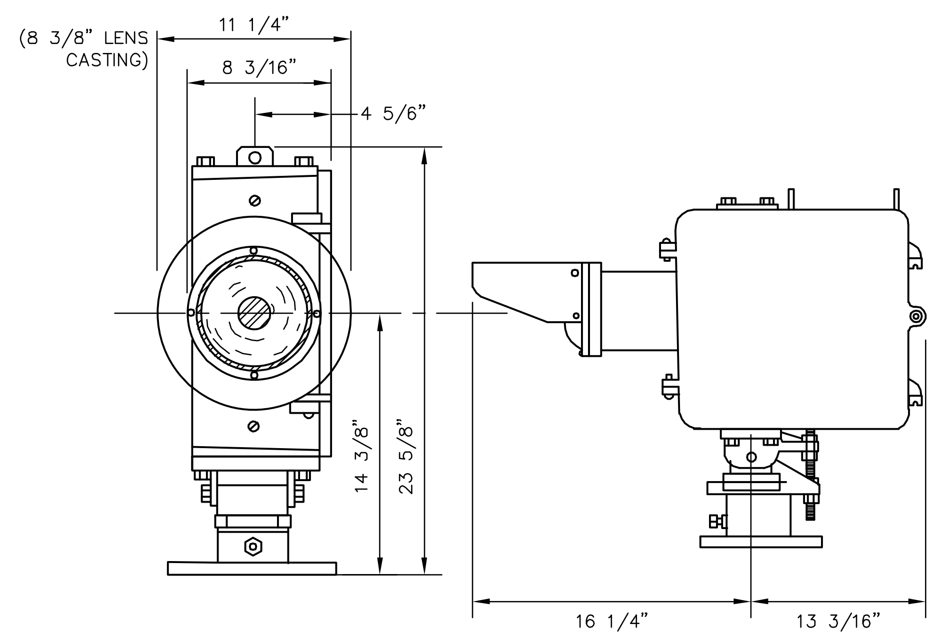
TOP OF MAST MOUNTED



LENSES



MOUNTING BRACKETS



DWARF BASE MOUNTED
OUTER DIMENSIONS

NOTES:

1. LOOSEN LIGHT GUIDE HOLDING SCREW A AND THE FOUR PANEL SCREWS B.
2. SET DISTANCE "X" FROM THE END OF THE LIGHT GUIDE TO FACE OF LENS CASTING PER TABLE BY SLIDING THE PANEL FORWARD OR BACK AS REQUIRED.
3. CHECK LIGHT INDICATION AND ADJUST FOCAL LENGTH SETTING FOR OPTIMUM COLLIMATED BEAM INDICATION.
4. TIGHTEN SCREWS A AND B.
5. UNI-LENS SHOWN. TRICOLOR LED LAMP UNITS, HOWEVER, SHALL BE INSTALLED, IF THEY FIT INTO THE SIGNALS.

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REV	DATE	BY	CHK	APP	

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STANDARD DRAWINGS
SIGNAL AND COMMUNICATIONS
SIGNAL APPARATUS
TYPICAL DWARF SIGNAL LENSES

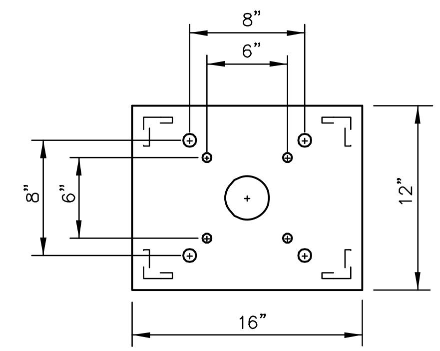
CADD FILE NAME: SD-5215
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5215

L&W INDUSTRIES DWARF SIGNAL OR EQUIVALENT
FOUNDATION #8A20133-X

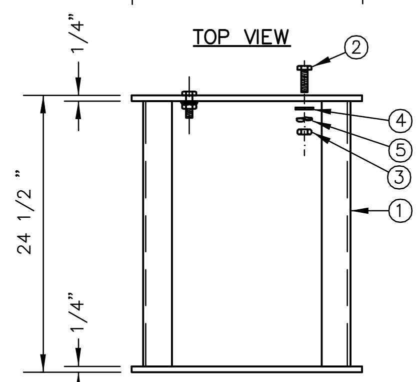
ITEM	PART #	QTY	DESCRIPTION
1	8B20133	1	DWARF FOUNDATION WELDMENT
2	KA95491	4	3/4-10 X 2 1/2 HEX HEAD BOLT Z/Y
3	KD96182	4	3/4-10 HEX NUT Z/Y
4	KE97431	4	3/4" SPLIT LOCK WASHER Z/Y
5	KF97146	4	3/4" FLAT WASHER Z/Y

SIEMENS CLS20R COLOR LIGHT OR EQUIVALENT SIGNAL HEAD

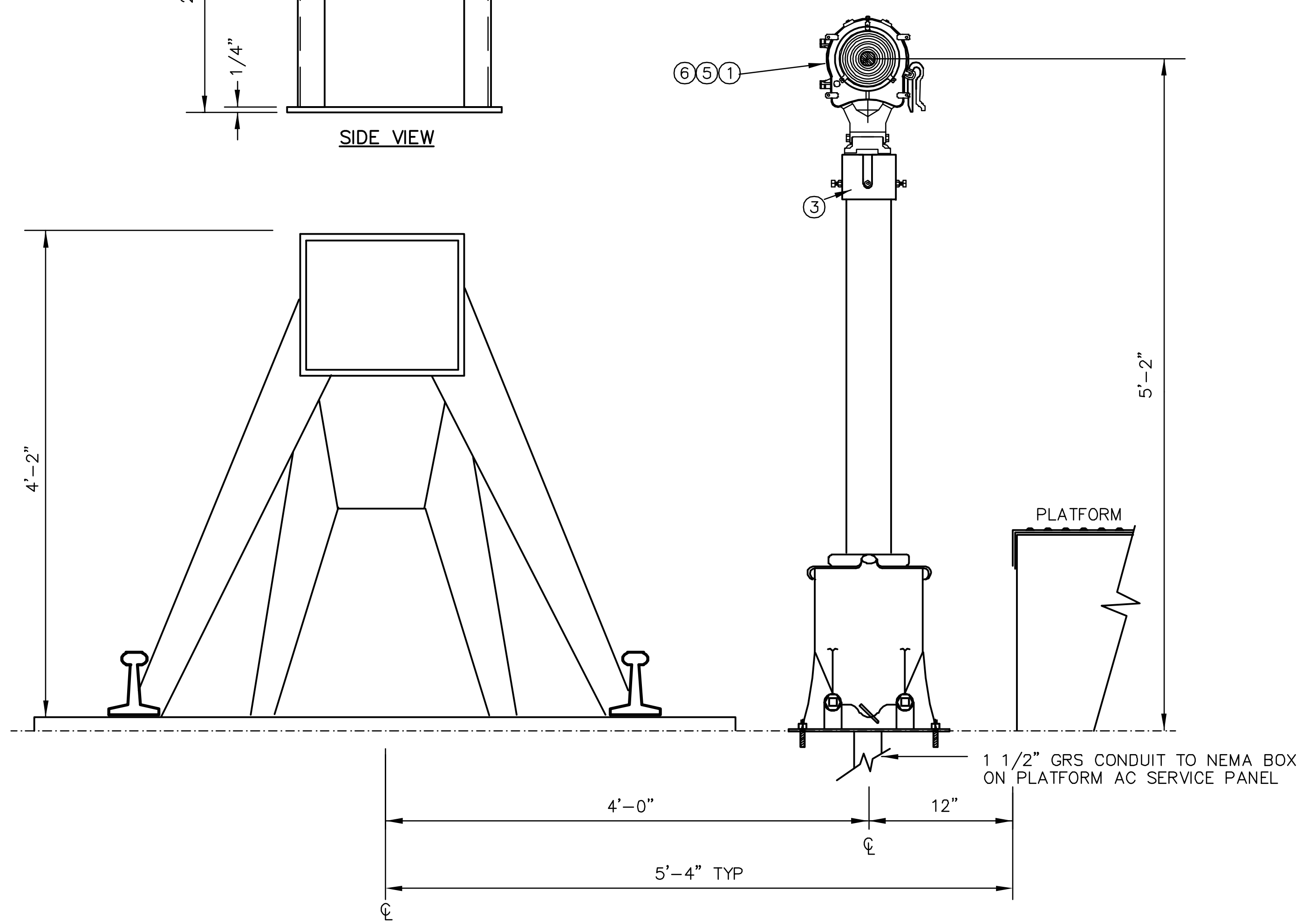
ITEM	QTY.	U.O.M	PART #	DESCRIPTION	* NOT SHOWN
1	1	EA.	EM-3411-CR	COLOR LIGHT SINGLE HEAD RED	
2	1	EA.	EM-3411-CL	COLOR LIGHT SINGLE HEAD LUNAR	*
3	1	EA.	044011-4X	TOP OF 5" MAST MOUNTING BRACKET	
4	1	EA.	044027-2X	DWARF BASE 8"X8" BOLT SPACING	*
5	1	EA.	042365-3	LAMP 10 VOLT 25 WATT	
6	1	EA.	042005-X1	VISOR STEEL WITH MOUNTING HARDWARE	
7	1	EA.	035800-900X	SIGNAL FOUNDATION STEEL	*



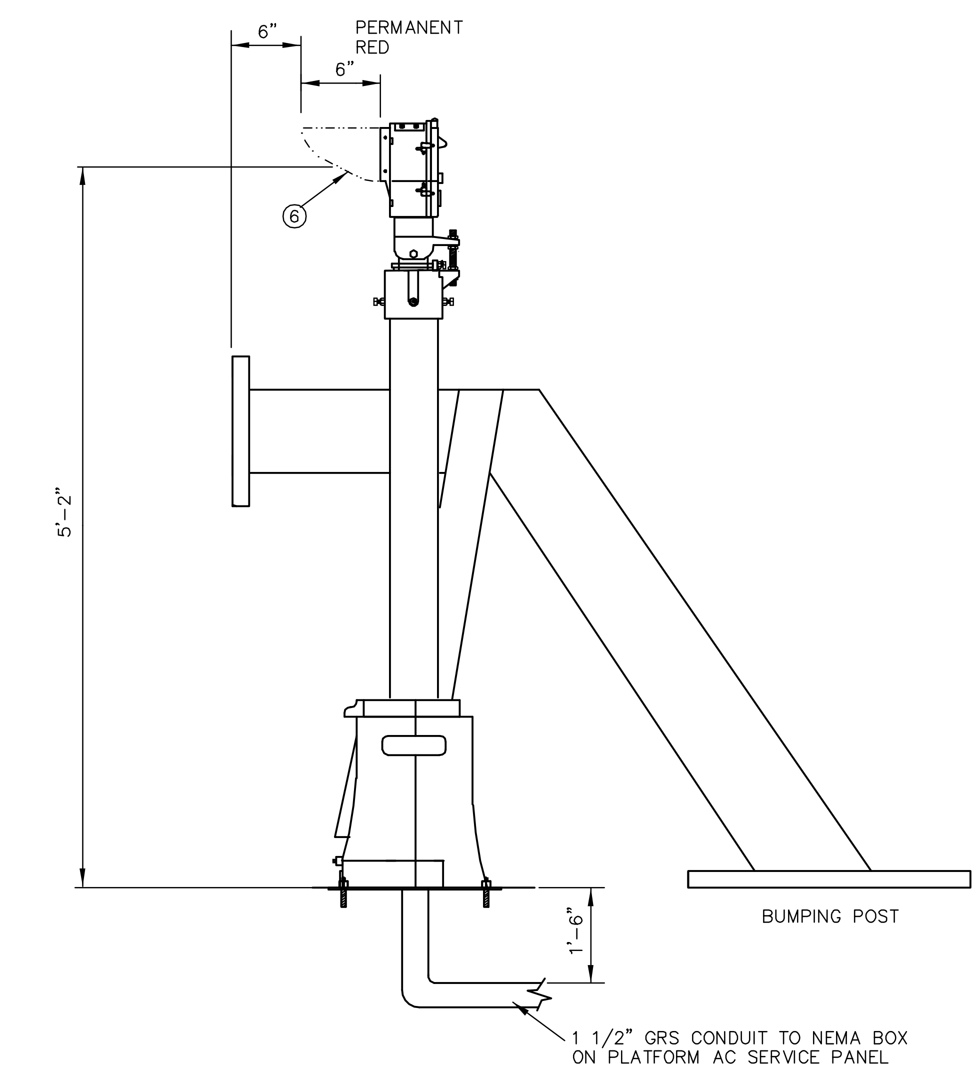
TOP VIEW



SIDE VIEW



BUMPING POST



SIEMENS CLS20R SIGNAL OR EQUIVALENT
ONE ASPECT (RED) WITH TOP OF MAST MOUNTING BRACKET

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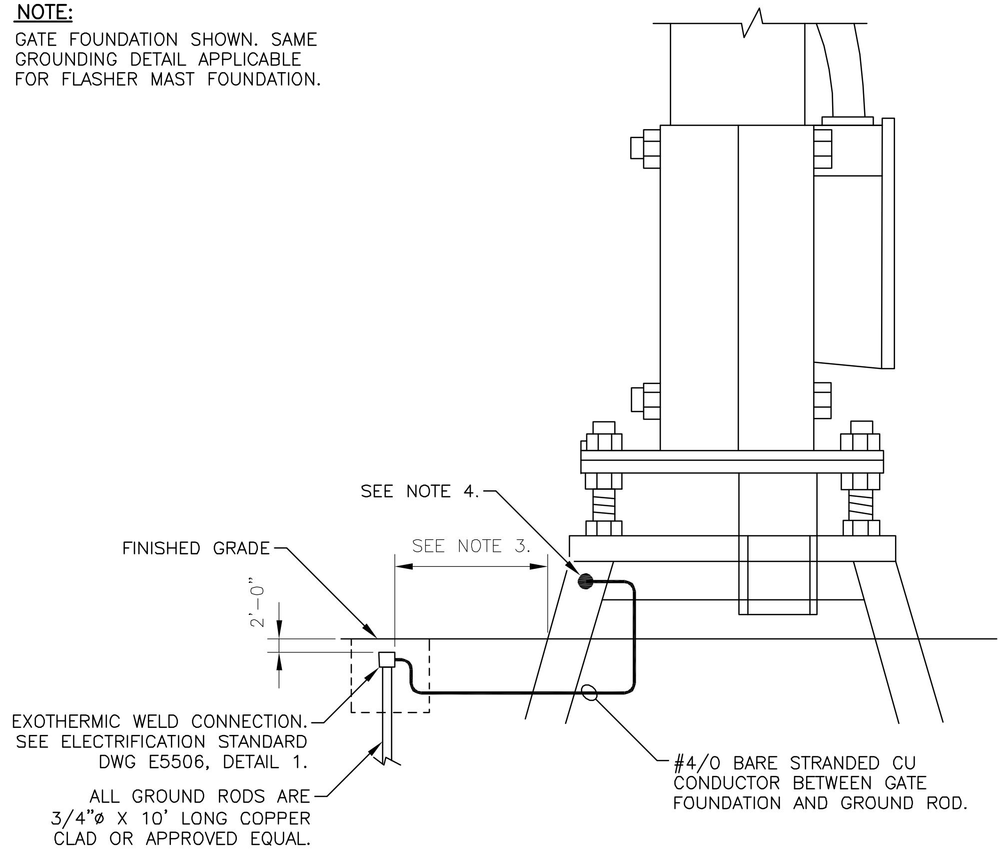
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SIGNAL APPARATUS
TYPICAL SIGNAL LAYOUT, PERMANENT RED END OF PLATFORM LIGHTS

CADD FILE NAME: SD-5216
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5216

NOTE:
GATE FOUNDATION SHOWN. SAME GROUNDING DETAIL APPLICABLE FOR FLASHER MAST FOUNDATION.



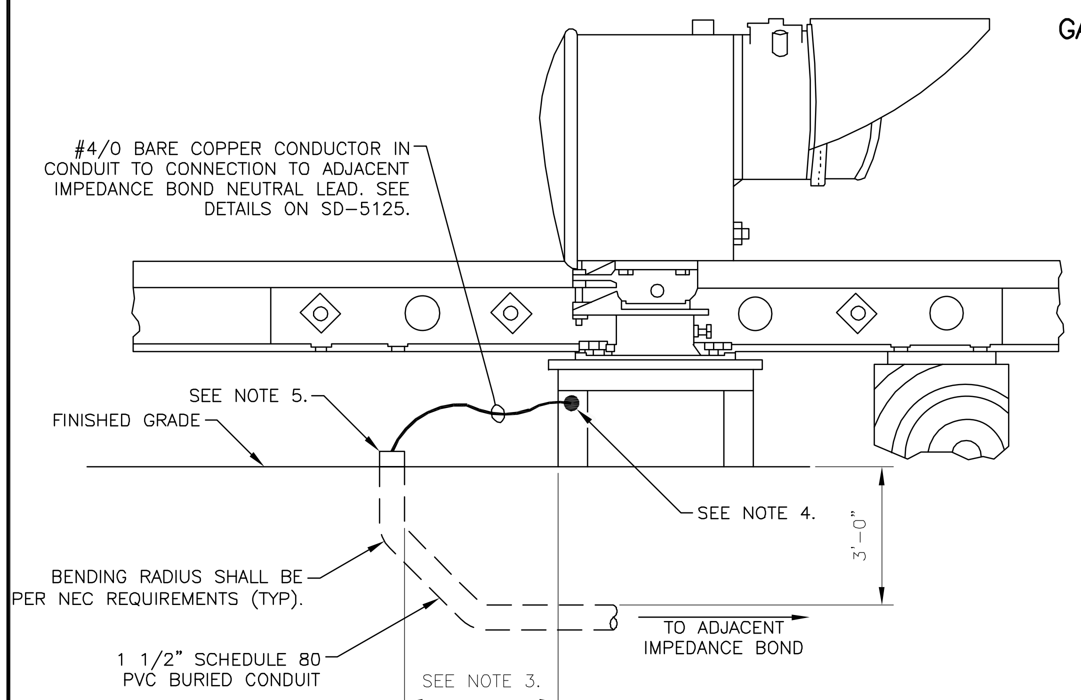
GATE OR FLASHER MAST FOUNDATION

DETAIL

SCALE: NOT TO SCALE

NOTES:

1. DRESS ALL GROUNDING CONDUCTORS AGAINST THE STRUCTURES WITH WIRE TIES SUITABLE FOR OUTDOOR USE.
2. ACTUAL GROUND RODS MAY BE LONGER AND HAVE MULTIPLE CONNECTED RODS TO ACHIEVE THE REQUIRED GROUND MAT-TO-EARTH RESISTANCE LEVELS.
3. CONDUIT TO BE LOCATED 12" MIN. FROM STRUCTURE. GROUND ROD OR CONDUIT SHALL NOT INTERFERE WITH UNDERGROUND STRUCTURES.
4. CONNECTION TO STEEL STRUCTURE TO BE MADE CEMBRE AR61E SINGLE SIDED, SEE ELECTRIFICATION STANDARD DWG E5500, DETAIL 4. IF THE STRUCTURE IS ALUMINUM, USE THE TINNED LUG FOR CONNECTION.
5. PROVIDE WATERTIGHT BUSHING AT CABLE EXIT, SIZED FOR APPROPRIATE CABLE TYPE.
6. STRUCTURES WITHIN THE OCLZ REQUIRE CONNECTIONS TO THE IMPEDANCE BOND OR STATIC WIRE OR LOCAL COUNTERPOISE BY MEANS OF A #4/0 AWG BARE STRANDED COPPER BOND CONDUCTOR. THE CONDUCTOR TO BE IN PVC CONDUIT BURIED BELOW FINISHED GRADE AT 3 FEET MIN.

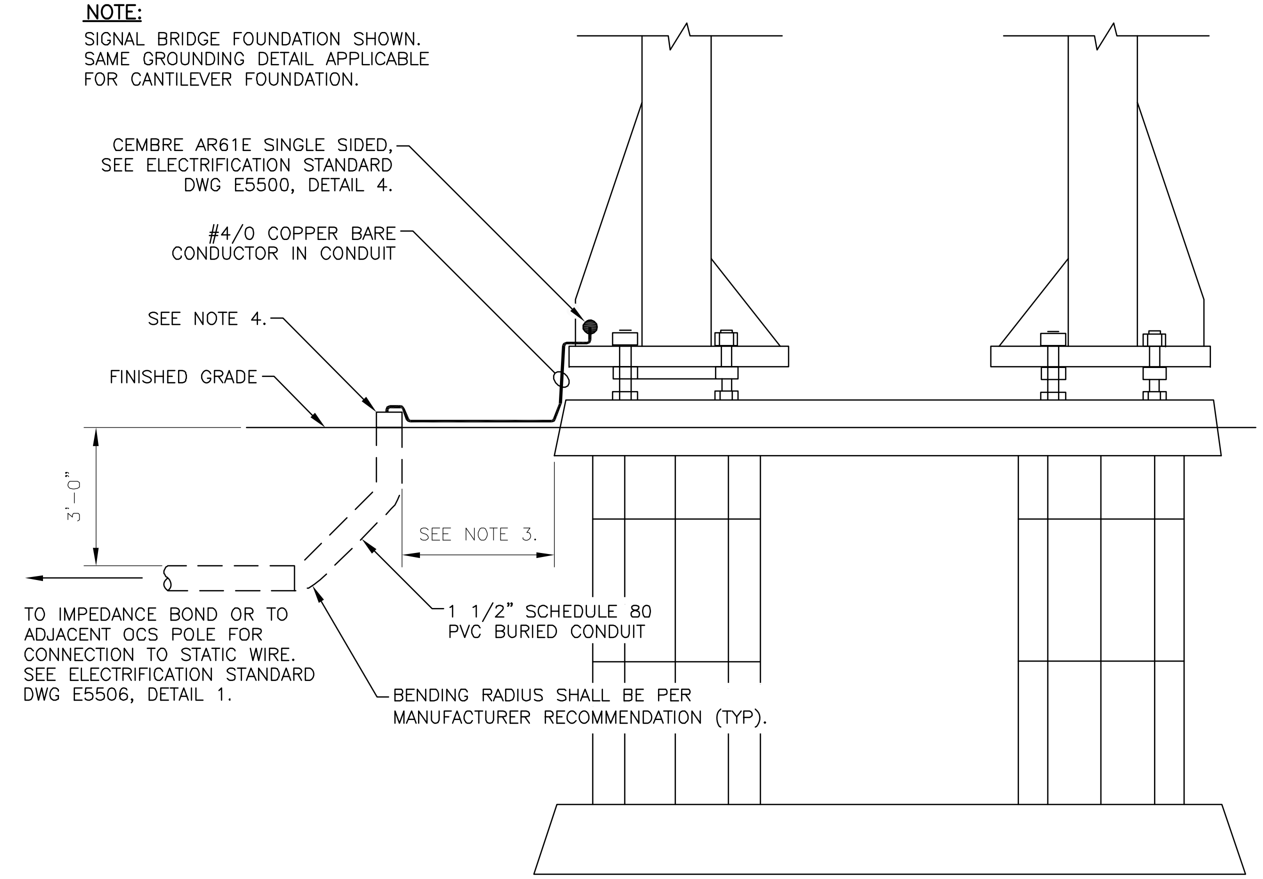


TYPICAL SINGLE UNIT DWARF SIGNAL

DETAIL

SCALE: NOT TO SCALE

NOTE:
SIGNAL BRIDGE FOUNDATION SHOWN. SAME GROUNDING DETAIL APPLICABLE FOR CANTILEVER FOUNDATION.



SIGNAL BRIDGE OR CANTILEVER FOUNDATION

DETAIL

SCALE: NOT TO SCALE

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PENINSULA CORRIDOR JOINT POWERS BOARD

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SIGNAL APPARATUS
TYPICAL SIGNAL
APPARATUS GROUNDING

CADD FILE NAME: SD-5217

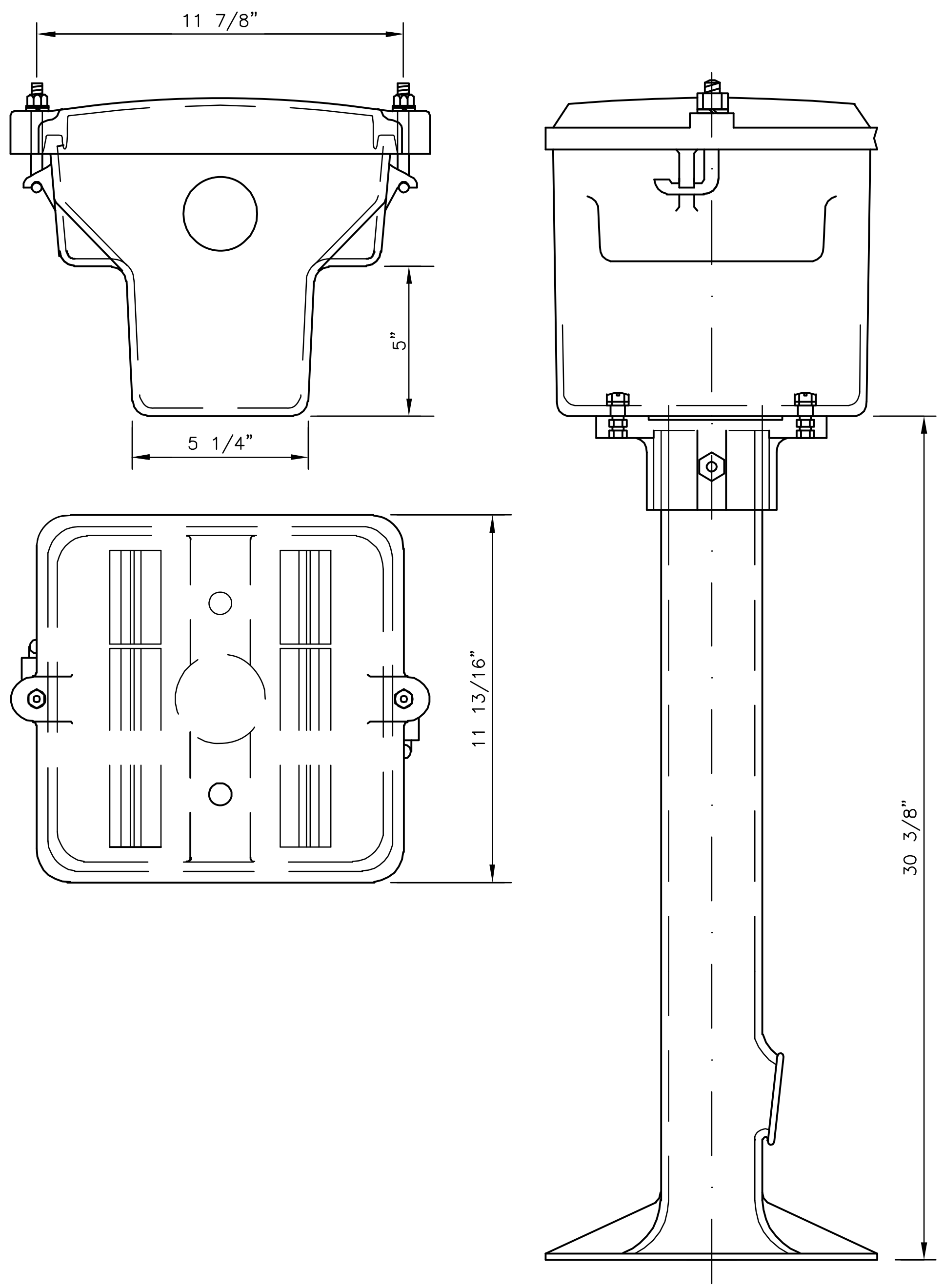
REV: | EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

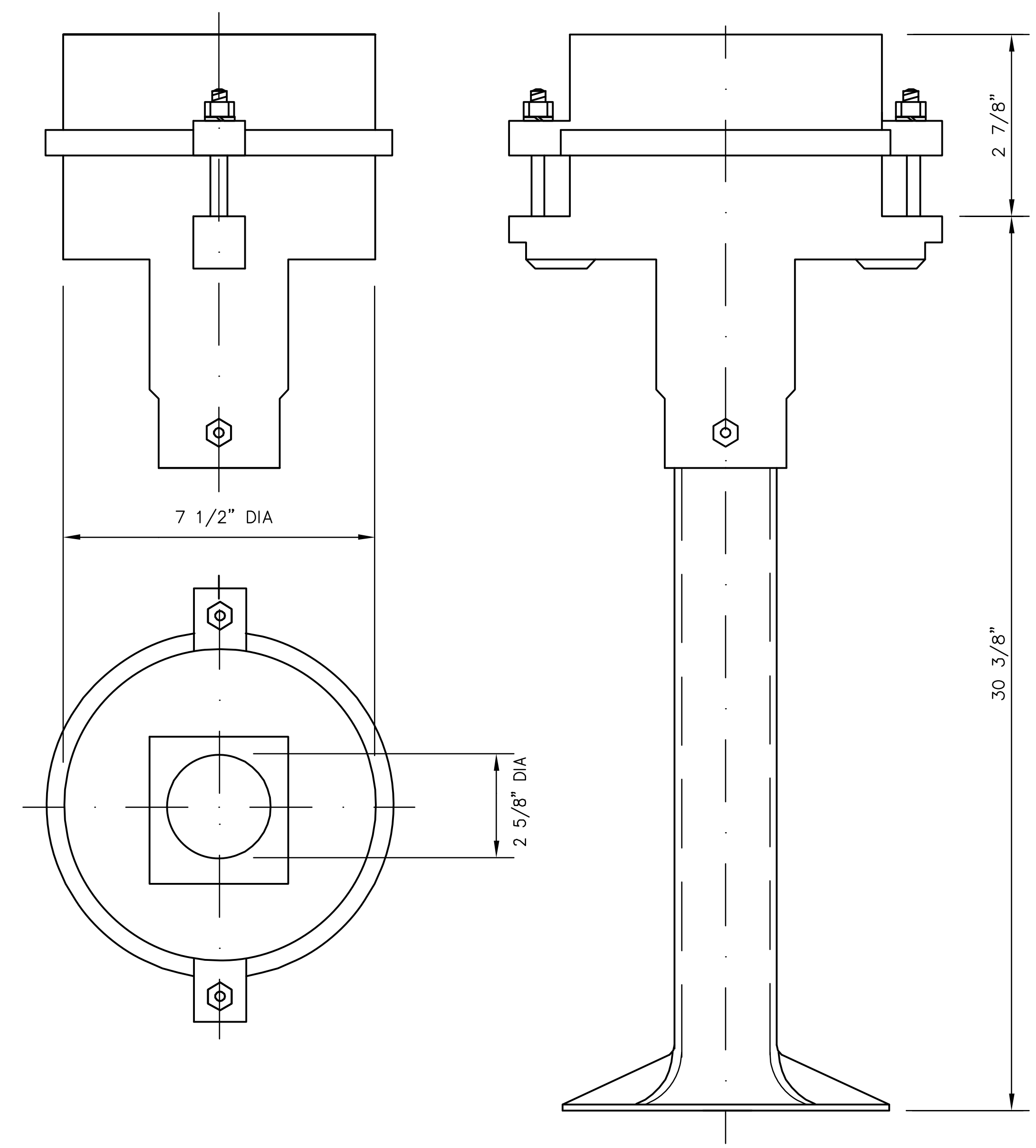
STANDARD DRAWING NO.: SD-5217

NOTES:

1. STANDARD JUNCTION BOX SHALL CONTAIN A MINIMUM OF 36 AAR TERMINALS
2. ALTERNATE JUNCTION BOX SHALL CONTAIN A MINIMUM OF 12 AREMA C&S MANUAL PART 14.1.5 TERMINAL – TO BE USED ON NEW INSTALLATIONS ONLY WITH APPROVAL OF THE ENGINEER
3. ONLY ONE SOLID WIRE PER TERMINAL INCLUDING SPARES
4. HMAC INSTALLATION – PEDESTAL MODIFICATION. TOP OF BOX LID LEVEL WITH TOP OF TIE
5. GALVANIZED RIGID STEEL (GRS) MAY BE USED IN LIEU OF PEDESTAL AS PART OF A CONDUIT AND PULL BOX INSTALLATION



STANDARD TYPE



ALTERNATE TYPE

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
TYPICAL PEDESTAL
JUNCTION BOX

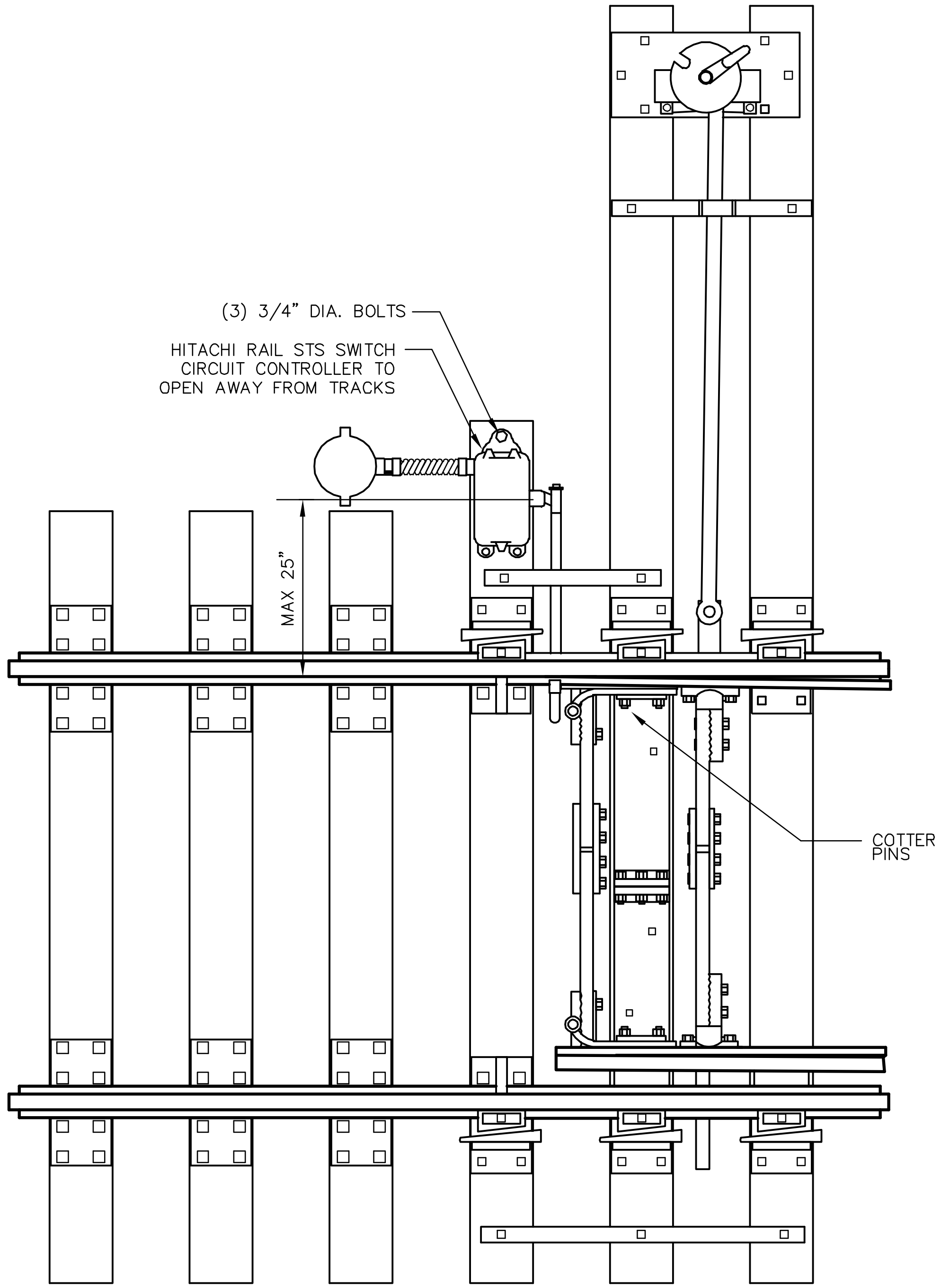
CADD FILE NAME: SD–5301

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

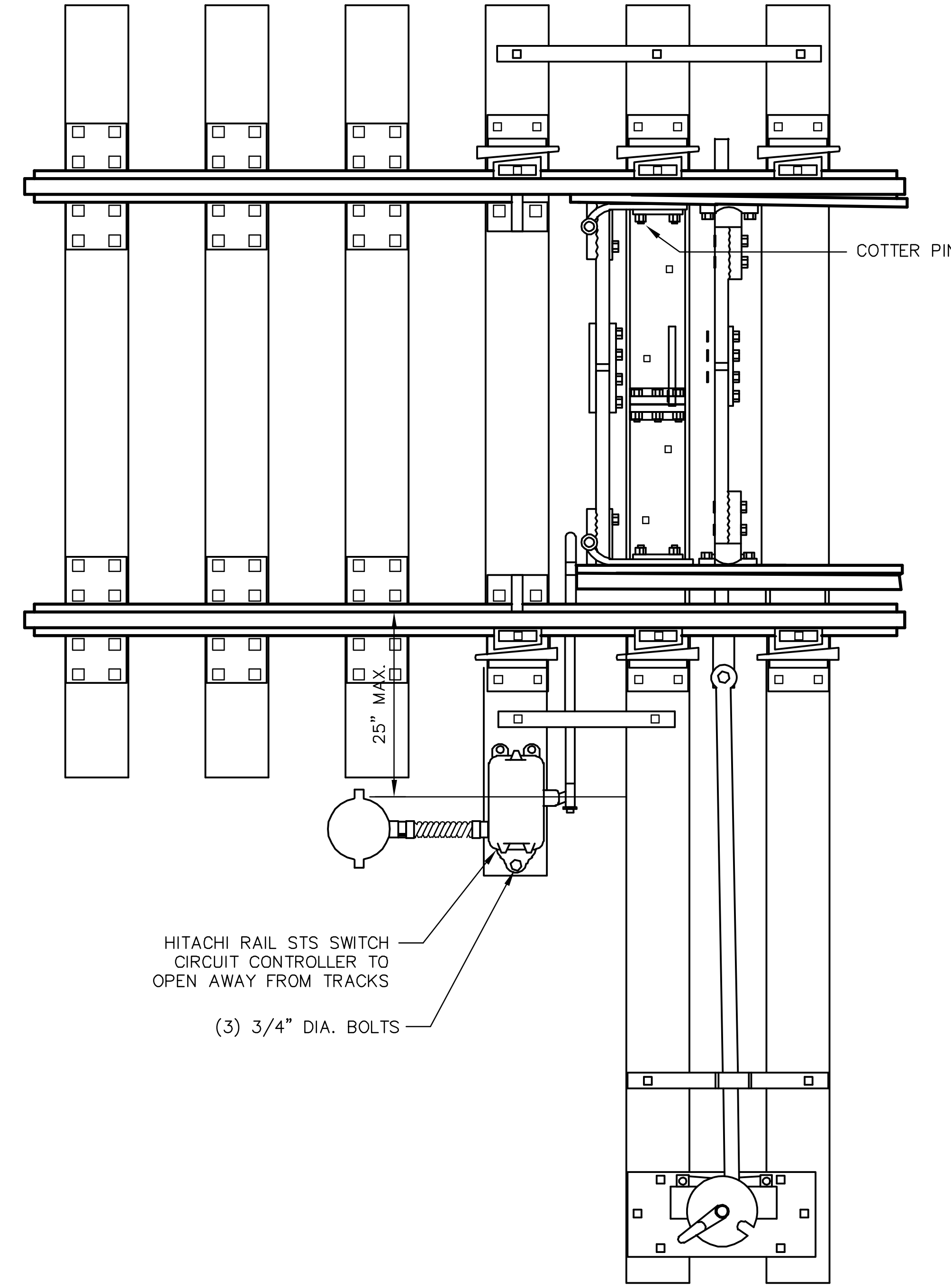
STANDARD DRAWING NO.: SD–5301



NEAR POINT NORMALLY CLOSED (PREFERRED)

NOTES:

1. TOP OF JUNCTION BOX LID SHALL BE LEVEL WITH TOP OF TIE.
2. SWITCH CIRCUIT CONTROLLER SHALL BE EQUIPPED WITH RETURN INTERNAL OR EXTERNAL SPRING.
3. U-5 BOX SHALL BE MOUNTED ON A 10' TIE AND TO OPEN AWAY FROM TRACK.
4. THE CENTER LINE OF THE CRANK SHAFT SHALL BE A MAXIMUM 25" FROM THE GAGE OF THE RAIL.
5. FLEX CONDUIT BETWEEN JUNCTION BOX AND SWITCH CIRCUIT CONTROLLER SHALL BE 18" TO 24" AND CONTAIN A STEEL CORE.
6. FLEX CONDUIT SHALL BE ROUTED SO IT DOES NOT INTERFERE WITH ROD MOVEMENT.
7. SEE TRACK STANDARDS FOR PROPER TIE LENGTH AND SPACING.
8. LAYOUT BASED ON USE OF HIGH SWITCH STAND. MAKE ADJUSTMENTS BASED ON SWITCH STAND USED.
9. WITH THE OPERATING CRANK POINTING VERTICALLY DOWNWARD AND THE SWITCH POINTS IN MID-POSITION, MARK THE LOCATION OF THE CONTROLLER BOX MOUNTING HOLES AND DRILL.
10. PLACE 3/4" DIA. BOLTS THROUGH TIE. HEAD OF BOLT SHALL BE SECURED WITH BRIDGE WASHER AT BOTTOM OF TIE.
11. INSTALL OPERATING ROD ON POINT LUG AND OPERATING CRANK WITH THE SWITCH POINTS IN MID-POSITION.
12. CENTER SCREW JAW ON THREADED PORTION OF POINT DETECTOR ROD.
13. ALLOW AMPLE CLEARANCE BETWEEN THE SIDE OF THE HEAD BLOCK TIE AND THE 3/4" OR 13/32" BALL STUD TO INSURE FREE MOVEMENT.



FAR POINT NORMALLY CLOSED

REV	DATE	BY	CHK	APP	DESCRIPTION
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REV	DATE	BY	CHK	APP

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
CIRCUIT CONTROLLER PLACEMENT AT HAND THROW SWITCHES

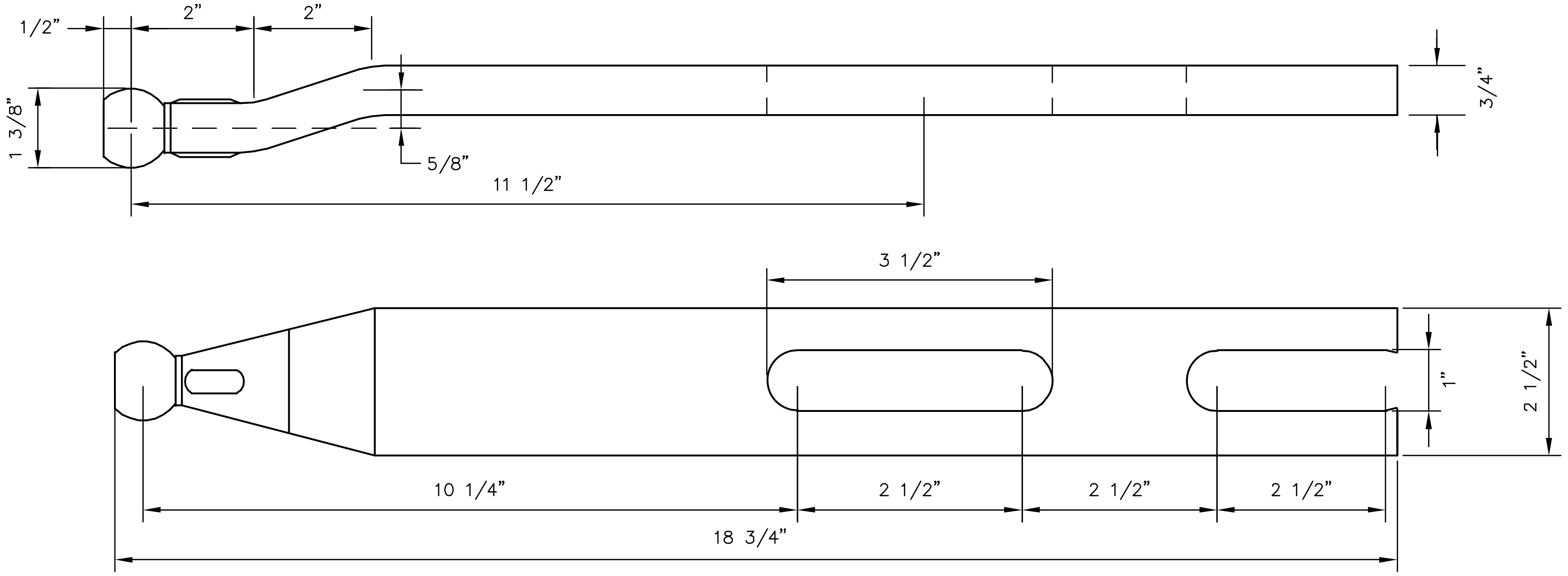
CADD FILE NAME: SD-5302

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5302



POINT DETECTOR LUG

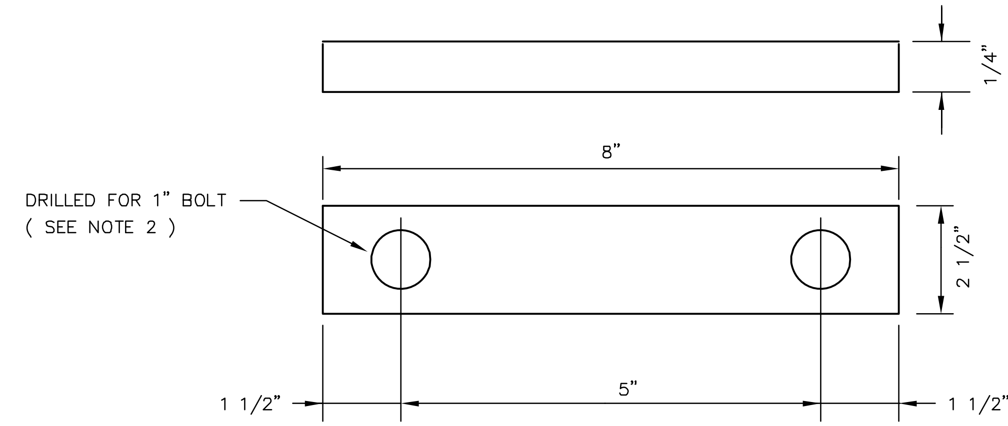
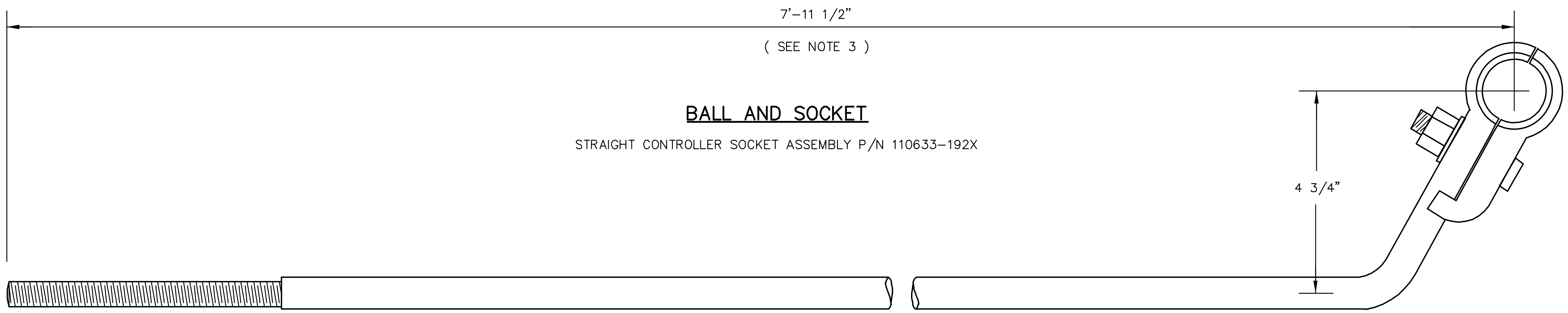


PLATE WASHER

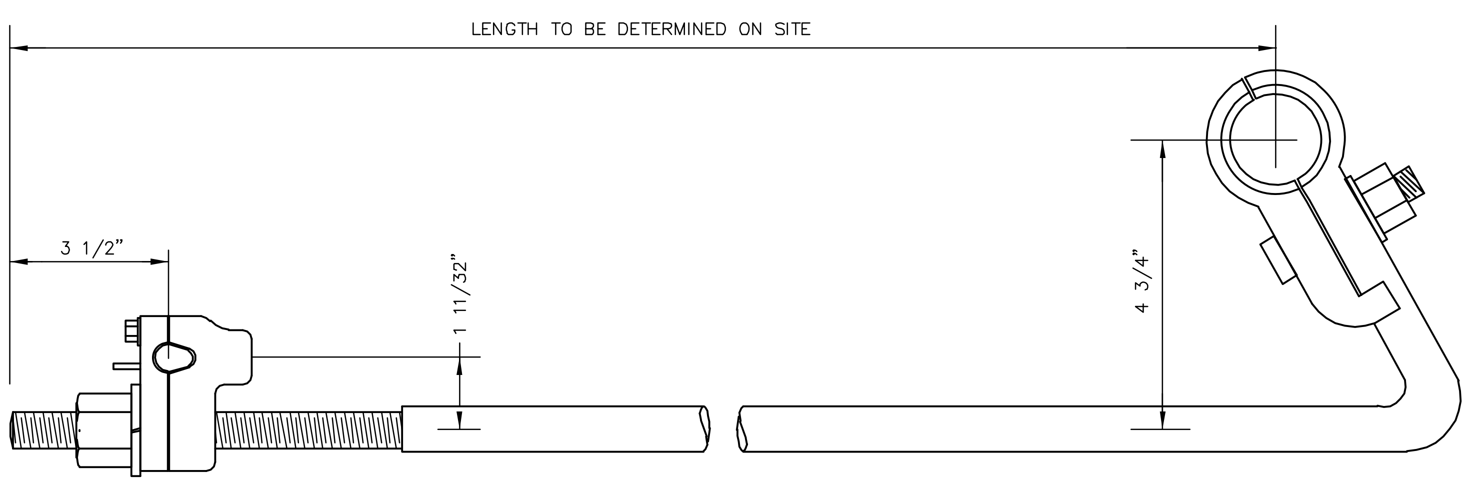


BALL AND SOCKET

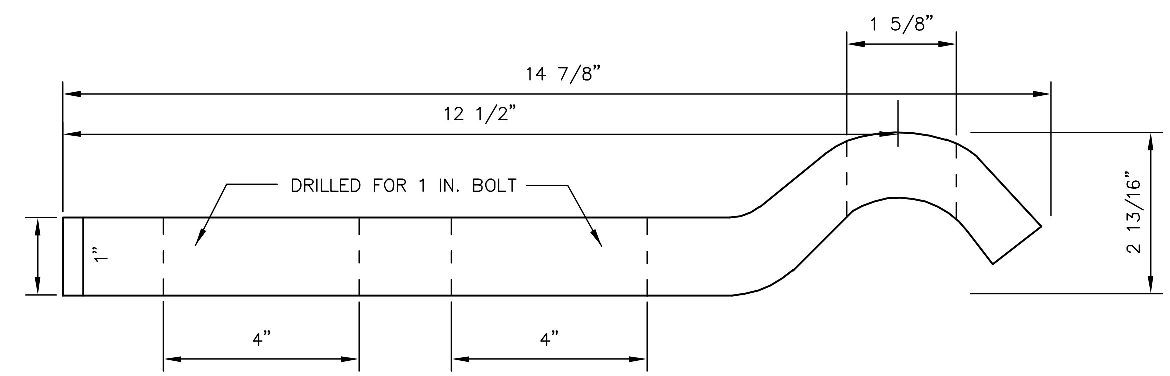
STRAIGHT CONTROLLER SOCKET ASSEMBLY P/N 110633-192X

NOTES:

1. ALL NUTS SHALL BE TIGHT AND SECURED WITH COTTER KEYS
2. DRILLED FOR 3/4" ON SOME INSTALLS
3. NOT USED ON NEW INSTALLATIONS



OPERATING RODS



POINT LUG SWIVEL

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
SWITCH CIRCUIT CONTROLLER
ROD AND LUG – BALL AND SOCKET

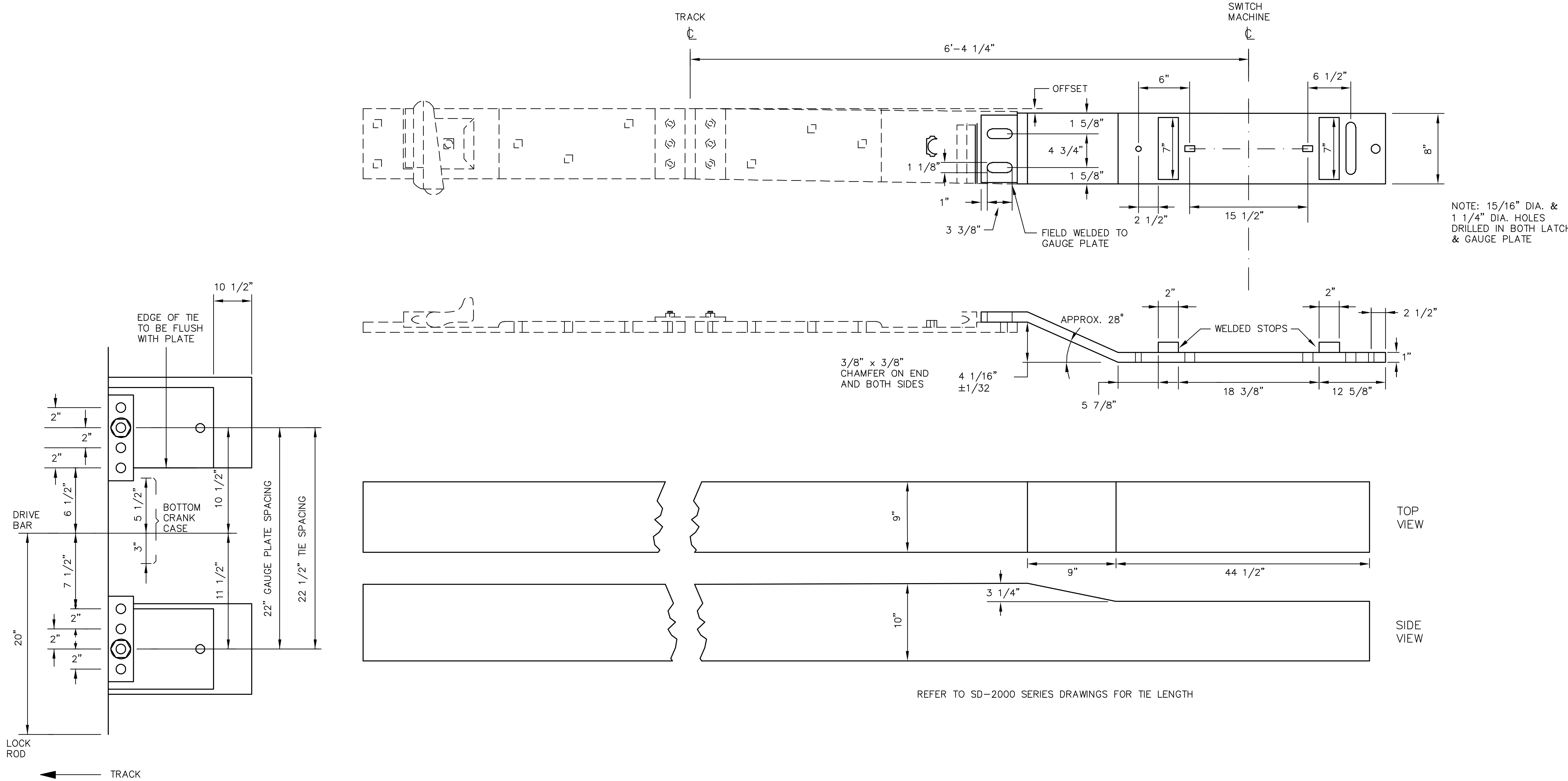
CADD FILE NAME: SD-5303

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5303



REFER TO SD-2000 SERIES DRAWINGS FOR TIE LENGTH

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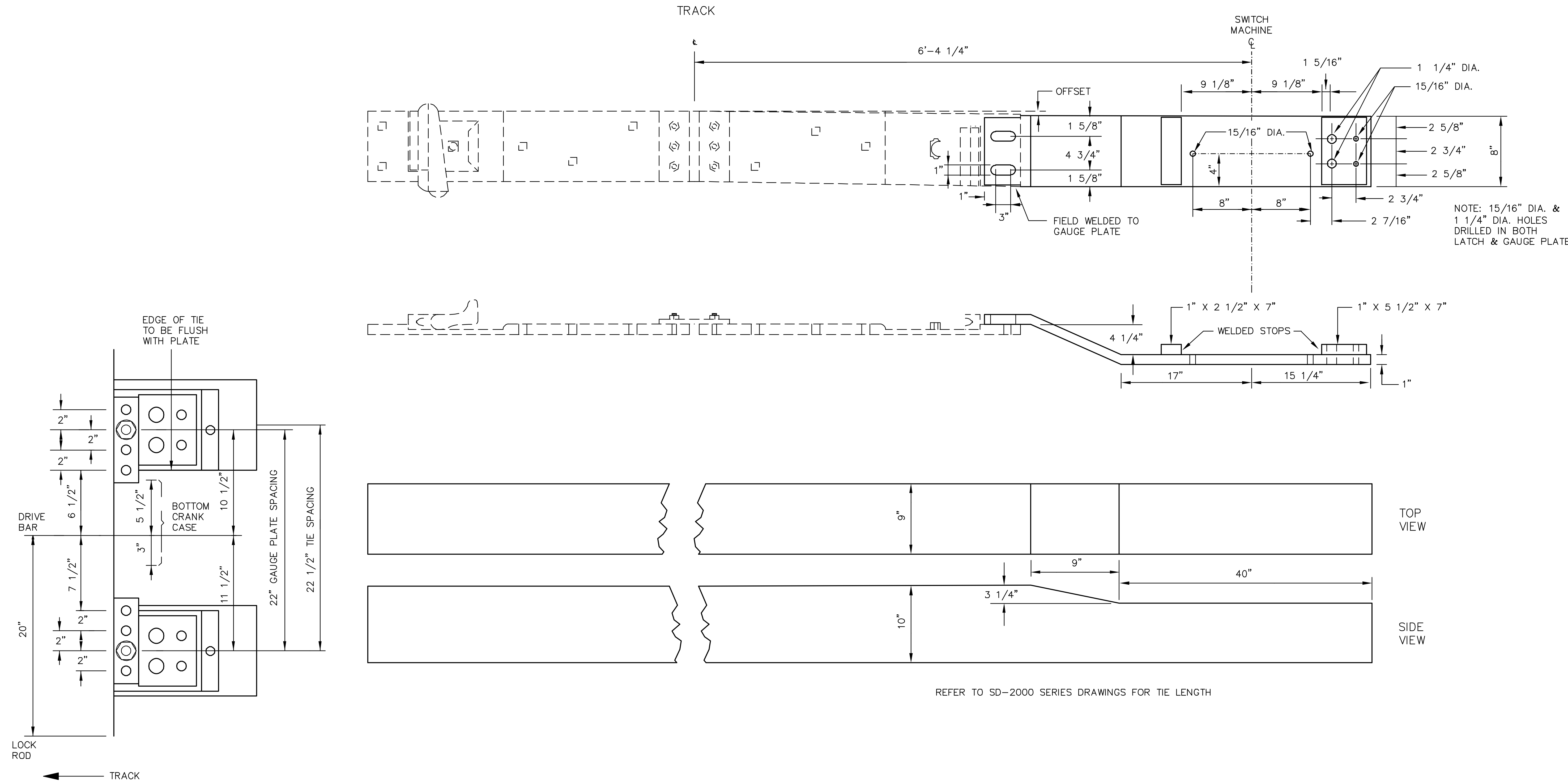
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
ALSTOM 5F SWITCH MACHINE
SWITCH TIES AND GAUGE PLATE EXT.

