GENERAL DYNAMICS
C4 Systems

FOUNDATION INTERFACE LOADS
FOR
120° AZIMUTH TRAVEL CONFIGURATION
OF
VERTEXRSI 4.8-METER KPKA
SATELLITE EARTH STATION ANTENNA

700-0646

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ISO 9001 Registered

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1.0 INTRODUCTION

This document provides foundation interface loads for the 120° azimuth travel configuration of the VertexRSI 4.8-meter KPKA satellite earth station antenna. Loads are provided for four wind speed scenarios, 30 mph gusting to 45 mph excluding dead weight, 45 mph gusting to 60 mph excluding dead weight, 125 mph excluding dead weight and 125 mph in combination with dead weight. As an aid to the structural analyst the corresponding loads for dead weight only are also provided. Use the 30 mph gusting to 45 mph wind loads to evaluate the antenna support system for adequate rigidity as required by VertexRSI specification 300-2107. The loads for 125 mph wind combined with dead weight are maximum antenna survival loads; they should be used to evaluate the antenna support system for adequate strength as required by the governing building and/or construction codes.

2.0 LOAD CONDITIONS

All wind loads presented in this document were derived from the results of extensive wind tunnel studies of parabolic antenna structures. Load conditions are defined by specific combinations of wind speed, antenna orientation (azimuth and elevation) and wind direction. Each condition is represented by three angles (azimuth, elevation, and wind approach). X, Y, Z cartesian coordinate axes have been defined to facilitate the description of load vectors and antenna orientations. Sign conventions for the X, Y, Z coordinate axes, azimuth angle, and elevation angle are shown on page 3. Using the right hand sign convention, wind approach angle (wind angle) is measured about the Z-axis from the azimuth heading of the antenna. A 0° wind angle represents a head wind or frontal wind approach. A 180° wind angle represents a tail wind. Antenna symmetry precludes the need to consider wind angles between 180° and 360°.

3.0 CRITICAL LOADS

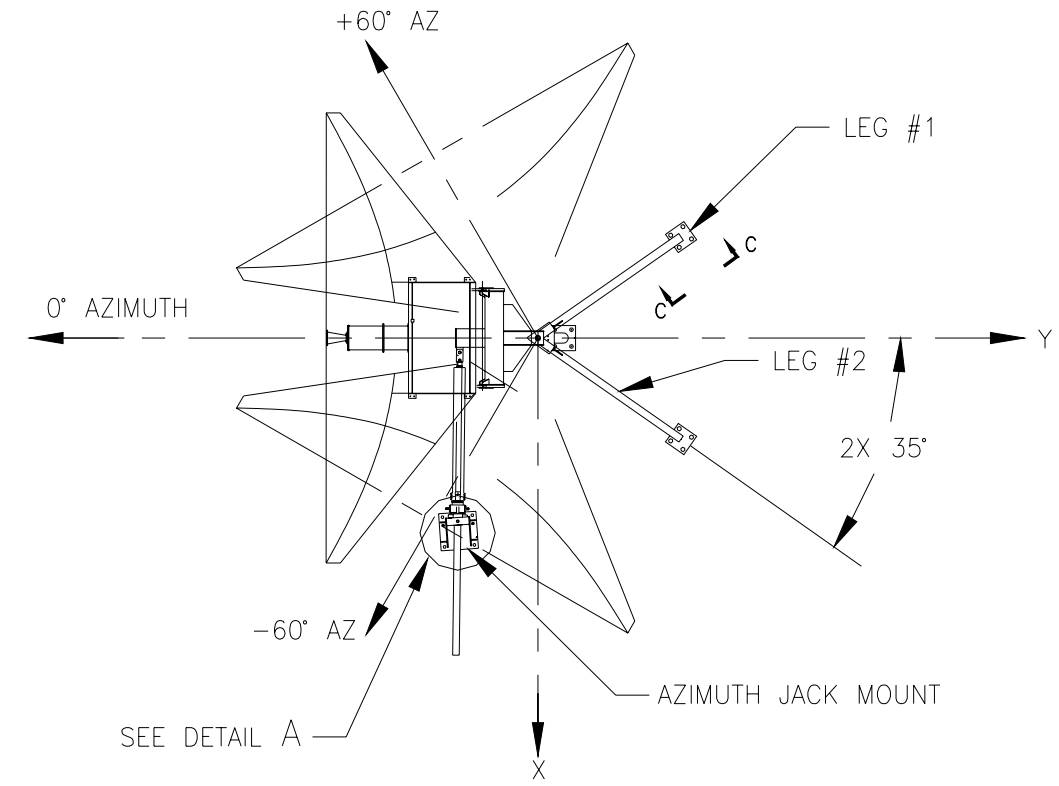
Design loads acting on each foundation interface have been tabulated according to load condition and interface location. Each row represents a specific load condition with all forces acting concurrently. Forces that are critical design loads are shown in shaded print. Note that due to antenna structural configuration, varying wind direction, and the antenna's steerability, all maximum interface component forces do not occur simultaneously under a single load condition.