CADD FILE NAME: SD-5304
REV: EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5304



REFER TO SD-2000 SERIES DRAWINGS FOR TIE LENGTH

REV	DATE	BY	CHK	APP	DESCRIPTION
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REV	DATE	BY	CHK	APP

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
M-23A SWITCH MACHINE
SWITCH TIES AND GAUGE PLATE EXT.

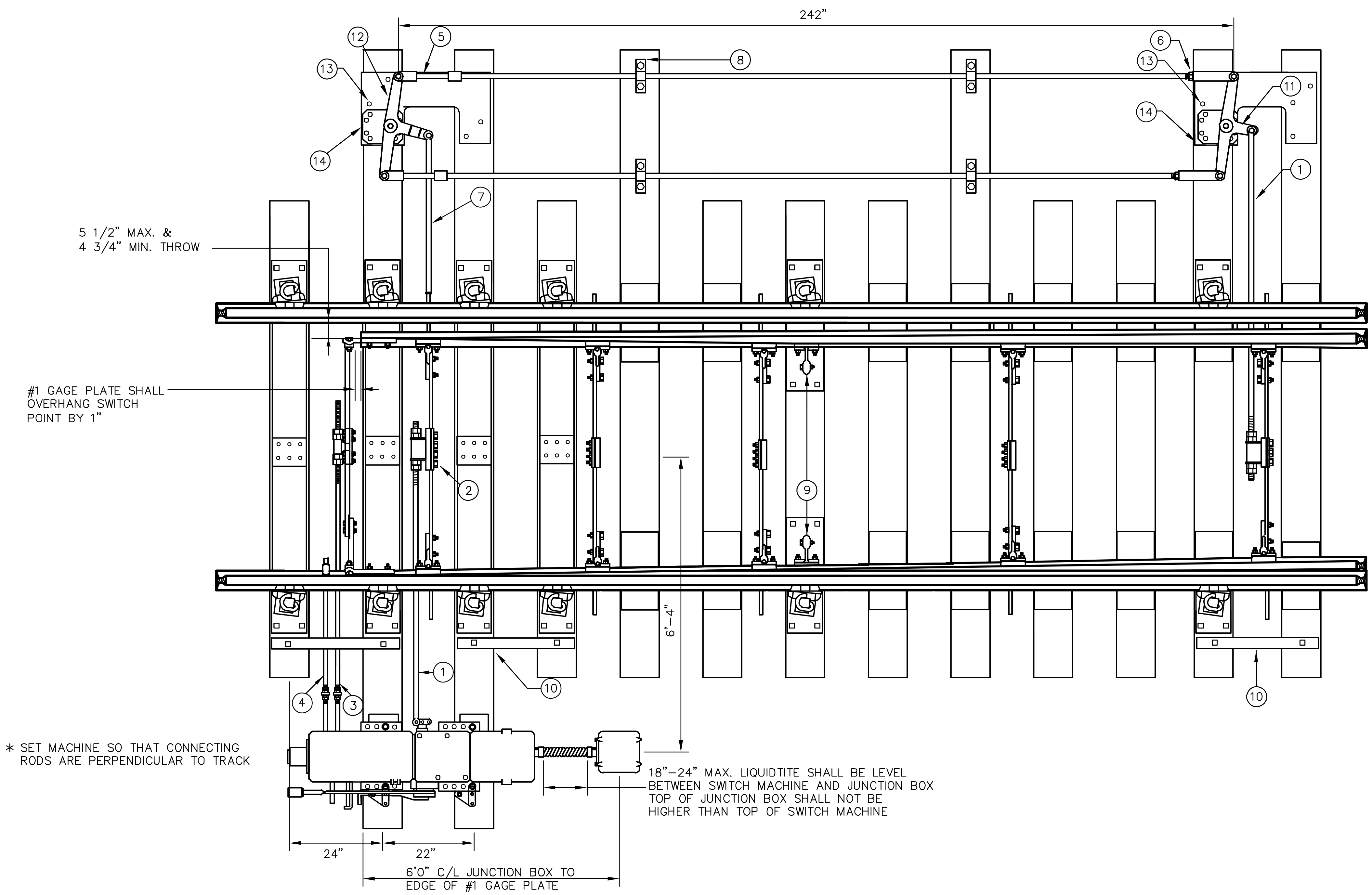
CADD FILE NAME: SD-5305

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5305



NOTES:

1. THROW ROD CUT OFF TO 74" LENGTH. REMOVE ALEMITE FITTING FROM TURNED BOLT TO CLEAR COVER ON SWITCH MACHINE
2. SWITCH ADJUSTER, VERTICAL
3. LOCK ROD CONNECTION
4. POINT DETECTOR ROD
5. SOLID JAW
6. SCREW JAW
7. ADJUSTABLE LINK
8. PIPE GUIDE
9. SWITCH POINT ROLLER, GW-9 (TWO PER SET, 3 SETS PER SWITCH)
10. 2" X 1/2" STEEL STRAPS
11. "T" CRANK STAND ASSEMBLY (SHORT)
12. "T" CRANK STAND ASSEMBLY (LONG)
13. SCREW, 3/4" X 6" LAGS
14. CRANK STAND BASE
15. FOR TIE LENGTH AND TIE SPACING REFER TO SD-2000 SERIES DRAWINGS

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STANDARD DRAWINGS

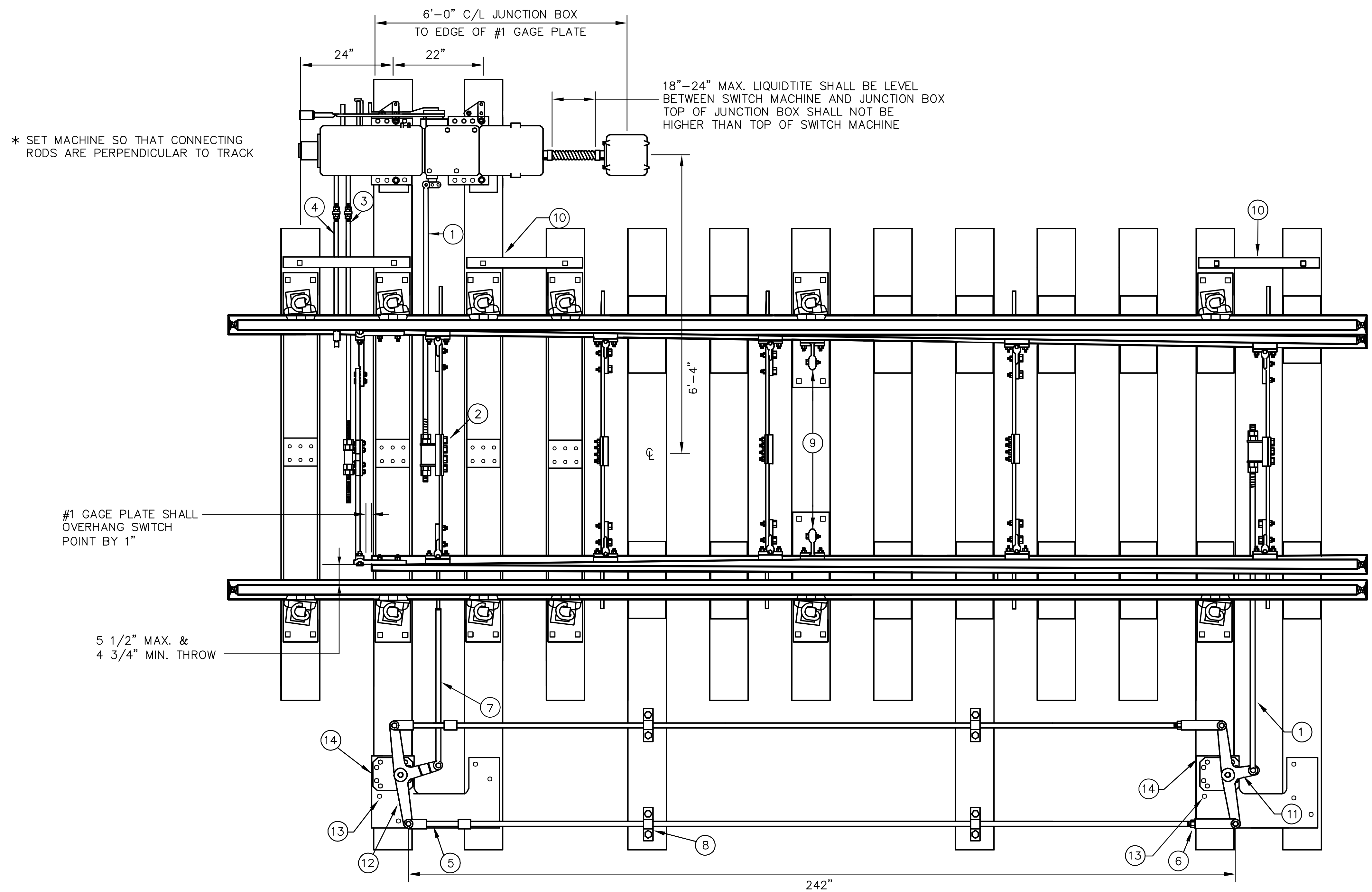
SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
M-23A SWITCH MACHINE LAYOUT
NO. 20 TURNOUT, RIGHT MOUNTED

CADD FILE NAME: SD-5306

REV: | EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5306



NOTES:

1. THROW ROD CUT OFF TO 74" LENGTH. REMOVE ALEMITE FITTING FROM TURNED BOLT TO CLEAR COVER ON SWITCH MACHINE
2. SWITCH ADJUSTER, VERTICAL
3. LOCK ROD CONNECTION
4. POINT DETECTOR ROD
5. SOLID JAW
6. SCREW JAW
7. ADJUSTABLE LINK
8. PIPE GUIDE
9. SWITCH POINT ROLLER, GW–9 (TWO PER SET, 3 SETS PER SWITCH)
10. 2" X 1/2" STEEL STRAPS
11. "T" CRANK STAND ASSEMBLY (SHORT)
12. "T" CRANK STAND ASSEMBLY (LONG)
13. SCREW, 3/4" X 6" LAGS
14. CRANK STAND BASE
15. FOR TIE LENGTH AND TIE SPACING REFER TO SD–2000 SERIES DRAWINGS

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STANDARD DRAWINGS

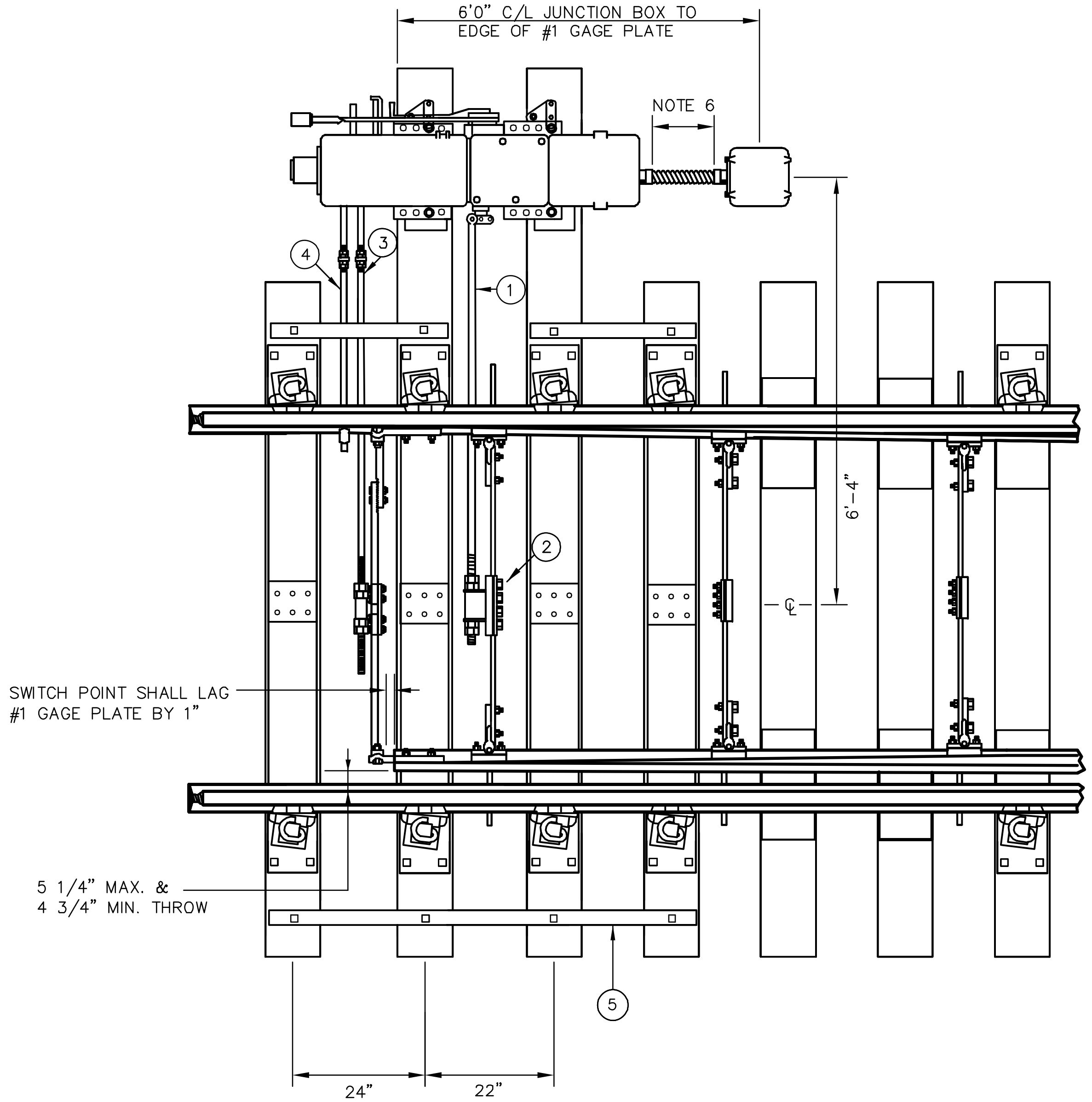
SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
M–23A SWITCH MACHINE LAYOUT
NO. 20 TURNOUT, LEFT MOUNTED

CADD FILE NAME: SD–5307

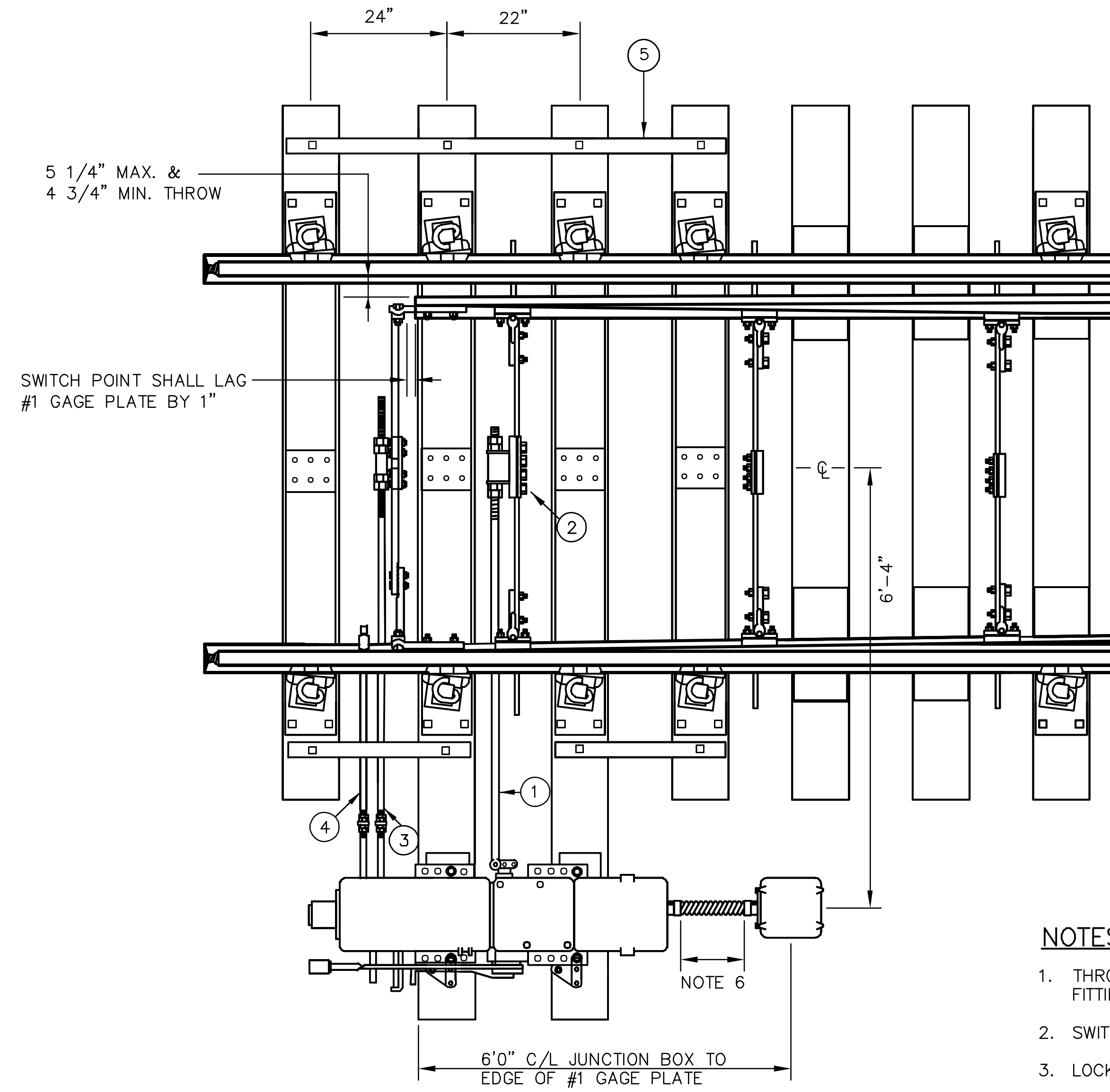
REV: | EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD–5307



LEFT HAND MOUNTED
NO. 10 CONCRETE
TIES SPACING



RIGHT HAND MOUNTED
NO. 14 CONCRETE
TIES SPACING

NOTES:

1. THROW ROD CUT OFF TO 74" LENGTH. REMOVE ALEMITE FITTING TURNED BOLT TO CLEAR COVER ON SWITCH MACHINE
2. SWITCH ADJUSTER, VERTICAL
3. LOCK ROD CONNECTION
4. POINT DETECTOR ROD
5. 1/2" X 2" STEEL STRAP CUT TO REQUIRED LENGTH AND DRILLED FOR 3/4" LAG SCREW
6. 18"–24" MAX. LIQUIDTITE SHALL BE LEVEL BETWEEN SWITCH MACHINE AND JUNCTION BOX. TOP OF JUNCTION BOX SHALL NOT BE HIGHER THAN TOP OF SWITCH MACHINE
7. FLEX CONDUIT TO BE STEEL CORE
8. SET MACHINE SO THAT CONNECTING RODS ARE PERPENDICULAR TO TRACK
9. REFER TO SD–2000 SERIES DRAWINGS FOR TIE SPACING AND LENGTH

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STANDARD DRAWINGS

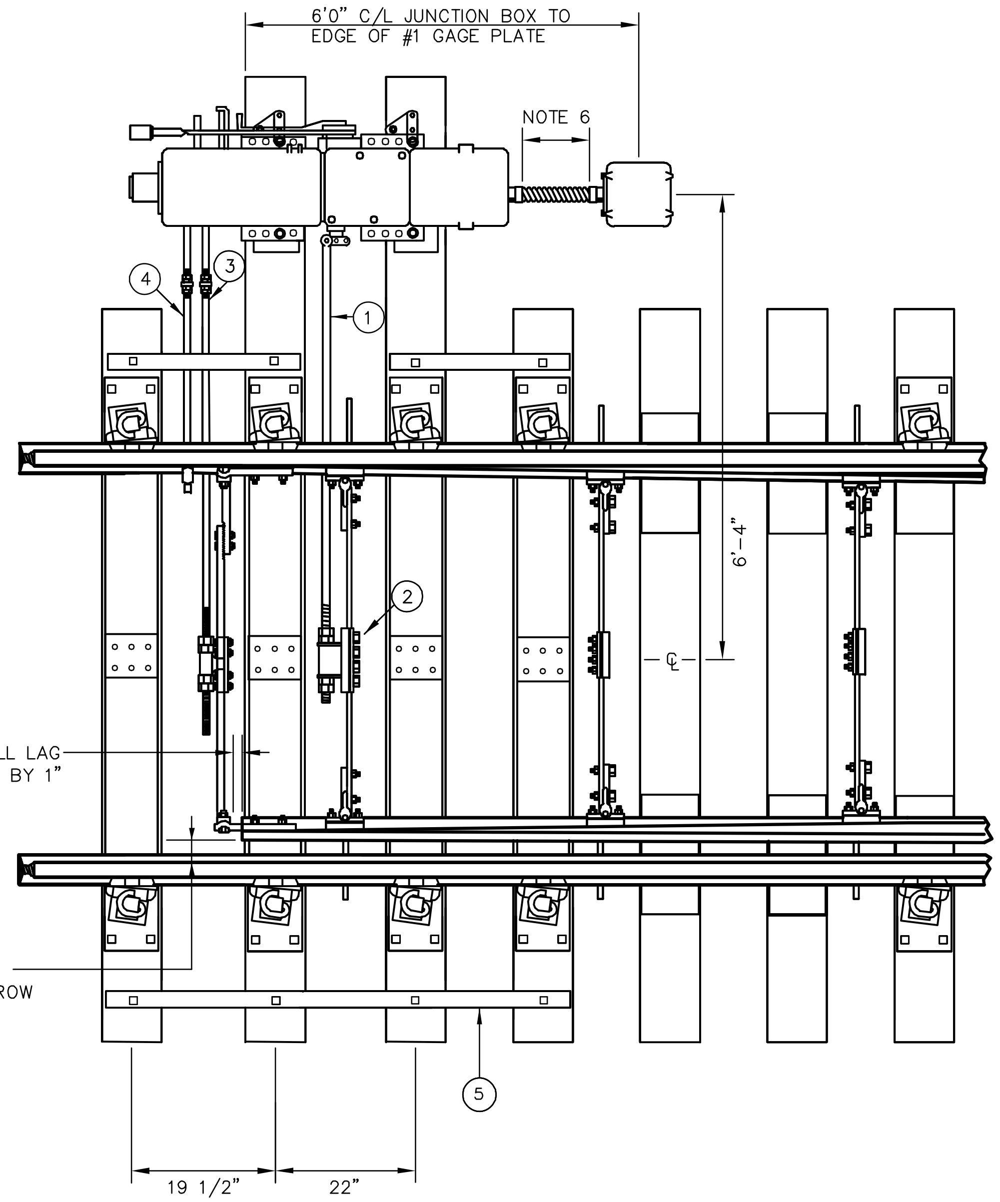
SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
M–23A SWITCH MACHINE LAYOUT
NO. 10 OR NO. 14 CONCRETE TIES

CADD FILE NAME: SD–5308

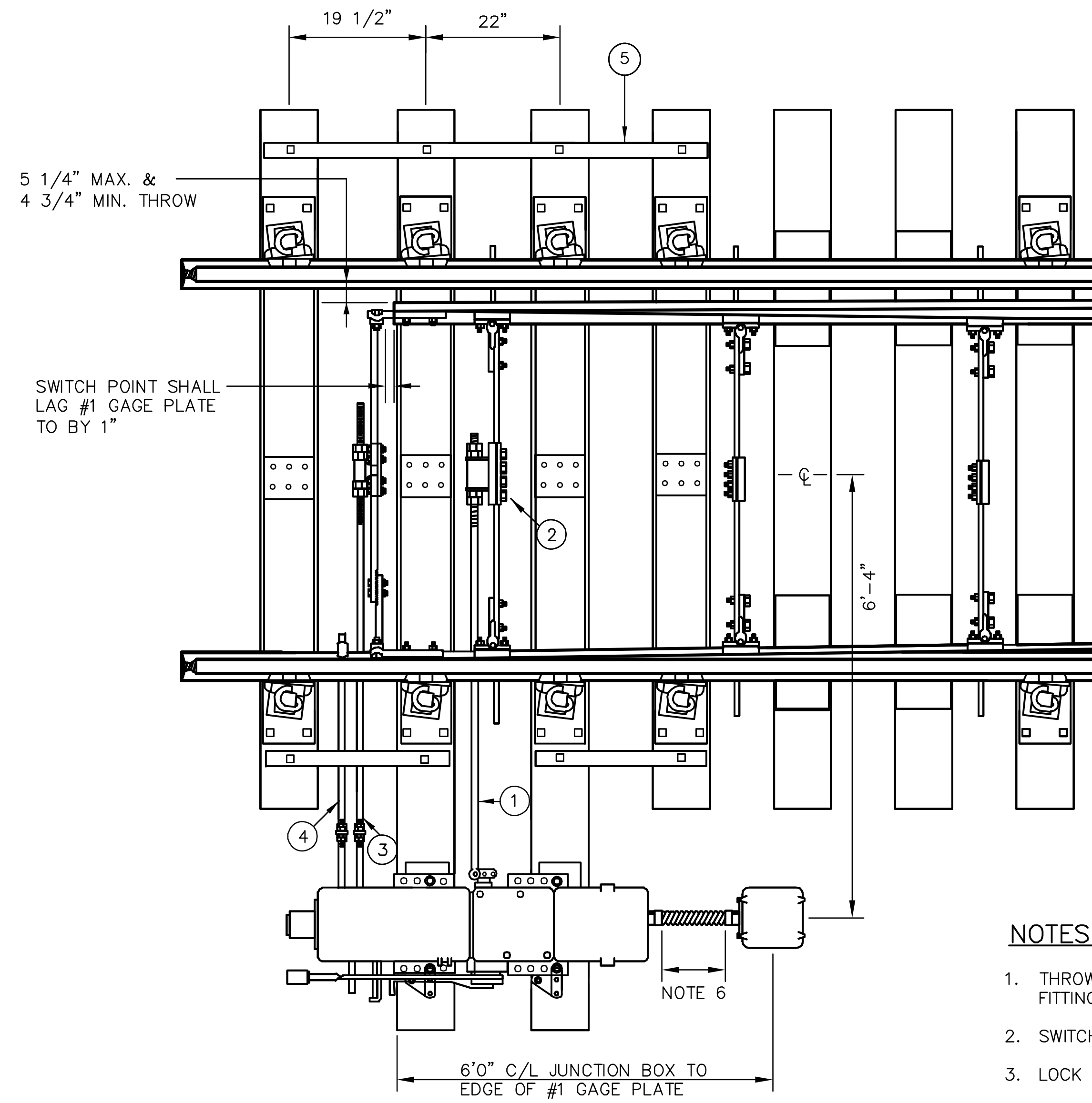
REV: | EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD–5308



LEFT HAND MOUNTED
NO. 10 WOOD TIES
SPACING



RIGHT HAND MOUNTED
NO. 14 WOOD TIES
SPACING

NOTES:

1. THROW ROD CUT OFF TO 74" LENGTH. REMOVE ALEMITE FITTING TURNED BOLT TO CLEAR COVER ON SWITCH MACHINE
2. SWITCH ADJUSTER, VERTICAL
3. LOCK ROD CONNECTION
4. POINT DETECTOR ROD
5. 1/2" X 2" STEEL STRAP CUT TO REQUIRED LENGTH AND DRILLED FOR 3/4" LAG SCREW
6. 18"-24" MAX. LIQUIDTITE SHALL BE LEVEL BETWEEN SWITCH MACHINE AND JUNCTION BOX. TOP OF JUNCTION BOX SHALL NOT BE HIGHER THAN TOP OF SWITCH MACHINE
7. FLEX CONDUIT TO BE STEEL CORE
8. SET MACHINE SO THAT CONNECTING RODS ARE PERPENDICULAR TO TRACK
9. REFER TO SD-2000 SERIES DRAWINGS FOR TIE SPACING AND LENGTH

REV	DATE	BY	CHK	APP	DESCRIPTION
	01012024				FOURTH EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

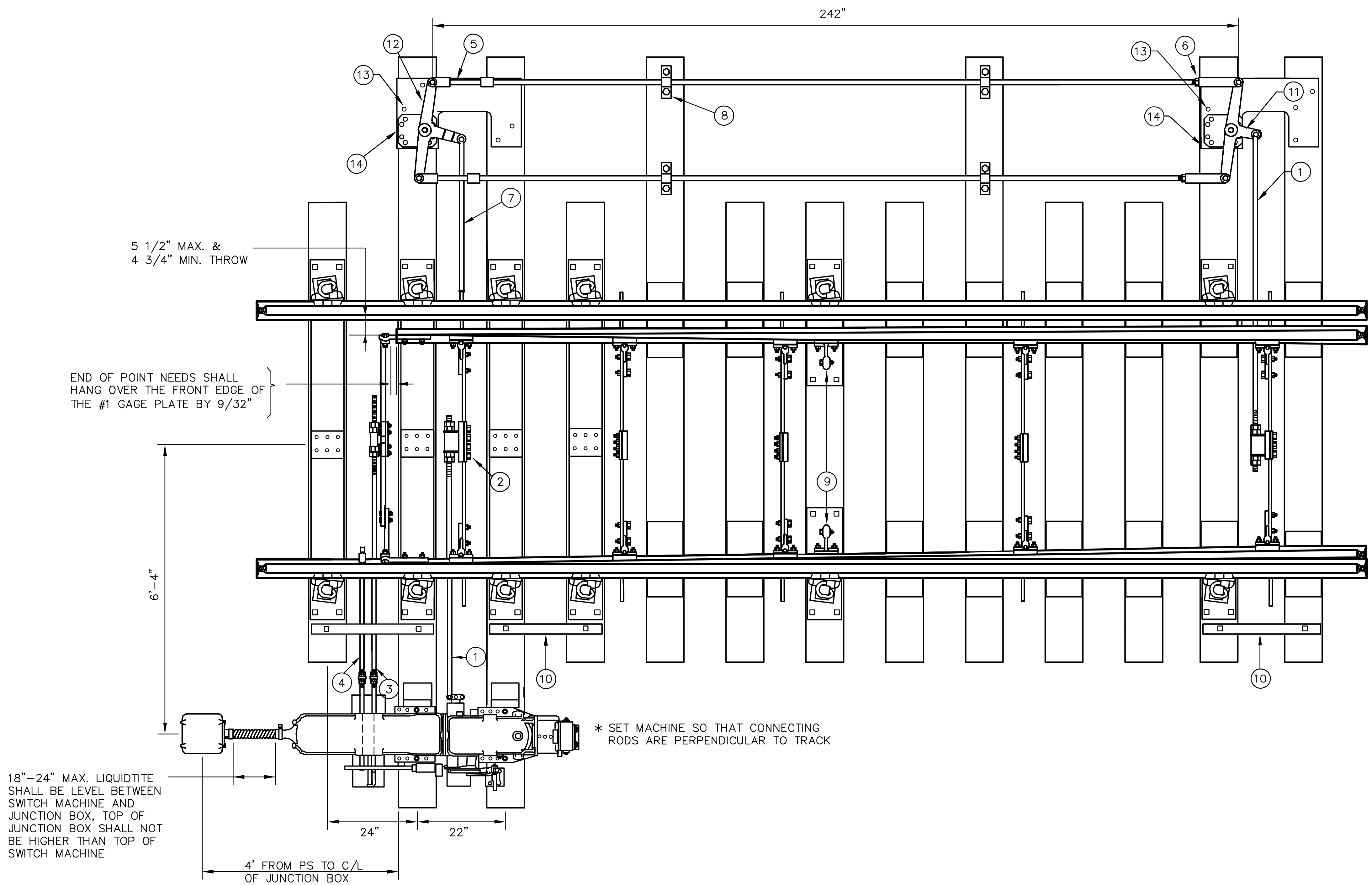
APPROVED BY:
Bin Zhang
DEPUTY DIRECTOR, ENGINEERING

Caltrain
1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
M-23A SWITCH MACHINE LAYOUT
NO. 10 OR NO. 14 WOOD TIES

CADD FILE NAME: SD-5309
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5309



NOTES:

1. THROW ROD CUT OFF TO 74" LENGTH. REMOVE ALEMITE FITTING TURNED BOLT TO CLEAR COVER ON SWITCH MACHINE
2. SWITCH ADJUSTER, VERTICAL
3. LOCK ROD CONNECTION
4. POINT DETECTOR ROD
5. SOLID JAW
6. SCREW JAW
7. ADJUSTABLE LINK
8. PIPE GUIDE
9. SWITCH POINT ROLLER, GW-9 (TWO PER SET, 3 SETS PER SWITCH)
10. 2 IN X 1/2 IN STEEL STRAPS
11. "T" CRANK STAND ASSEMBLY (SHORT)
12. "T" CRANK STAND ASSEMBLY (LONG)
13. SCREW, ¾ IN X 6 IN LAGS
14. CRANK STAND BASE
15. FOR TIE LENGTH AND TIE SPACING REFER TO SD-2000 SERIES DRAWINGS

REV	DATE	BY	CHK	APP	DESCRIPTION
	01012024				FOURTH EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

Bin Zhang

DEPUTY DIRECTOR, ENGINEERING

Caltrain

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San Carlos, CA 94070

STANDARD DRAWINGS

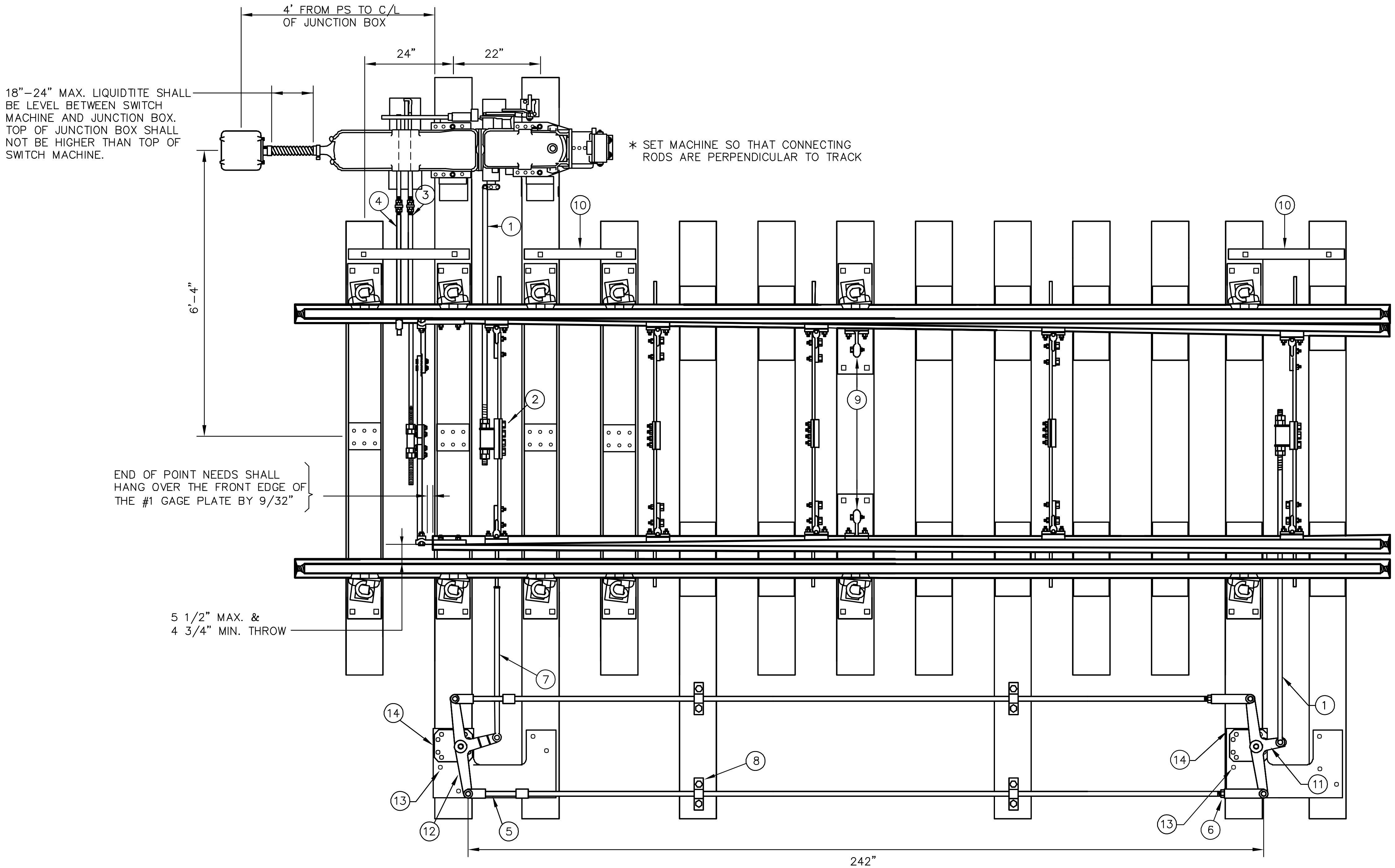
SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
5F SWITCH MACHINE LAYOUT
NO. 20 TURNOUT, RIGHT MOUNTED

CADD FILE NAME: SD-5310

REV: EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5310



NOTES:

1. THROW ROD CUT OFF TO 74" LENGTH. REMOVE ALEMITE FITTING TURNED BOLT TO CLEAR COVER ON SWITCH MACHINE
2. SWITCH ADJUSTER, VERTICAL
3. LOCK ROD CONNECTION
4. POINT DETECTOR ROD
5. SOLID JAW
6. SCREW JAW
7. ADJUSTABLE LINK
8. PIPE GUIDE
9. SWITCH POINT ROLLER, GW-9 (TWO PER SET, 3 SETS PER SWITCH)
10. 2 IN X 1/2 IN STEEL STRAPS
11. "T" CRANK STAND ASSEMBLY (SHORT)
12. "T" CRANK STAND ASSEMBLY (LONG)
13. SCREW, ¾ IN X 6 IN LAGS
14. CRANK STAND BASE
15. FOR TIE LENGTH AND TIE SPACING REFER TO SD-2000 SERIES DRAWINGS

REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
5F SWITCH MACHINE LAYOUT
NO. 20 TURNOUT, LEFT MOUNTED

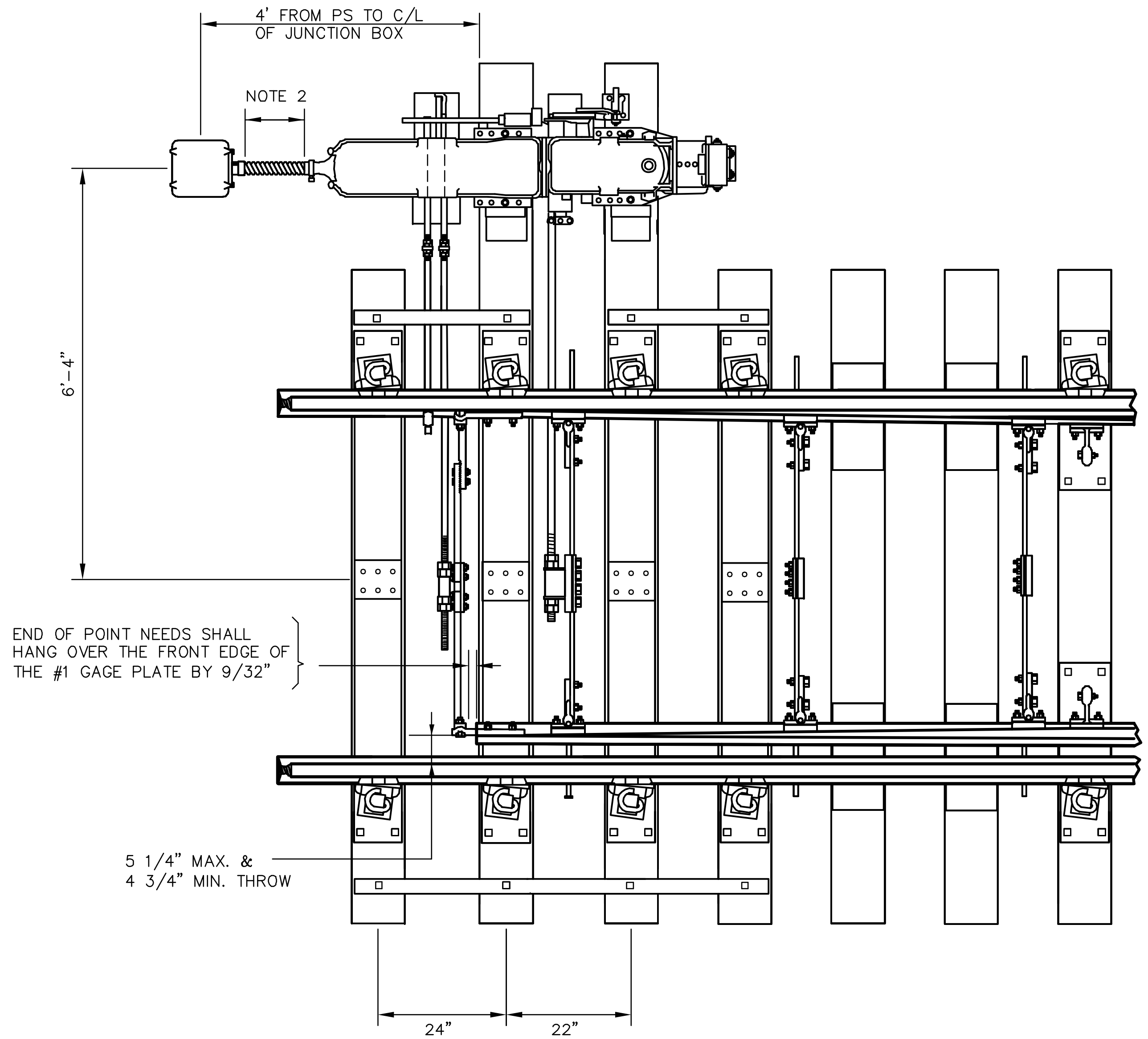
CADD FILE NAME: SD-5311

REV:

EDITION: FOURTH

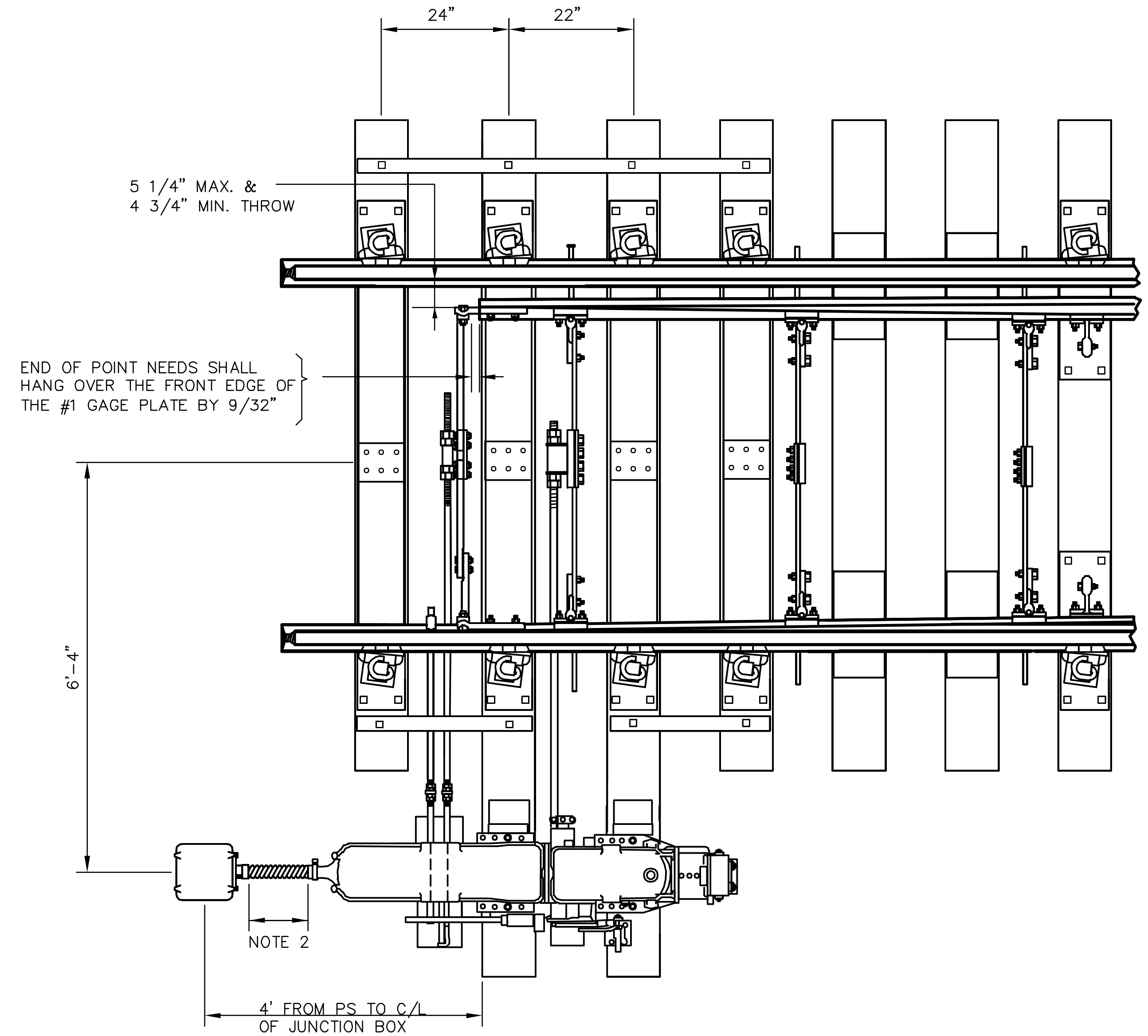
SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5311



LEFT HAND MOUNTED

NO. 10 CONCRETE
TIES SPACING



RIGHT HAND MOUNTED

NO. 14 CONCRETE
TIES SPACING

NOTES:

1. SET MACHINE SO THAT CONNECTING RODS ARE PERPENDICULAR TO TRACK
2. 18"-24" MAX. LIQUIDTITE SHALL BE LEVEL BETWEEN SWITCH MACHINE AND JUNCTION BOX. TOP OF JUNCTION BOX SHALL NOT BE HIGHER THAN TOP OF SWITCH MACHINE
3. REFER TO SD-2000 SERIES DRAWINGS FOR TIE SPACING AND LENGTH

REV	DATE	BY	CHK	APP	DESCRIPTION
	01012024				FOURTH EDITION

REV	DATE	BY	CHK	APP	

PENINSULA CORRIDOR JOINT POWERS BOARD

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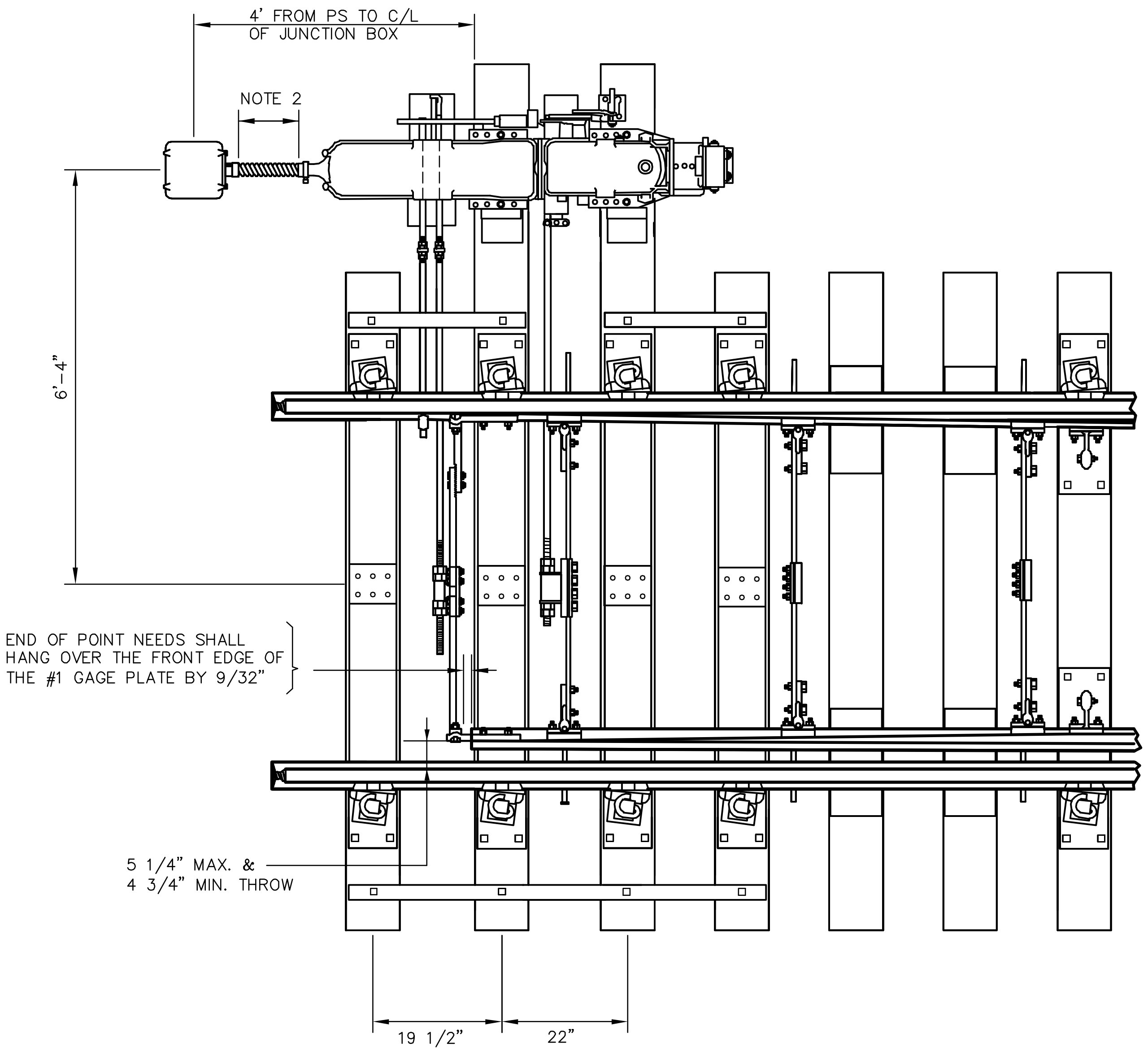
STANDARD DRAWINGS

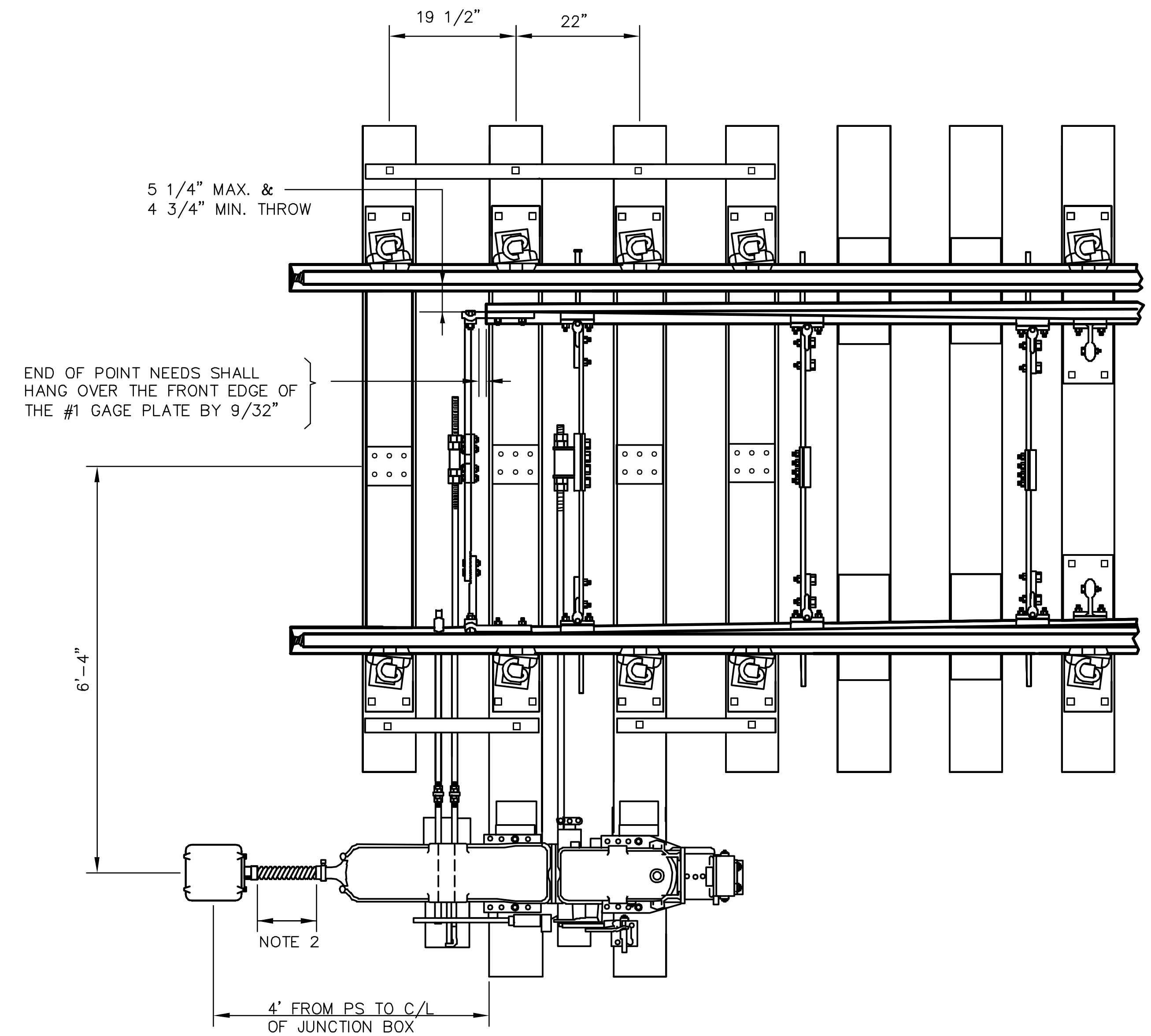
SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
5F SWITCH MACHINE LAYOUT
NO. 10 OR NO. 14 CONCRETE TIES

CADD FILE NAME: SD-5312
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5312



LEFT HAND MOUNTED

NO. 10 WOOD TIES
SPACING



RIGHT HAND MOUNTED

NO. 14 WOOD TIES
SPACING

NOTES:

1. SET MACHINE SO THAT CONNECTING RODS ARE PERPENDICULAR TO TRACK
2. 18"–24" MAX. LIQUIDTITE SHALL BE LEVEL BETWEEN SWITCH MACHINE AND JUNCTION BOX. TOP OF JUNCTION BOX SHALL NOT BE HIGHER THAN TOP OF SWITCH MACHINE
3. REFER TO SD–2000 SERIES DRAWINGS FOR TIE SPACING AND LENGTH

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					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

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San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
5F SWITCH MACHINE LAYOUT
NO. 10 OR NO. 14 WOOD TIES

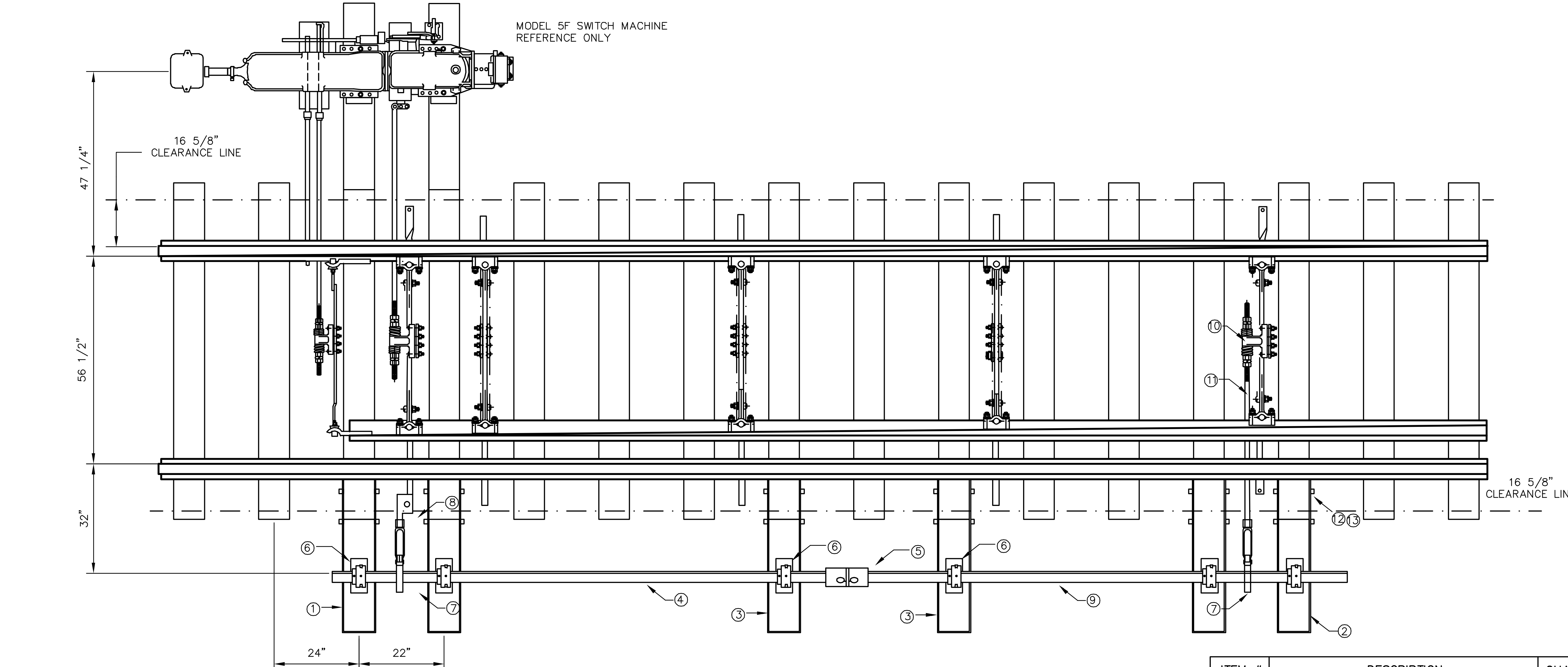
CADD FILE NAME: SD–5313

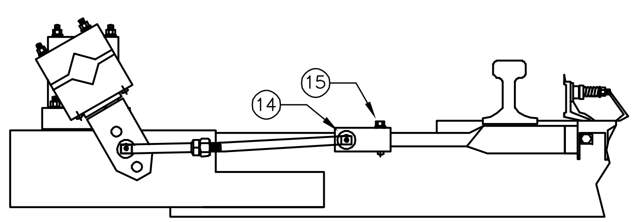
REV:

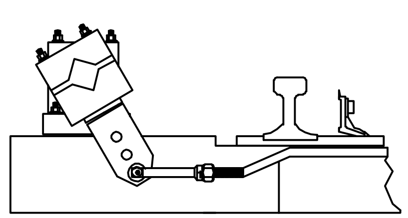
EDITION: FOURTH

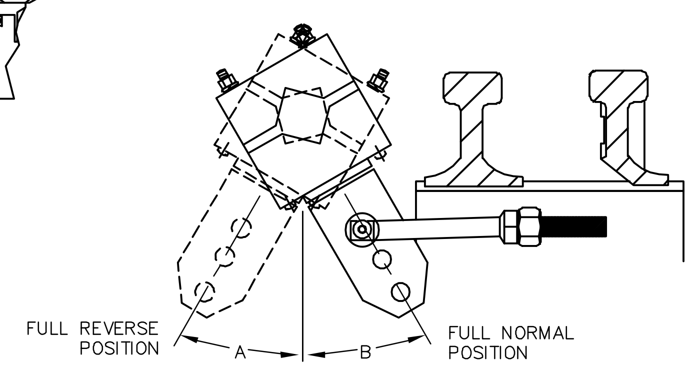
SIGNAL AND COMMUNICATIONS

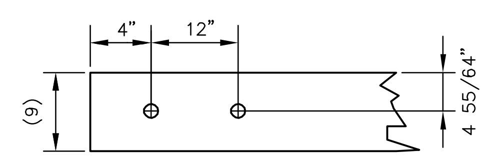
STANDARD DRAWING NO.: SD–5313











ITEM #	DESCRIPTION	QUANTITY
1	MOUNTING PLATE, POINT END PILLOW BLOCK	1
2	MOUNTING PLATE, HEEL END PILLOW BLOCK	1
3	MOUNTING PLATE, MID POINT PILLOW BLOCK	2
4	DRIVE BAR, 2" X 2" X 144" LONG	2
5	DRIVE BAR COUPLING ASSEMBLY	1
6	PILLOW BLOCK ASSEMBLY	4
7	DRIVE ARM ASSEMBLY	2
8	FRONT ROD ASSEMBLY	1
9	DRIVE BAR, 2" X 2" X 144" LONG	1
10	BASKET ASSEMBLY	1
11	REAR DRIVE ROD ASSEMBLY	1
12	LOCK WASHER, 1" EXTRA DUTY, ZINC/YELLOW	32
13	BOLT, 1"-8 X 3" HEAVY HEX, ZINC/YELLOW	32
14	VERTICAL CONNECTION ADAPTER	1
15	BOLT ASSEMBLY	1

NOTES:

1. 1"-12 INSERTS SHALL BE PRE-INSTALLED INTO CONCRETE TIES #1A, #2A, #6, #8, #11A AND #12A TO INSURE PROPER INSTALLATION OF MOUNTING PLATES

2. PLACE DRIVE ARM IN A VERTICAL POSITION MIDWAY BETWEEN THE NORMAL AND REVERSE POSITIONS. MAKE ADJUSTMENTS SO THAT SEGMENTS "A" AND "B" ARE APPROXIMATELY EQUAL DISTANCES

REV	DATE	BY	CHK	APP	DESCRIPTION	REV	DATE	BY	CHK	APP	DESCRIPTION
	01012024				FOURTH EDITION						

PENINSULA CORRIDOR JOINT POWERS BOARD

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San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
ROTATING HELPER ROD ASSEMBLY
LAYOUT, NO. 20 CONCRETE TIES

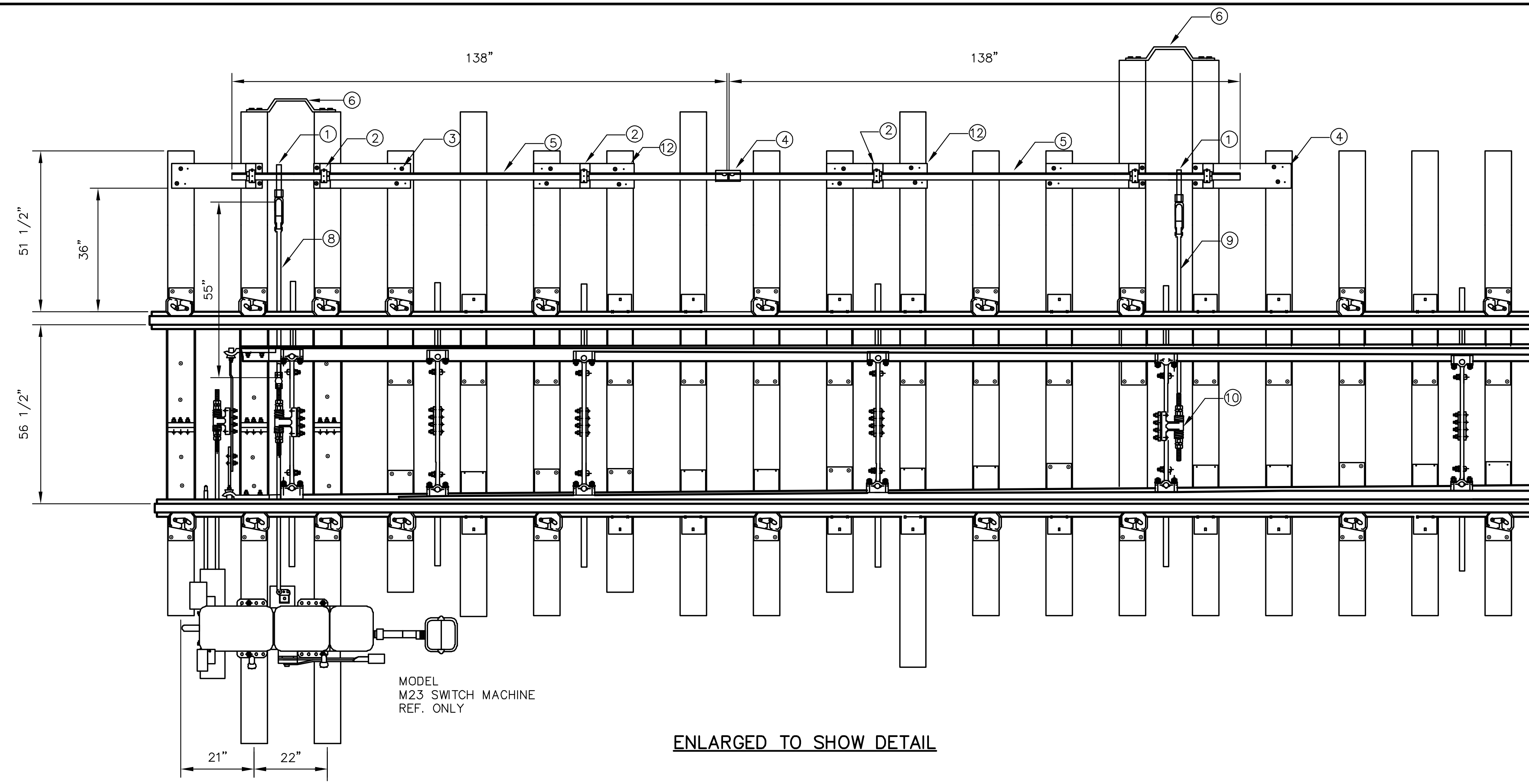
CADD FILE NAME: SD-5314

REV:

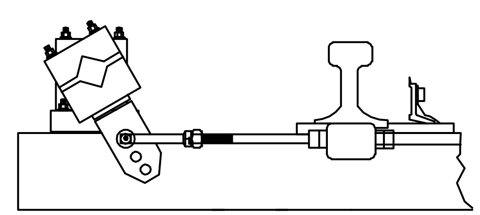
EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

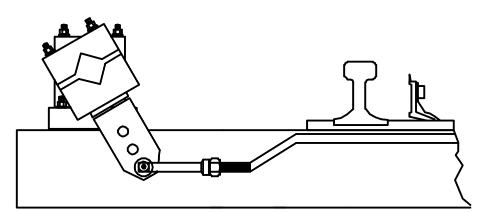
STANDARD DRAWING NO.: SD-5314



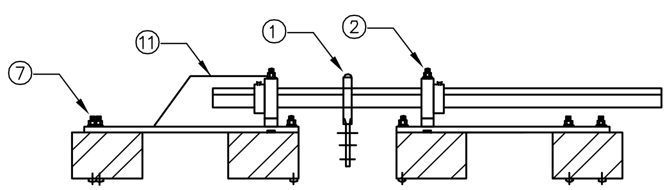
ENLARGED TO SHOW DETAIL



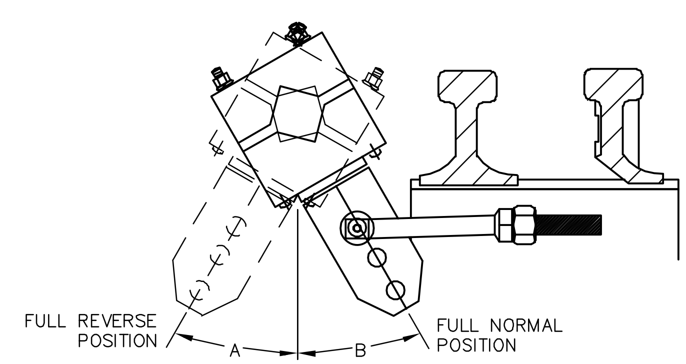
FRONT DRIVE ROD



REAR DRIVE ROD



SECTION AT HELPER ROD



DRIVE ROD POSITION

ITEM	DESCRIPTION	QUANTITY
1	DRIVE ARM ASSEMBLY	2
2	PILLOW BLOCK ASSEMBLY	6
3	PILLOW BLOCK MOUNTING PLATE	4
4	DRIVE BAR COUPLING ASSEMBLY	1
5	DRIVE BAR, 138" WITH ONE HOLE	2
6	BALLAST KEEPER ASSEMBLY	2
7	STUD ASSEMBLY, 3/4" X 13"	24
8	FRONT ASSIST ROD 55" LONG, 1 END LH	1
9	REAR ASSIST DRIVE ROD	1
10	SWITCH POINT ADJUSTER	1
11	DRIVE BAR HOOD	2
12	PILLOW BLOCK TIE PLATE	2

NOTE:

PLACE DRIVE ARM IN A VERTICAL POSITION MIDWAY BETWEEN NORMAL AND REVERSE POSITIONS. MAKE ADJUSTMENTS SO THAT SEGMENTS "A" AND "B" ARE APPROXIMATELY EQUAL DISTANCES

REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP	DESCRIPTION

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

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San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
ROTATING HELPER ROD ASSEMBLY
LAYOUT, NO. 20 WOOD TIES

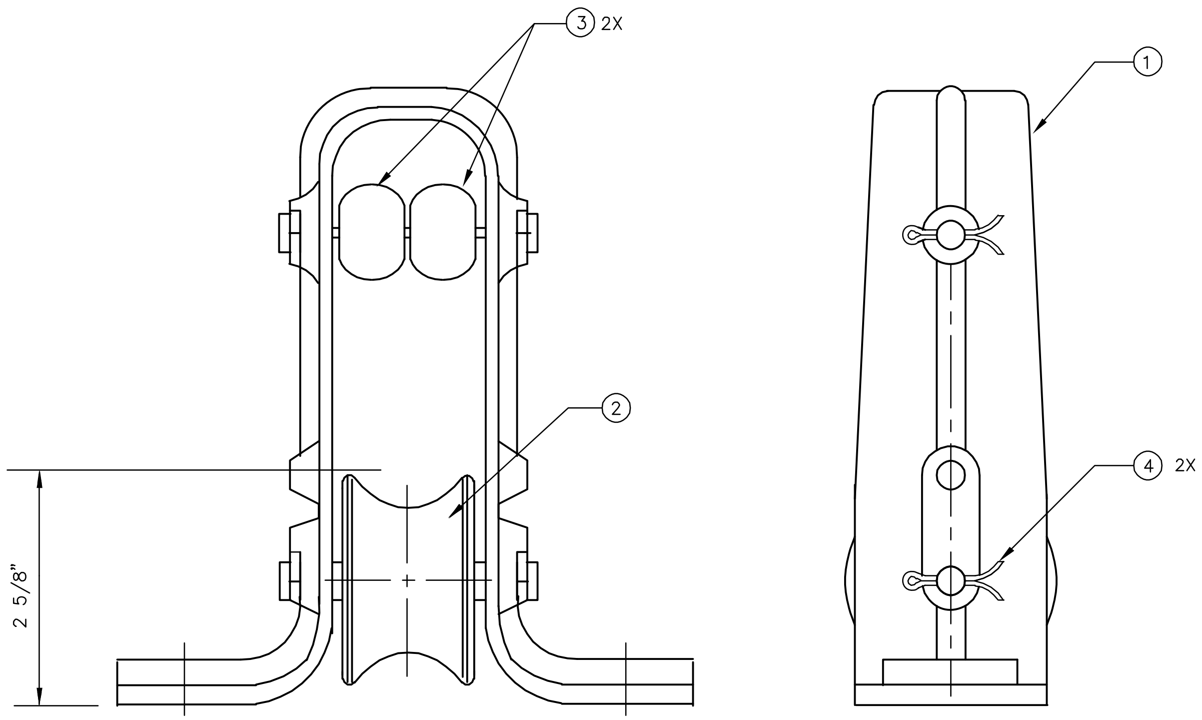
CADD FILE NAME: SD-5315

REV:

EDITION: FOURTH

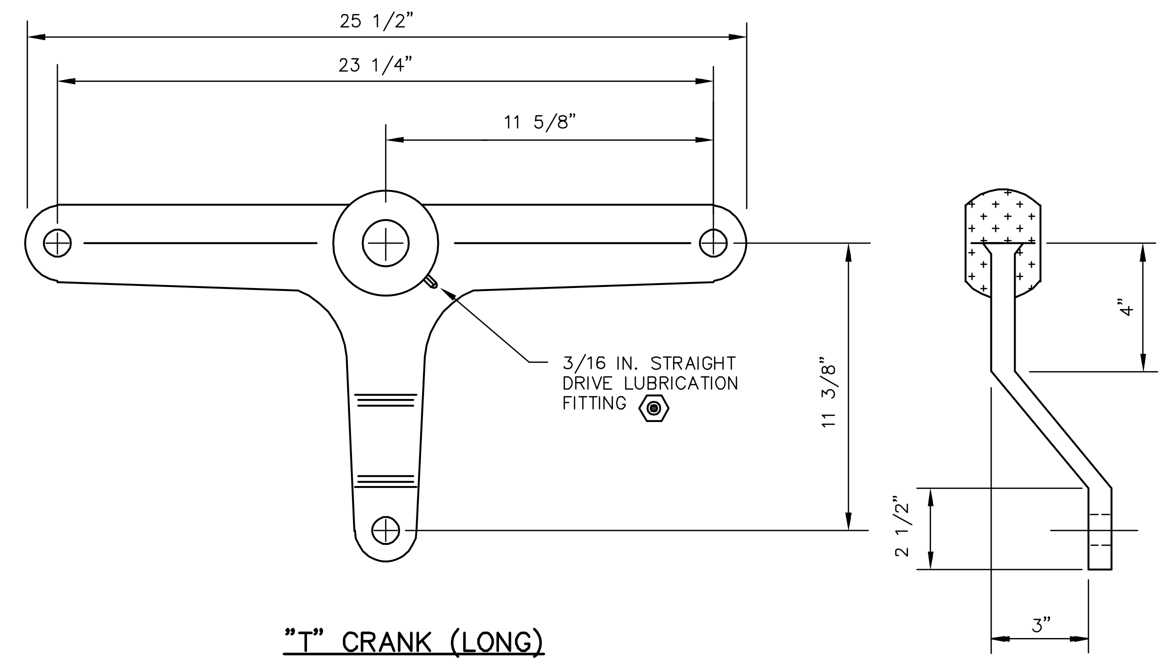
SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5315



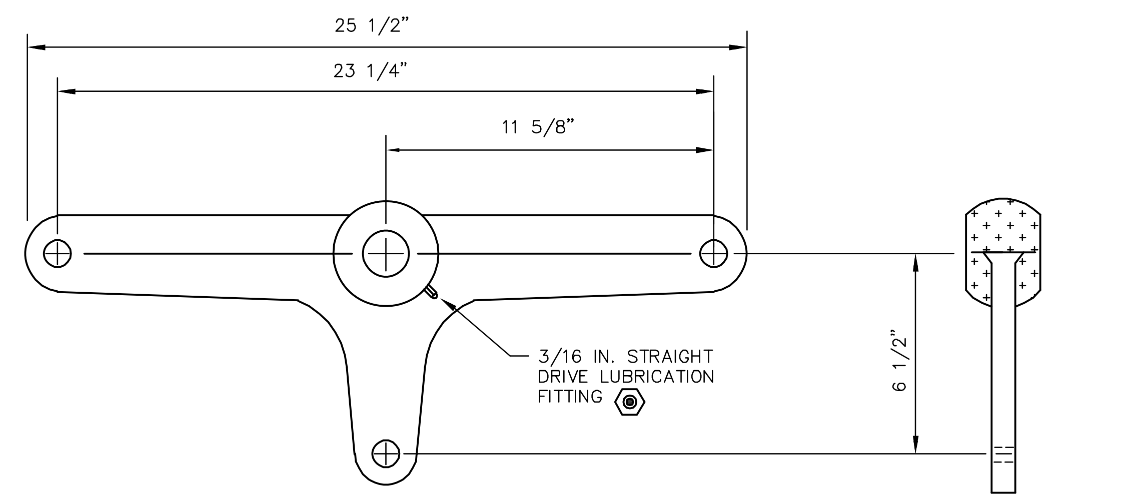
PIPE GUIDE

1. PIPE CARRIER STAND
2. PIPE CARRIER ROLLER (LOWER)
3. PIPE CARRIER ROLLER (UPPER)
4. COTTER PIN FOR ROLLERS



"T" CRANK (LONG)

DRILL & REAM FOR 7/8" PIN
MANUFACTURER OF HELPER ROD
ASSEMBLY TO DETERMINE FINAL
DIMENSIONS



"T" CRANK (SHORT)

DRILL & REAM FOR 7/8" PIN
MANUFACTURER OF HELPER ROD
ASSEMBLY TO DETERMINE FINAL
DIMENSIONS

REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP	

PENINSULA CORRIDOR JOINT POWERS BOARD

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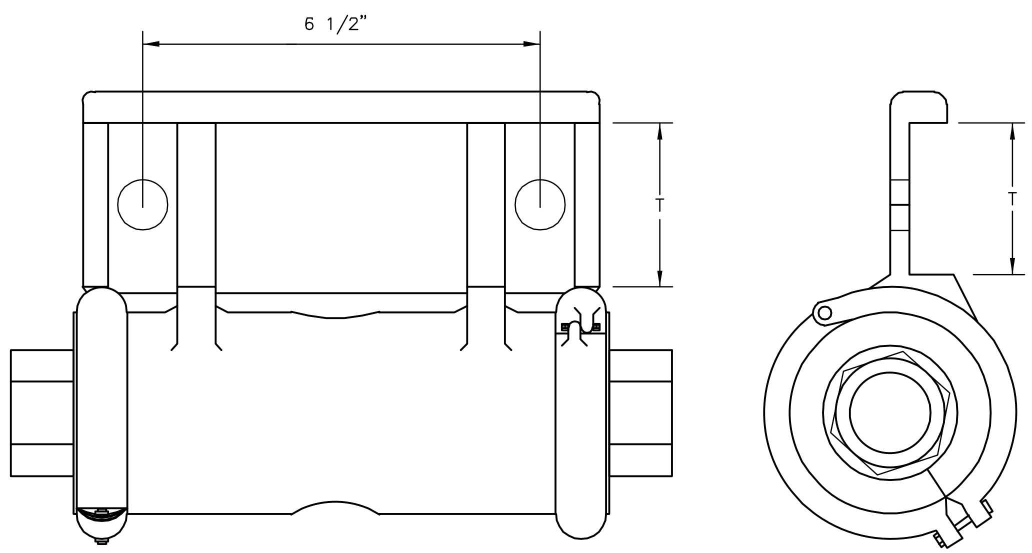
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
TYPICAL "T" CRANK AND PIPE GUIDE
AUXILIARY CONNECTION

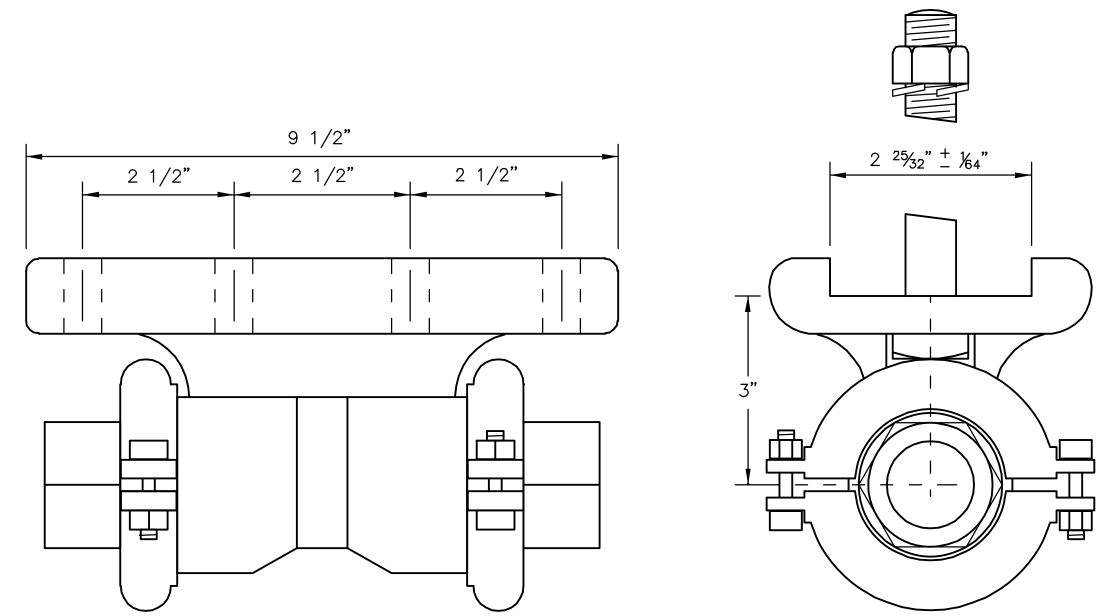
CADD FILE NAME: SD-5316
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5316



SWITCH ADJUSTER FOR HORIZONTAL SWITCH RODS

BOSSERT ADJUSTERS SHALL BE FURNISHED COMPLETE WITH ADJUSTING NUTS AND MOUNTING BOLTS

BOSSERT STYLE	WIDTH "T" (IN.)	SIZE (IN.)	QTY.	FOR USE WITH
2B	2 5/8"	3/4 X 3	2	75–119# RAIL
2B–3	3 3/16"	3/4 X 3 1/2	2	131–136# RAIL



SWITCH ADJUSTER FOR VERTICAL SWITCH RODS

ADJUSTER SHALL BE FURNISHED COMPLETE WITH ADJUSTING NUTS AND FOUR 3/4" X 4" MOUNTING BOLTS. (FURNISHED WITH RACOR TYPE MJ ROD)

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	01012024				FOURTH EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
ADJUSTER FOR
INTERLOCKING SWITCHES

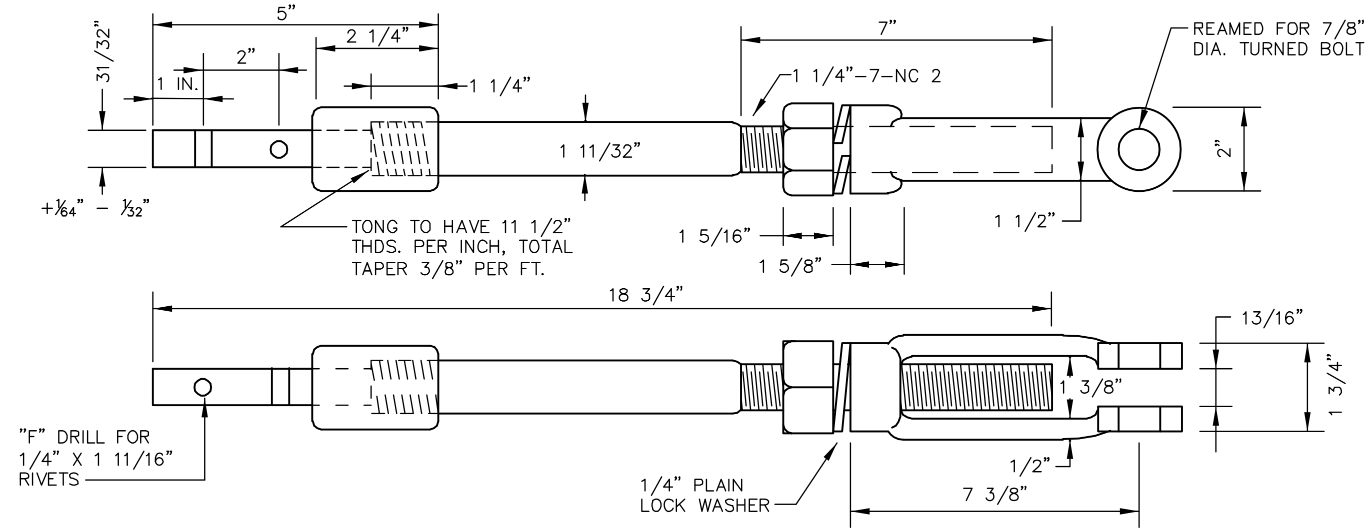
CADD FILE NAME: SD–5317

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

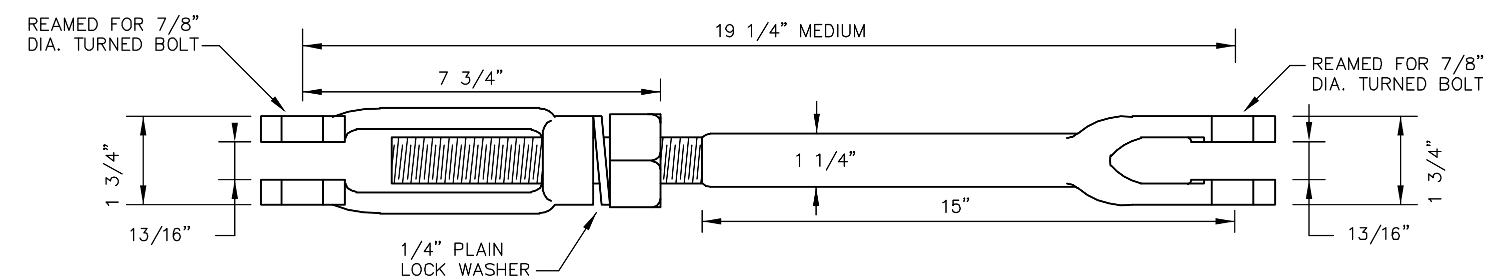
STANDARD DRAWING NO.: SD–5317



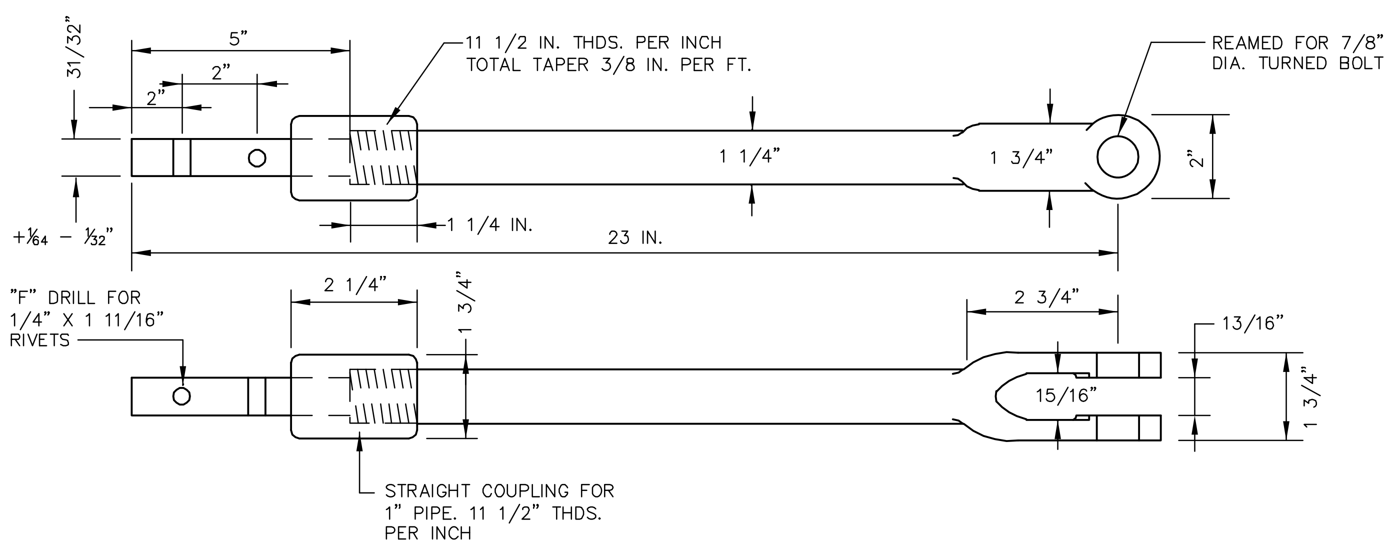
SCREW JAW

NOTE:

GALVANIZED 1" PIPE SHALL BE SECURED TO SCREW JAW AND SOLID JAW WITH A MINIMUM OF TWO RIVETS.



ADJUSTABLE LINK



SOLID JAW

REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
SCREW JAW, SOLID JAW
AND ADJUSTABLE LINK

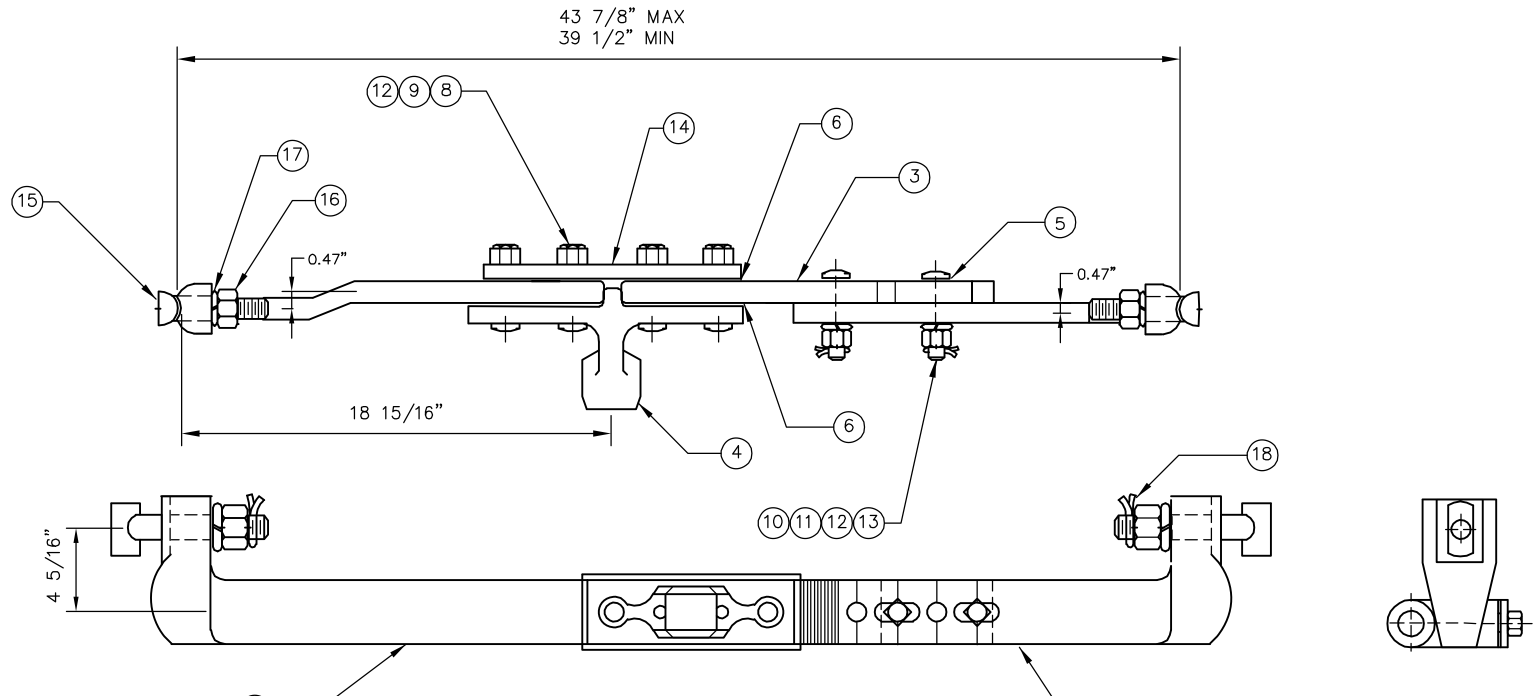
CADD FILE NAME: SD−5318

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD−5318

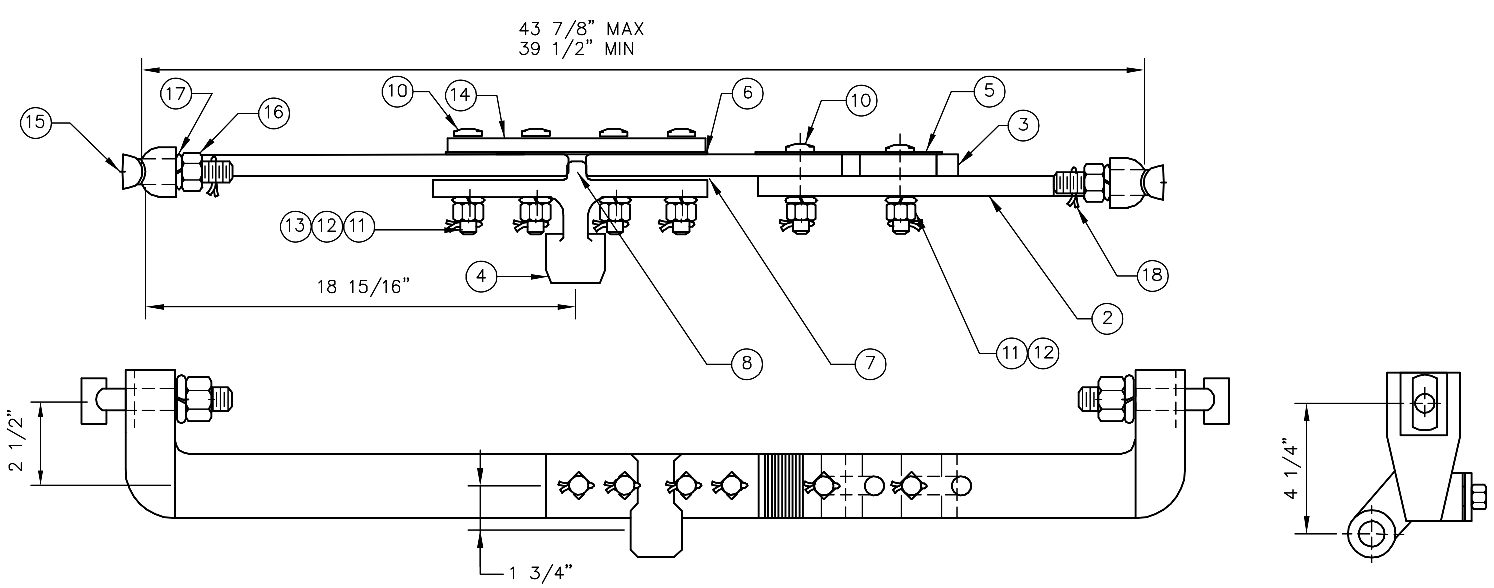


HIGH PROFILE SWIVEL FRONT ROD

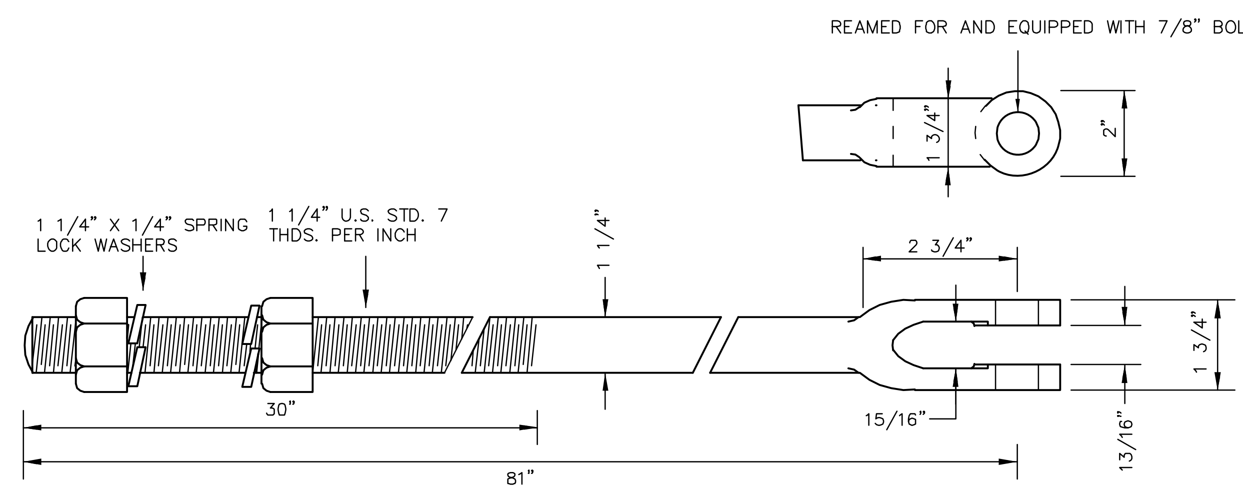
ITEM #	DESCRIPTION / MATERIAL/ APPROX. SIZE
1	SWIVEL FRONT ROD
2	ADJUSTABLE SWIVEL FRONT BAR
3	ADJUSTMENT BAR
4	FRONT LUG
5	PLATE WASHER
6	INSULATION, PLATE
7	INSULATION, L-SHAPE
8	INSULATION BUSHING, ø 1" OD X ø .766 ID X 1 7/32 LG
9	BOLT. 3/4-10 X 2 3/4" HEX HEAD
10	BOLT. 3/4-10 X 3 3/4" LONG SQ HD DR FOR 3/16 COTTER @ 3 7/16"
11	NUT, 3/4-10 HEAVY SQ. HD.
12	LOCK WASHER, 3/4" HEAVY
13	COTTER PIN, 3/16 X 1 3/4" LONG
14	SPLICE PLATE
15	T BOLT - FRONT ROD, SWIVEL STYLE
16	NUT 1 1/4-7 HEAVY HEX HD.
17	LOCK WASHER, 1 1/4 HEAVY
18	COTTER PIN 1/4" X 2 1/2" LG.
19	COTTER PIN 1 1/4 X 3"

NOTE:

THROW RODS SHALL BE MADE FROM 1 1/4" ROUND BAR STOCK, FURNISHED WITH ONE 7/8" TURNED BOLT, 2 HEXAGONAL NUTS AND 2 SPRING WASHERS, AS SHOWN. NO WELDING OF ROD IS PERMITTED.



LOW PROFILE SWIVEL FRONT ROD



THROW ROD FOR INTERLOCKED SWITCH LAYOUTS

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STANDARD DRAWINGS

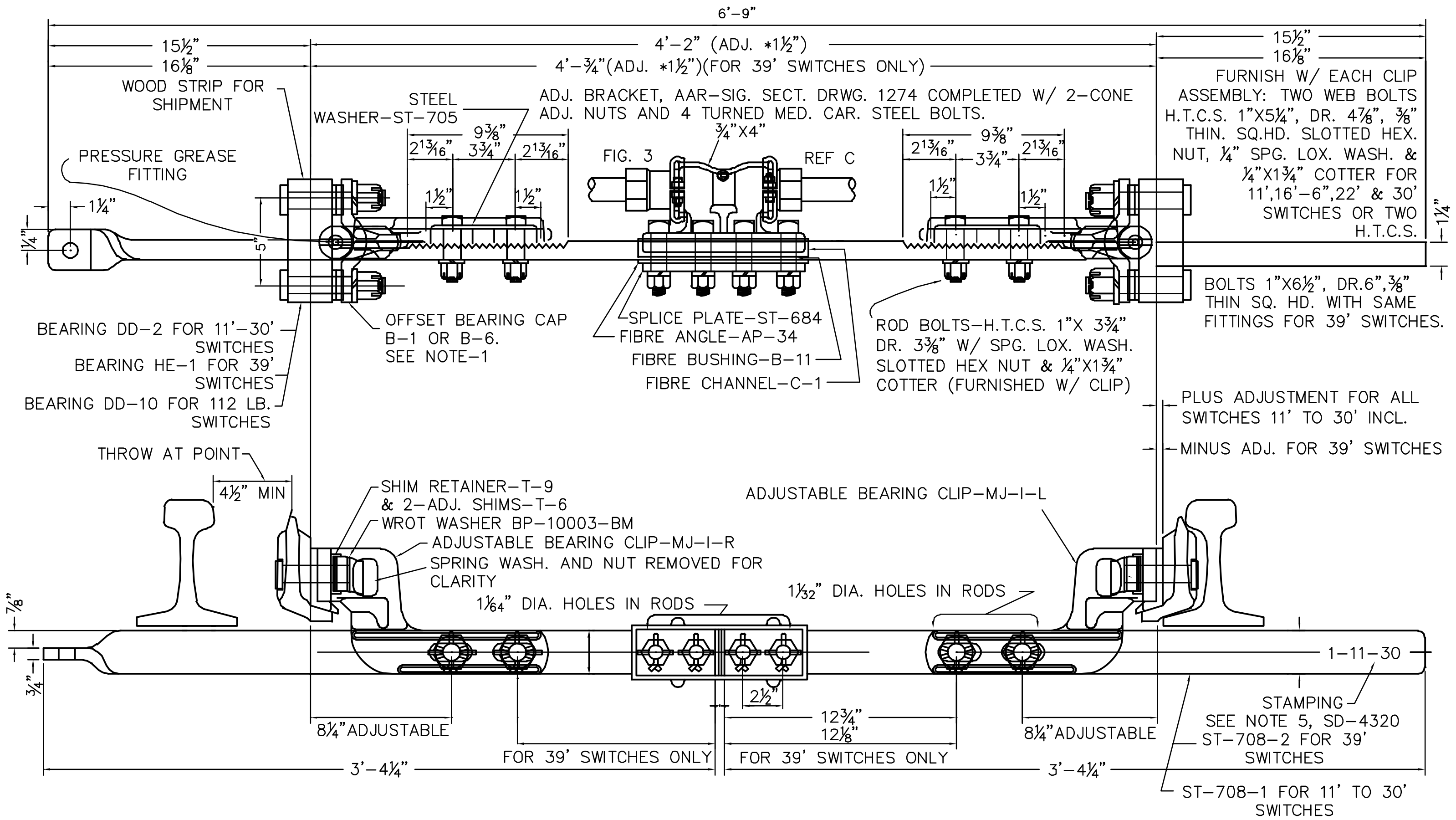
SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
THROW ROD AND SWIVEL ROD
FOR SWITCH MACHINE

CADD FILE NAME: SD-5319

REV: EDITION: FOURTH

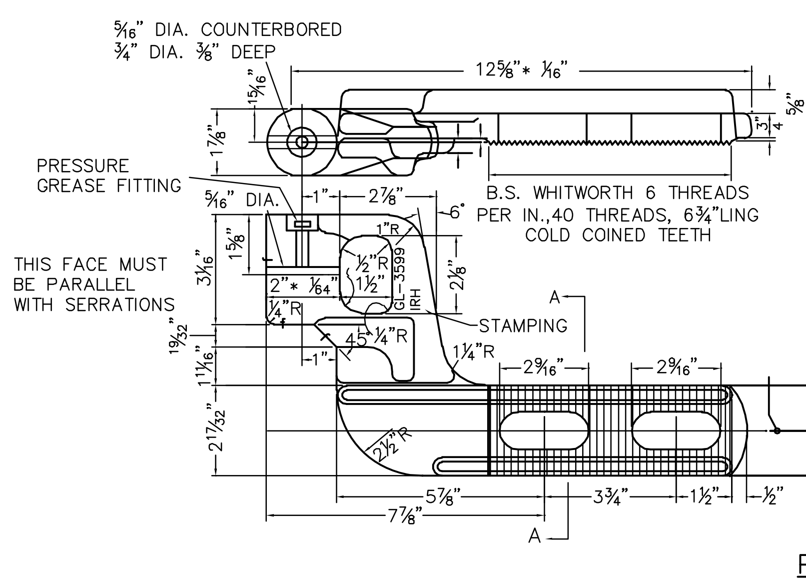
SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5319

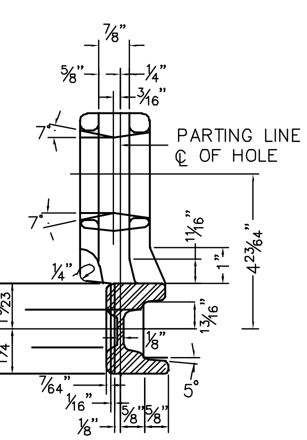


NO.1 SWITCH ROD ASSEMBLY
(SHOW ON MACHINE ON RIGHT)
SEE NOTE-2

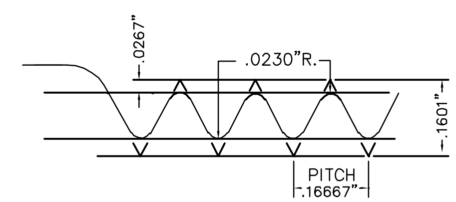
WEIGHT OF RAIL & LENGTH OF SWITCH	BILL OF MATERIAL FOR 1 TYPE "MJ" SWITCH ROD ASSEMBLY				4603-1
	# REQ'D.	PART #	MATERIAL SPECIF.	DESCRIPTION	DETAIL REMARKS
ALL	1	M-J-I-L	S.A.E.1020-FOR.STL.	L.H. BEARING CLIP	GL-3598, LH, MACHINED PER DETAIL
ALL	1	M-J-I-R	S.A.E.1020-FOR.STL.	R.H. BEARING CLIP	GL-3599, RH, MACHINED PER DETAIL
ALL	4		H.T.C.S.	WEB BOLT	SEE NOTE
115 TO 136 11' TO 30'	2	DD-2	MALLEABLE IRON	BEARING	PATT. NO. L-2910, MACHINED PER DETAIL
112 11' TO 30'	2	DD-10	MALLEABLE IRON	BEARING	PATT. NO. L-2910, MACHINED PER DETAIL
132 & 136 39'	2	HE-1	MALLEABLE IRON	BEARING	PATT. NO. L-2915, MACHINED PER DETAIL
115 TO 136 11' TO 30'	2	B-1	S.A.E.1045-FOR.STL.	OFFSET BEARING CAP	HEAT TREATED-BRINDELL-.225 TO .250
132 & 136 39'	2	B-6	S.A.E.1045-FOR.STL.	OFFSET BEARING CAP	HEAT TREATED-BRINDELL-.225 TO .250
112 11' TO 30'	2	B-6	S.A.E.1045-FOR.STL.	OFFSET BEARING CAP	HEAT TREATED-BRINDELL-.225 TO .250
ALL	4	T-9	S.A.E.1020	SHIM RETAINER	1/8" X 2 3/4" X 2 1/4"
ALL	12	T-6	STAINLESS STEEL	ADJUSTMENT SHIM	1/16" X 2" X 1 3/4"
ALL	4	BP-10003-BM	WROT IRON	WROT WASHER	1 1/16" I.D. X 2" O.D. X 1/8" THICK
ALL	4		H.T.C.S.	ROD BOLT	1" X 3 3/4" DR. 3 3/8" REG. SQ. HD. SLOTTED HEX NUT
ALL	4		STEEL	SPG. LOX WASHER	FOR 1" ROD BOLTS
ALL	4		STEEL	COTTER	1/4" X 1 3/4" FOR ROD BOLTS
ALL	2		STEEL	GREASE FITTING	PRESSURE - FOR BEARING CLIP
ALL	2	ST-705	S.A.E.1020	STEEL WASHER	1/4" X 1 3/8" X 6 1/4" - FOR ROD BOLTS
115 TO 136 11' TO 30'	2		WOOD	FILLER STRIP	2" X 7" X 1 1/2" THICK - FOR SHIPPING
132 & 136 39'	2		WOOD	FILLER STRIP	2" X 7" X 2 1/2" THICK - FOR SHIPPING
MATERIAL FOR VERTICAL ROD					
112 TO 136 11' TO 30'	1			VERTICAL ROD	USE ONE-ST-708-1 USE ONE-ST-708-1 TWIST, MACHINE AND DRILL END HOLE.
132 & 136 39'	1			VERTICAL ROD	USE ONE-ST-708-2 USE ONE-ST-708-2 TWIST, MACHINE AND DRILL END HOLE.
ALL	4		MED.CARBON STEEL	CONN.& INSUL. BOLT	3/4" X 4"-TURNED, A.S.A. REG. HEX. NUT
ALL	4		STEEL	SPRING WASHER	1/4" THICK
ALL	4		STEEL	COTTER	3/16" X 1 1/2"
ALL	1	ST-684	H.R. MILD STEEL	SPLICE PLATE	1/2" X 2 1/2" X 9 1/2" FOR INSULATION
ALL	2	AP-34	AAR-SIG.SEC.13-52	ANGLE	1/8" X 2 1/2" X 4 13/16" HARD FIBRE-PARAFIN COATED
ALL	4	B-11	AAR-SIG.SEC.13-52	BUSHING	1" O.D. HARD FIBRE-PARAFIN COATED
ALL	1	C-1	AAR-SIG.SEC.13-52	CHANNEL	1/8" X 1" X 10" HARD FIBRE-PARAFIN COATED
ALL	1		MALLEABLE IRON	ADJUSTMENT BRACKET	
ALL	2		MALLEABLE IRON	CONE ADJ. NUT	FOR 1 1/4" THROW ROD



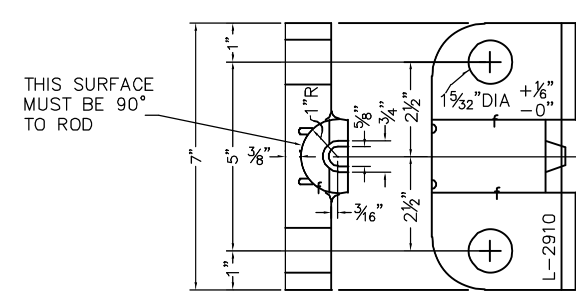
ADJUSTABLE BEARING CLIP-M-J-I-R
CLIP M-J-I-L OPPOSITE HAND



PART SECTION - A-A



ENLARGED PROFILE OF SERRATIONS



BEARING - DD-2

NOTES:

1. PARTS MAY BE PROCURED SEPARATELY. WHEN A BEARING CLIP ASSEMBLY ONLY IS REQUIRED, SPECIFY WHETHER IT IS FOR CLIP MJ-I-R OR MJ-I-L INCLUDING RAIL SECTION AND LENGTH OF SWITCH. ALL PARTS SHOWN IN BILL OF MATERIAL SHALL BE FURNISHED WITH CLIP ASSEMBLIES

2. WHEN AN INDIVIDUAL PART IS REQUIRED, ORDER BY PART NUMBER. CLIP ASSEMBLIES TO BE USED ON 112-LB. SWITCHES SHALL HAVE BEARING CAP B-6 APPLIED WITH THE BOTTOM SIDE UP AS SHOWN IN ELEVATION ON SHEET-2 OF THIS DRAWING IN ORDER TO SEAT CLIP ON BEARING AT PROPER HEIGHT

3. WHEN COMPLETE RODS ARE ORDERED THEY SHALL BE ASSEMBLED AND INCLUDE ALL PARTS SHOWN IN BILL OF MATERIAL. ORDERS SHALL SPECIFY RAIL SECTION AND LENGTH OF SWITCH. ON INTERLOCKED SWITCHES WITH AUXILIARY THROW ROD, MACHINE SIDE (RIGHT OR LEFT) SHALL ALSO BE SPECIFIED. HOWEVER, THE TWISTED END OF ROD MAY BE POSITIONED FOR OPPOSITE SIDE OF SWITCH BY REMOVING THE ROD BOLTS AND TURNING ROD PORTION OF ASSEMBLY END FOR END 180°

(NOTES CONTINUED ON SHEET 2 OF 2)

FOR 112, 115, 119, 131, 132, AND 136 LB RAIL

REV	DATE	BY	CHK	APP	DESCRIPTION
	01012024				FOURTH EDITION

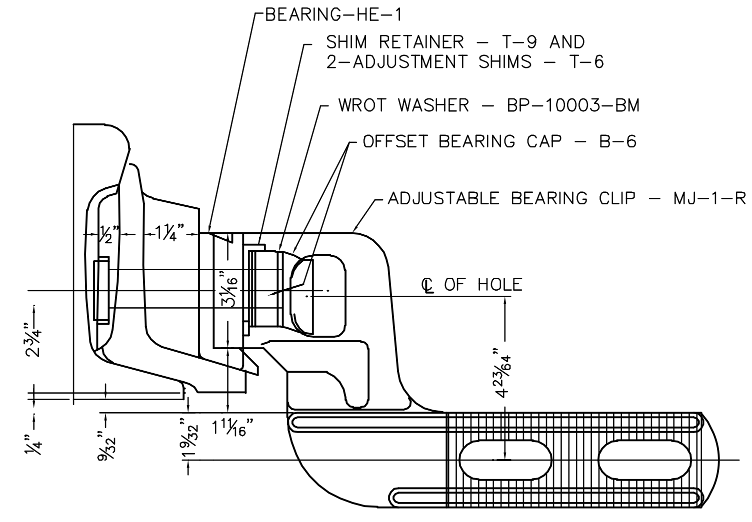
PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY: Bin Zhang
DEPUTY DIRECTOR, ENGINEERING

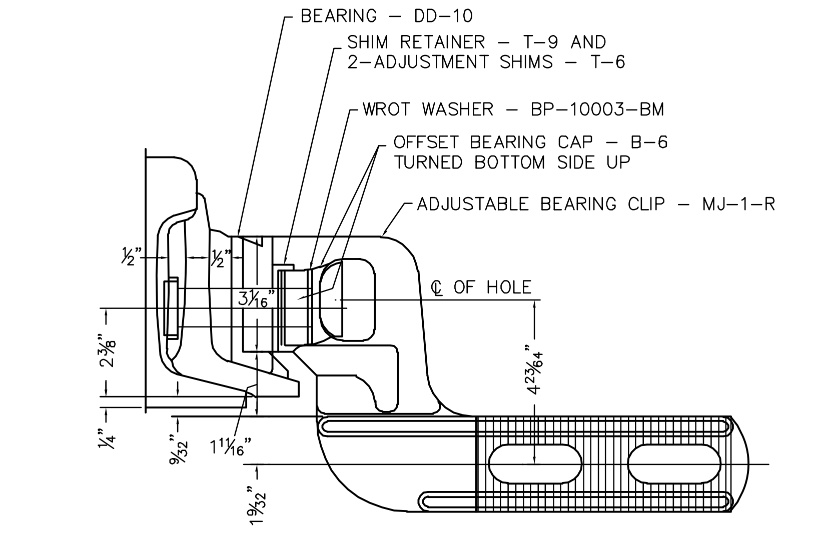
Caltrain
1250 San Carlos Avenue San Carlos, CA 94070

STANDARD DRAWINGS
SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
RACOR TYPE "MJ"
NO. 1 INSULATED SWITCH ROD
SHEET 1 OF 2

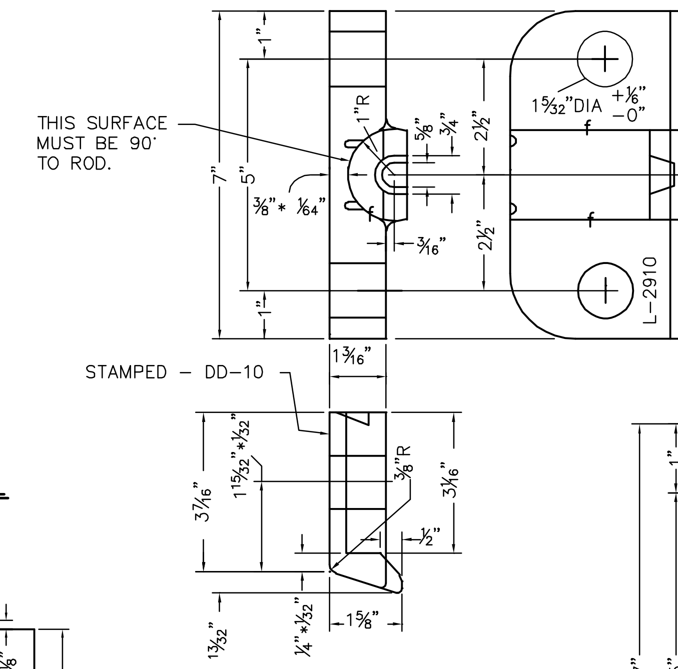
CADD FILE NAME: SD-5320
REV: EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5320



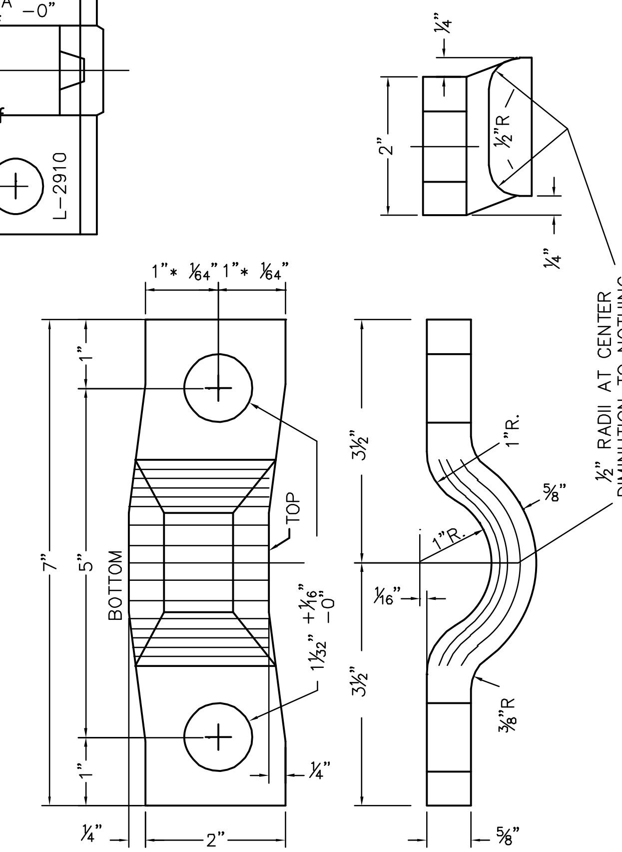
ELEVATION OF "MJ" CLIP ASSEMBLY FOR 39' SWITCHES (DRAWN FOR 136 LB. RAIL) SPRING WASHER AND NUT REMOVED



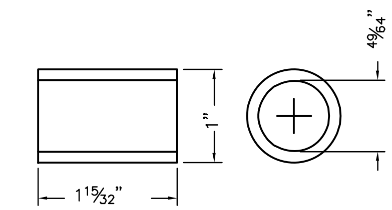
ELEVATION OF "MJ" CLIP ASSEMBLY FOR 112 LB. RE RAIL (FOR 11', 16'-6", 22" & 30 SWITCHES) SPRING WASHER AND NUT REMOVED



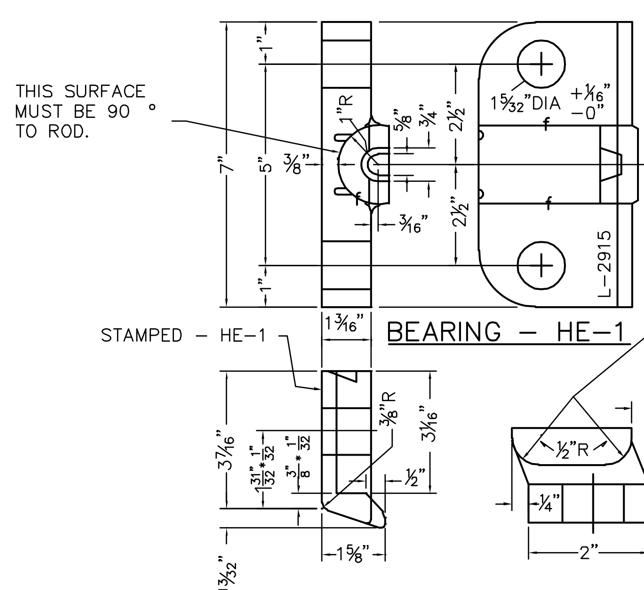
BEARING – DD-10



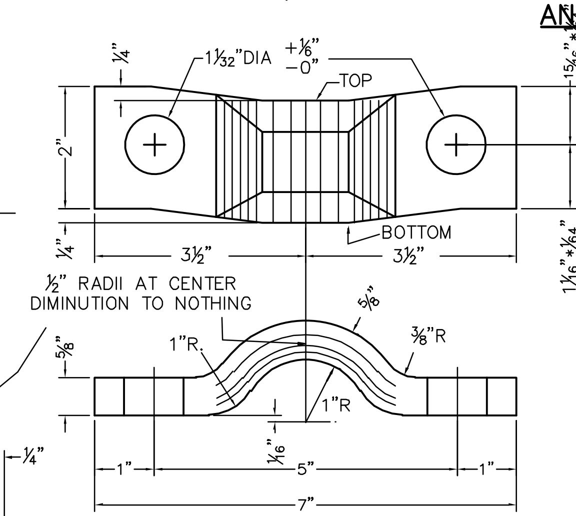
OFFSET BEARING CAP – B-6



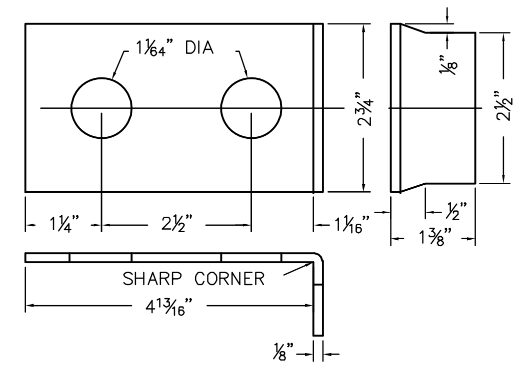
FIBER BUSHING – B-11



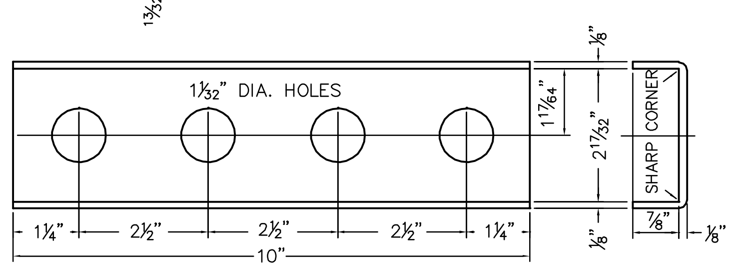
BEARING – HE-1



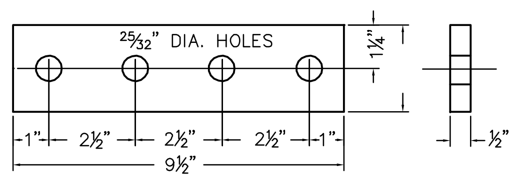
OFFSET BEARING CAP –B-1



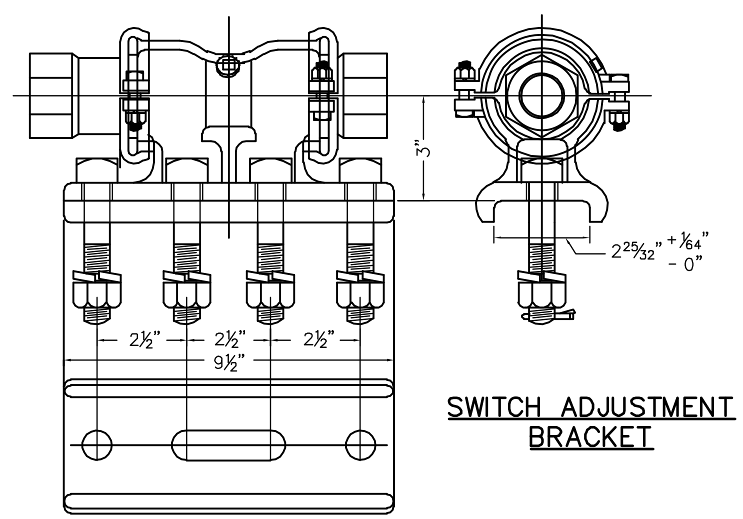
FIBER ANGLE – AP-34



FIBER CHANNEL – C-1



SPLICE PLATE – ST-684



SWITCH ADJUSTMENT BRACKET

NOTES: (CONTINUED FROM SHEET 1)

4. TWO WEB BOLTS SHALL BE FURNISHED WITH EACH CLIP ASSEMBLY AS CALLED FOR BY NOTE IN TOP VIEW OF ROD ASSEMBLY. WHEN ROD IS USED ON 11'-0" AND 16'-6" SWITCHES, THE ¼" THICK SPRING WASHER SHALL BE REPLACED WITH A 3/8" THICK SPRING WASHER TO BRING COTTER WITHIN THE LIMITS OF SLOT IN WEB BOLT NUTS

5. MATERIALS AND WORKMANSHIP SHALL MEET CURRENT AREMA SPECIFICATIONS FOR SPECIAL TRACKWORK

6. VERTICAL SWITCH ROD SHALL BE PLAINLY STAMPED TO INDICATE SWITCH THAT ROD ASSEMBLY CAN BE USED UPON. IDENTIFICATION MARKING SHALLL BE AS FOLLOWS:

- 1-39 FOR USE ON 39'-0" SWITCHES, 132-LB. AND 136-LB. PE RAIL SECTIONS
- 1-11-30 FOR USE ON 11'-0 TO 30'-0" SWITCHES, 115-LB. RE, 119-LB. C.F.& I., 131-LB, 132-LB. AND 136-LB. RE RAIL SECTIONS
- 1-112 FOR USE ON 11'-0" TO 30'-0" SWITCHES, 112-LB. RE RAIL SECTION

FOR 112, 115, 119, 131, 132, AND 136 LB RAIL

REV	DATE	BY	CHK	APP	DESCRIPTION	REV	DATE	BY	CHK	APP
					01012024 FOURTH EDITION					

PENINSULA CORRIDOR JOINT POWERS BOARD

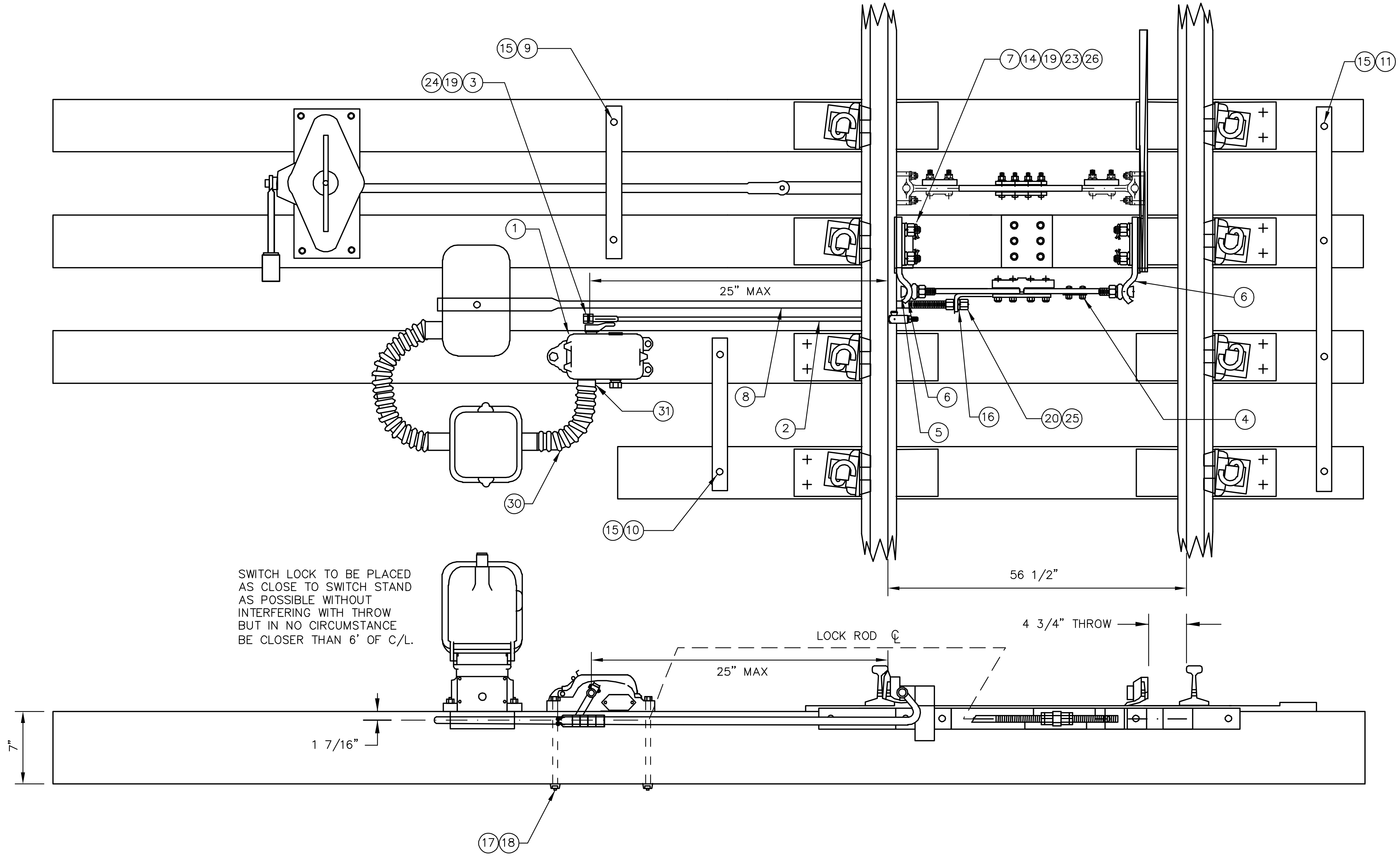
APPROVED BY:
Bin Zhang
DEPUTY DIRECTOR, ENGINEERING

Caltrain
1250 San Carlos Avenue
San Carlos, CA 94070

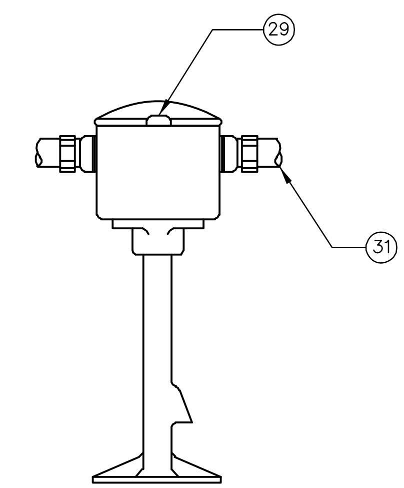
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
RACOR TYPE "MJ"
NO. 1 UNSULATED SWITCH ROD
SHEET 2 OF 2

CADD FILE NAME: SD-5321
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5321



ITEM #	DESCRIPTION / MATERIAL/ APPROX. SIZE	NO. REQ'D
1	U-5 SWITCH CIRCUIT CONTROLLER, 4 POINT CAM, 2 POSITION W/ SPRING, 3/4" OFFSET CRANK & INSULATED BALL STUD	1
2	CIRCUIT CONTROLLER CONNECTING ROD, NEARSIDE	1
3	CONTROLLER SOCKET, STRAIGHT, ASSEMBLY	1
4	SWIVEL FRONT ROD, HIGH PROFILE	1
5	POINT LUG, BALL END	1
6	SWIVEL POINT LUG	2
7	PLATE WASHER	2
8	LOCKROD CONNECTING ROD, ELECTRIC LOCK	1
9	TIE STRAP, DOUBLE OFFSET, 2-TIE	1
10	TIE STRAP, FLAT, 2-TIE	1
11	TIE STRAP, FLAT, 4-TIE	1
12		
13	STUD, 3/4-10 X 12"	3
14	BOLT, 1-8 X 5" THIN SQ. HD. DR. @ 3 29/32" & 4 21/32"	4
15	LAG SCREW, 3/4" X 5"	8
16	WASHER, SPERICAL	2
17	FLAT WASHER, 3/4" USS	3
18	LOCK WASHER 3/4" HEAVY SPLIT	3
19	LOCK WASHER, 1" HEAVY SPLIT	5
20	NUT, 1 1/4-7 HEAVY HEX CUPPED	3
21	NUT, 3/4" HEAVY HEX HEAD	4
22	NUT, 3/4" HEAVY SQUARE HEAD	4
23	NUT, 1" HEAVY HEX HEAD SLOTTED	5
24	NUT, 1-8 HEAVY HEX	1
25	NUT, 1 1/4-7 HEAVY HEX JAM	2
26	COTTER PIN, 1/4" X 1 3/4"	4
27	GRIP WASHER	3
28		
29	JUNCTION BOX COMPLETE, DOUBLE OUTLET	1
30	CONDUIT, 1 1/2" LUQUIDTITE FLEX	
31	SEALTITE COUPLING, 1 1/2"	2



JUNCTION BOX DETAIL

FOR PEDESTAL JUNCTION BOX DETAIL SEE SD-5301. LOCATE JUNCTION BOX OUTSIDE BALLAST LINE AND BURY CONDUIT TO PREVENT TRIPPING HAZARD. TOP OF JUNCTION BOX LEVEL WITH TOP OF TIE.

PROCEDURE:

1. CENTER SCREW JAWS ON THREADED PORTION OF POINT DETECTOR ROD
2. POSITION SWCC ON HEADBLOCK TIE INSURING AMPLE CLEARANCE FOR OPERATING ROD ON THE POINT LUG AND OPERATING CRANK POINTED VERTICALLY DOWNWARD
3. WITH THE SWITCH POINT IN MID-POSITION INSTALL THE OPERATING ROD ON THE POINT LUG AND OPERATING CRANK
4. WITH CRANK VERTICALLY DOWNWARD AND SWITCH POINTS CENTERED, MARK HOLES AND DRILL

NOTES:

1. THIS DRAWING SHALL BE USED ONLY IF SWITCH STAND MUST BE BETWEEN TRACKS
2. FLEX CONDUIT BETWEEN JUNCTION BOX AND SWITCH CIRCUIT CONTROLLER TO BE A MAXIMUM 24". TOP OF JUNCTION BOX LID LEVEL W/ TOP OF TIE
3. FOR TIE LENGTH AND SPACING REFER TO TRACK STANDARDS
4. CIRCUIT CONTROLLER SHALL BE POSITIONED SO THAT LID OPENS AWAY FROM THE TRACK

REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

Bin Zhang

DEPUTY DIRECTOR, ENGINEERING

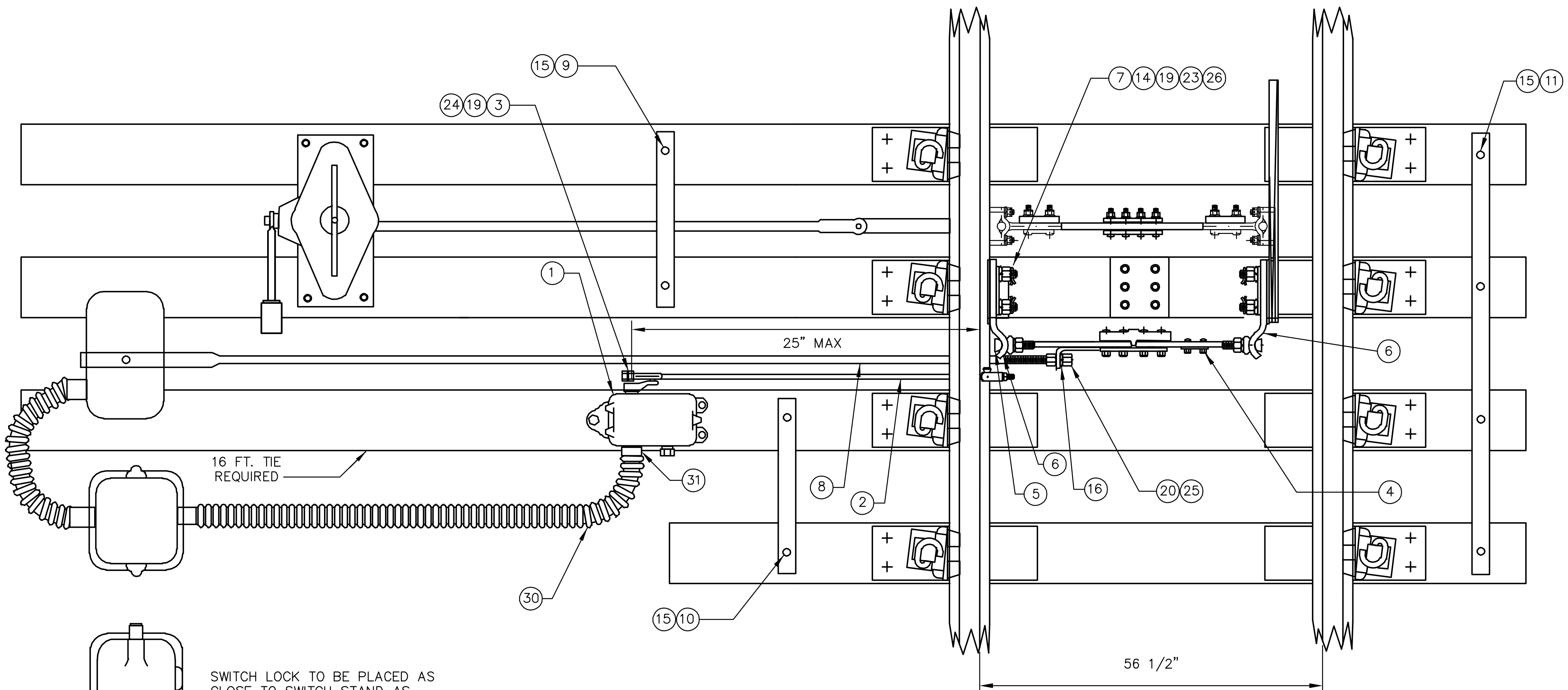
Caltrain

1250 San Carlos Avenue
San Carlos, CA 94070

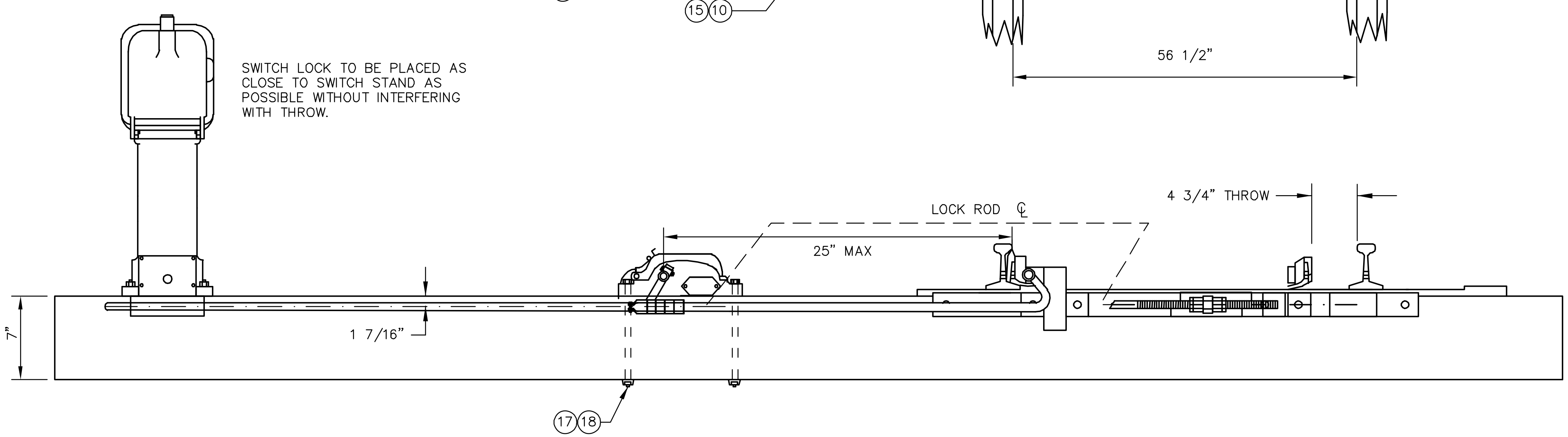
STANDARD DRAWINGS

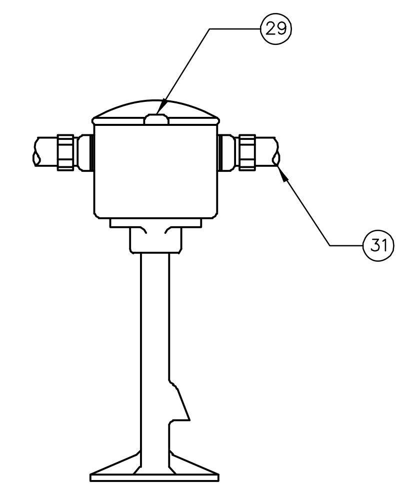
SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
9B ELECTRIC LOCK
LOW SWITCH LAYOUT

CADD FILE NAME: SD-5322
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5322



ITEM #	DESCRIPTION / MATERIAL/ APPROX. SIZE	NO. REQ'D
1	U-5 SWITCH CIRCUIT CONTROLLER, 4 POINT CAM, 2 POSITION W/ SPRING, 3/4" OFFSET CRANK & INSULATED BALL STUD	1
2	CIRCUIT CONTROLLER CONNECTING ROD, NEARSIDE	1
3	CONTROLLER SOCKET, STRAIGHT, ASSEMBLY	1
4	SWIVEL FRONT ROD, HIGH PROFILE	1
5	POINT LUG, BALL END	1
6	SWIVEL POINT LUG	2
7	PLATE WASHER	2
8	LOCKROD CONNECTING ROD, ELECTRIC LOCK	1
9	TIE STRAP, DOUBLE OFFSET, 2-TIE	1
10	TIE STRAP, FLAT, 2-TIE	1
11	TIE STRAP, FLAT, 4-TIE	1
12		
13	STUD, 3/4-10 X 12"	3
14	BOLT, 1-8 X 5" THIN SQ. HD. DR. @ 3 29/32" & 4 21/32"	4
15	LAG SCREW, 3/4" X 5"	8
16	WASHER, SPERICAL	2
17	FLAT WASHER, 3/4" USS	3
18	LOCK WASHER 3/4" HEAVY SPLIT	3
19	LOCK WASHER, 1" HEAVY SPLIT	5
20	NUT, 1 1/4-7 HEAVY HEX CUPPED	3
21	NUT, 3/4" HEAVY HEX HEAD	4
22	NUT, 3/4" HEAVY SQUARE HEAD	4
23	NUT, 1" HEAVY HEX HEAD SLOTTED	5
24	NUT, 1-8 HEAVY HEX	1
25	NUT, 1 1/4-7 HEAVY HEX JAM	2
26	COTTER PIN, 1/4" X 1 3/4"	4
27	GRIP WASHER	3
28		
29	JUNCTION BOX COMPLETE, DOUBLE OUTLET	1
30	CONDUIT, 1 1/2" LUQUIDTITE FLEX	
31	SEALTITE COUPLING, 1 1/2"	2





JUNCTION BOX DETAIL

FOR PEDESTAL JUNCTION BOX DETAIL SEE SD-5301. LOCATE JUNCTION BOX OUTSIDE BALLAST LINE AND BURY CONDUIT TO PREVENT TRIPPING HAZARD. TOP OF JUNCTION BOX LEVEL WITH TOP OF TIE.

PROCEDURE:

1. CENTER SCREW JAWS ON THREADED PORTION OF POINT DETECTOR ROD
2. POSITION SWCC ON HEADBLOCK TIE INSURING AMPLE CLEARANCE FOR OPERATING ROD ON THE POINT LUG AND OPERATING CRANK POINTED VERTICALLY DOWNWARD
3. WITH THE SWITCH POINT IN MID-POSITION INSTALL THE OPERATING ROD ON THE POINT LUG AND OPERATING CRANK
4. WITH CRANK VERTICALLY DOWNWARD AND SWITCH POINTS CENTERED, MARK HOLES AND DRILL

NOTES:

1. TOP OF JUNCTION BOX LID LEVEL W/ TOP OF TIE
2. FOR TIE LENGTH AND SPACING REFER TO TRACK STANDARDS
3. CIRCUIT CONTROLLER SHALL BE POSITIONED SO THAT LID OPENS AWAY FROM THE TRACK

REV	DATE	BY	CHK	APP	DESCRIPTION	REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION						

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

Bin Zhang

DEPUTY DIRECTOR, ENGINEERING

Caltrain

1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
9B ELECTRIC LOCK
HIGH SWITCH LAYOUT

CADD FILE NAME: SD-5323

REV: | EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5323

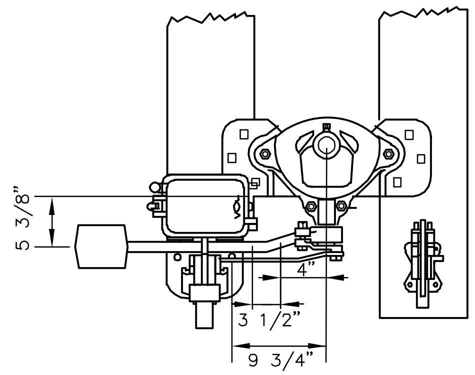


FIGURE A
LAYOUT OF LOCK ON SWITCH STAND

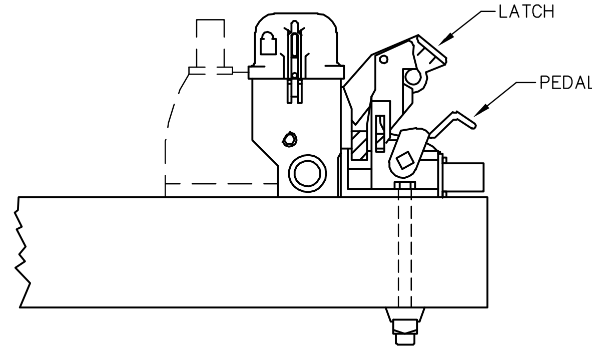


FIGURE B
INSTALLATION OF LOCK ON SWITCH STAND

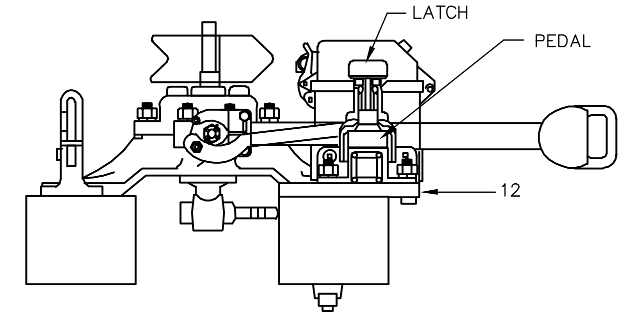


FIGURE A
INSTALLATION OF LOCK ON SWITCH STAND

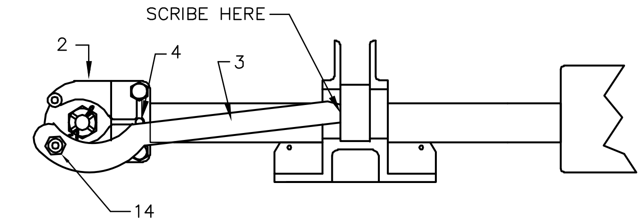


FIGURE B
LATCH ROD ARRANGEMENT

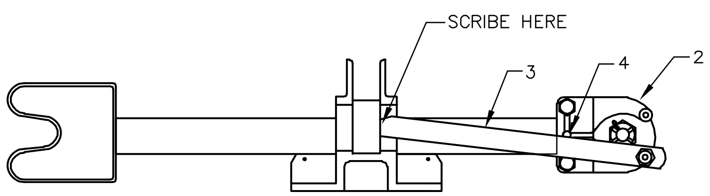


FIGURE C
LATCH ROD ARRANGEMENT

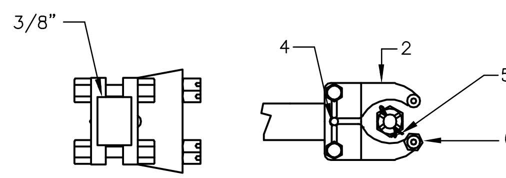
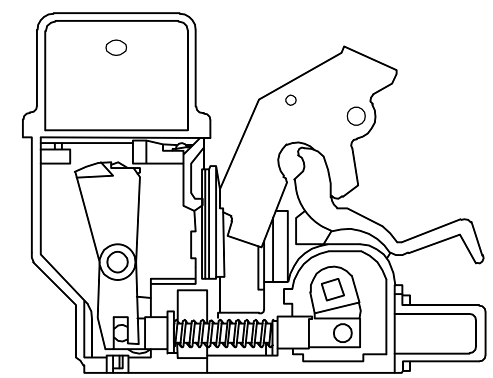


FIGURE D
PIN THROUGH CLAMP & LEVER



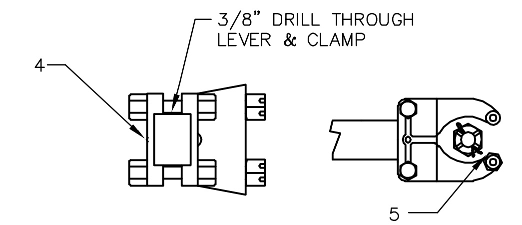


FIGURE C
PIN THROUGH CLAMP & LEVER

50/51 SWITCH STAND

MERIDIAN (RACOR) SWITCH STAND

NOTES FOR 50/51 SWITCH STAND:

1. BOLT CLAMP 2 TO SWITCH LEVER, FIGURES A AND D
2. USING A 3/8" DRILL, DRILL THROUGH CLAMP AND LEVER AND INSTALL RIVET 4, FIGURE D
3. NO TIE DAPPING, FIGURE B
4. INSTALL CABLE ENTRANCE ADAPTERS AND VENTILATORS BEFORE BOLTING LOCK IN PLACE. SECURE LOCK ON TIE WITH RODS, GRIP WASHER, NUTS, AND LOCK WASHERS
5. TO ASSEMBLE LATCH ROD FIGURE C-3, PLACE SWITCH LEVER IN LOCKED-UP POSITION, FIGURE A. PRESS PEDAL DOWN AND INSERT LATCH ROD THROUGH RECTANGULAR HOLE IN LOCK STAND. INSERT STUD 6 FIGURE D, THROUGH PIVOT HOLE IN LATCH ROD AND TEMPORARILY SECURE IT TO CLAMP. DEPRESS LATCH AS FAR AS IT WILL GO AND HOLD IT IN POSITION. SCRIBE ACROSS FACE OF LATCH ROD NEXT TO PEDAL CASTING FIGURE C. REMOVE STUD AND LATCH ROD. CUT OFF LATCH ROD 1/32" SHORT OF SCRIBE MARK
6. FOR ADJUSTABLE LATCH ROD FOLLOW PREVIOUS PROCEDURE, EXCEPT ADJUST LATCH ROD IN 1/8" INCREMENTS INSTEAD OF CUTTING
7. IN FINAL ASSEMBLY. TIGHTEN STUD 6 FIGURE D, WITH A WRENCH TO SECURE LATCH ROD TO CLAMP. DRILL THROUGH CLAMP AND STUD WITH A 1/8" DRILL. INSERT PIN 5, FIGURE D

NOTES FOR MERIDIAN (RACOR) SWITCH STAND:

1. BOLT CLAMP 2 FIGURE B, TO SWITCH LEVER FIGURE C
2. USING A 3/8" DRILL, DRILL THROUGH CLAMP AND LEVER AND INSTALL RIVET 4 FIGURE C
3. INSTALL CABLE ENTRANCE ADAPTERS AND VENTILATORS BEFORE BOLTING LOCK IN PLACE. SECURE LOCK ON TIE AND SUPPORTING PLATE 12 WITH THREADED ROD, BOLT, NUTS, AND WASHERS FIGURE A
4. TO ASSEMBLE LATCH ROD FIGURE B-3, PLACE SWITCH LEVER IN LOCKED-UP POSITION, FIGURE B. PRESS PEDAL DOWN AND INSERT LATCH ROD THROUGH RECTANGULAR HOLE IN LOCK STAND. INSERT STUD BOLT 14 THROUGH PIVOT HOLE IN LATCH ROD AND TEMPORARILY SECURE IT TO CLAMP. DEPRESS LATCH AS FAR AS IT WILL GO AND HOLD IT IN THIS POSITION. SCRIBE ACROSS FACE OF LATCH ROD NEXT TO PEDAL CASTING. REMOVE STUD AND LATCH ROD. CUT OFF LATCH ROD 1/32" SHORT OF SCRIBE MARK
5. IN FINAL ASSEMBLY, TIGHTEN STUD FIGURE B-14 WITH A WRENCH TO SECURE LATCH ROD TO CLAMP. DRILL THROUGH CLAMP AND STUD WITH A 1/8" DRILL. INSERT PIN 5. FIGURE C

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PENINSULA CORRIDOR JOINT POWERS BOARD

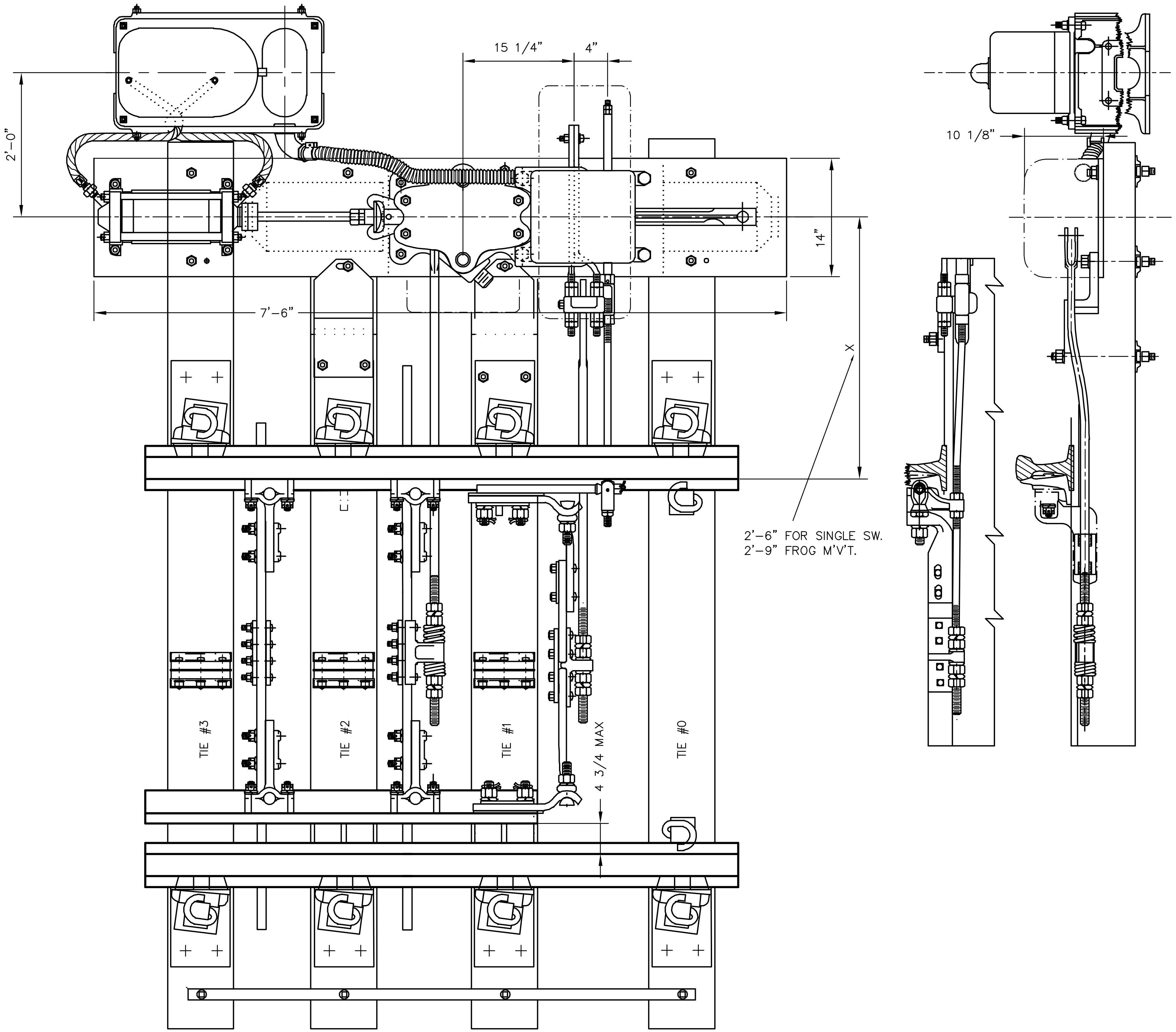
APPROVED BY:
Bin Zhang
DEPUTY DIRECTOR, ENGINEERING

Caltrain
1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
MODEL 10A
ELECTRIC SWITCH LOCK LAYOUT

CADD FILE NAME: SD-5324
REV: EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5324



CONSTRUCTION NOTES:

NOTE 1:

WHEN DISMANTLING OR MAKING ADJUSTMENTS, AIR SHALL BE SHUT OFF AT THE GLOBE VALVE LOCATED AT ONE END OF THE "CP" SWITCH VALVE.

NOTE 2: SLIDE BAR

THE SLIDE BAR STROKE (12") MAY BE ADJUSTED BY MEANS OF THE ADJUSTING NUT ON THE END OF THE PISTON ROD TO OBTAIN EQUAL TRAVEL OF THE SLIDE BAR ROLLER ON EITHER SIDE OF THE ESCAPEMENT CRANK BEARING. THE CORRECT POSITION IS OBTAINED WHEN THE LUBRICATING FITTING ON THE SLIDE BAR ROLLER LINES UP WITH THE CENTER OF ONE OF TWO GREASE GUN HOLES IN THE TOP PLATE, WHEN THE BAR IS IN RESPECTIVE EXTREME POSITIONS.

NOTE 3: ESCAPEMENT CRANK

THE MAXIMUM OPERATING ROD THRUST FOR A SWITCH THROW IS OBTAINED WHEN THE OPERATING ARM IS ADJUSTED TO THE SHORTEST POSSIBLE LENGTH TO GIVE THE NECESSARY SWITCH STROKE. ONE-HALF INCH (1/2") LOST MOTION IN THE SWITCH BASKET IS GENERALLY CONSIDERED SUFFICIENT.

NOTE 4: FRICTION LOCK

ADJUSTMENT OF THE FRICTION LOCK SPRING IS OBTAINED WHEN THE SLOTTED END OF THE ADJUSTING SCREW COMES FLUSH WITH THE BODY OF THE FRICTION LOCK ARM INTO WHICH IT IS THREADED.

NOTE 5: ADJUSTMENT

LOOSEN THE CLAMPING OR LOCKING BOLT, ADJUST THE POSITION OF NUTS ON THE SWITCH END UNTIL THE LOCKING DOGS ON THE SLIDE BAR ENTER THEIR RESPECTIVE NOTCHES IN THE LOCK ROD WITHOUT ANY INTERFERENCE AND WITH APPROXIMATELY THE SAME CLEARANCE ON EACH SIDE OF THE LOCKING DOG. TIGHTEN THE CLAMP BOLT AND LOCK NUTS. LOCK RODS ARE IN ADJUSTMENT WHEN THE INDICATING POINTS COINCIDE WITH THE OUTER EDGES OF LONG NOTCHES.

NOTE 6: POINT DETECTOR BAR ADJUSTMENT

TURN THE BAR BY MEANS OF THE TURNBUCKLE, IN OR OUT, ON THE THREADED PORTION OF THE CONNECTING ROD UNTIL THE BEVELED PORTION NEARER THE SWITCH POINT CLEARS THE POINT DETECTOR ROLLER BY 1/16". THIS DIMENSION SHALL BE CHECKED BY USING A 1/16" THICK GAUGE TO ENSURE A SNUG FIT. LOCK THIS ADJUSTMENT WITH THE LOCK NUT ON THE CONNECTING ROD. OPERATE THE MACHINE TO THE OTHER EXTREME POSITION AND OBTAIN THE SAME RELATIONSHIP BETWEEN THE BEVELED PORTION OF THE ADJUSTABLE SLEEVE ON THE DETECTOR BAR AND THE OTHER POINT DETECTOR ROLLER BY TURNING THE SLEEVE IN OR OUT AS NECESSARY. LOCK THE ADJUSTMENT. WITH THESE ADJUSTMENTS. A 1/4" MOTION FROM POINT DETECTOR BAR SHALL BREAK THE INDICATION CIRCUIT AND 5/16" MOTION SHOULD LATCH THE CONTROLLER.

NOTE:

REFER TO SD-2000 SERIES DRAWINGS FOR TIE SPACING

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
SWITCH APPARATUS
A-5 E. P. SWITCH MACHINE
TYPICAL SWITCH MACHINE LAYOUT

CADD FILE NAME: SD-5325
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5325

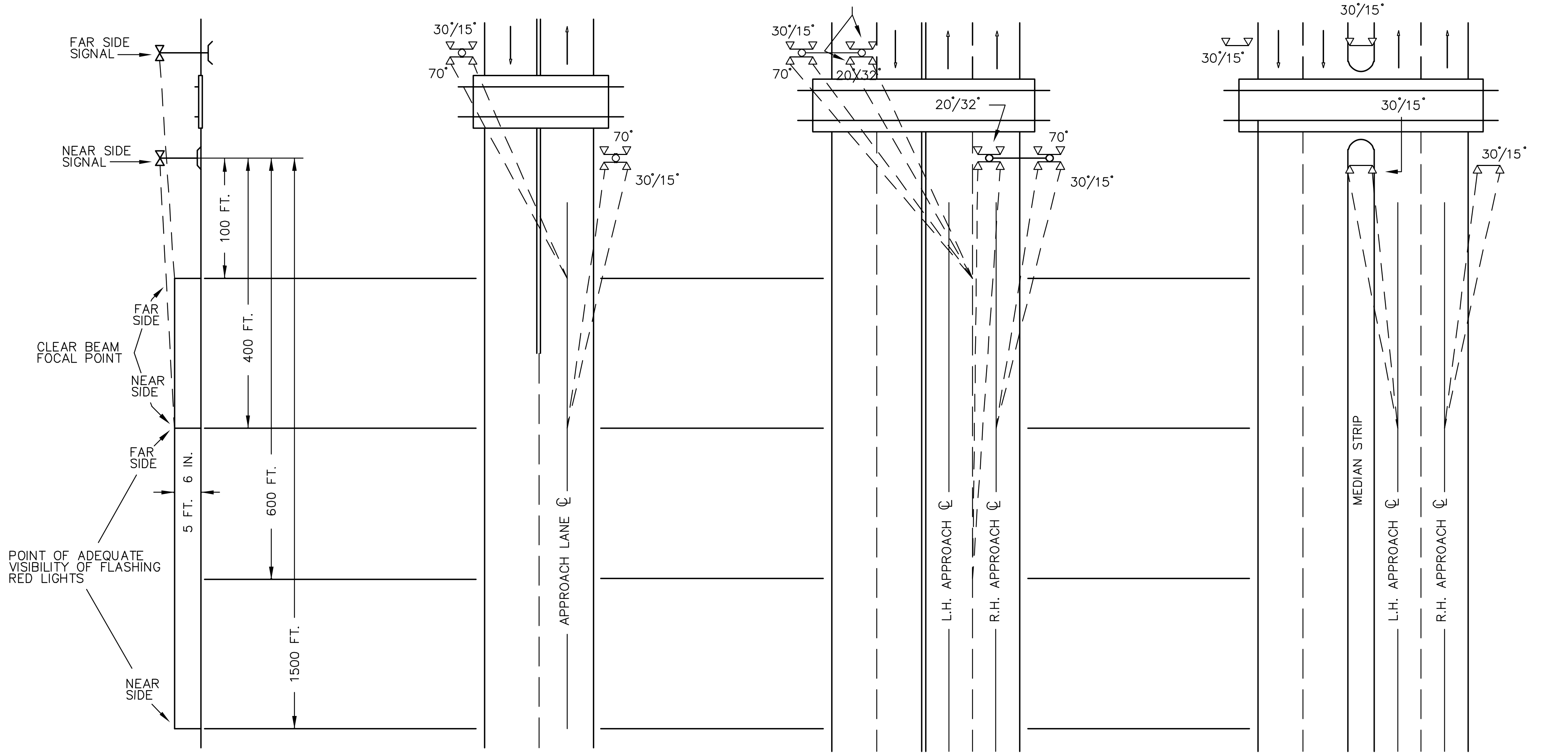

FIGURE 1
SINGLE LANE GROUND FLASHERS WITH BACK LIGHTS

FIGURE 2
TWO LANE APPROACH CANTILEVER FLASHERS WITH BACK LIGHTS

FIGURE 3
TWO LANE APPROACH GROUND FLASHERS ON R.H. SIDE AND ONE MEDIAN – NO BACK LIGHTS

NOTES:

1. THIS DRAWING SHALL BE USED ONLY AS A GUIDE. EACH CROSSING SHALL BE EVALUATED AND LED LAMPS ADJUSTED TO PROVIDE OPTIMUM COVERAGE
2. DEFLECTION FOR BACK LIGHTS AND SIDE LIGHTS: 70°
3. DEFLECTION FOR LIGHTS FACING TRAFFIC: 30°/15°
4. DEFLECTION FOR LIGHTS OVER TRAFFIC, BOTH DIRECTIONS: 20°/32°
5. FIRST NUMBER IS HORIZONTAL DEFLECTION
6. SECOND NUMBER IS DOWNWARD DEFLECTION
7. ANGLES OF DEFLECTION DO NOT APPLY TO LED SIGNALS
8. FOCUS LED LIGHTS TO FOCAL POINT ON DRAWING
9. MAINTAIN 30 INCH SEPARATION BETWEEN FLASHERS

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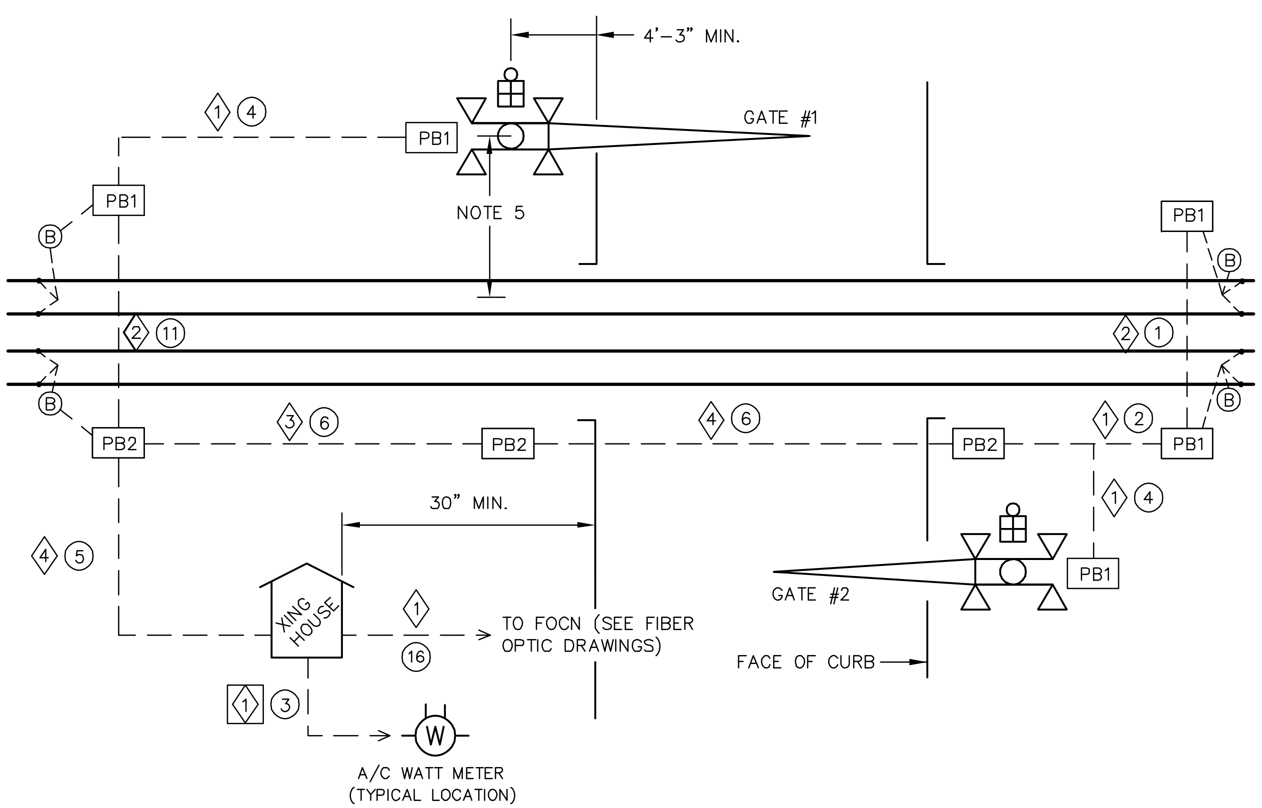
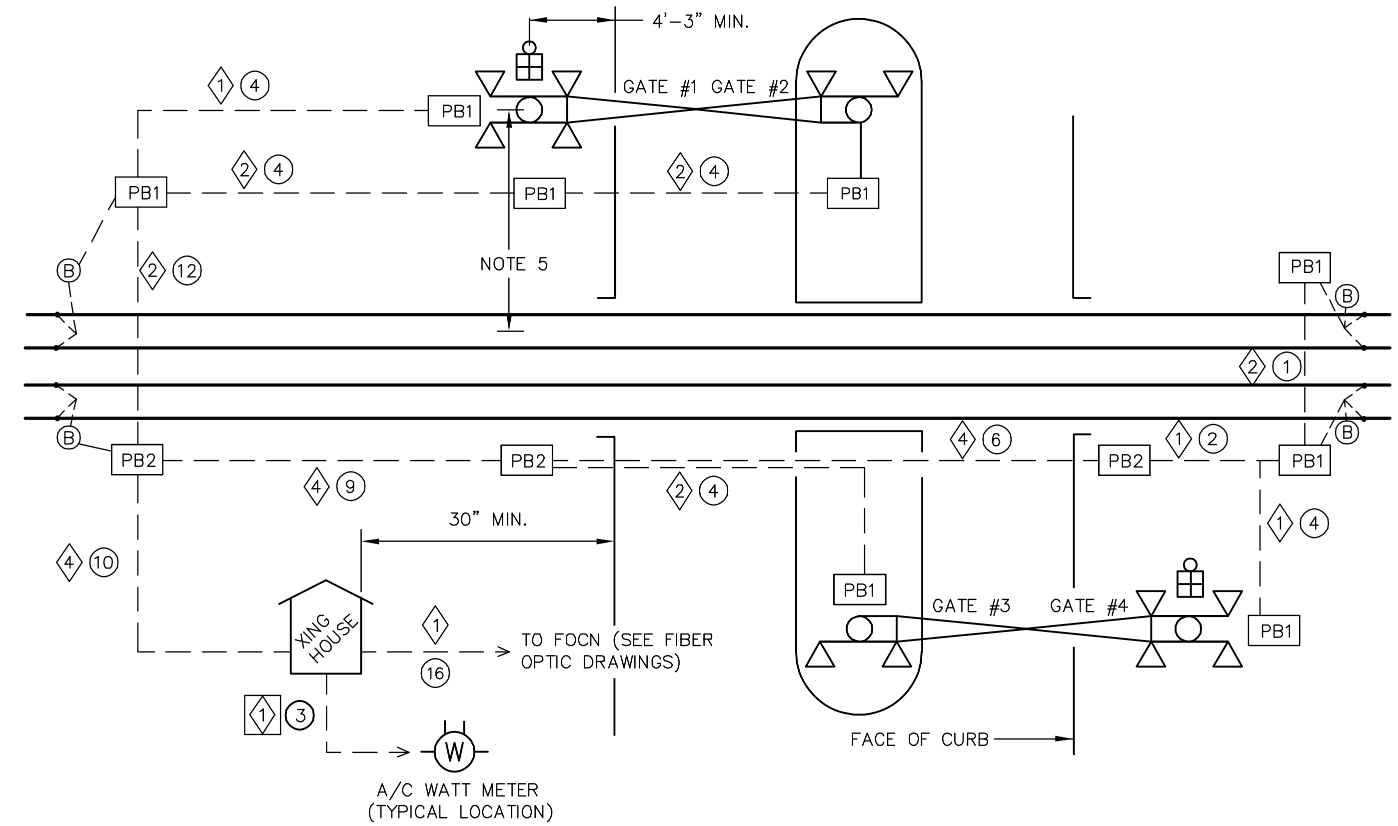
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
TYPICAL HIGHWAY CROSSING SIGNALS
LIGHT UNIT ALIGNMENT

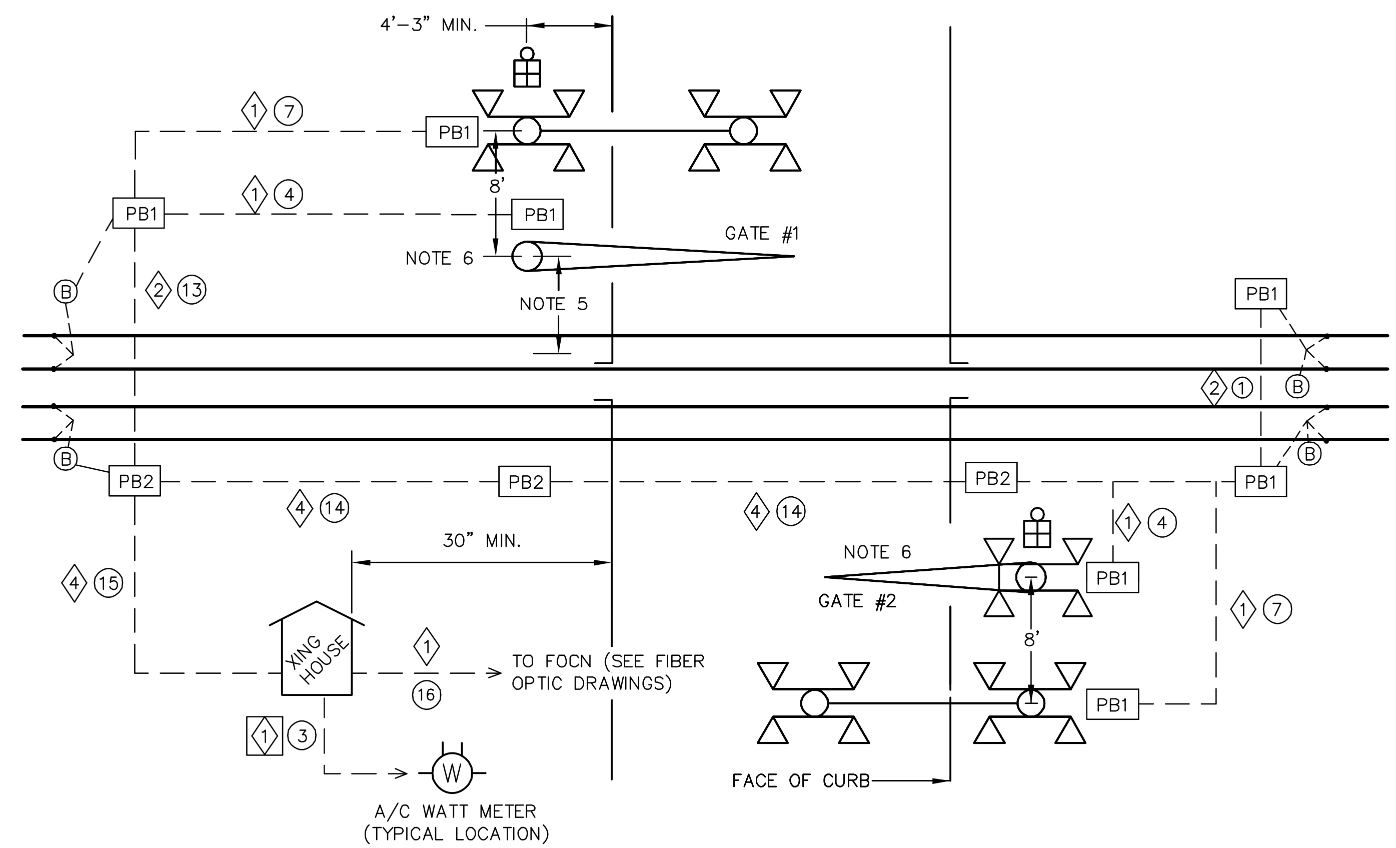
CADD FILE NAME: SD–5401
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD–5401



FLASHING LIGHT SIGNALS W/ GATE



FOUR FLASHING LIGHT SIGNALS W/ GATE



CANTILEVER FLASHERS W/ GATES

◇ = NUMBER INSCRIBED DENOTES QUANTITY OF 4 INCH SCH. 80 PVC

◇ (boxed) = NUMBER INSCRIBED DENOTES QUANTITY OF 2 INCH SCH. 80 PVC

PB1 = 2'X3' PULL BOX

PB2 = 3'X5' PULL BOX

(B) = TRACK WIRE BOOTLEGS (SEE SD-4112)

(1) = 1-TW 2C #6
(2) = 2-TW 2C #6
(3) = 1-3C #2 W/ GND
(4) = 2-5C #6, 1-7C #14
(5) = 4-TW 2C #6, 4-5C #6, 2-7C #14
(6) = 2-TW 2C #6, 2-5C #6, 1-7C #14
(7) = 1-5C #6
(8) = 3-5C #6, 1-7C #14
(9) = 2-TW 2C #6, 4-5C #6, 2-7C #14
(10) = 4-TW 2C #6, 8-5C #6, 4-7C #14
(11) = 1-TW 2C #6, 2-5C #6, 1-7C #14
(12) = 1-TW 2C #6, 4-5C #6, 2-7C #14
(13) = 1-TW 2C #6, 3-5C #6, 1-7C #14
(14) = 2-TW 2C #6, 3-5C #6, 1-7C #14
(15) = 4-TW 2C #6, 6-5C #6, 2-7C #14
(16) = SMFO CABLE (12 STRAND)

NOTES:

1. CROSSING HOUSE AND METER SERVICE LOCATION IS TYPICAL, MAY BE LOCATED IN ANY QUADRANT
2. CROSSING HOUSE LOCATED 25' FROM CENTER LINE OF TRACK. VARIATION ONLY ON APPROVAL OF THE ENGINEER
3. TRACK LEADS LOCATED MINIMUM 50' FROM CURB FACE
4. 125' MINIMUM ISLAND CIRCUIT LENGTH
5. 15' MAXIMUM AND 12' MINIMUM SHALL BE MAINTAINED. NO PART OF FLASHER LIGHT ASSEMBLY TO INTRUDE INTO PUC CLEARANCE ENVELOPE 8'-6" INCHES FROM CENTER LINE ON TANGENT TRACK
6. BACKLIGHTS AND BELL LOCATIONS ON CANTILEVER AND GATES TO BE DETERMINED ON DESIGN OR BY THE ENGINEER
7. COVER OUT OF SERVICE FLASHERS WITH BURLAP AND REMOVE ENERGY

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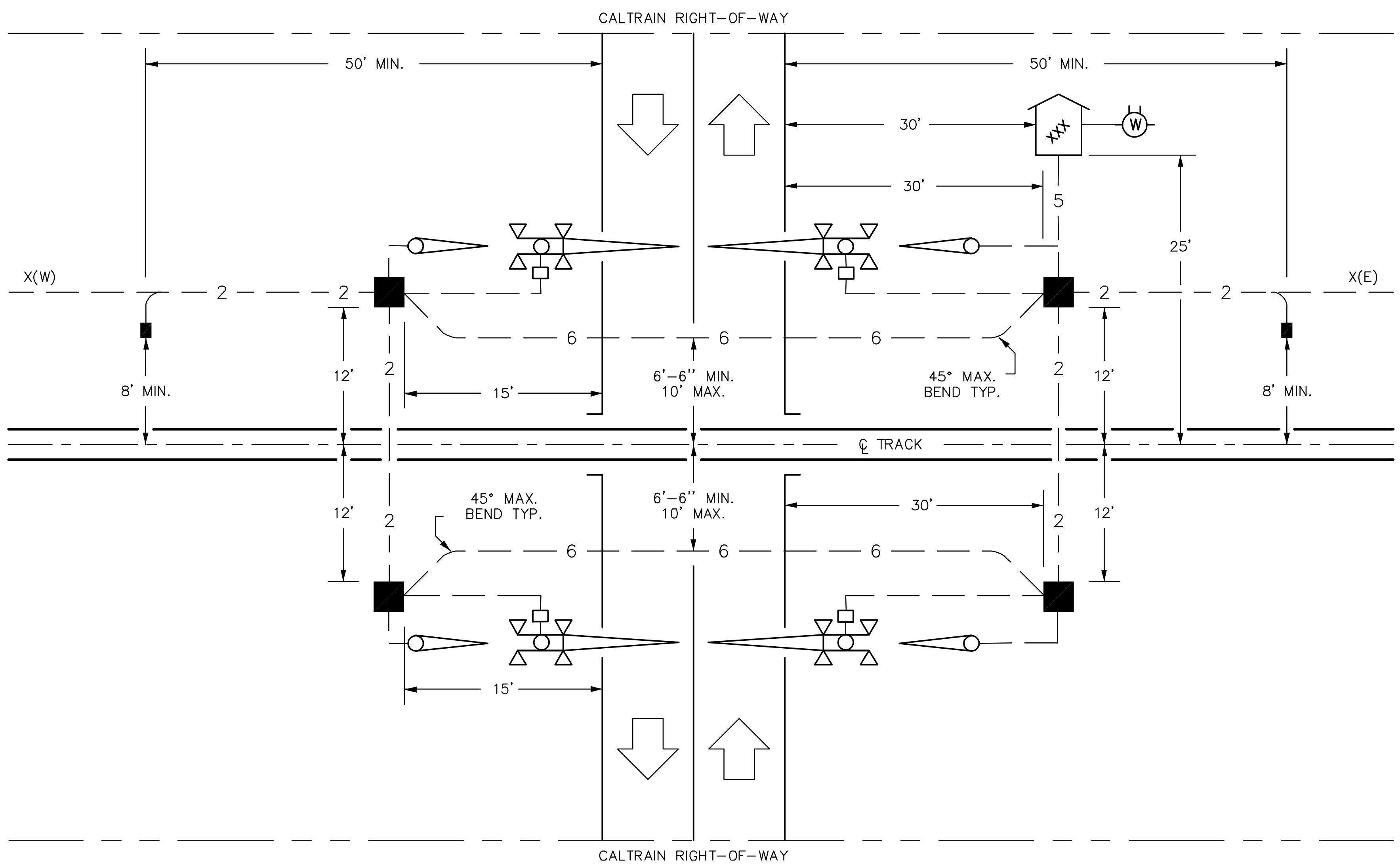
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS

TYPICAL CROSSING LOCATIONS

CADD FILE NAME: SD-5402
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5402



FLASHING LIGHT SIGNALS WITH ENTRANCE AND EXIT GATES

SIGNAL CROSSING HOUSE, PULL BOX AND CONDUIT CONFIGURATION

LEGEND

■	– 10" x 17" x 12" CONCRETE PULL BOX
□	– 24" x 18" x 13" FIBERGLASS PULL BOX
■	– 4' x 4' x 4' CONCRETE PULL BOX
—N—	– MULTIPLE CONDUITS (N=NUMBER OF CONDUITS)
——	– SINGLE CONDUIT
(W)	– METER SERVICE
8X6	– 8X6 CROSSING HOUSE

NOTES:

1. CROSSING SIGNAL HOUSE LOCATION IS TYPICAL, MAY BE LOCATED IN ANY NEUTRAL QUADRANT
2. ALL CONDUITS SHALL BE 4" SCHEDULE 80 PVC UNLESS OTHERWISE SPECIFIED
3. A MINIMUM OF 4 CONDUITS SHALL BE MAINTAINED UNDERNEATH THE ROADWAY ON BOTH SIDES OF TRACK AFTER INITIAL INSTALLATION
4. SPARE CONDUITS SHALL BE INSTALLED COMPLETELY FROM ONE 4' X 4' X 4' PULL BOX TO THE OTHER 4' X 4' X 4' PULL BOX
5. THE AMOUNT OF EXPRESS CONDUITS (6 SHOWN) SHALL BE DETERMINED BY CALTRAIN DURING DESIGN
6. ALL CONDUIT SHALL BE BURIED A MINIMUM OF 36" BELOW TOP OF FINAL GRADE
7. INSTALL CABLE AND TRACK WIRE AS SPECIFIED BY SIGNAL DESIGN DRAWINGS
8. 24" X 18" X 13" PULL BOXES SHALL BE PLACED DIRECTLY BESIDE THE SIGNAL MAST AT A MINIMUM DISTANCE OF 3'-0"
9. DEVIATION FROM THIS STANDARD SHALL BE APPROVED BY CALTRAIN

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
FLASHING LIGHT SIGNALS WITH GATES
HOUSE CONDUIT LAYOUT

CADD FILE NAME: SD-5403

REV: | EDITION: FOURTH

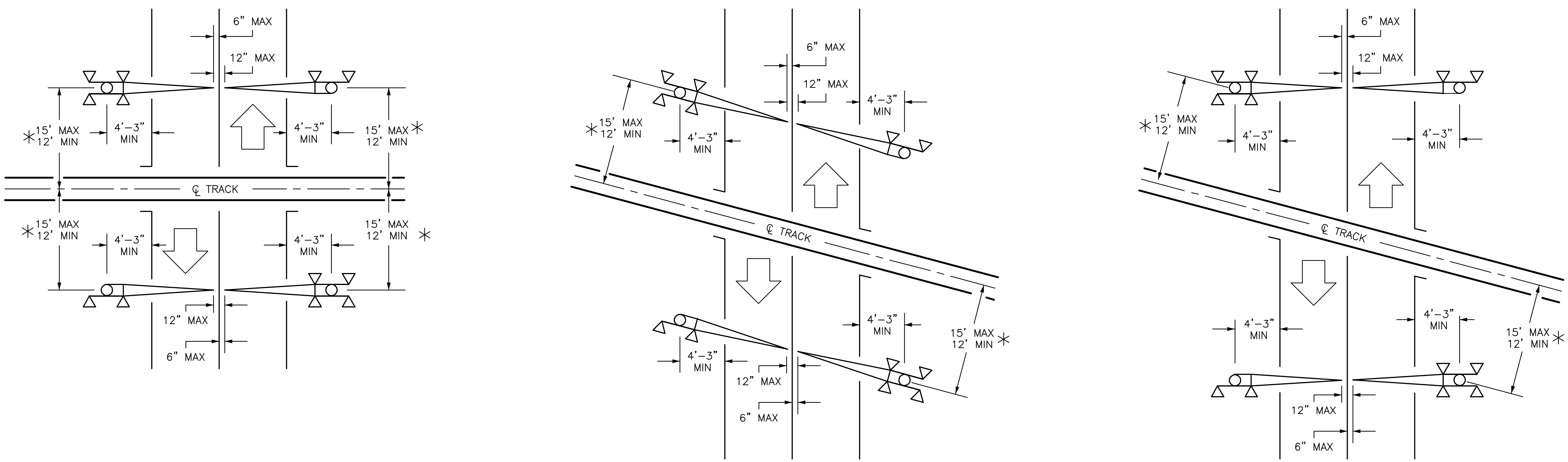
SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5403

RIGHT ANGLE CROSSING

ANGLED CROSSING
GATES PARALLEL TO TRACK

ANGLED CROSSING
GATES PERPENDICULAR TO ROADWAY



FLASHING LIGHT SIGNALS WITH ENTRANCE AND EXIT GATES

ONE OR MORE TRACKS, TWO-WAY VEHICULAR TRAFFIC, ONE LANE EACH WAY

* USE OF MINIMUM DIMENSIONS SHALL BE AUTHORIZED BY CALTRAIN

NOTES:

1. TYPICAL LOCATION PLAN MAY VARY AS FIELD CONDITIONS REQUIRE
2. ROADWAY GATE ARM LENGTH SHALL NOT EXCEED 32' MEASURED FROM THE CENTER OF KINGPIN TO THE TIP OF GATE ARM
3. SEE STANDARD DRAWINGS SD-7000 SERIES FOR ADDITIONAL INFORMATION
4. REFERENCE AREMA C&S MANUAL PART 3.1.36 FOR DIFFERENT CONFIGURATION

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
FLASHING LIGHT SIGNALS WITH
ENTRANCE AND EXIT GATES

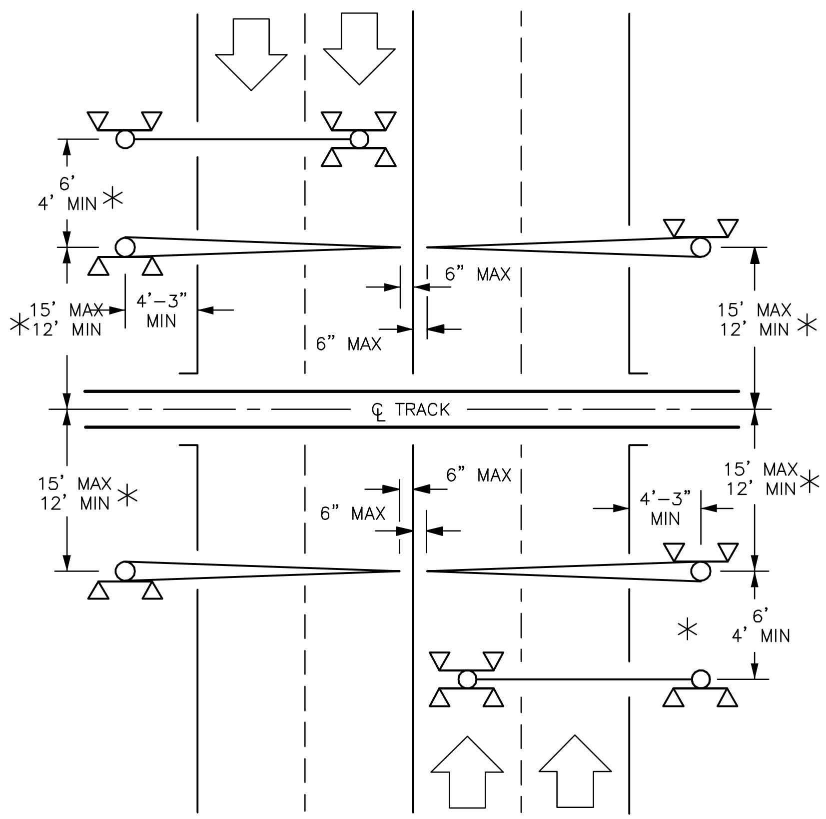
CADD FILE NAME: SD-5404

REV: EDITION: FOURTH

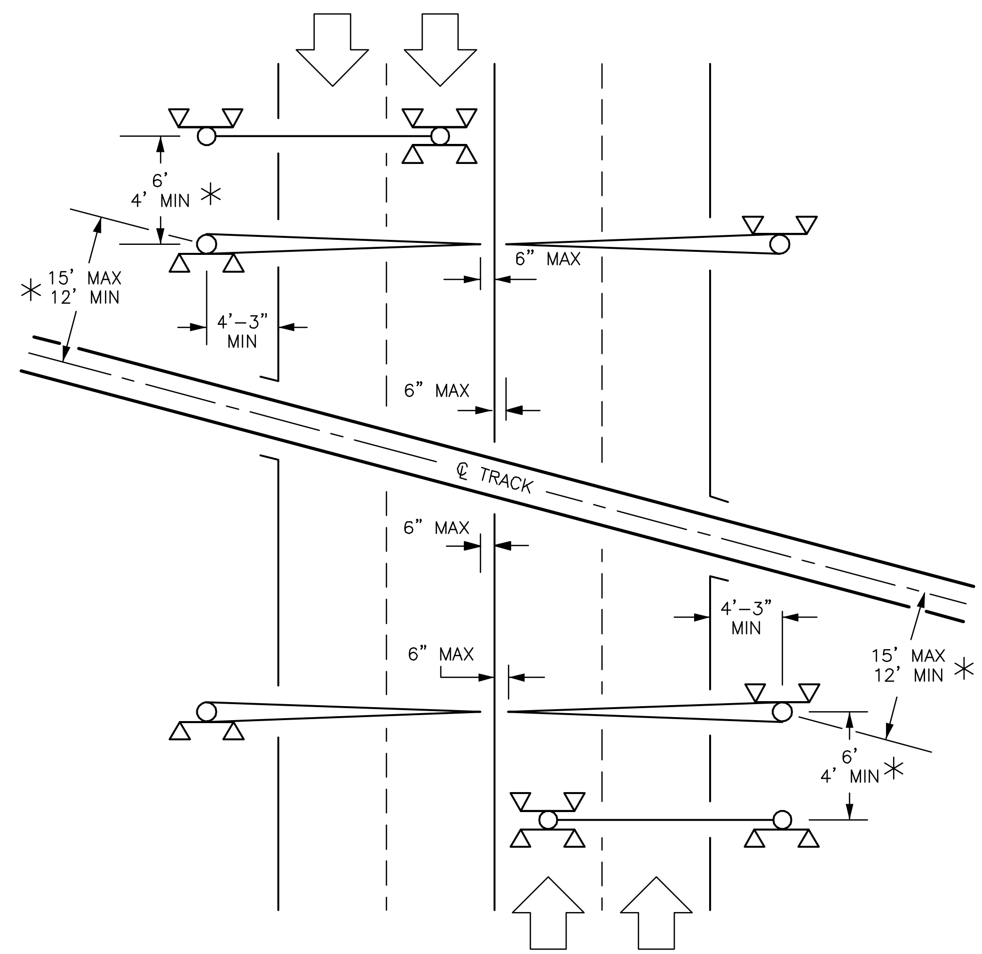
SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5404

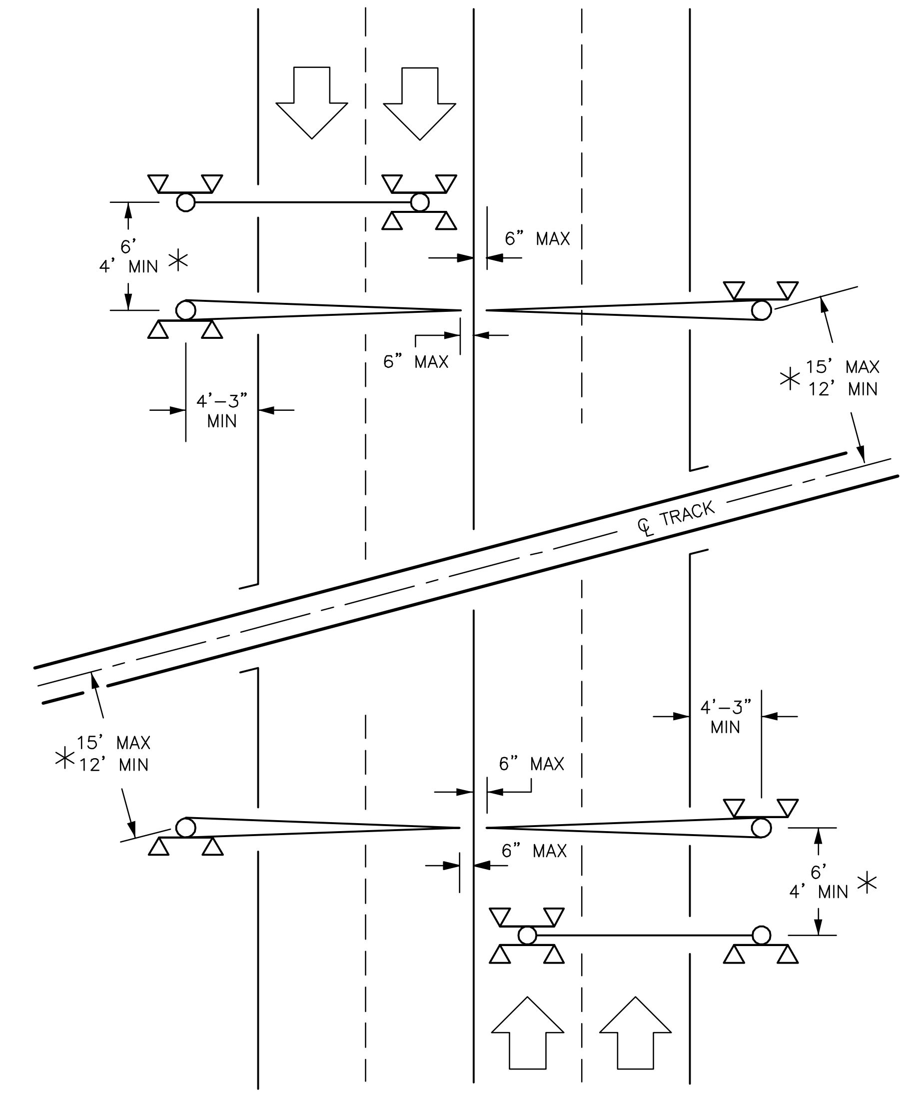
RIGHT ANGLE CROSSING



ACUTE ANGLE CROSSING



OBTUSE ANGLE CROSSING



CANTILEVER FLASHERS WITH ENTRANCE AND EXIT GATES:

ONE OR MORE TRACKS, TWO-WAY VEHICULAR TRAFFIC, TWO LANES EACH WAY

⁎ USE OF MINIMUM DIMENSIONS SHALL BE AUTHORIZED BY CALTRAIN

NOTES:

1. TYPICAL LOCATION PLAN MAY VARY AS CONDITIONS REQUIRE
2. ROADWAY GATE ARM LENGTH SHALL NOT EXCEED 32' MEASURED FROM THE CENTER OF KINGPIN TO THE TIP OF GATE ARM
3. SEE STANDARD DRAWINGS SD-7000 SERIES FOR ADDITIONAL INFORMATION

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SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
CANTILEVER FLASHERS WITH
ENTRANCE AND EXIT GATES

CADD FILE NAME: SD-5405

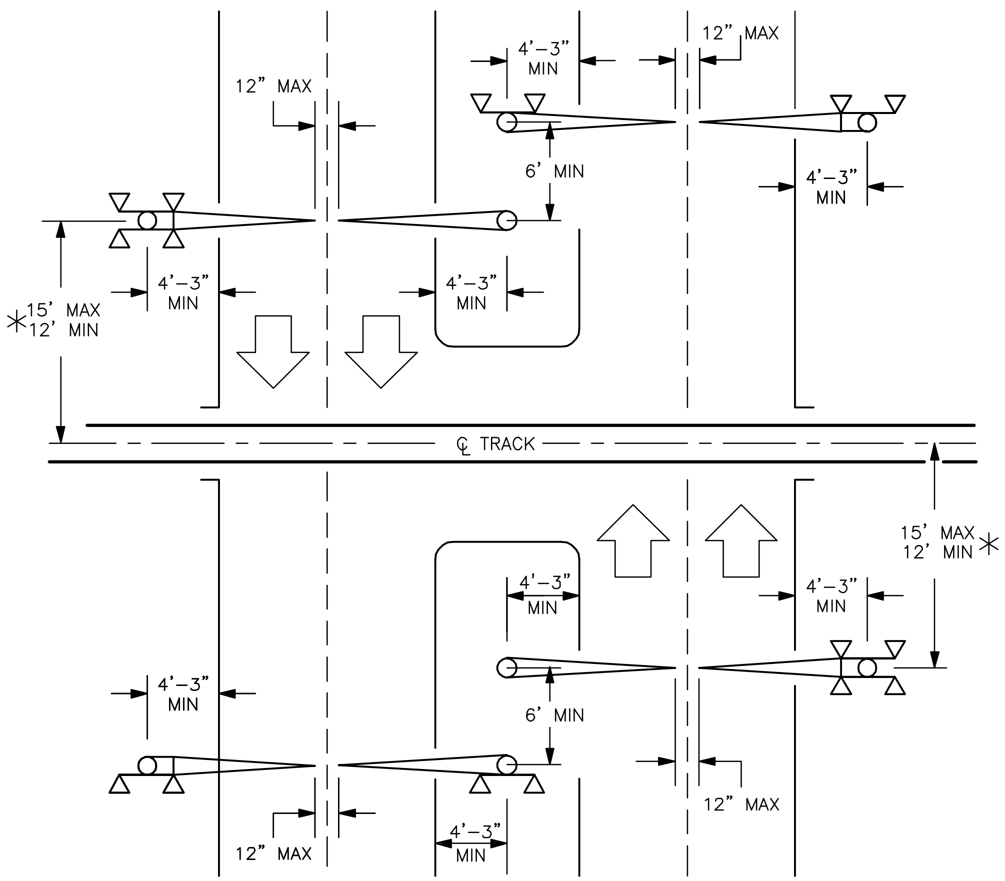
REV:

EDITION: FOURTH

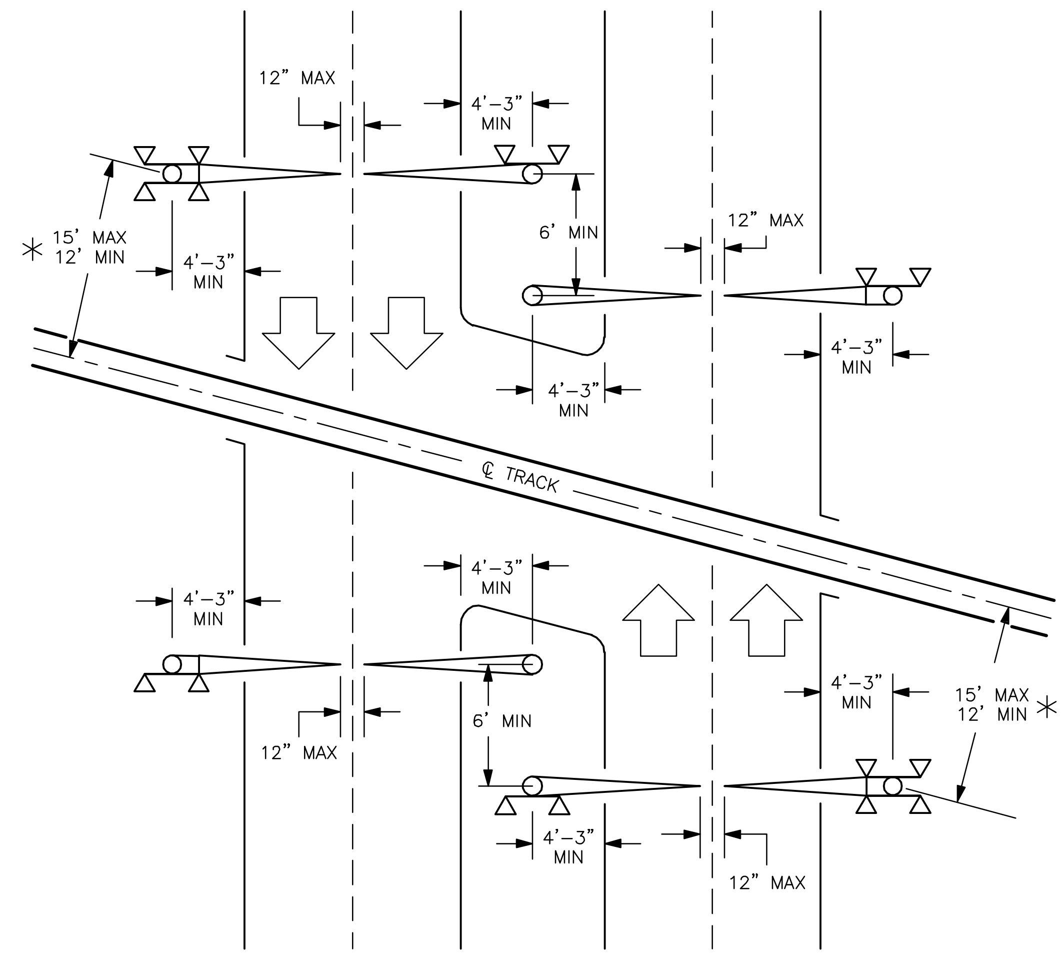
SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5405

RIGHT ANGLE CROSSING



ACUTE ANGLE CROSSING



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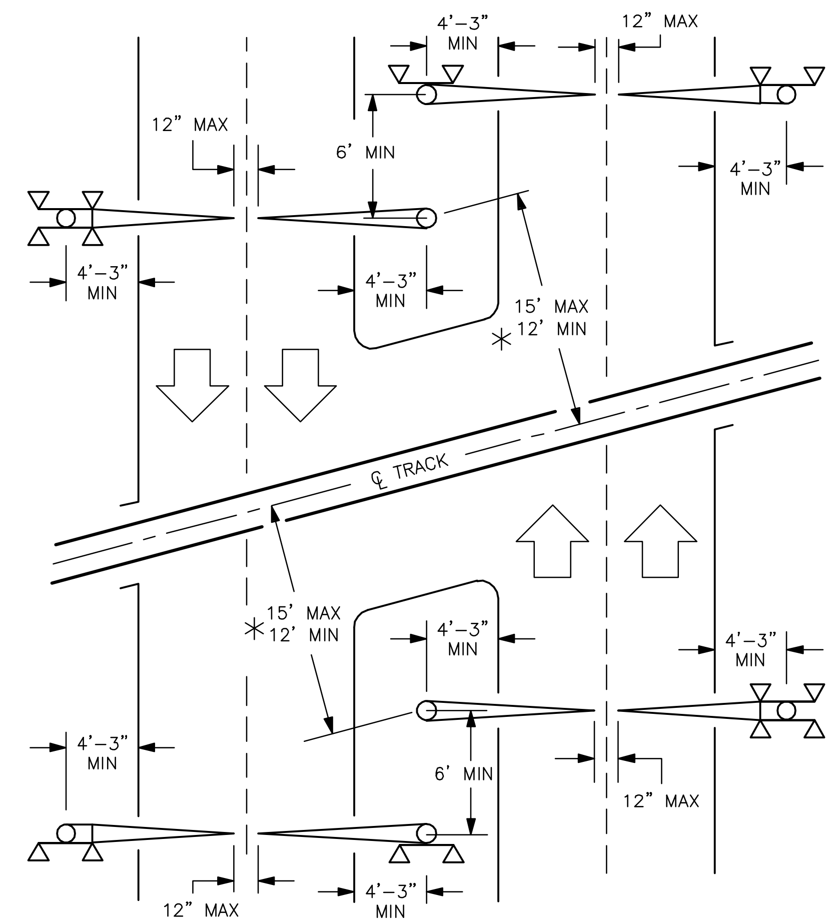

FLASHING LIGHT SIGNALS WITH ENTRANCE AND EXIT GATES AND MEDIAN

ONE OR MORE TRACKS, TWO-WAY VEHICULAR TRAFFIC, TWO LANES EACH WAY WITH MEDIAN

* USE OF MINIMUM DIMENSIONS SHALL BE AUTHORIZED BY CALTRAIN

NOTES:

1. TYPICAL LOCATION PLAN MAY VARY AS CONDITIONS REQUIRE
2. ADDITIONAL MEDIAN WIDTH MAY BE REQUIRED TO PROVIDE CLEARANCE FOR 24" BACKROUNDS, WINDGUARD OR GATE COUNTERWEIGHTS
3. BACKLIGHTS MAY BE ADDED AS CONDITIONS REQUIRE
4. ROADWAY GATE ARM LENGTH SHALL NOT EXCEED 32' MEASURED FROM THE CENTER OF KINGPIN TO THE TIP OF GATE ARM
5. WHERE BOTH ENTRANCE GATES AND EXIT GATES ARE ALIGNED ON A MEDIAN, FRONT LIGHTS SHALL BE INSTALLED ON THE ASSEMBLY CLOSEST TO TRAFFIC APPROACHING IN THE LAWFUL DIRECTION
6. MAINTAIN 30" SEPARATION FOR FLASHERS
7. SEE STANDARD DRAWINGS SD-7000 SERIES FOR ADDITIONAL INFORMATION
8. REFERENCE AREMA C&S MANUAL PART 3.1.36 FOR DIFFERENT CONFIGURATIONS

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STANDARD DRAWINGS

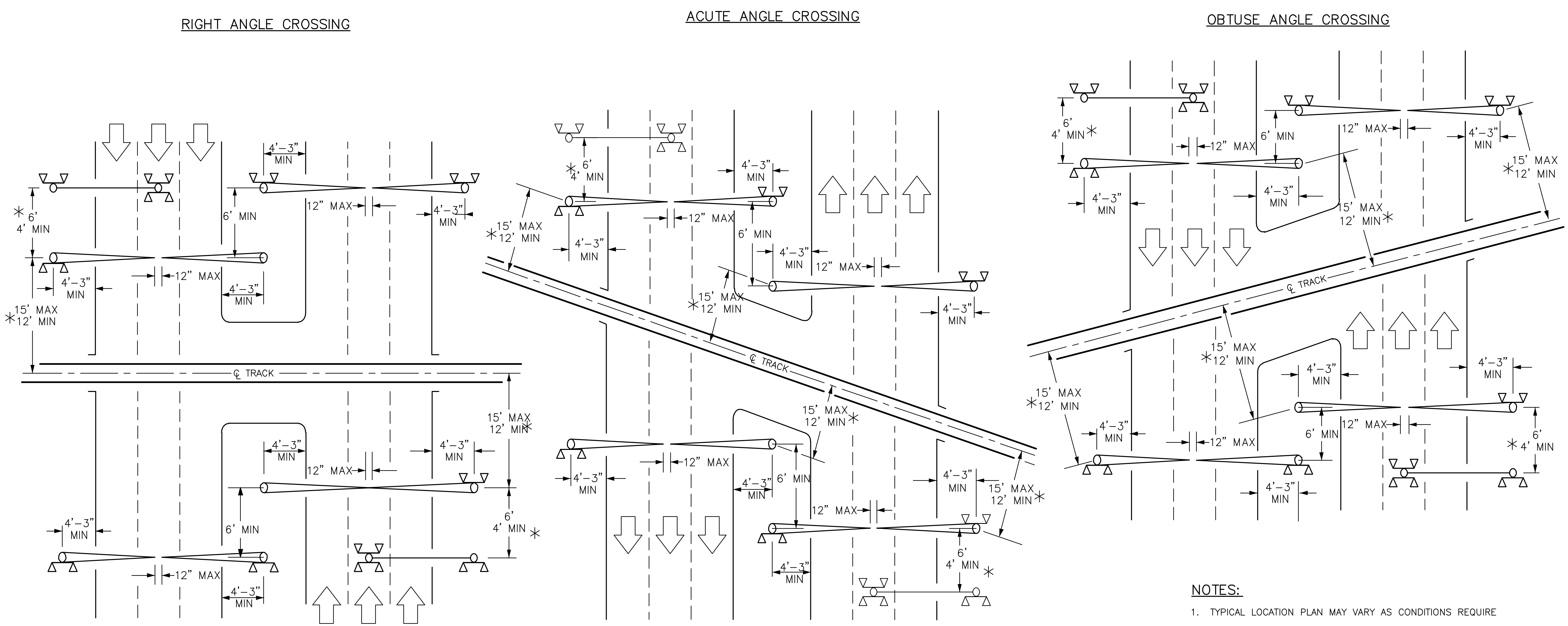
SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
FLASHING LIGHT SIGNALS WITH
ENTRANCE AND EXIT GATES
AND MEDIAN

CADD FILE NAME: SD-5406

REV: EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5406



CANTILEVER FLASHERS WITH ENTRANCE AND EXIT GATES AND MEDIAN

ONE OR MORE TRACKS, TWO-WAY VEHICULAR TRAFFIC, THREE OR MORE LANES EACH WAY WITH MEDAN

* USE OF MINIMUM DIMENSIONS SHALL BE AUTHORIZED BY CALTRAIN

NOTES:

1. TYPICAL LOCATION PLAN MAY VARY AS CONDITIONS REQUIRE
2. ADDITIONAL MEDIAN WIDTH MAY BE REQUIRED TO PROVIDE CLEARANCE FOR 24" BACKROUNDS, WINDGUARD OR GATE COUNTERWEIGHTS
3. ROADWAY GATE ARM LENGTH SHALL NOT EXCEED 32' MEASURED FROM THE CENTER OF KINGPIN TO THE TIP OF GATE ARM
4. SEE STANDARD DRAWINGS SD-7000 SERIES FOR ADDITIONAL INFORMATION
5. WHERE BOTH ENTRANCE GATES AND EXIT GATES ARE ALIGNED ON A MEDIAN, FRONT LIGHTS SHALL BE INSTALLED ON THE ASSEMBLY CLOSEST TO TRAFFIC APPROACHING IN THE LAWFUL DIRECTION

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
CANTILEVER FLASHERS WITH
ENTRANCE AND EXIT GATES
AND MEDIAN

CADD FILE NAME: SD-5407

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5407

NOT USED.

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SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS

CADD FILE NAME: SD-5408

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5408

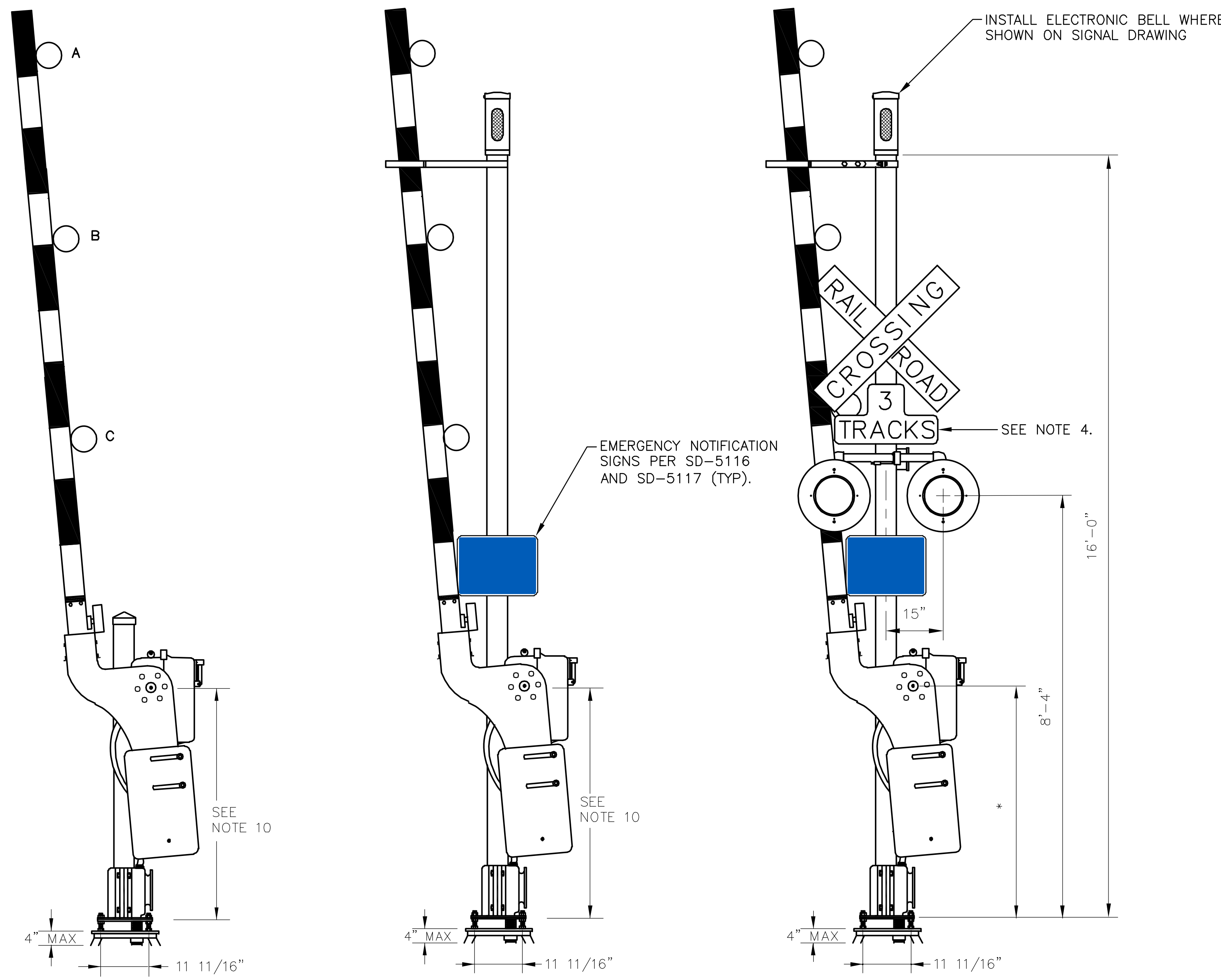
NOTES FOR GATE ARMS:

1. GATE ARM LENGTH IS MEASURED FROM GATE MECHANISM CAM SHAFT TO END OF GATE ARM.
2. END OF GATE ARM SHALL BE LOCATED WITHIN 12" OF THE CENTERLINE OF ROADWAY OR FACE OF MEDIAN CURB. WHERE PRACTICAL, END OF GATE ARM SHALL EXTEND TO CENTERLINE OF ROADWAY OR FACE OF MEDIAN CURB.
3. THE FOLLOWING GUIDELINES SHALL BE USED FOR GATE ARM LAMP PLACEMENT. HIGHWAY CROSSING SHALL BE EVALUATED AND LAMPS PLACED FOR OPTIMUM VIEWING BY MOTORIST.

   LAMP A:
   12" FROM END OF GATE ARM.

   LAMP B:
   GATE LAMP SHALL BE CENTERED BETWEEN LAMP A AND LAMP C.

   LAMP C:
   GATE LAMP SHALL BE 8' FROM CENTER OF MAST.



STUB GATE
(NOT FOR NEW WORK)

GATE USED W/CFLS
(PUC NO. 9A)
SEE NOTE 13

FLS W/GATE
(PUC NO. 9)

NOTES:

1. TOP OF FOUNDATION SHALL BE LEVEL WITH CROWN OF ROAD AT MAXIMUM 4" ABOVE TOP OF GROUND LEVEL.
2. WHEN USED, SIDELIGHT ASSEMBLY SHALL BE PLACED SO AS NOT TO INTERFERE WITH GATE ARM OR REDUCE TRACK CLEARANCE. 30" SEPARATION OF LIGHT UNITS SHALL BE MAINTAINED.
3. ALL PARTS SHALL BE ALUMINUM IN COLOR EXCEPT VISORS AND BACKGROUNDS, WHICH SHALL BE FLAT BLACK.
4. TRACK SIGN SHALL BE USED WHEN TWO OR MORE TRACKS CROSS STREET.
5. GATE LAMPS SHALL BE 4" DIAMETER
6. FLASHING LIGHT SIGNAL UNIT BACKGROUNDS-24" AND VISORS SHALL BE STEEL
7. LENS HORIZONTAL DOWNWARD DEFLECTION PER AAR/AREMA.
8. BELL SHALL BE ELECTRONIC.
9. GATE MECHANISM SHALL BE ADJUSTED SO THAT, WHEN GATE IS IN FULL HORIZONTAL POSITION, THE GATE ARM RESTS BETWEEN 3'-6" TO 4'-6" ABOVE CROWN OF ROADWAY.
10. PEDESTRIAN GATE ARM SHALL HAVE TIP LIGHT UP TO 10'. GATE ARMS LONGER THAN 10' TO HAVE THREE LIGHTS.
11. PEDESTRIAN GATE ARM SHALL NOT BLOCK ENTIRE WALKWAY. AN EXIT PATH MUST BE PROVIDED FOR PEDESTRIANS WHO ARE IN TRANSIT WHEN GATES ACTIVATE.
12. BACK LIGHT AND BELL LOCATIONS ON CANTILEVER AND GATES SHALL BE DETERMINED DURING DESIGN.
13. ENS SIGNS TO BE INSTALLED AS NEEDED TO FULLY COMPLY WITH FRA REGULATION 234.311.
14. GATE MECHANISM TO BE WESTERN CULLEN HAYES MODEL 3597 2-WIRE GATE CONTROL OR EQUIVALENT.
15. PER CPUC GENERAL ORDER #75D, SIGNALS AT ALL NEW LOCATIONS SHALL HAVE LED FLASHER ASSEMBLIES.

REV	DATE	BY	CHK	APP	DESCRIPTION
	01012024				FOURTH EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

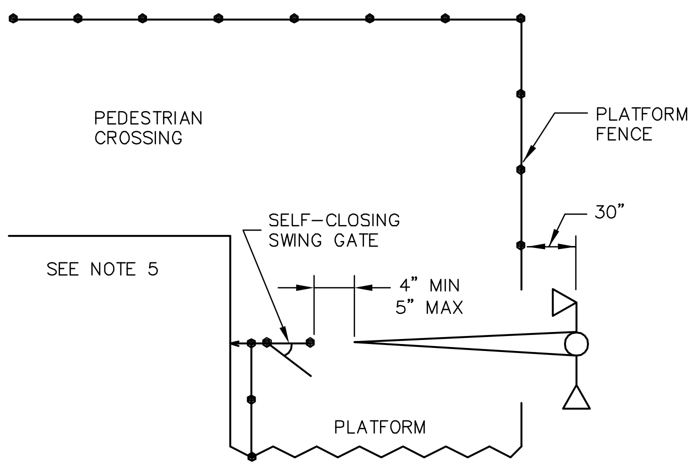
APPROVED BY:
Bin Zhang
DEPUTY DIRECTOR, ENGINEERING

Caltrain
1250 San Carlos Avenue
San Carlos, CA 94070

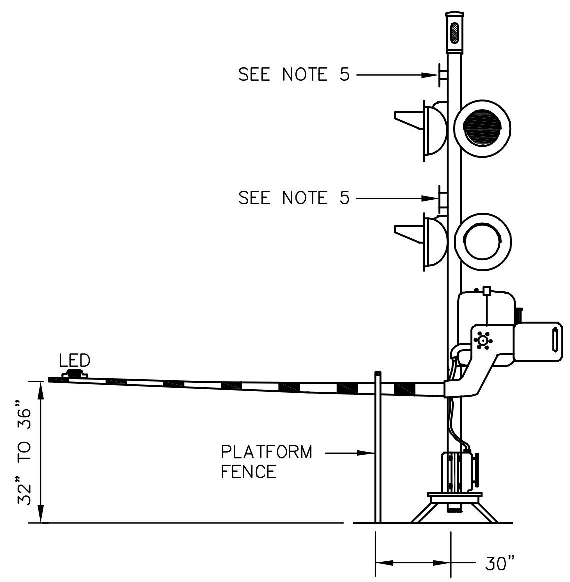
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
CROSSING GATES WITH AND WITHOUT
FLASHING LIGHT SIGNALS

CADD FILE NAME: SD-5409
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5409

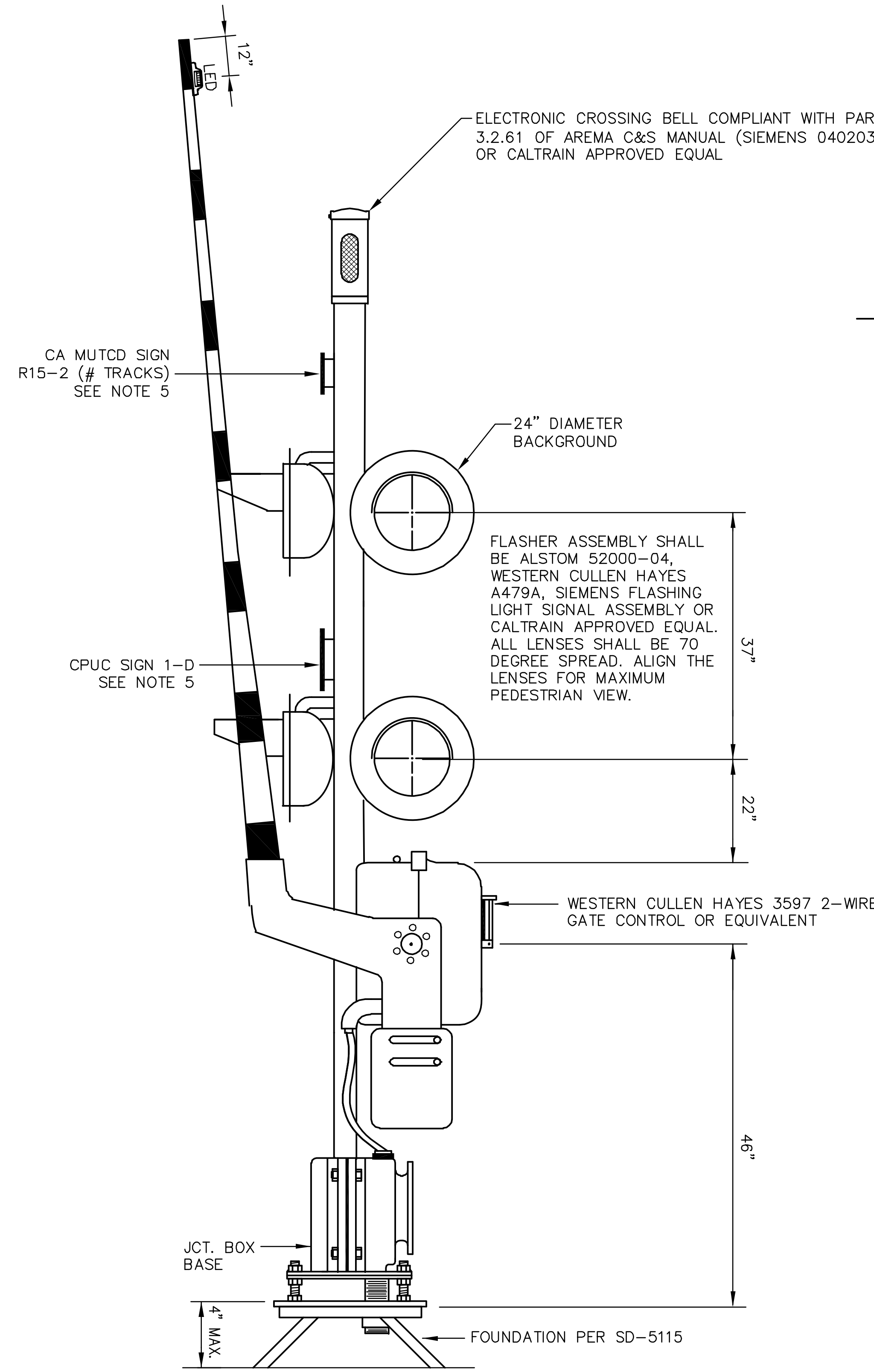


PLAN VIEW



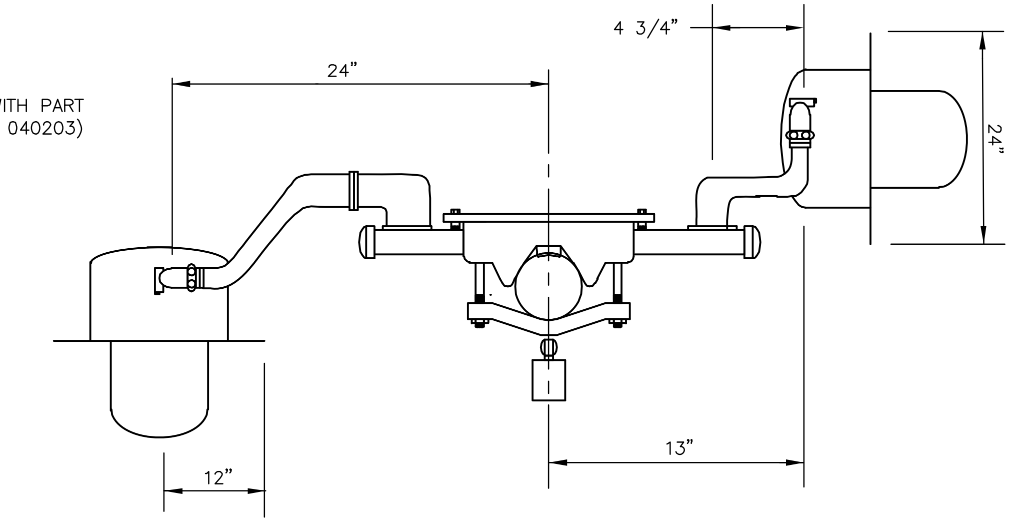
SIDE VIEW

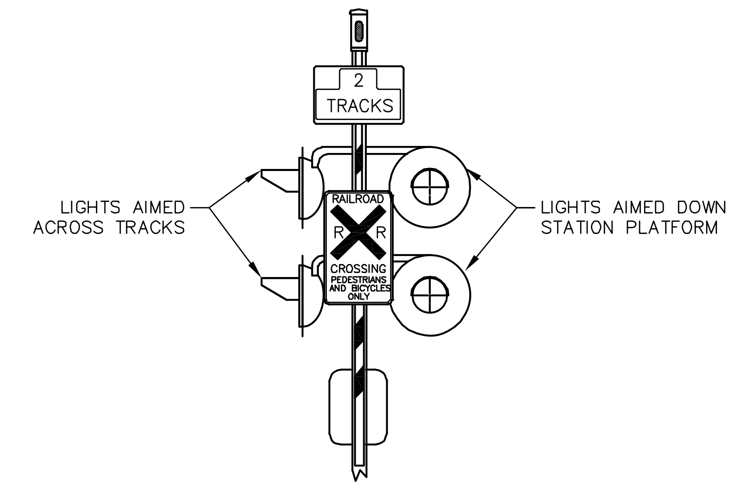
TYPICAL LOCATION



SIDE VIEW

GATE ASSEMBLY PER SD-5409 WITH ADDITION OF PEDESTRIAN APPURTENANCES





NOTES:

1. PER CPUC GENERAL ORDER #75D, SIGNALS AT ALL NEW LOCATIONS SHALL HAVE LED FLASHER ASSEMBLIES.
2. LIGHT ASSEMBLIES SHALL BE PLACED SO AS NOT TO INTERFERE WITH GATE ARM MOVEMENT.
3. INSTALL BACKLIGHTS WHERE NECESSARY.
4. LOCATE TIP LIGHT 12" FROM TIP OF GATE.
5. SEE SD-7000 SERIES DRAWINGS FOR SIGNAGE AND MOUNTING DETAILS.
6. SMOOTHEN GATE TIP TO REMOVE BURRS AND SHARP EDGES.
7. ENS SIGNS TO BE INSTALLED AS NEEDED TO FULLY COMPLY WITH FRA REGULATION 234.311.
8. GATE MECHANISM TO BE WESTERN CULLEN HAYES MODEL 3597 2-WIRE GATE CONTROL OR EQUIVALENT.

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					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP	

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

Bin Zhang

DEPUTY DIRECTOR, ENGINEERING

Caltrain

1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

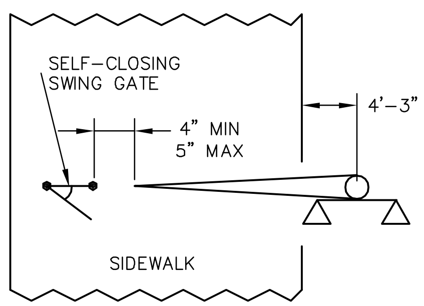
SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
PEDESTRIAN WARNING DEVICE
STATION PED CROSSING GATE

CADD FILE NAME: SD-5410

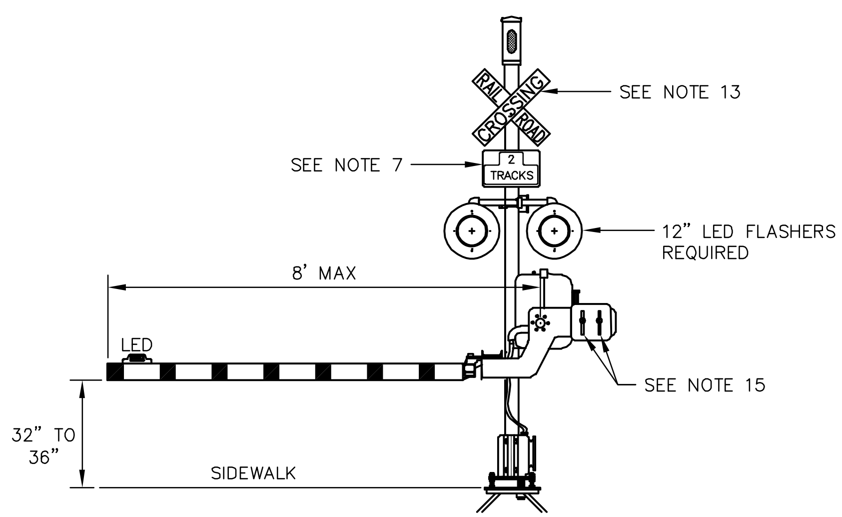
REV: | EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5410

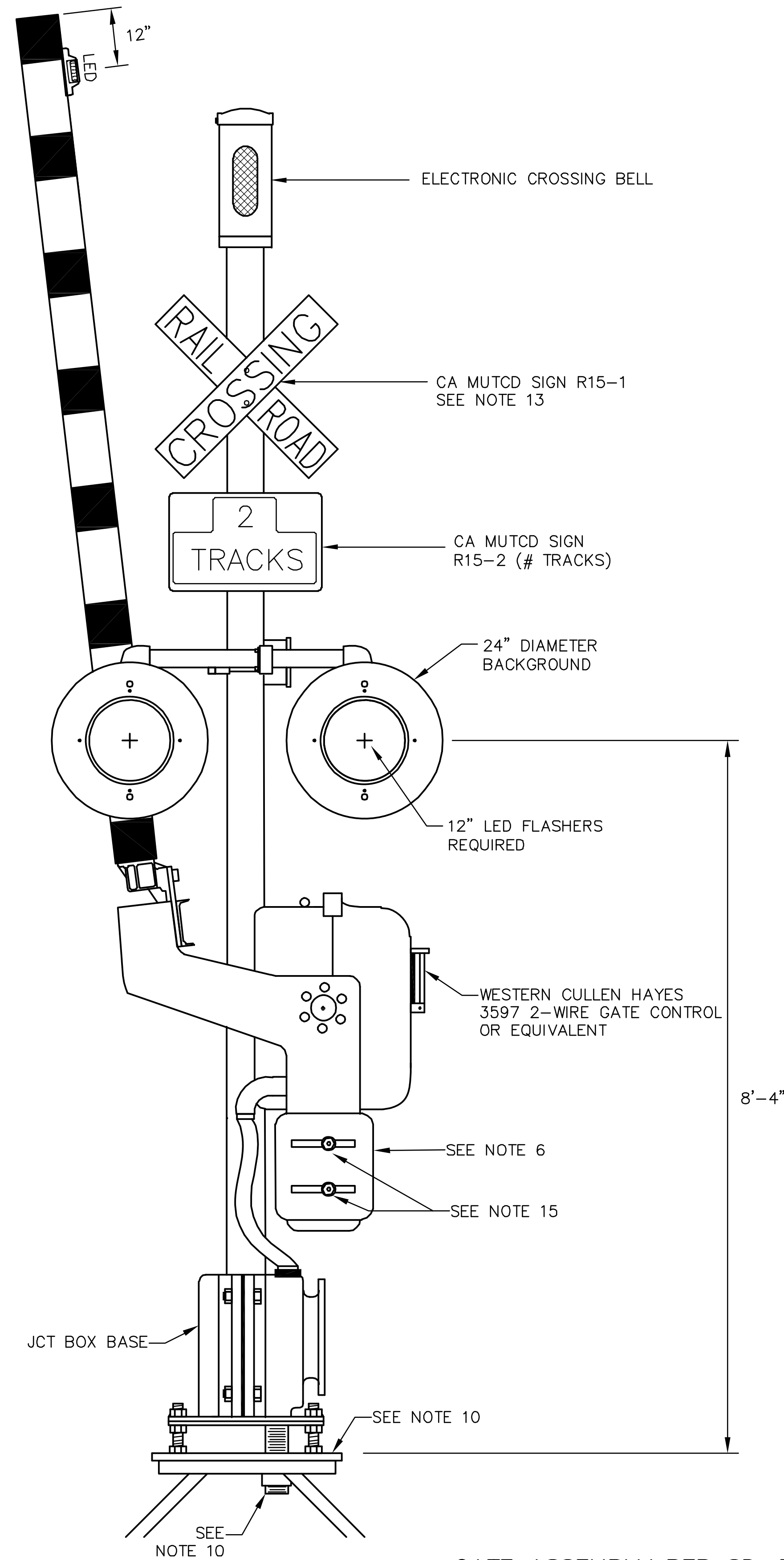


PLAN VIEW



SIDE VIEW

TYPICAL LOCATION



SIDE VIEW

GATE ASSEMBLY PER SD–5409 WITH
ADDITION OF PEDESTRIAN APPURTENANCES.

NOTES:

1. PER CPUC GENERAL ORDER 75D, SIGNALS AT ALL NEW LOCATIONS SHALL HAVE LED FLASHER ASSEMBLIES.
2. FLASHING LIGHT SIGNAL UNITS SHALL BE 12" LED TYPE DESIGNED TO OPERATE WITH A SOLID STATE CROSSING CONTROLLER AND SHALL CONFORM TO AREMA C&S MANUAL RECOMMENDATIONS.
3. 1–WAY OR 2–WAY LED FLASHER ASSEMBLIES SHALL INCLUDE JUNCTION BOX CROSS ARM ASSEMBLY AND LAMP MOUNTING BRACKETS PER AREMA C&S MANUAL PART 3.2.51, 12" LED LAMP UNITS, 24" STEEL BACKGROUNDS, STEEL HOODS AND ALL ASSOCIATED HARDWARE.
4. LIGHT ASSEMBLIES SHALL BE PLACED SO AS NOT TO INTERFERE WITH GATE ARM MOVEMENT.
5. INSTALL FLASHERS PER SITE SPECIFIC SIGNAL DRAWINGS.
6. WHEN COUNTER WEIGHTS ARE ADDED, ENSURE THAT SMALL PLATES ARE USED TO AVOID EXCESSIVE OVERHANG IN AREA PEDESTRIANS MAY OCCUPY.
7. SEE SD–7000 SERIES DRAWINGS FOR CIVIL DETAILS.
8. SMOOTHEN GATE TIP TO REMOVE BURRS AND SHARP EDGES.
9. CABLE ENTRY SHALL BE PROTECTED FROM RODENTS AND VANDALISM.
10. TOP OF FOUNDATION SHALL BE LEVEL WITH SIDEWALK.
11. FOR FLASHER HEIGHT SEE SD–5409 (PUC NO. 9).
12. ORIENTATION OF GATE ARM AND MECHANISM WILL VARY DEPENDING ON SITE SPECIFIC REQUIREMENTS. ORIENTATION AS SHOWN HERE FOR ILLUSTRATION PURPOSES ONLY.
13. INSTALL SIGNS EQUIDISTANT FROM FLASHERS AND ELECTRONIC BELL.
14. ON PEDESTRIAN GATES HALF ARM CAN BE USED ON OPPOSITE SIDE OF ARM WITH COUNTER WEIGHT.
15. ON PEDESTRIAN GATES EXCESS BOLT LENGTH SHALL BE REMOVED FROM SUPPORT BOLTS AFTER INSTALLATION OF COUNTER WEIGHTS.
16. ENS SIGNS TO BE INSTALLED AS NEEDED TO FULLY COMPLY WITH FRA REGULATION 234.311.
17. GATE MECHANISM TO BE WESTERN CULLEN HAYES MODEL 3597 2–WIRE GATE CONTROL OR EQUIVALENT.

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PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

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DEPUTY DIRECTOR, ENGINEERING

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
PEDESTRIAN WARNING DEVICE
AT VEHICLE CROSSINGS

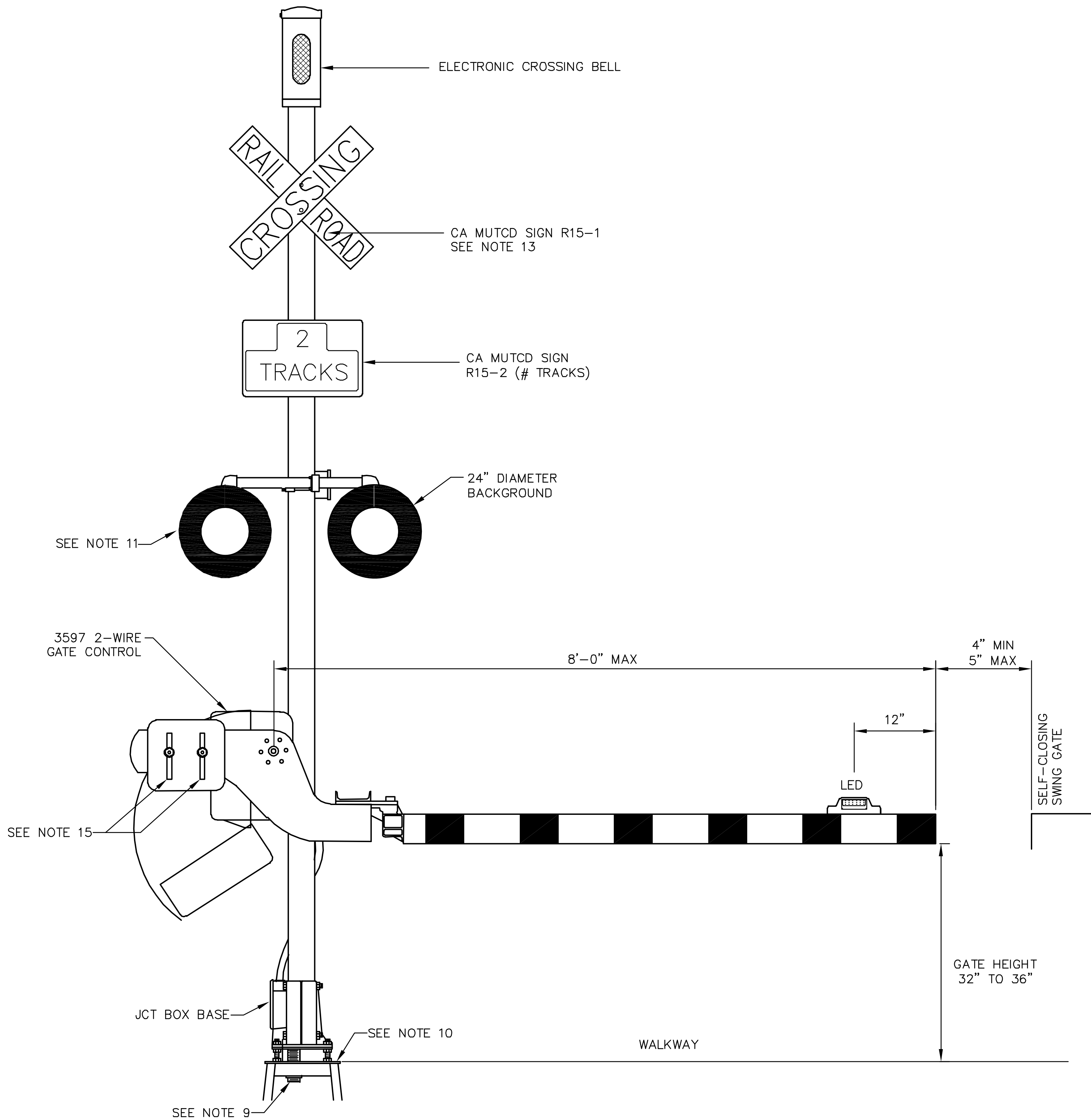
CADD FILE NAME: SD–5411

REV:

EDITION: FOURTH

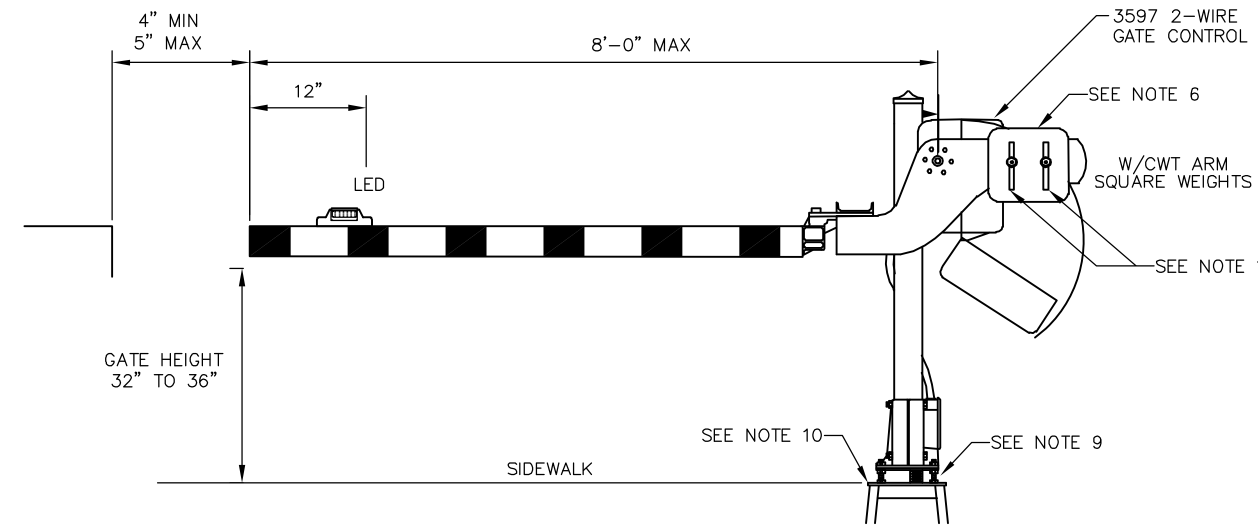
SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD–5411



PEDESTRIAN GATE ASSEMBLY FOR "OFF-QUADRANT" APPLICATIONS AND LED 12" FLASHERS

TYPICAL ASSEMBLY SHALL BE USED IN QUADRANTS THAT DO NOT HAVE ROADWAY WARNING DEVICES INSTALLED



PEDESTRIAN GATE WITH STUB MAST

TYPICAL ASSEMBLY SHALL BE USED IN QUADRANTS THAT HAVE ROADWAY WARNING DEVICES INSTALLED.

NOTES:

1. PER CPUC GENERAL ORDER 75D, SIGNALS AT ALL NEW LOCATIONS SHALL HAVE LED FLASHER ASSEMBLIES.
2. FLASHING LIGHT SIGNAL UNITS SHALL BE 12" LED TYPE DESIGNED TO OPERATE WITH A SOLID STATE CROSSING CONTROLLER AND SHALL CONFORM TO AREMA C&S MANUAL RECOMMENDATIONS.
3. 1-WAY OR 2-WAY LED FLASHER ASSEMBLIES SHALL INCLUDE JUNCTION BOX CROSS ARM ASSEMBLY AND LAMP MOUNTING BRACKETS PER AREMA C&S MANUAL PART 3.2.51, 12" LED LAMP UNITS, 24" STEEL BACKGROUNDS, STEEL HOODS AND ALL ASSOCIATED HARDWARE.
4. LIGHT ASSEMBLIES SHALL BE PLACED SO AS NOT TO INTERFERE WITH GATE ARM MOVEMENT.
5. INSTALL FLASHERS PER SITE SPECIFIC SIGNAL DRAWINGS.
6. WHEN COUNTER WEIGHTS ARE ADDED, ENSURE THAT SMALL PLATES ARE USED TO AVOID EXCESSIVE OVERHANG IN AREA PEDESTRIANS MAY OCCUPY.
7. SEE SD-7000 SERIES DRAWINGS FOR CIVIL DETAILS.
8. SMOOTHEN GATE TIP TO REMOVE BURRS AND SHARP EDGES.
9. CABLE ENTRY SHALL BE PROTECTED FROM RODENTS AND VANDALISM.
10. TOP OF FOUNDATION SHALL BE LEVEL WITH SIDEWALK.
11. FOR FLASHER HEIGHT SEE SD-5409 (PUC NO. 9).
12. ORIENTATION OF GATE ARM AND MECHANISM WILL VARY DEPENDING ON SITE SPECIFIC REQUIREMENTS. ORIENTATION AS SHOWN HERE FOR ILLUSTRATION PURPOSES ONLY.
13. INSTALL SIGNS EQUIDISTANT FROM FLASHERS AND ELECTRONIC BELL.
14. ON PEDESTRIAN GATES HALF ARM CAN BE USED ON OPPOSITE SIDE OF ARM WITH COUNTER WEIGHT.
15. ON PEDESTRIAN GATES EXCESS BOLT LENGTH SHALL BE REMOVED FROM SUPPORT BOLTS AFTER INSTALLATION OF COUNTER WEIGHTS.
16. ENS SIGNS TO BE INSTALLED AS NEEDED TO FULLY COMPLY WITH FRA REGULATION 234.311.
17. GATE MECHANISM TO BE WESTERN CULLEN HAYES MODEL 3597 2-WIRE GATE CONTROL OR EQUIVALENT.

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PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

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DEPUTY DIRECTOR, ENGINEERING

Caltrain

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San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
PEDESTRIAN GATE ASSEMBLY
AT VEHICLE CROSSINGS

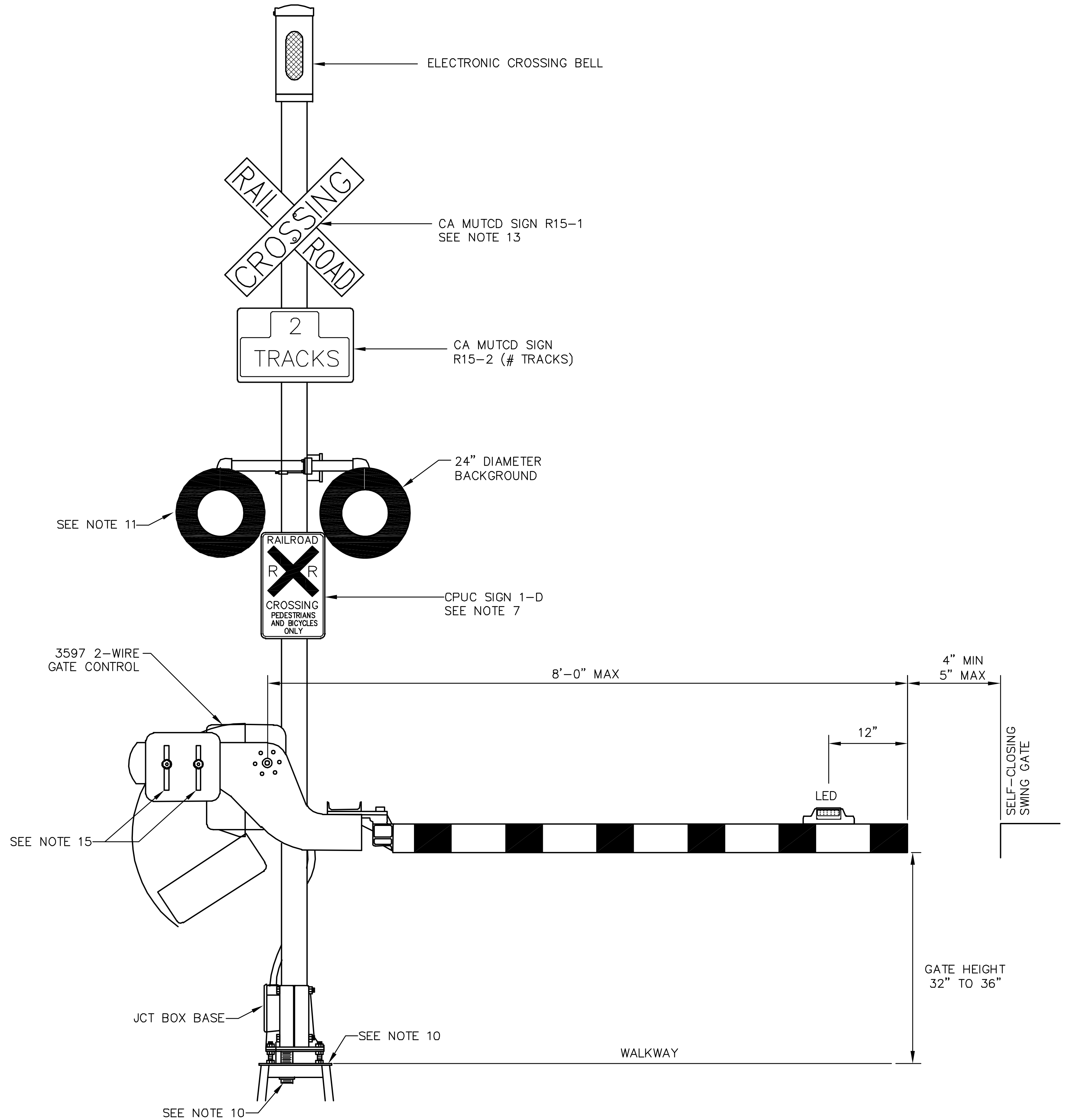
CADD FILE NAME: SD-5412

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5412



PED GATE WITH ELECTRONIC BELL, LED 12" FLASHERS AND CPUC STD. 1-D

NOTES:

1. PER CPUC GENERAL ORDER 75D, SIGNALS AT ALL NEW LOCATIONS SHALL HAVE LED FLASHER ASSEMBLIES.
2. FLASHING LIGHT SIGNAL UNITS SHALL BE 12" LED TYPE DESIGNED TO OPERATE WITH A SOLID STATE CROSSING CONTROLLER AND SHALL CONFORM TO AREMA C&S MANUAL RECOMMENDATIONS.
3. 1-WAY OR 2-WAY LED FLASHER ASSEMBLIES SHALL INCLUDE JUNCTION BOX CROSS ARM ASSEMBLY AND LAMP MOUNTING BRACKETS PER AREMA C&S MANUAL PART 3.2.51, 12" LED LAMP UNITS, 24" STEEL BACKGROUNDS, STEEL HOODS AND ALL ASSOCIATED HARDWARE.
4. LIGHT ASSEMBLIES SHALL BE PLACED SO AS NOT TO INTERFERE WITH GATE ARM MOVEMENT.
5. INSTALL FLASHERS PER SITE SPECIFIC SIGNAL DRAWINGS.
6. WHEN COUNTER WEIGHTS ARE ADDED, ENSURE THAT SMALL PLATES ARE USED TO AVOID EXCESSIVE OVERHANG IN AREA PEDESTRIANS MAY OCCUPY.
7. SEE SD-7000 SERIES DRAWINGS FOR CIVIL DETAILS.
8. SMOOTHEN GATE TIP TO REMOVE BURRS AND SHARP EDGES.
9. CABLE ENTRY SHALL BE PROTECTED FROM RODENTS AND VANDALISM.
10. TOP OF FOUNDATION SHALL BE LEVEL WITH SIDEWALK.
11. FOR FLASHER HEIGHT SEE SD-5409 (PUC NO. 9).
12. ORIENTATION OF GATE ARM AND MECHANISM WILL VARY DEPENDING ON SITE SPECIFIC REQUIREMENTS. ORIENTATION AS SHOWN HERE FOR ILLUSTRATION PURPOSES ONLY.
13. INSTALL SIGNS EQUIDISTANT FROM FLASHERS AND ELECTRONIC BELL.
14. ON PEDESTRIAN GATES HALF ARM CAN BE USED ON OPPOSITE SIDE OF ARM WITH COUNTER WEIGHT.
15. ON PEDESTRIAN GATES EXCESS BOLT LENGTH SHALL BE REMOVED FROM SUPPORT BOLTS AFTER INSTALLATION OF COUNTER WEIGHTS.
16. ENS SIGNS TO BE INSTALLED AS NEEDED TO FULLY COMPLY WITH FRA REGULATION 234.311.
17. GATE MECHANISM TO BE WESTERN CULLEN HAYES MODEL 3597 2-WIRE GATE CONTROL OR EQUIVALENT.

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REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY: Bin Zhang

DEPUTY DIRECTOR, ENGINEERING

Caltrain
1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
PEDESTRIAN WARNING DEVICE
FOR PEDESTRIAN AND BICYCLE
ONLY CROSSINGS

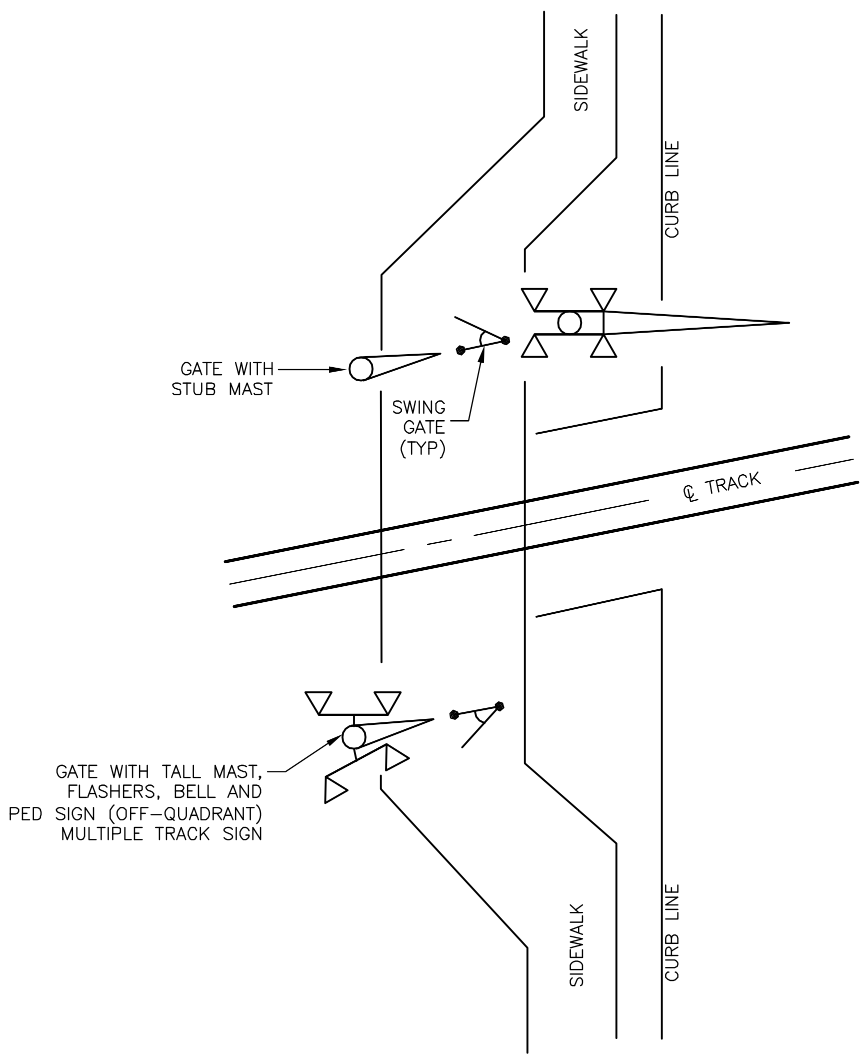
CADD FILE NAME: SD-5413

REV: EDITION: FOURTH

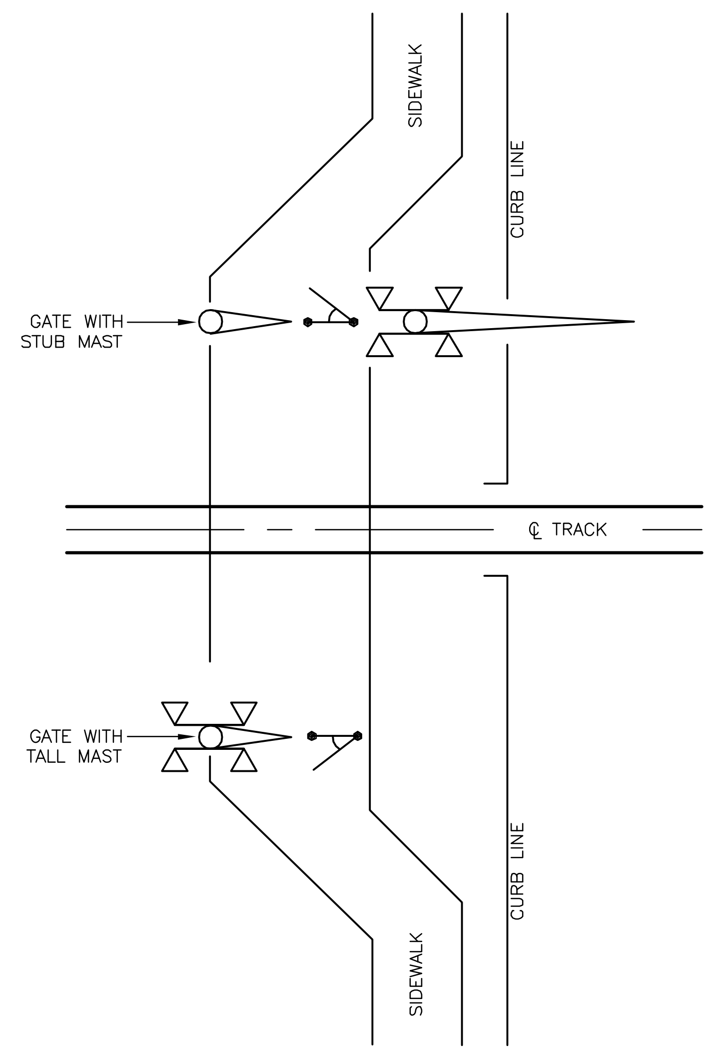
SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5413

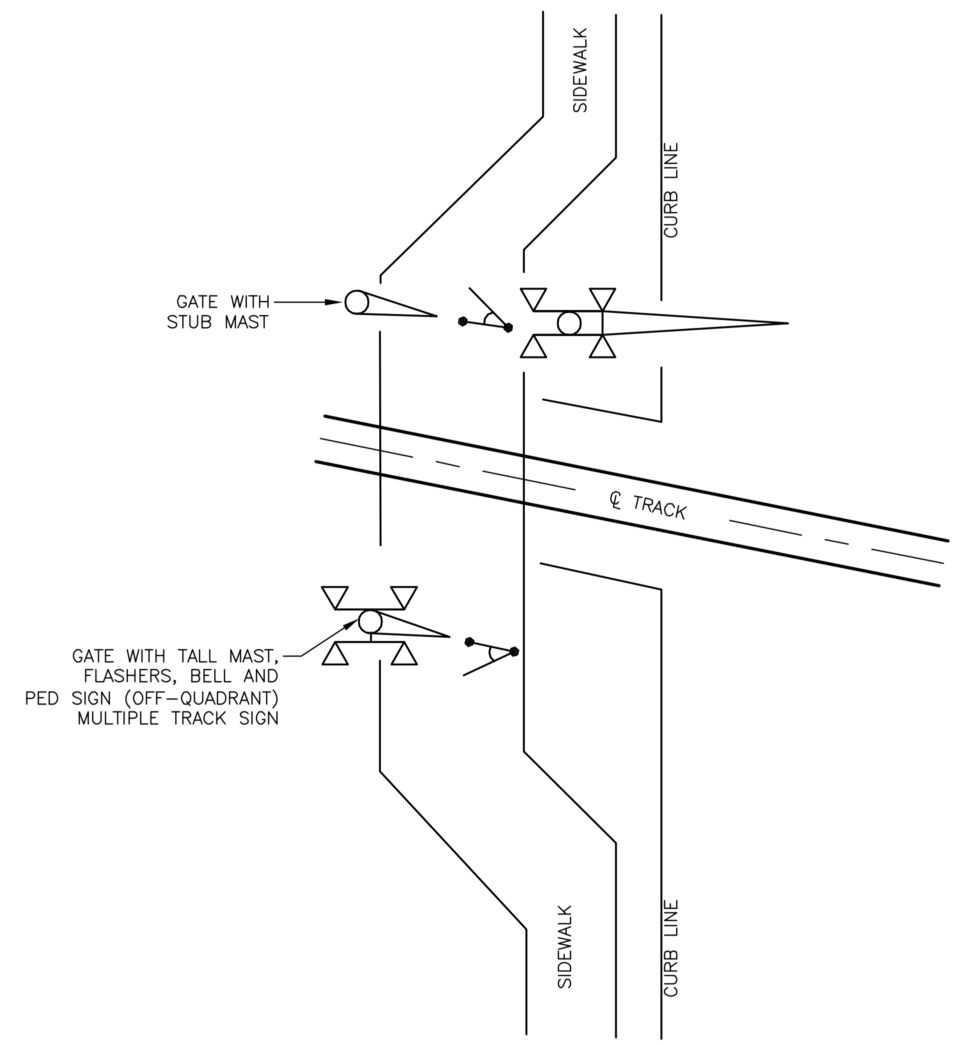
EXAMPLE OF PEDESTRIAN
TREATMENT AT GRADE CROSSING
WITH ENTRANCE GATE ONLY



EXAMPLE OF PEDESTRIAN
TREATMENT AT GRADE CROSSING
WITH ENTRANCE GATE ONLY



EXAMPLE OF PEDESTRIAN
TREATMENT AT GRADE CROSSING
WITH ENTRANCE GATE ONLY



NOTE:

TO MINIMIZE CROSSING DISTANCE, THE PEDESTRIAN GATE SHALL BE PARALLEL TO TRACKS. ALIGN WITH EITHER SIDE OF THE VEHICULAR GATE COUNTER WEIGHT THAT PROVIDES 12' MIN AND 15' MAX (TRACK CENTER TO PED SIGNAL MAST)

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Bin Zhang

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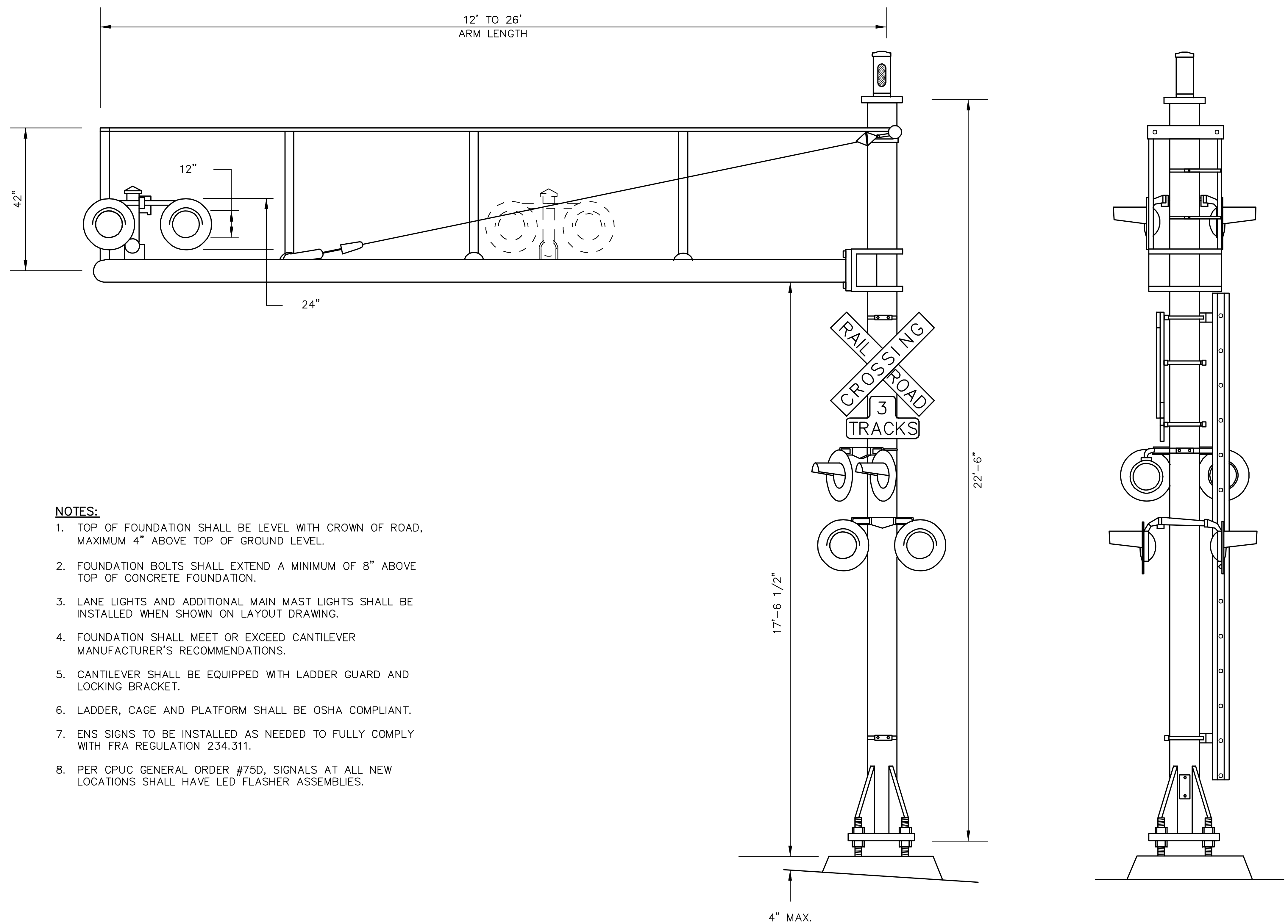
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
PEDESTRIAN WARNING DEVICE LAYOUT
AT VEHICLE CROSSINGS

CADD FILE NAME: SD–5414
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD–5414



FRONT VIEW

SIDE VIEW

NOTES:

1. TOP OF FOUNDATION SHALL BE LEVEL WITH CROWN OF ROAD, MAXIMUM 4" ABOVE TOP OF GROUND LEVEL.
2. FOUNDATION BOLTS SHALL EXTEND A MINIMUM OF 8" ABOVE TOP OF CONCRETE FOUNDATION.
3. LANE LIGHTS AND ADDITIONAL MAIN MAST LIGHTS SHALL BE INSTALLED WHEN SHOWN ON LAYOUT DRAWING.
4. FOUNDATION SHALL MEET OR EXCEED CANTILEVER MANUFACTURER'S RECOMMENDATIONS.
5. CANTILEVER SHALL BE EQUIPPED WITH LADDER GUARD AND LOCKING BRACKET.
6. LADDER, CAGE AND PLATFORM SHALL BE OSHA COMPLIANT.
7. ENS SIGNS TO BE INSTALLED AS NEEDED TO FULLY COMPLY WITH FRA REGULATION 234.311.
8. PER CPUC GENERAL ORDER #75D, SIGNALS AT ALL NEW LOCATIONS SHALL HAVE LED FLASHER ASSEMBLIES.

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REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

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DEPUTY DIRECTOR, ENGINEERING

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San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
MODEL "W" WALKOUT
CANTILEVER SIGNAL

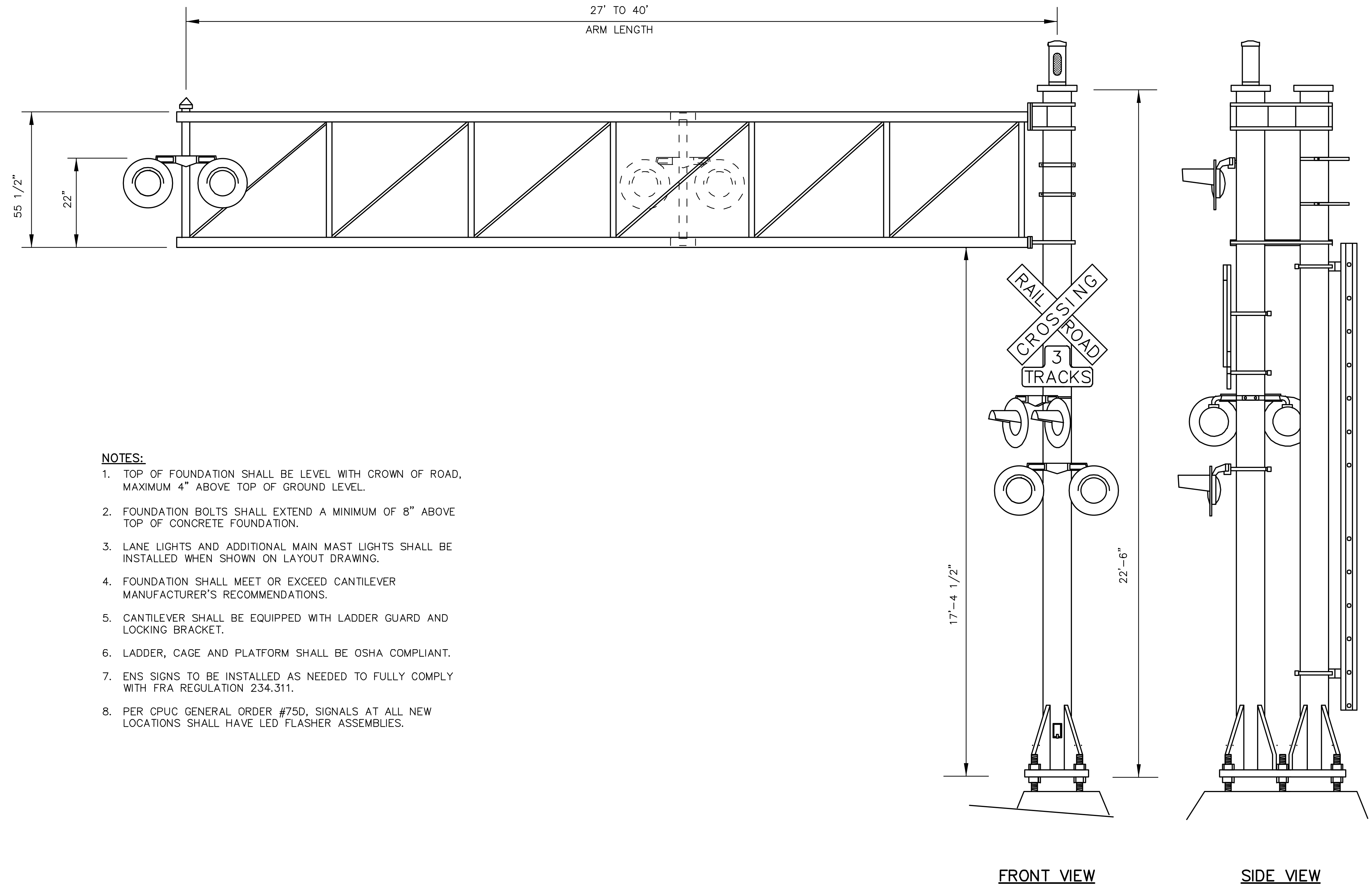
CADD FILE NAME: SD-5415

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5415



NOTES:

1. TOP OF FOUNDATION SHALL BE LEVEL WITH CROWN OF ROAD, MAXIMUM 4" ABOVE TOP OF GROUND LEVEL.
2. FOUNDATION BOLTS SHALL EXTEND A MINIMUM OF 8" ABOVE TOP OF CONCRETE FOUNDATION.
3. LANE LIGHTS AND ADDITIONAL MAIN MAST LIGHTS SHALL BE INSTALLED WHEN SHOWN ON LAYOUT DRAWING.
4. FOUNDATION SHALL MEET OR EXCEED CANTILEVER MANUFACTURER'S RECOMMENDATIONS.
5. CANTILEVER SHALL BE EQUIPPED WITH LADDER GUARD AND LOCKING BRACKET.
6. LADDER, CAGE AND PLATFORM SHALL BE OSHA COMPLIANT.
7. ENS SIGNS TO BE INSTALLED AS NEEDED TO FULLY COMPLY WITH FRA REGULATION 234.311.
8. PER CPUC GENERAL ORDER #75D, SIGNALS AT ALL NEW LOCATIONS SHALL HAVE LED FLASHER ASSEMBLIES.

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REV	DATE	BY	CHK	APP	DESCRIPTION

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:
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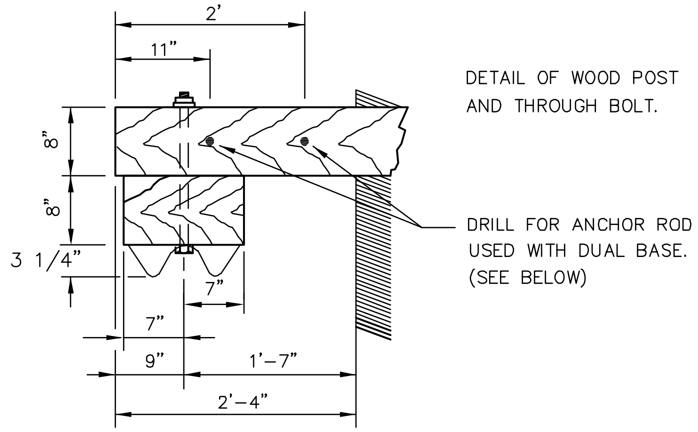
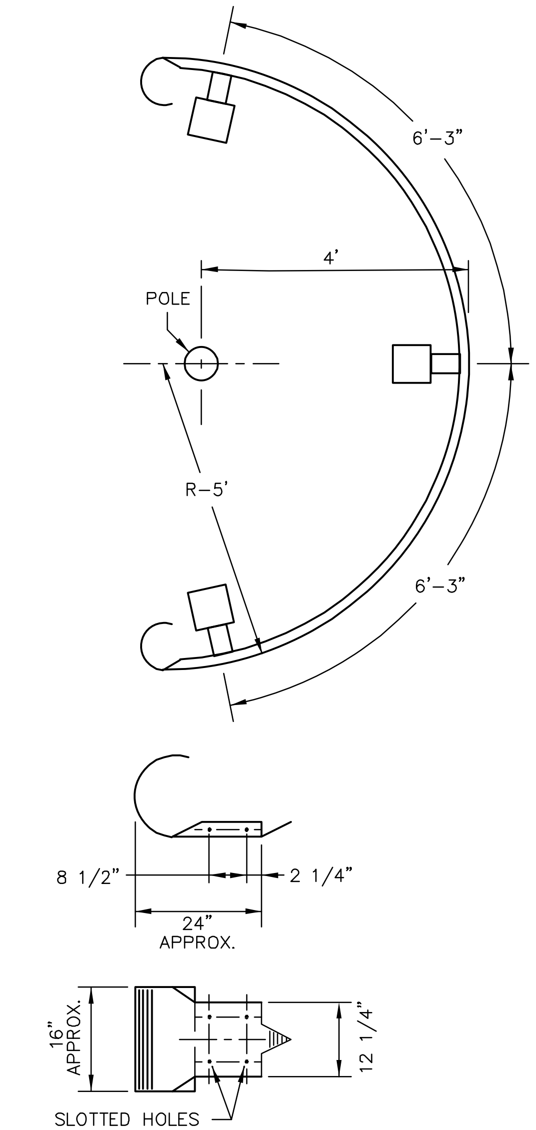
1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

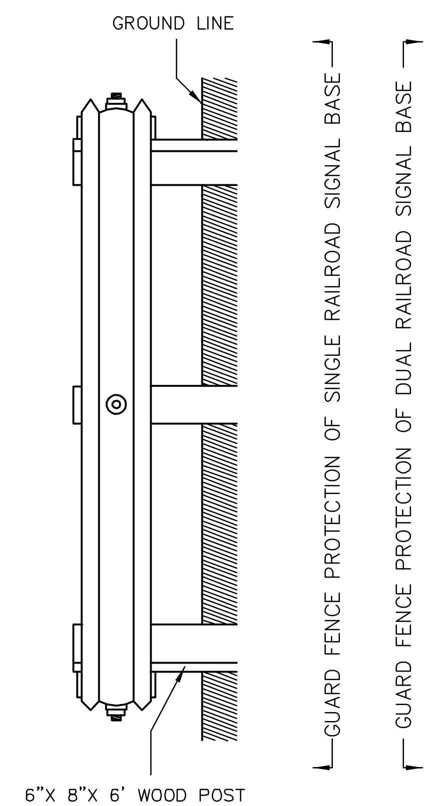
SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
MODEL "WNR" WALKOUT
CANTILEVER SIGNAL

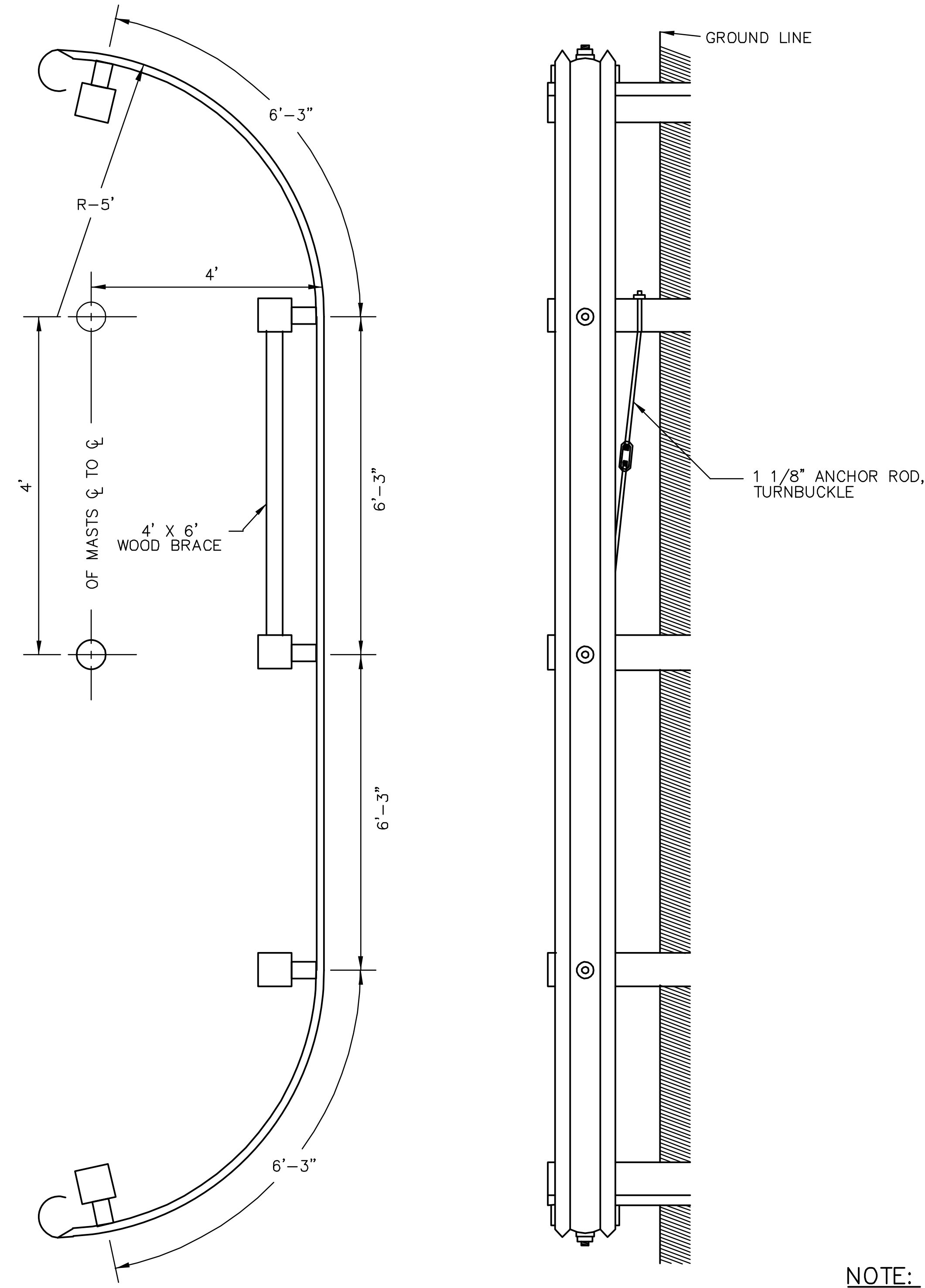
CADD FILE NAME: SD-5416
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5416





DETAIL OF TERMINAL SECTION





NOTE:
GUARD RAILS SHALL NOT BE INSTALLED WITHOUT APPROVAL OF CALTRAIN

REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP	

PENINSULA CORRIDOR JOINT POWERS BOARD

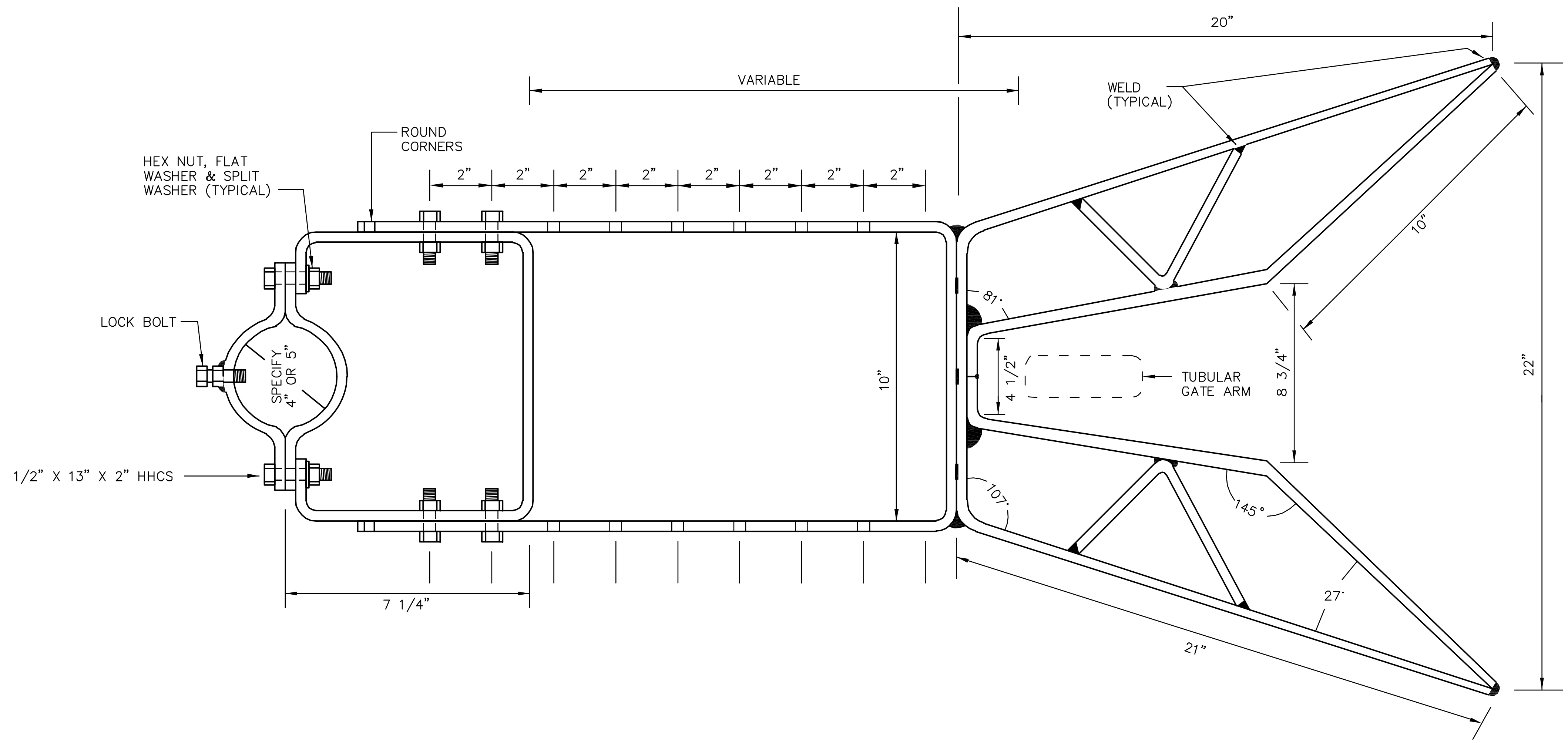
APPROVED BY:
Bin Zhang
DEPUTY DIRECTOR, ENGINEERING

Caltrain
1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
TYPICAL GUARD RAILS
FOR HIGHWAY CROSSINGS

CADD FILE NAME: SD-5417
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5417



NOTES:

1. ALL HARDWARE SHALL BE 1/2" X 13" X 1 1/2" EXCEPT AS NOTED.
2. SUPPORT SHALL BE CONSTRUCTED OF 1/4" X 2" FLAT BAR ALUMINUM 6061T6 OR 6063T5 OR MATERIAL OF EQUIVALENT TENSILE STRENGTH AND CORROSION RESISTANCE.
3. MAINTAIN MUTCD MINIMUM CLEARANCE

REV	DATE	BY	CHK	APP	DESCRIPTION
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PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:
Bin Zhang
DEPUTY DIRECTOR, ENGINEERING

Caltrain
1250 San Carlos Avenue
San Carlos, CA 94070

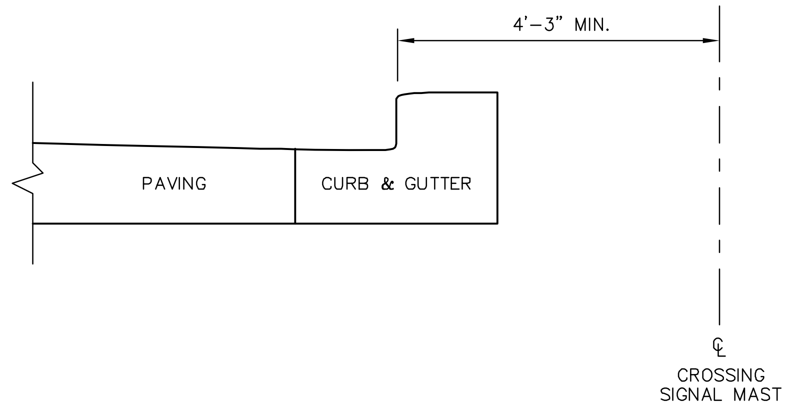
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
WIND SUPPORT FOR
TUBULAR GATE ARM

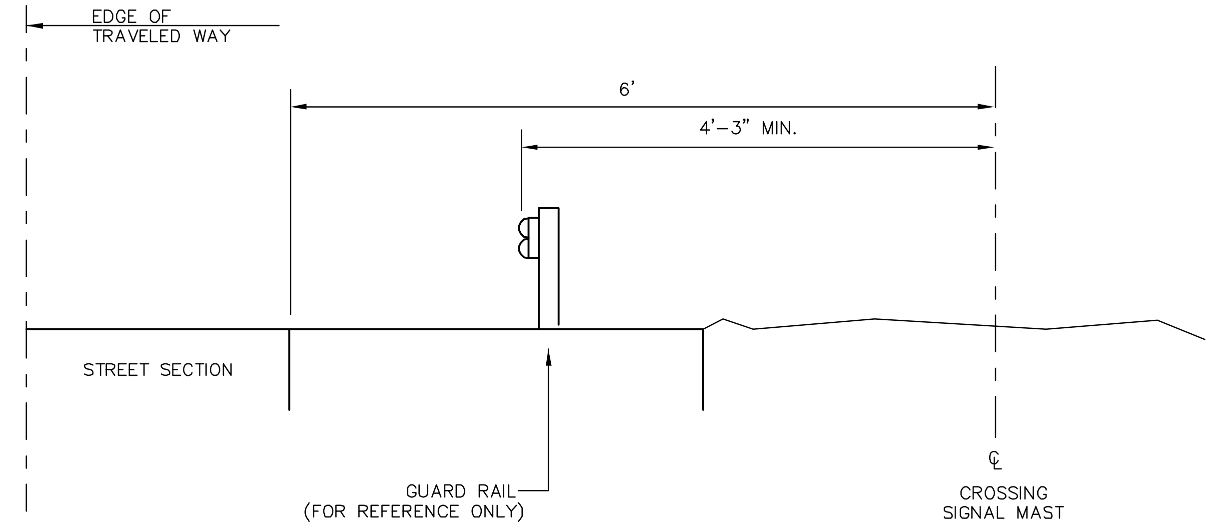
CADD FILE NAME: SD-5418
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5418

NOTE:

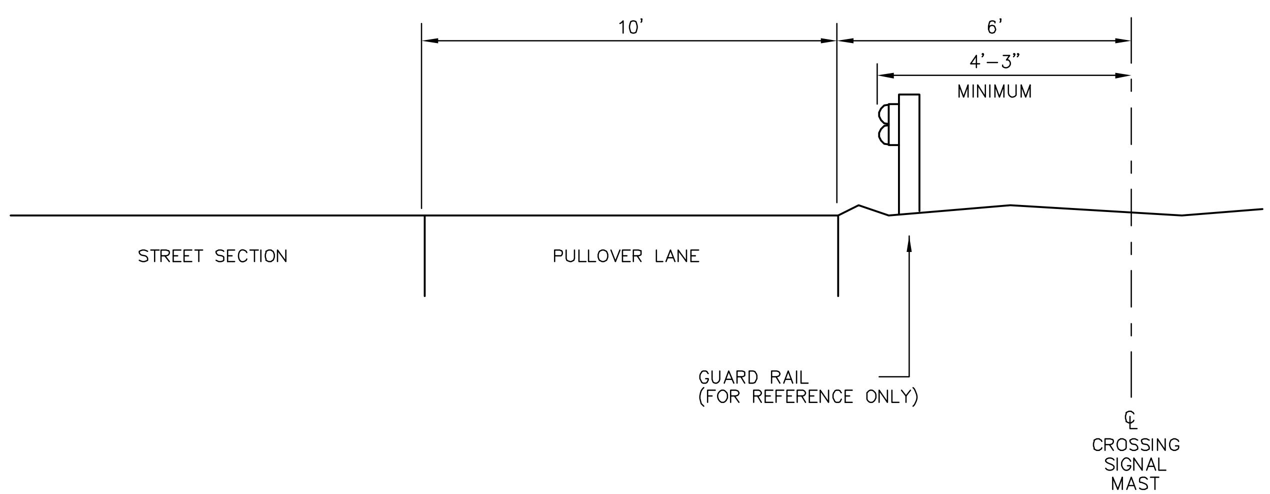
GUARD RAILS ARE ONLY USED WHEN APPROVED BY CALTRAIN



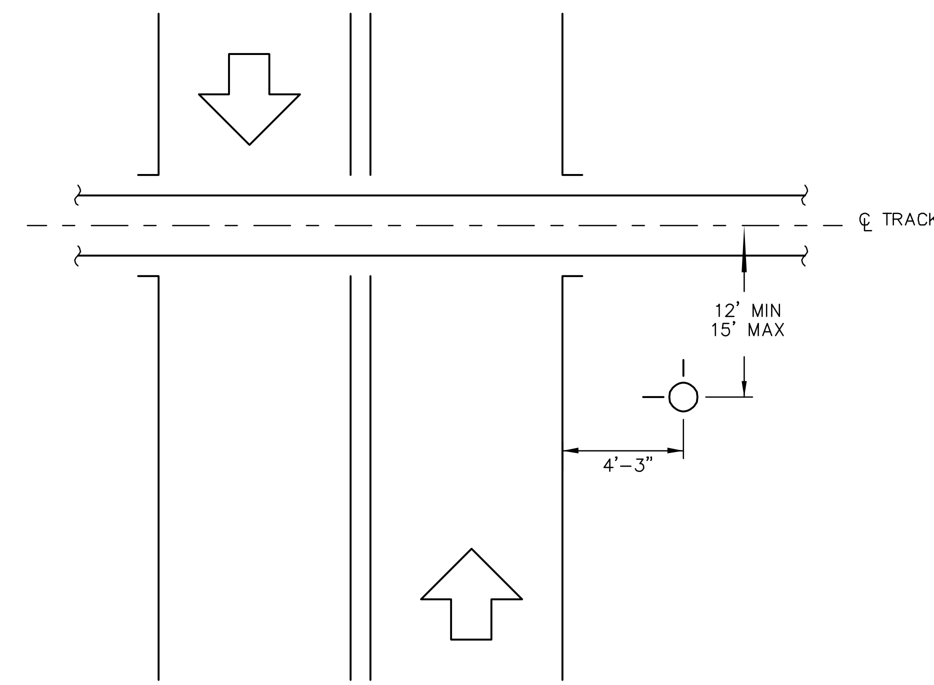
LOCATION OF AUTOMATIC WARNING DEVICE FROM CURB



LOCATION OF AUTOMATIC WARNING DEVICE
FROM ROADWAY WITH NO CURB



LOCATION OF AUTOMATIC WARNING DEVICE
FROM PULLOVER OR DECELERATION LANE



LOCATION OF AUTOMATIC WARNING
DEVICE FROM ℄ OF TRACK

REV	DATE	BY	CHK	APP	DESCRIPTION
	01012024				FOURTH EDITION

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

Bin Zhang

DEPUTY DIRECTOR, ENGINEERING

Caltrain

1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
HIGHWAY GRADE CROSSING
WARNING DEVICES

CADD FILE NAME: SD–5419

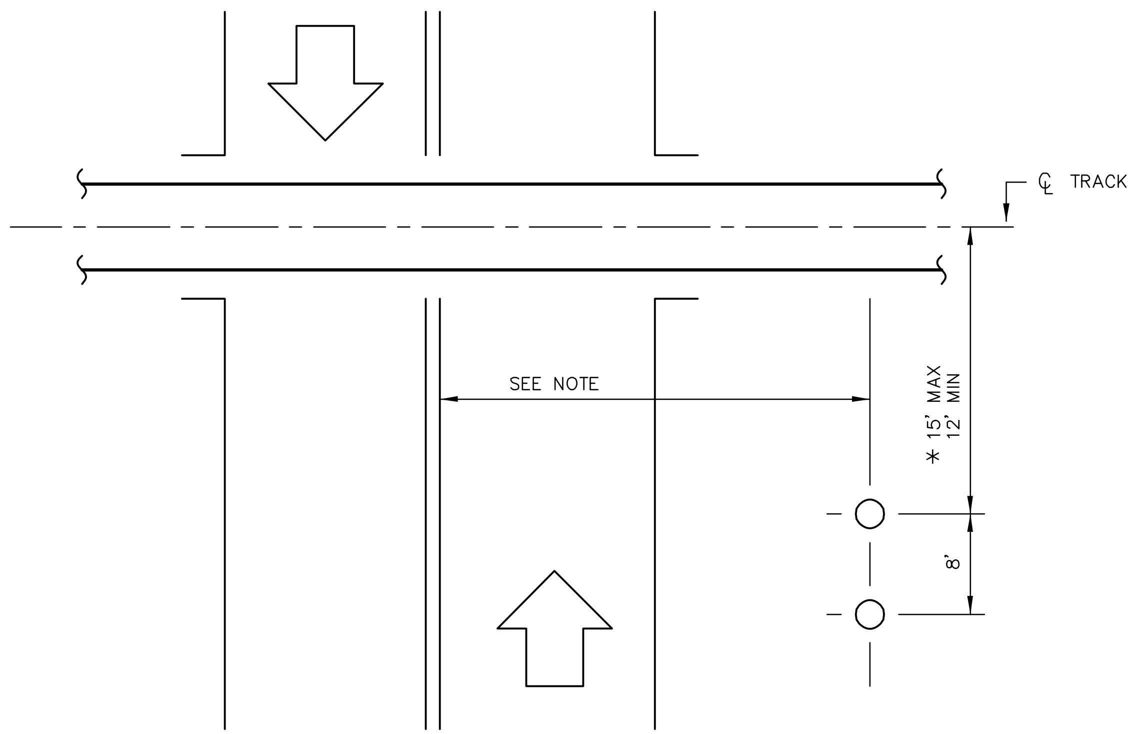
REV:

EDITION: FOURTH

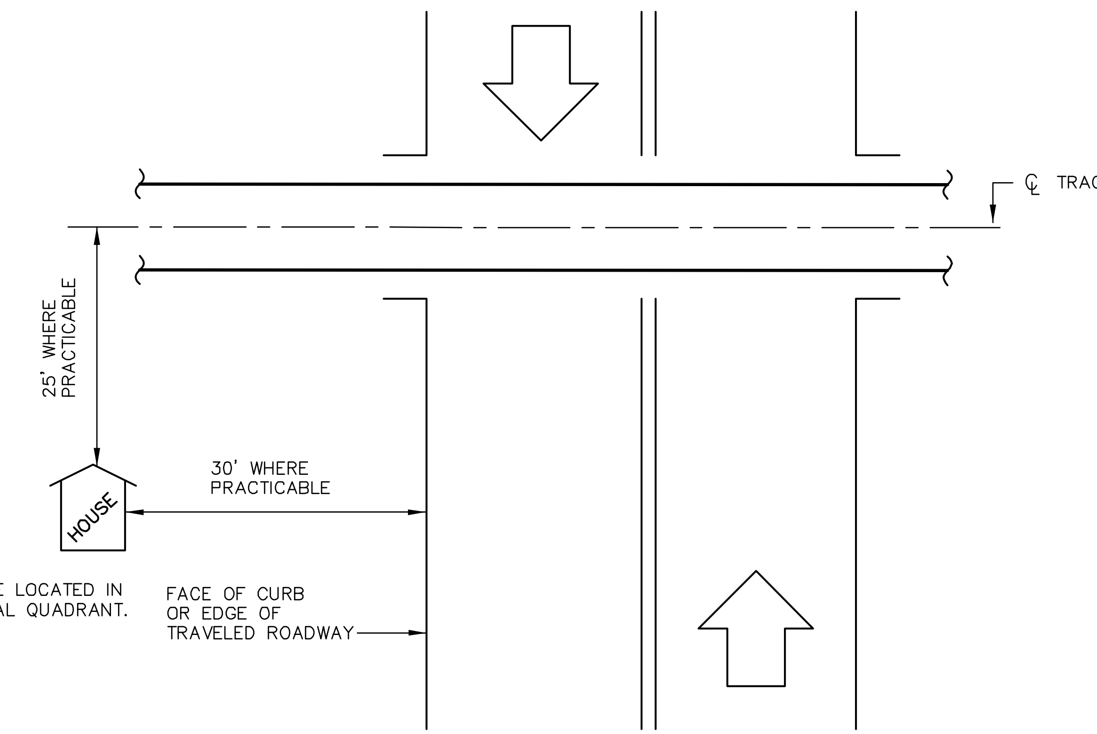
SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD–5419

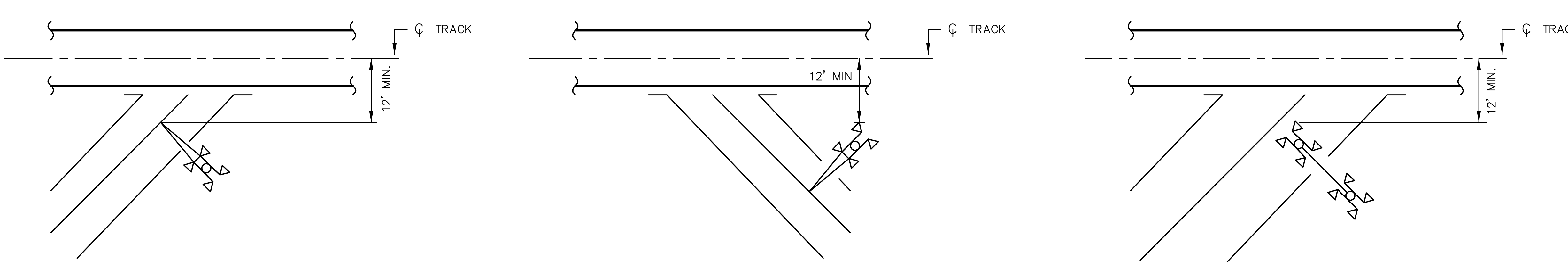
LOCATION OF AUTOMATIC WARNING DEVICE WHERE CANTILEVERS AND GATES ARE REQUIRED



LOCATION OF HOUSE FROM STREET AND TRACK



NOTE:
HOUSE CAN BE LOCATED IN EITHER NEUTRAL QUADRANT.



MINIMUM CLEARANCE OF AUTOMATIC WARNING DEVICES ANGLED CROSSINGS

NOTE:
EITHER CANTILEVER OR GATE MAY BE CLOSEST TO TRACK AS LOCAL CONDITIONS REQUIRE AND IF AUTHORIZED BY CALTRAIN.

REV	DATE	BY	CHK	APP	DESCRIPTION
	01012024				FOURTH EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
LOCATION OF AUTOMATIC
WARNING DEVICES

CADD FILE NAME: SD-5420
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5420

NOT USED.

REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP	

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS

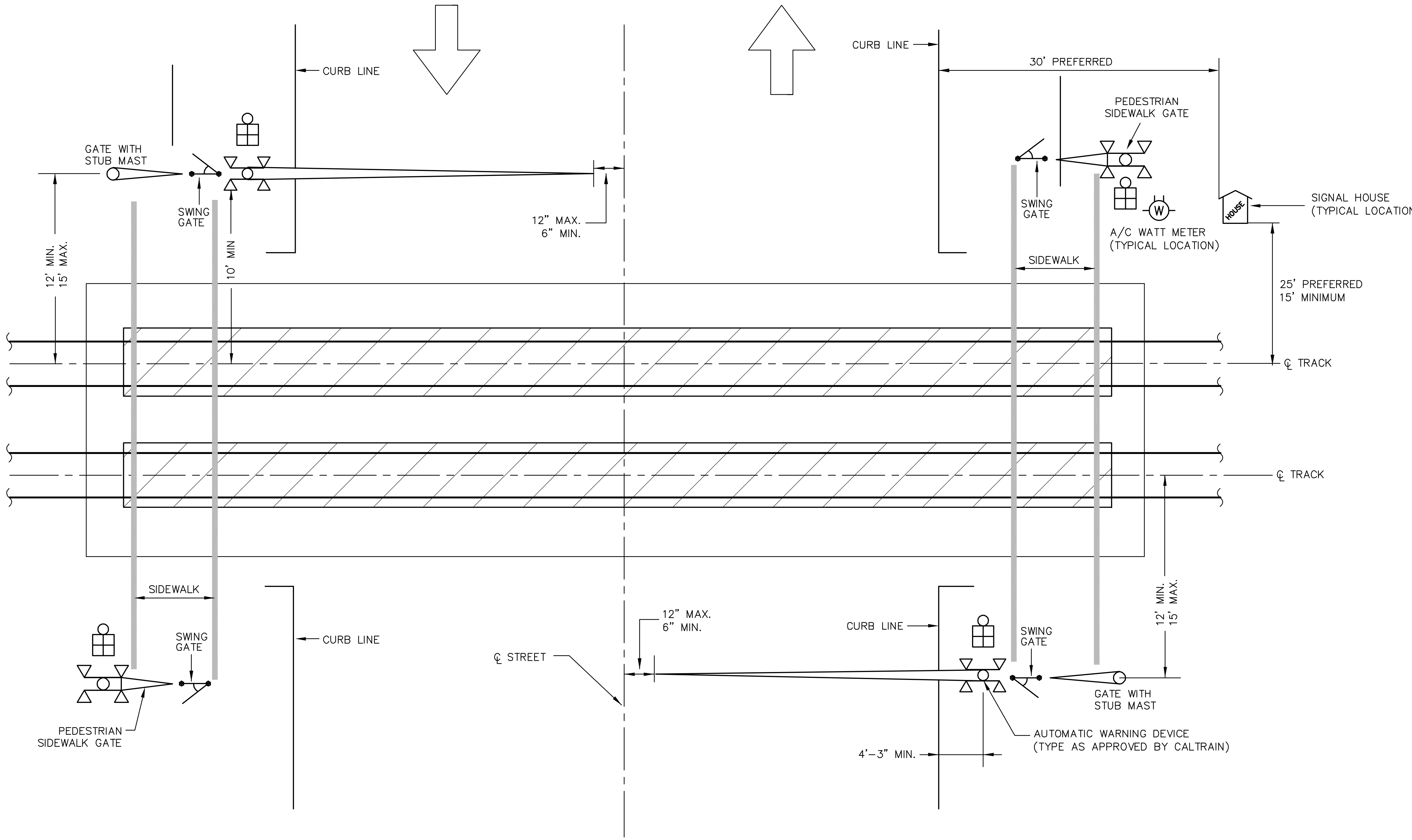
CADD FILE NAME: SD-5421

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5421



NOTES:

1. MAXIMUM VEHICULAR GATE LENGTH IS 32'. IF MORE THAN TWO LANES IN ONE DIRECTION USE CANTILEVER.
2. INSTALL ONE BELL PER QUADRANT.

REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
HIGHWAY GRADE CROSSING
TYPICAL 2-LANE WITH
PEDESTRIAN GATE

CADD FILE NAME: SD-5422

REV: | EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5422

NOT USED.

REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP	

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS

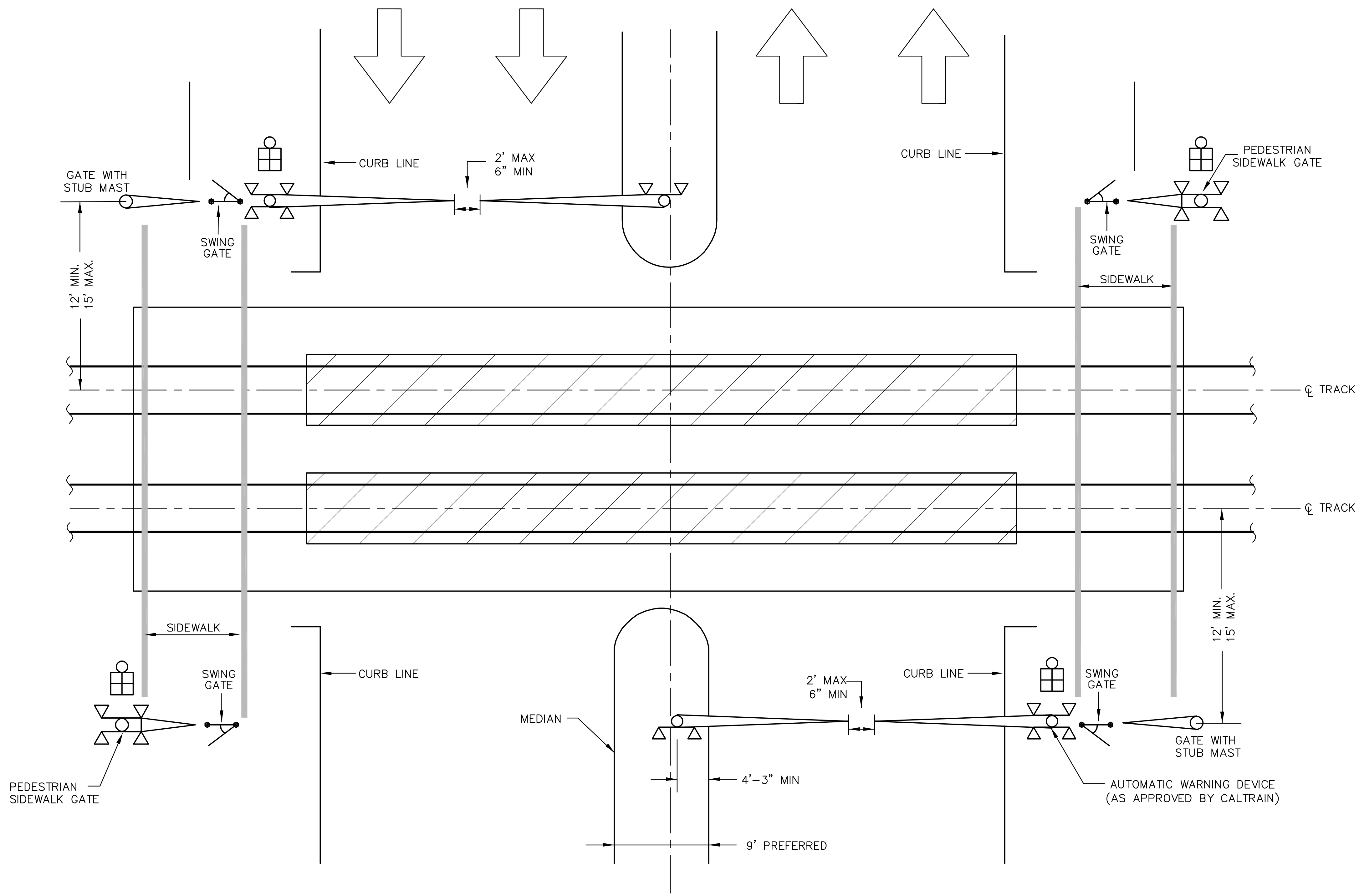
CADD FILE NAME: SD-5423

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5423



NOTES:

1. MAXIMUM VEHICULAR GATE LENGTH IS 32'. IF MORE THAN TWO LANES IN ONE DIRECTION USE CANTILEVER.
2. INSTALL ONE BELL PER QUADRANT.

REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP	

PENINSULA CORRIDOR JOINT POWERS BOARD

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
HIGHWAY GRADE CROSSING W/ MEDIAN
TYPICAL 4-LANE WITH
PEDESTRIAN GATE

CADD FILE NAME: SD-5421

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5424

NOT USED.

REV	DATE	BY	CHK	APP	DESCRIPTION
	01012024				FOURTH EDITION

REV	DATE	BY	CHK	APP	DESCRIPTION

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS

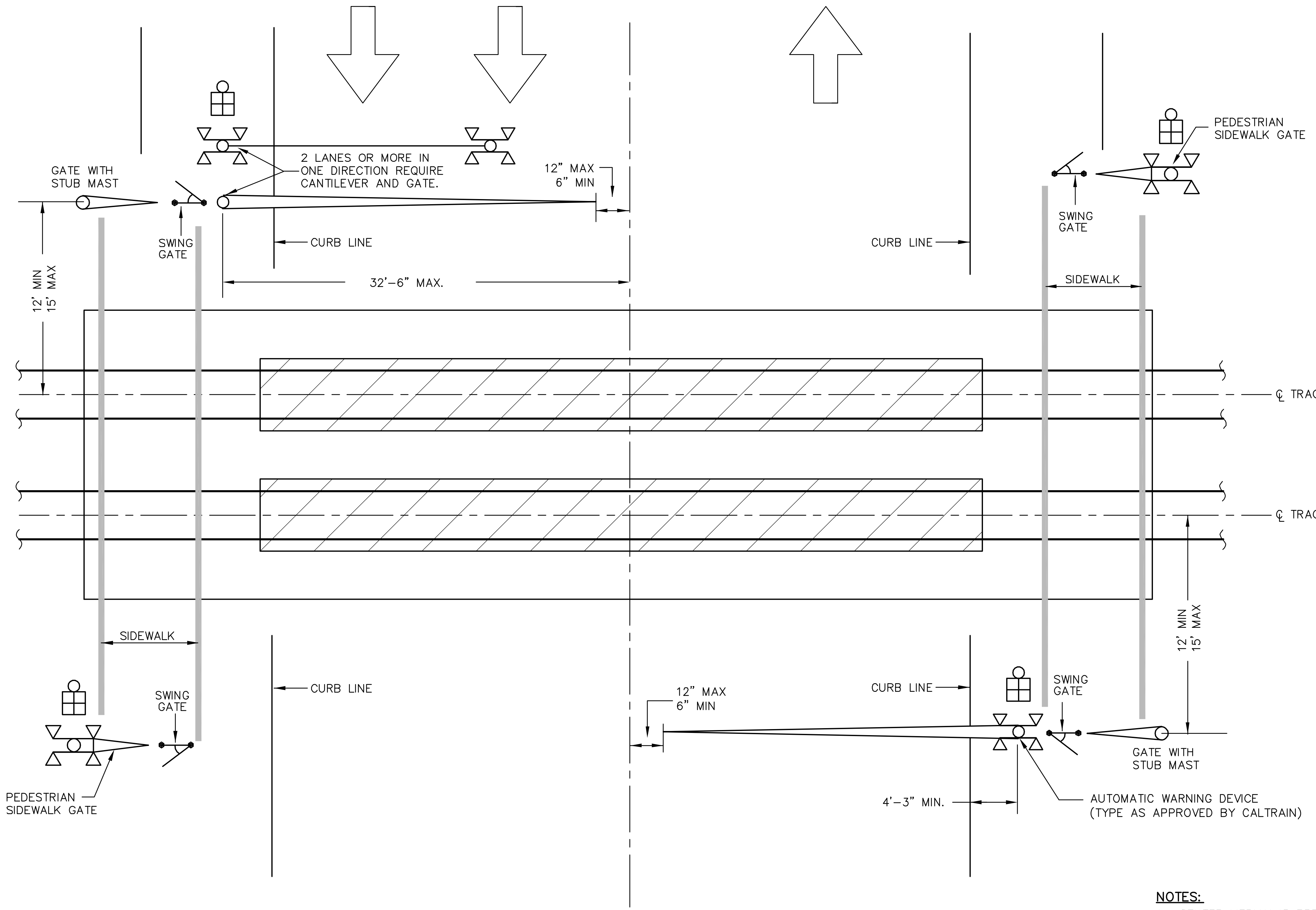
CADD FILE NAME: SD-5425

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5425



NOTES:

1. CENTER MEDIAN IS PREFERRED. WHERE DISTANCE OF GATE MAST TO CENTERLINE OF STREET IS GREATER THAN 32'-6", A 9' MEDIAN WITH FLASHER AND GATE SHALL BE INSTALLED. IF OVER TWO LANES PER DIRECTION, CANTILEVER AND GATES ARE REQUIRED. MAXIMUM GATE LENGTH, 32'.

2. INSTALL ONE BELL PER QUADRANT.

REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
HIGHWAY GRADE CROSSING NO MEDIAN
TYPICAL 3-LANE WITH
PEDESTRIAN GATE

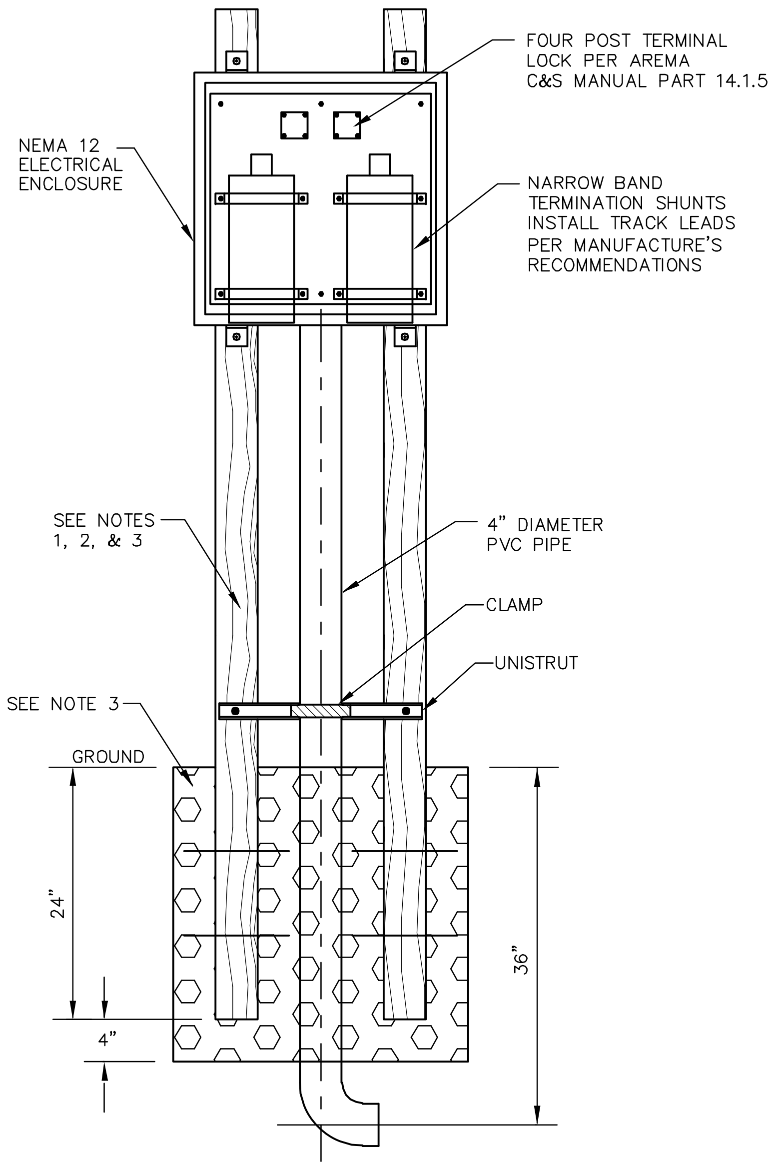
CADD FILE NAME: SD-5426

REV:

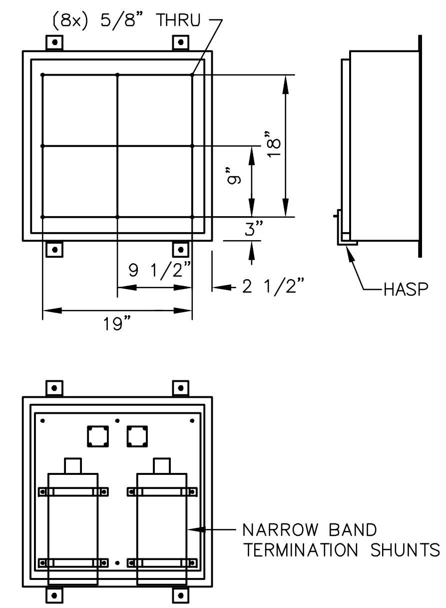
EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

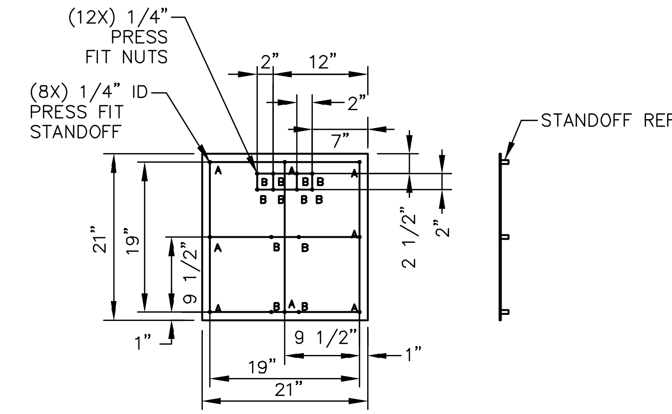
STANDARD DRAWING NO.: SD-5426



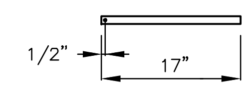
SHUNT ENCLOSURE



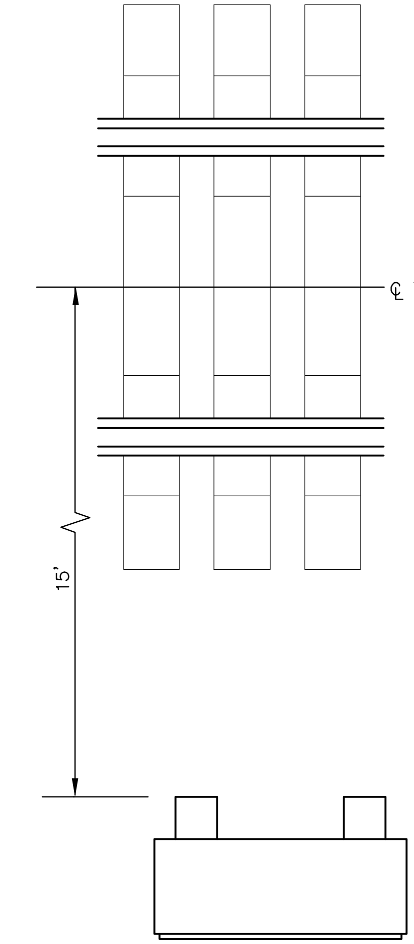
24" X 24" X 9"
ELECTRICAL ENCLOSURE
NEMA #12 HINGED COVER



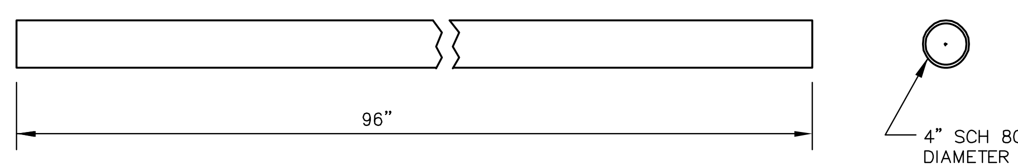
21" X 21" INSERT PLATE
FOR NEMA 12 ELEC ENCL



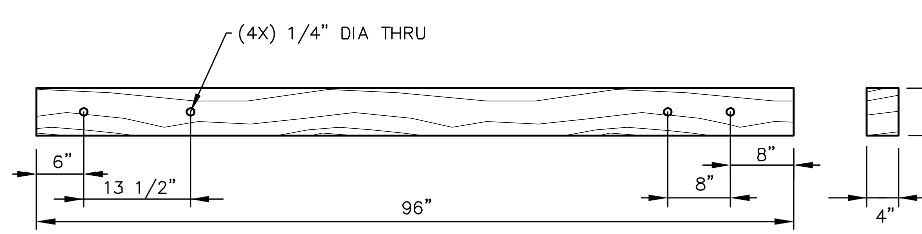
MOUNTING STRAP
OR CABLE TIES



LOCATION



PVC PIPE



(2X) 4" X 6" X 8'
PRESSURE TREATED POST

NOTES:

1. MATERIAL: POST – 4" X 4" X 8' PRESSURE TREATED WOOD
RIB BARS STEEL – 1/2" DIA X 12" LONG
CONDUIT – 4" DIA PVC SCHEDULE 80
ELECTRICAL BOX – NEMA JIC–12 ENCLOSURE, 24" X 24" X 9", GRAINGER #6C724
INTERIOR PANEL – 21" X 21", GRAINGER #2W829
STANDOFF – (8PCS)
2. THE LOCATION OF THE SHUNT BOX WITH RESPECT TO THE CENTER LINE OF THE TRACK SHALL BE AT LEAST 12', 15' DESIRED
3. THE POST SHALL BE BURIED 24" BELOW THE GROUND IF FOUNDATION IS CONCRETE. THE POST SHALL BE BURIED 36" BELOW THE GROUND IF THE FOUNDATION IS COMPACTED SOIL
4. THE POST SHALL HAVE TWO RIB BARS INSERTED THROUGH PER DIMENSION SPECIFIED FOR RIGID SUPPORT, DRILL HOLES AT THE POST FOR THE BOX AND RIB BARS
5. A PVC SCH 80 4" DIA CONDUIT SHALL BE SUPPLIED TO SUPPORT THE CABLE FROM THE ELECTRICAL BOX TO THE GROUND WITH AN ELBOW. CABLE MUST BE BURIED A MINIMUM OF 36" BELOW THE GROUND.
6. THE ELECTRICAL BOX SHALL BE MODIFIED BY DRILLING MOUNTING HOLES AT THE BACK OF THE PANEL.
7. THE INSERT PANEL SHALL BE MODIFIED BY DRILLING HOLES AND ADDING PRESS FIT NUTS.
8. MOUNT THE INSERT PANEL INTO THE BOX BY ADDING EIGHT STANDOFFS AND FASTEN WITH NUTS AND BOLTS
9. MOUNT THE BOX AGAINST THE POST WITH NUTS, BOLTS, FLAT AND LOCK WASHERS
10. ATTACH THE MOUNTING STRAP OF CABLE TIES TO HOLD THE SHUNT UNIT
11. WIDE BAND SHUNTS SHALL BE DIRECT BURIED A MINIMUM 2' FROM BOTTOM OF TIE WITH TRACK LEADS FACING DOWN – TRACK LEADS SHALL RUN IN BOOTLEG AS SHOWN IN SD–5110

REV	DATE	BY	CHK	APP	DESCRIPTION
	01012024				FOURTH EDITION

REV	DATE	BY	CHK	APP	DESCRIPTION

PENINSULA CORRIDOR JOINT POWERS BOARD

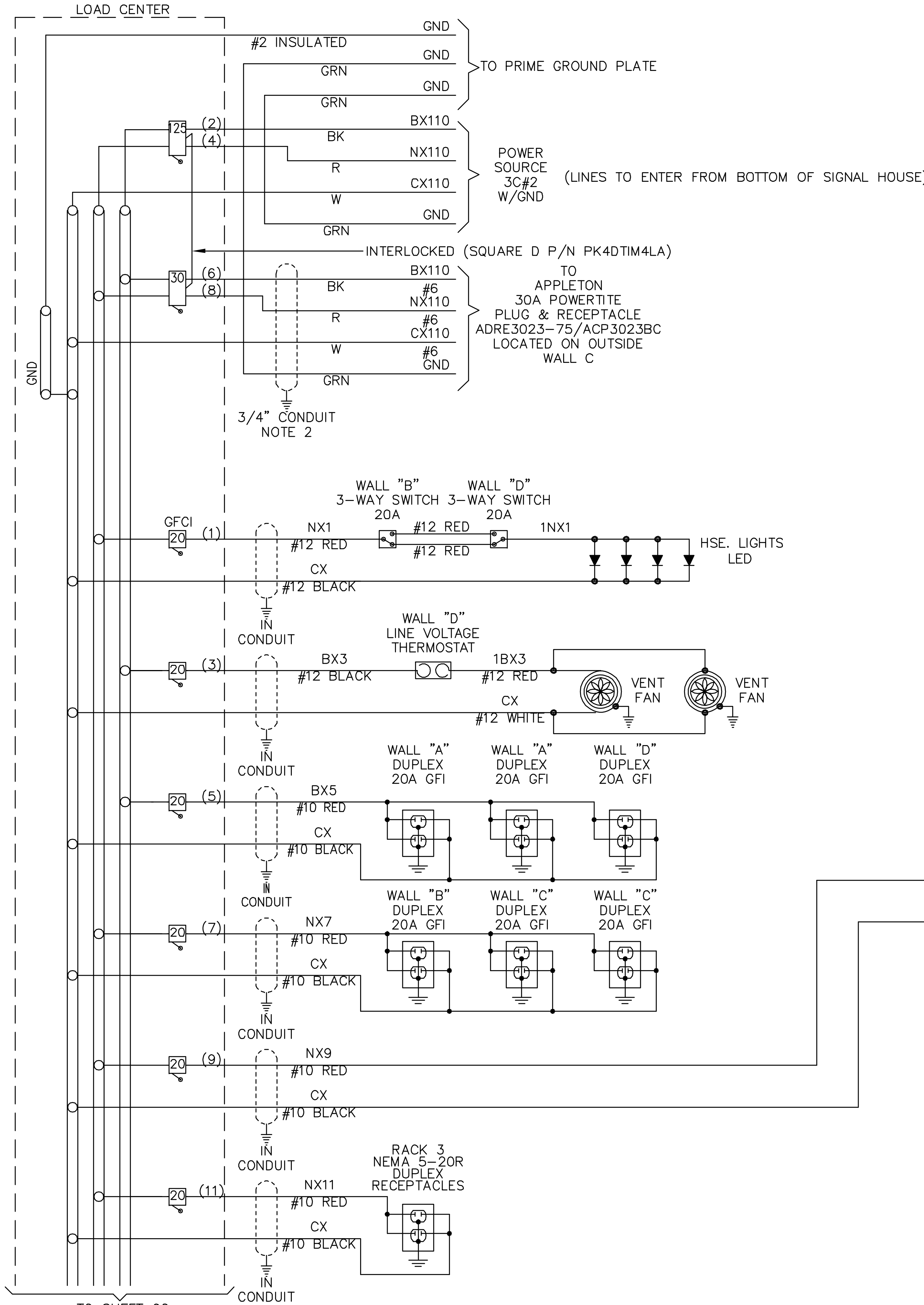
APPROVED BY:
Bin Zhang
DEPUTY DIRECTOR, ENGINEERING

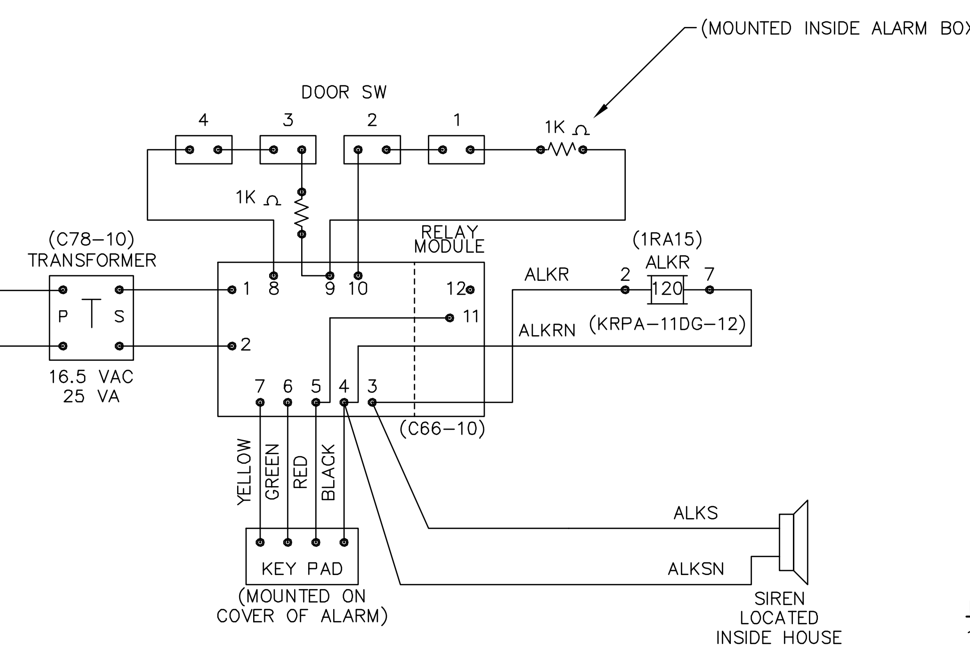
Caltrain
1250 San Carlos Avenue
San Carlos, CA 94070

STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
HIGHWAY GRADE CROSSING APPARATUS
TRACKSIDE TERMINATION
SHUNT ENCLOSURE

CADD FILE NAME: SD–5427
REV: EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD–5427





LOAD CENTER

LIGHTS	1	20A	125A	2	MAIN BREAKER
EXHAUST FAN	3	20A		4	
WALL A & D 120V RECEPTACLES	5	20A	60A	6	GENERTOR PLUG
WALL B & C 120V RECEPTACLES	7	20A		8	
ALARM TRANSFORMER	9	20A	20A	10	B12 CHARGER INCLUDED AS EXAMPLE.
RACK 3 120V RECEPTACLE	11	SPARE	SPARE	12	SPARE
SPARE	13	SPARE	30A	14	AIR CONDITIONER UNIT
SPARE	15	SPARE		16	
SPARE	17	SPARE	SPARE	18	SPARE
SPARE	19	SPARE	SPARE	20	SPARE

INTERLOCKED

QO120L125G

NOTES:

1. INSTALL MANUAL INTERLOCK (SQUARE D P/N PK4DTIM4LA) SO THAT ONLY ONE OF THE BACK-FED MAIN BREAKERS CAN BE ON AT ANY ONE TIME.
2. INSTALL 3/4" NIPPLE BETWEEN BACK OF LOAD CENTER AND APPLETON ADRE3023-75/ACP3023BC PLUG RECEPTACLE MOUNTED ON OUTSIDE OF WALL "C".
3. ALL WIRES THIS SHEET #14 AWG FLEX UNLESS OTHERWISE NOTED.

REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
8' X 14' SIGNAL HOUSE
AC DISTRIBUTION CIRCUITS
SHEET 1 OF 2

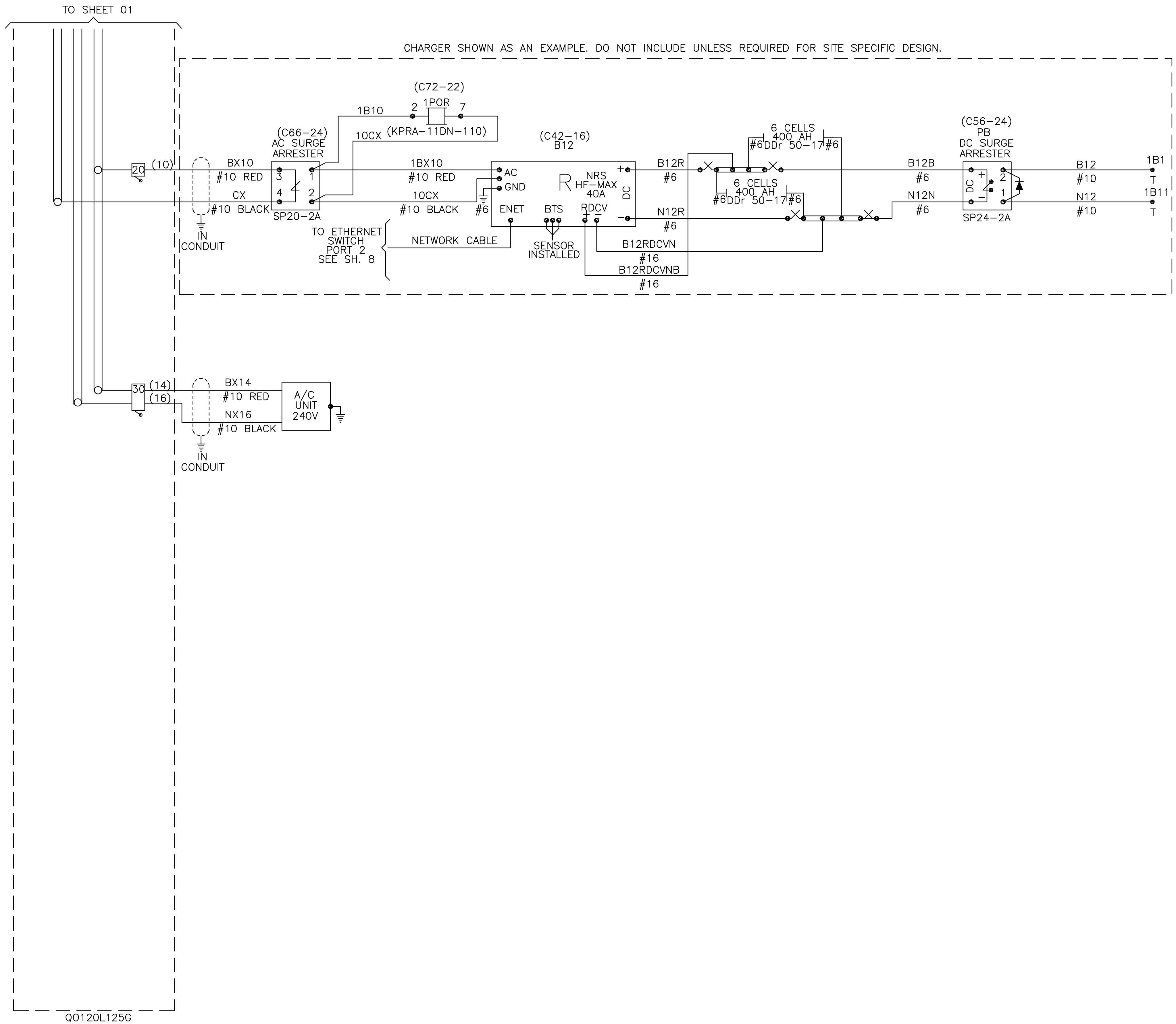
CADD FILE NAME: SD-5501

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5501



NOTE:
ALL WIRES THIS SHEET #14 AWG FLEX UNLESS OTHERWISE NOTED.

REV	DATE	BY	CHK	APP	DESCRIPTION
	01012024				FOURTH EDITION

REV	DATE	BY	CHK	APP

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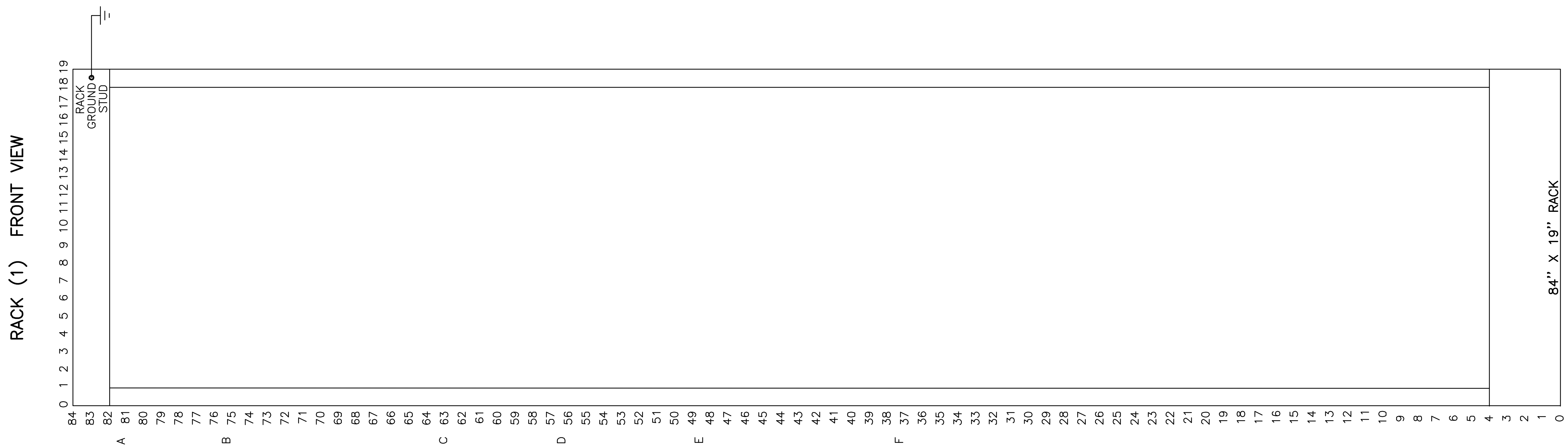
STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
8' X 14' SIGNAL HOUSE
AC DISTRIBUTION CIRCUITS
SHEET 2 OF 2

CADD FILE NAME: SD-5502
REV: EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5502



REV	DATE	BY	CHK	APP	DESCRIPTION	REV	DATE	BY	CHK	APP	
					01012024 FOURTH EDITION						

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
8' X 14' SIGNAL HOUSE

RACK 1 DETAILS

CADD FILE NAME: SD-5503

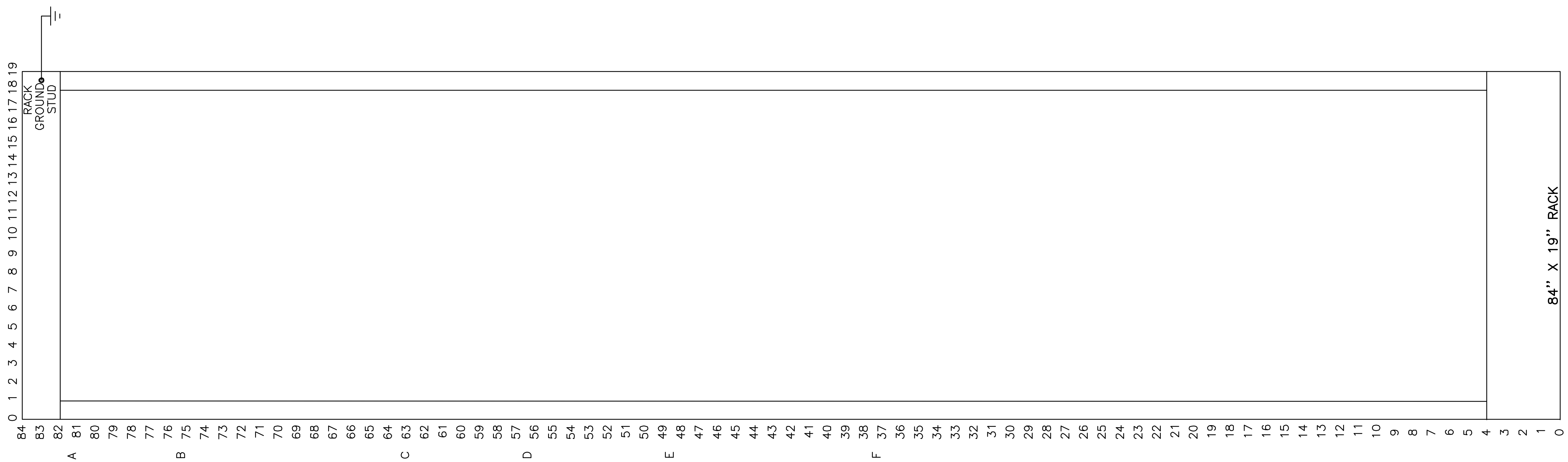
REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5503

RACK (2) FRONT VIEW



REV	DATE	BY	CHK	APP	DESCRIPTION
	01012024				FOURTH EDITION

REV	DATE	BY	CHK	APP	DESCRIPTION

PENINSULA CORRIDOR JOINT POWERS BOARD

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
8' X 14' SIGNAL HOUSE

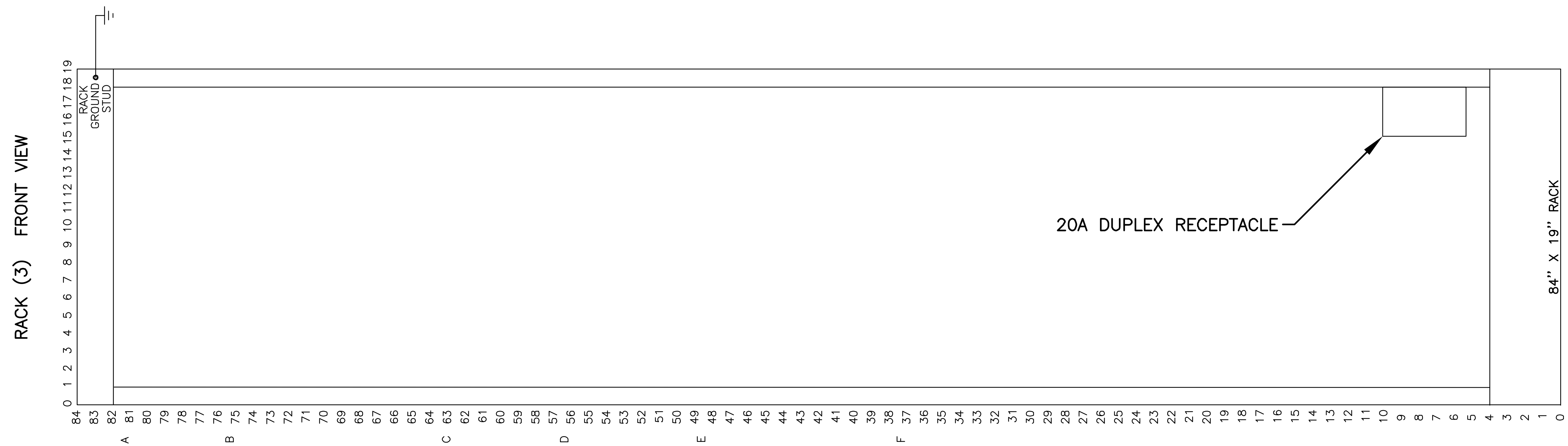
RACK 2 DETAILS

CADD FILE NAME: SD-5504

REV: | EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5504



REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
8' X 14' SIGNAL HOUSE

RACK 3 DETAILS

CADD FILE NAME: SD-5505
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5505

REV	DATE	BY	CHK	APP	DESCRIPTION
					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP	

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
8' X 14' SIGNAL HOUSE

TERMINAL BOARD 1

CADD FILE NAME: SD-5506

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5506

REV	DATE	BY	CHK	APP	DESCRIPTION
	01012024				FOURTH EDITION

REV	DATE	BY	CHK	APP	DESCRIPTION

PENINSULA CORRIDOR JOINT POWERS BOARD

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
8' X 14' SIGNAL HOUSE

TERMINAL BOARD 2

CADD FILE NAME: SD-5507

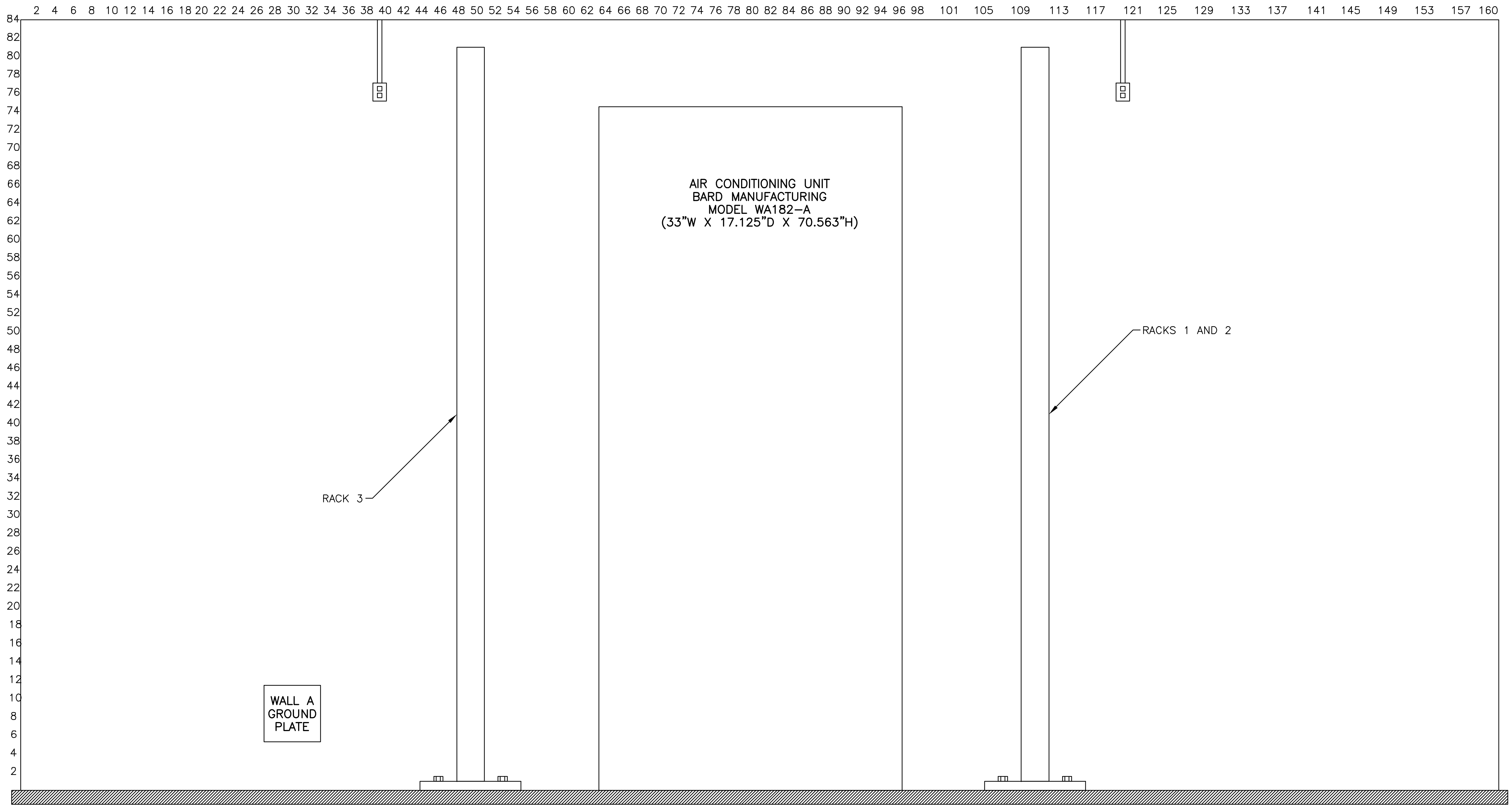
REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5507

SIDE 'A'



HOUSE FLOOR

REV	DATE	BY	CHK	APP	DESCRIPTION	REV	DATE	BY	CHK	APP	
					01012024 FOURTH EDITION						

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
8' X 14' SIGNAL HOUSE

SIDE A

CADD FILE NAME: SD–5508

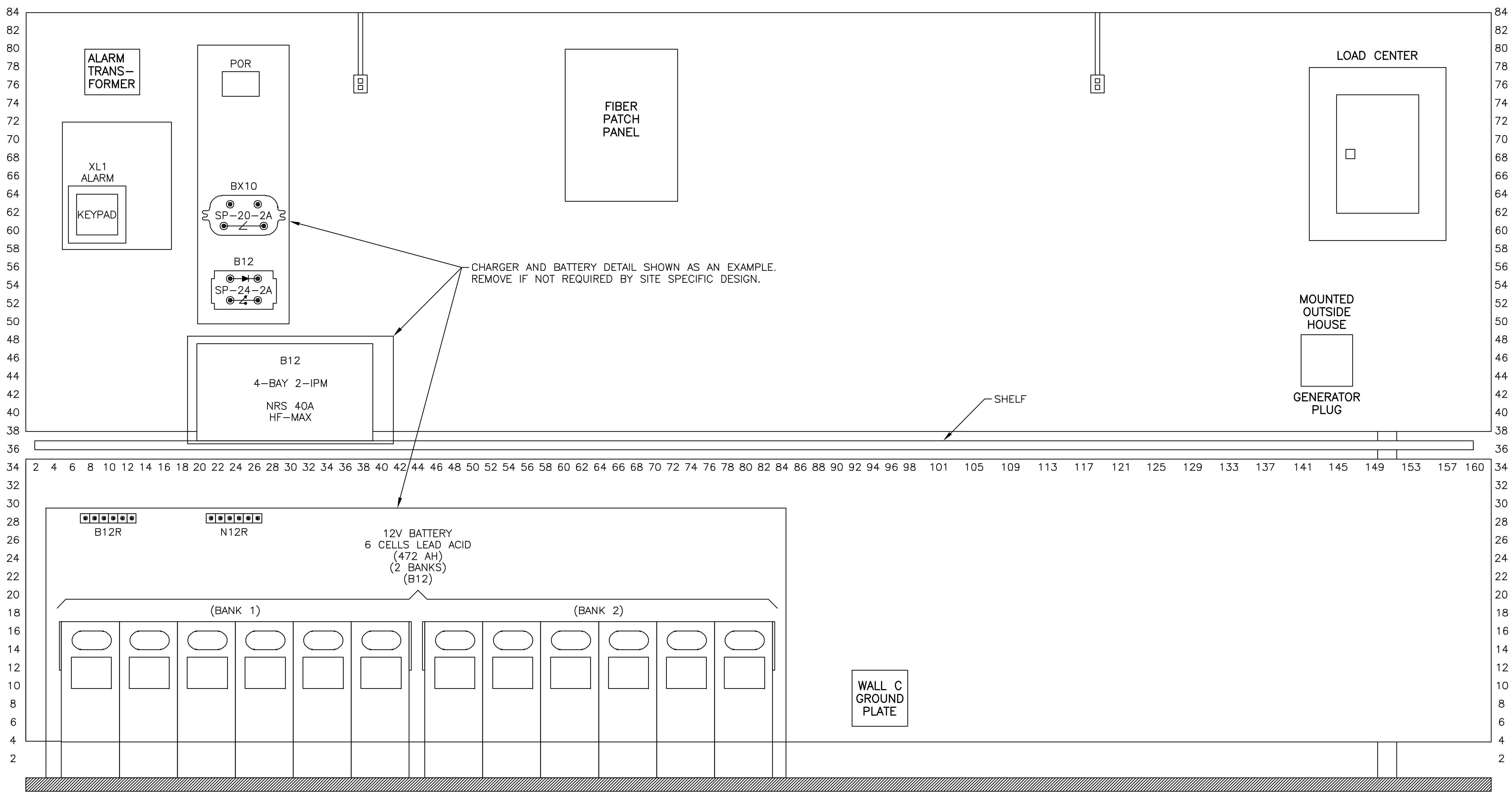
REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD–5508

SIDE 'C'



HOUSE FLOOR

REV	DATE	BY	CHK	APP	DESCRIPTION
	01012024				FOURTH EDITION

REV	DATE	BY	CHK	APP

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
8' X 14' SIGNAL HOUSE

SIDE C

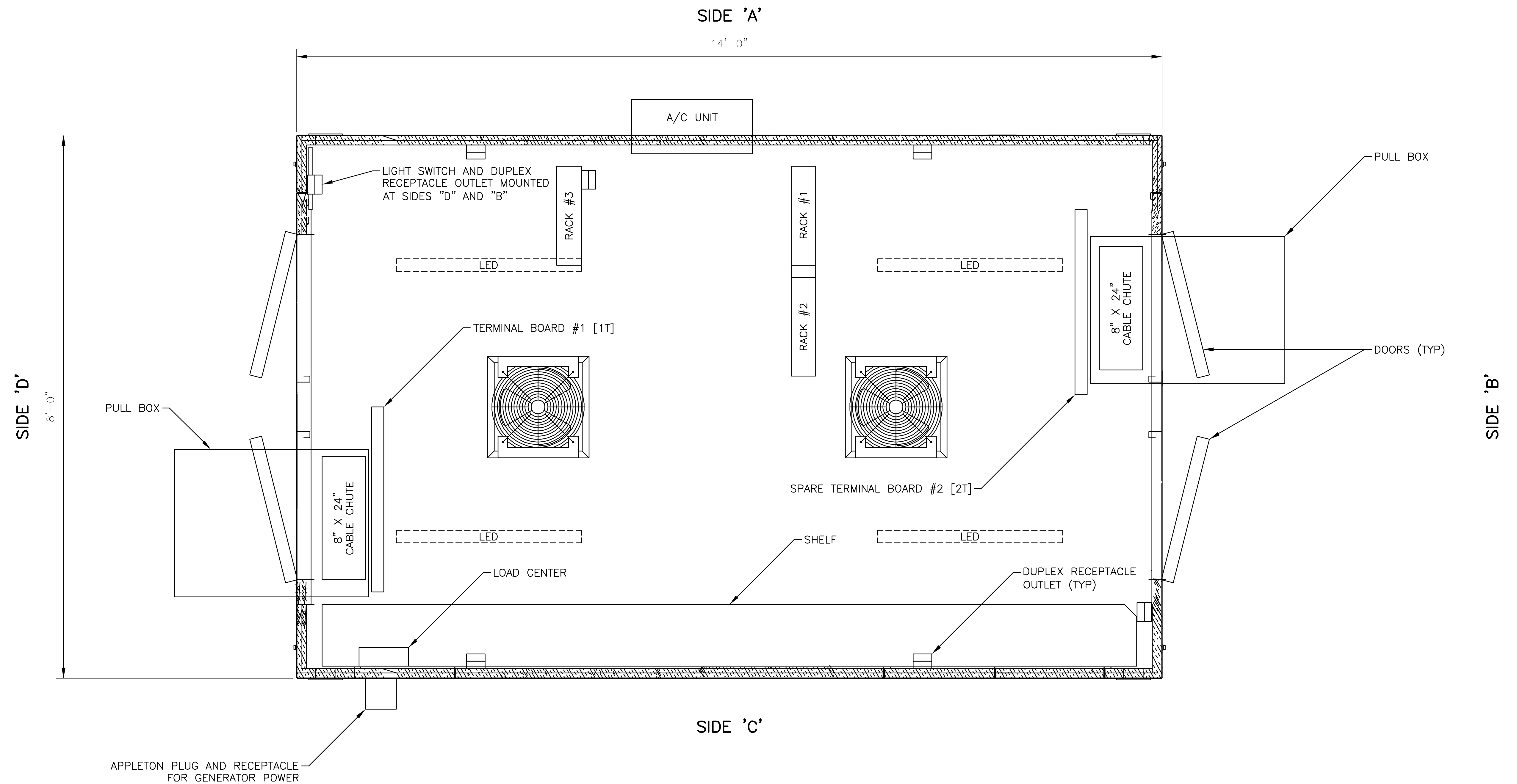
CADD FILE NAME: SD–5509

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD–5509



POWDER COATED STEEL HOUSE
PER PCJPB STANDARDS

PLAN

SCALE: NTS

REV	DATE	BY	CHK	APP	DESCRIPTION
	01012024				FOURTH EDITION

PENINSULA CORRIDOR JOINT POWERS BOARD

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
8' X 14' SIGNAL HOUSE

HOUSE LAYOUT

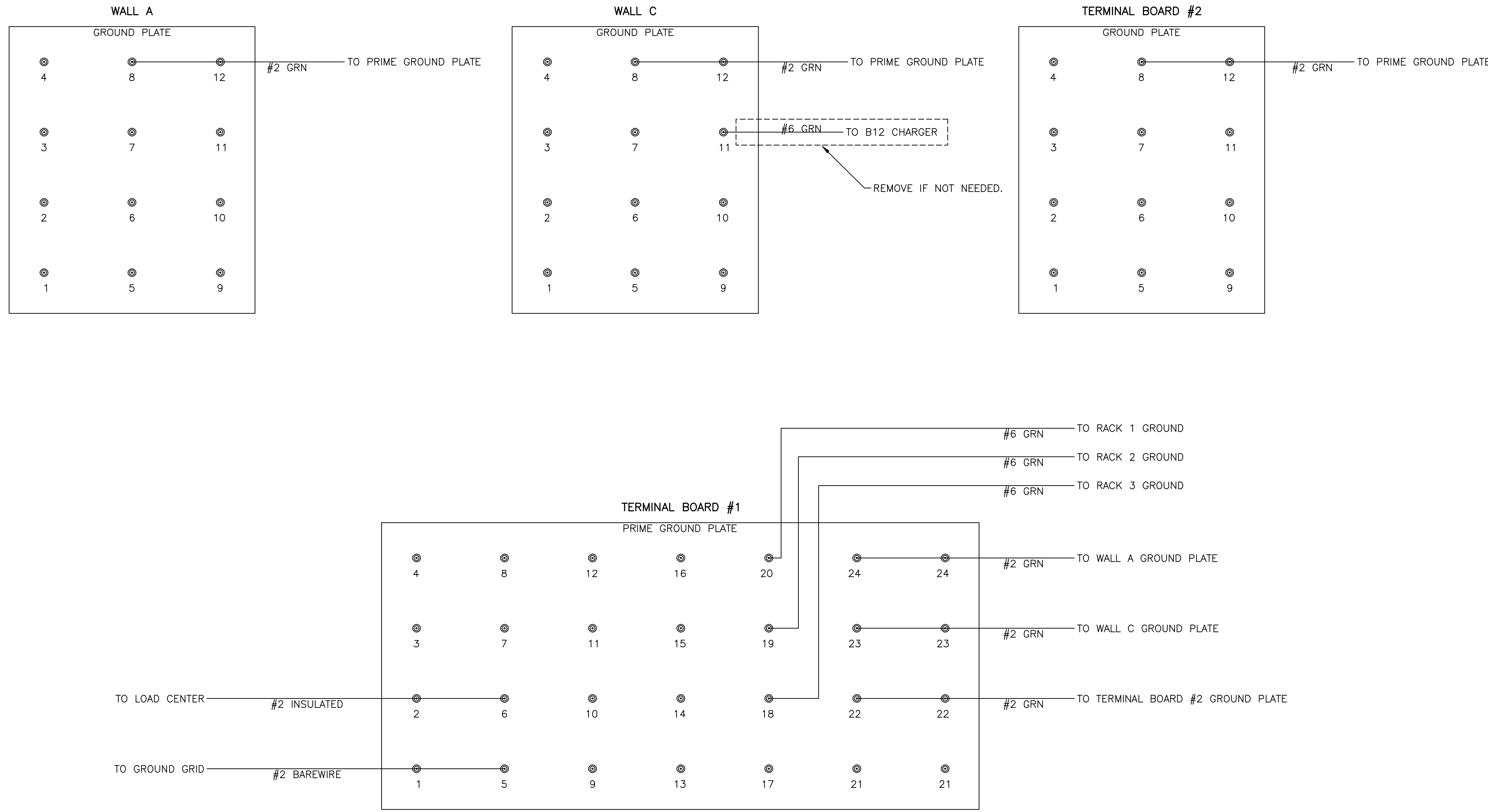
CADD FILE NAME: SD-5510

REV:

EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

STANDARD DRAWING NO.: SD-5510



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					01012024 FOURTH EDITION

REV	DATE	BY	CHK	APP	

PENINSULA CORRIDOR JOINT POWERS BOARD

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
8' X 14' SIGNAL HOUSE

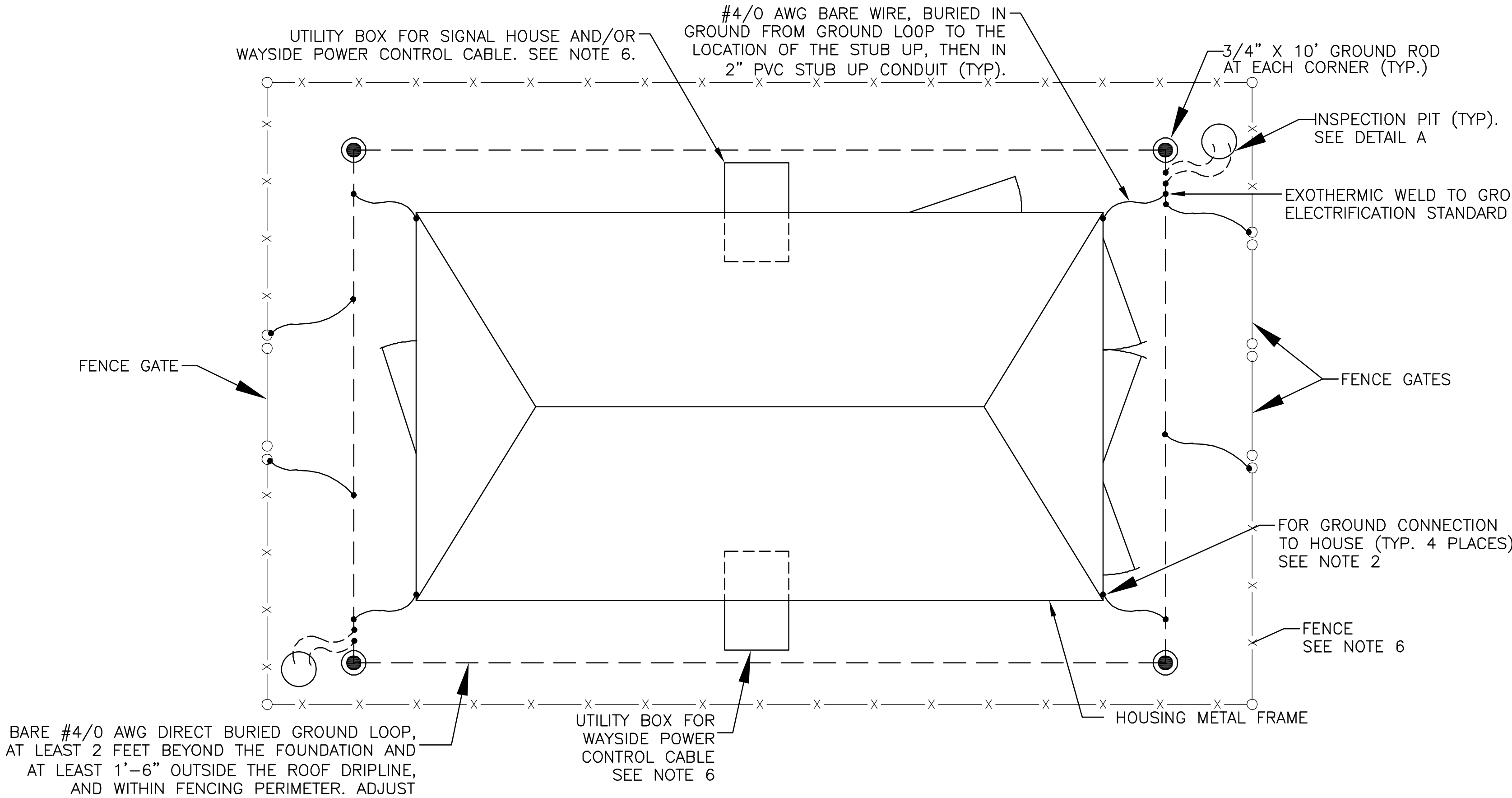
HOUSE GROUNDING DETAIL

CADD FILE NAME: SD-5511

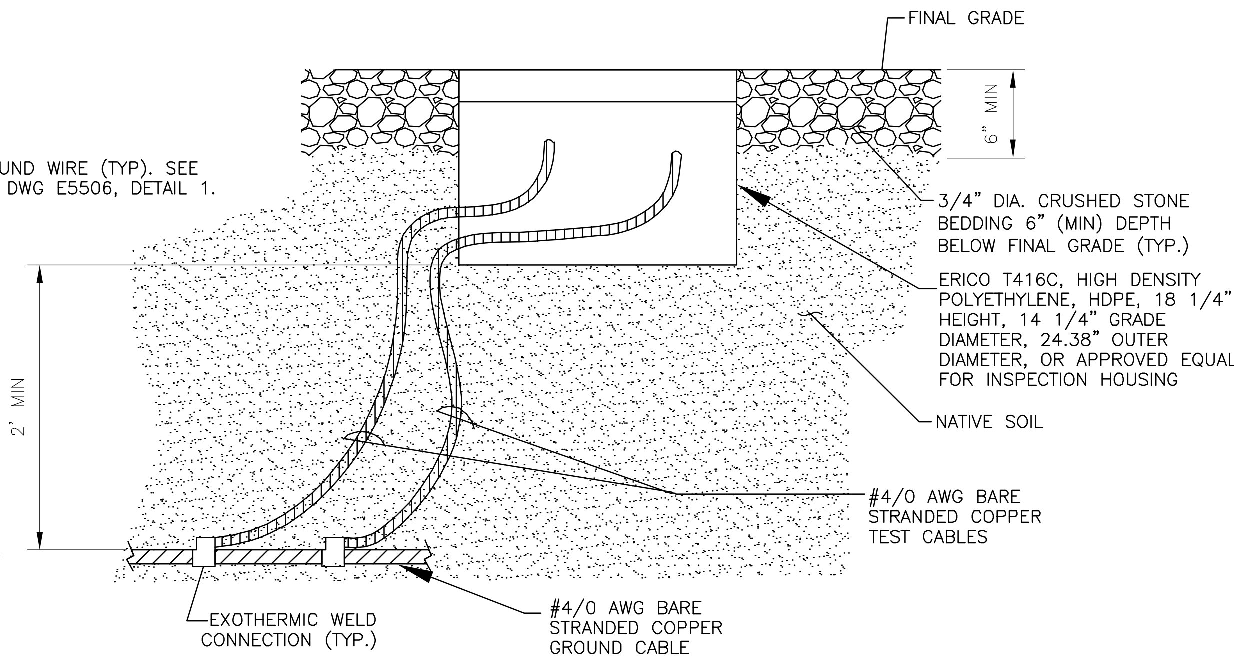
REV: EDITION: FOURTH

SIGNAL AND COMMUNICATIONS

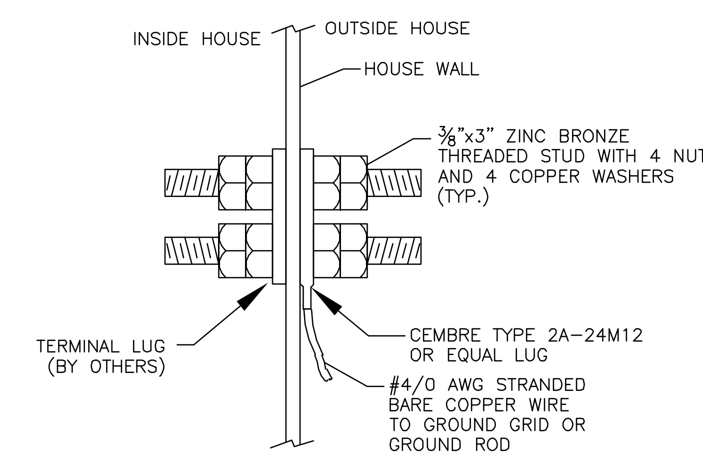
STANDARD DRAWING NO.: SD-5511



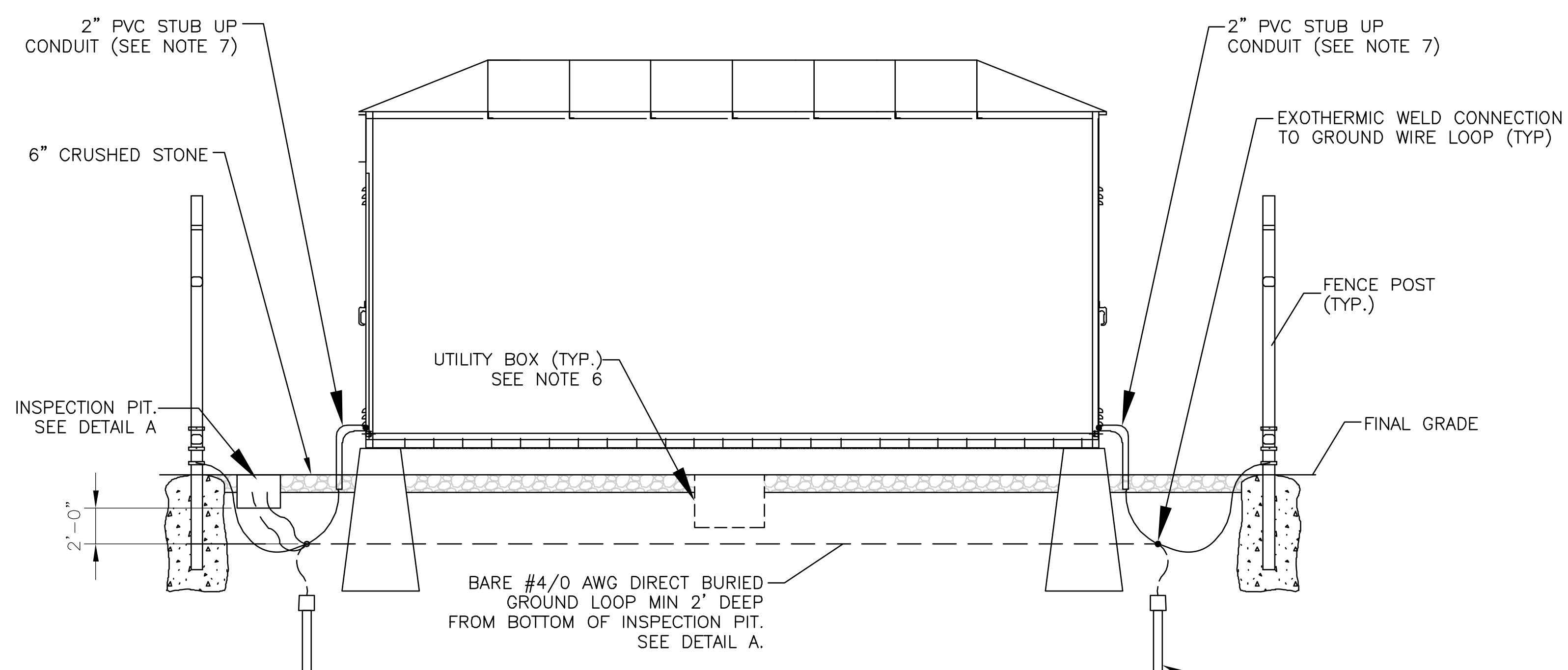
1 — PLAN VIEW EQUIPMENT HOUSE
NOT TO SCALE
SEE NOTE 5



A — INSPECTION PIT DETAILS
NOT TO SCALE



B — HOUSE GROUND CONNECTION DETAIL
NOT TO SCALE



2 — ELEVATION VIEW EQUIPMENT HOUSE
NOT TO SCALE

NOTES:

1. GROUND LOOP TO BE INSTALLED A MINIMUM OF 2-FEET BELOW INSPECTION BOX.
2. REFER TO DETAIL 'B' FOR GROUNDING STUD AND CABLE TERMINATION. GROUNDING STUD WILL BE PER THE HOUSE MANUFACTURER.
3. CONTRACTOR TO MEASURE GROUND RESISTANCE AFTER INSTALLATION. IF GROUND RESISTANCE IS GREATER THAN 15Ω, ADDITIONAL GROUND RODS TO BE INSTALLED TO MEET 15Ω RESISTANCE TO GROUND. IF NECESSARY USE CHEMICAL TREATMENT OF SOIL TO LOWER THE RESISTIVITY OF GROUND AS REQUIRED.
4. GROUND LOOP AND GROUNDING CABLES ARE #4/0 COPPER.
5. DESIGN APPLIES TO NEW SIGNAL HOUSES AND WPCs. FOR EXISTING HOUSES IN OCLZ WHERE EXISTING GROUND LOOP IS LESS THAN #4/0 CU, PROVIDE A SUPPLEMENTAL #4/0 CU GROUND LOOP.
6. FOR SITE SPECIFIC WAYSIDE ENCLOSURE, UTILITY BOXES AND FENCING PERIMETER AND LOCATION OF GROUND LOOP, SEE SIGNAL AND COMMUNICATIONS DUCTBANK DRAWINGS.
7. PROVIDE WATERTIGHT CONDUIT SEALING BUSHINGS AT EACH END, RATED FOR APPROPRIATE CONDUCTOR TYPE.

REV	DATE	BY	CHK	APP	DESCRIPTION	REV	DATE	BY	CHK	APP
					01012024 FOURTH EDITION					

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:
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DEPUTY DIRECTOR, ENGINEERING

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STANDARD DRAWINGS

SIGNAL AND COMMUNICATIONS
8' X 14' SIGNAL HOUSE
HOUSE GROUNDING LAYOUT

CADD FILE NAME: SD-5512
REV:
EDITION: FOURTH
SIGNAL AND COMMUNICATIONS
STANDARD DRAWING NO.: SD-5512