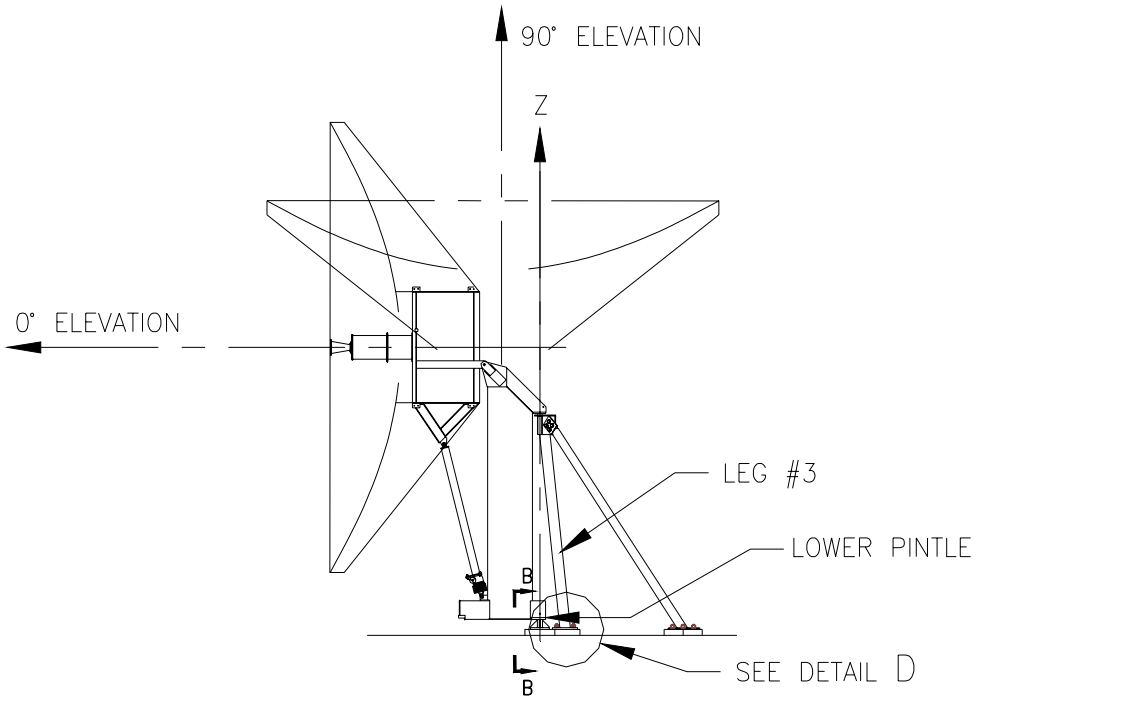
Sign conventions for the lower pintle loads correspond to those of the X, Y, Z coordinate axes (shown on pages 3 and 4). Azimuth jack and pedestal leg loads are axial forces that act along the member's centroidal axis; tensile loads are positive; compression is negative.

4.0 RESOLUTION OF FORCE COMPONENTS

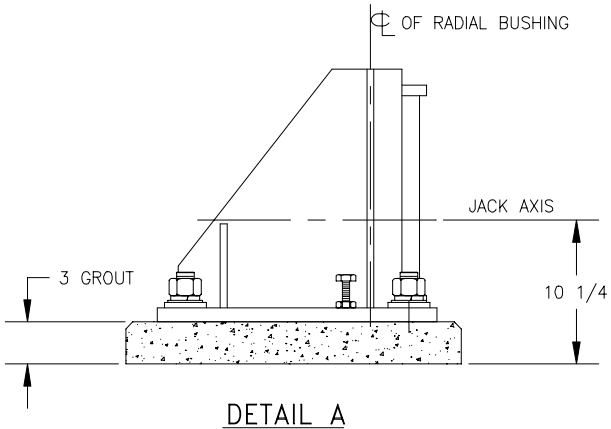
During the course of structural analysis it is often desirable to resolve forces into orthogonal vector components that correspond to convenient coordinate axes. Any orthogonal vector components of the leg loads can be easily resolved by applying appropriate trigonometric functions to the leg geometry (angles) illustrated on pages 3 and 4.

The X, Y vector components of the azimuth jack depend on azimuth angle of the load condition. Refer to page 5 to determine the angle of the azimuth jack relative to the foundation coordinate axes and the corresponding X, Y load coefficients.

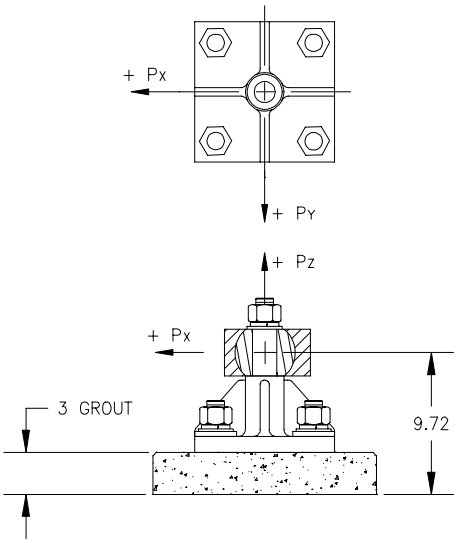




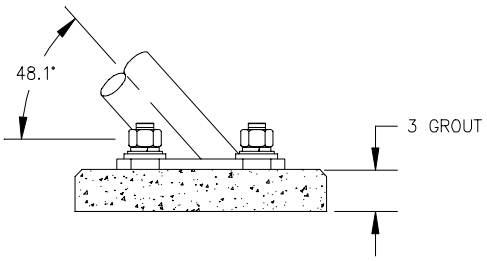
(AZIMUTH JACK NOT SHOWN IN THIS VIEW)



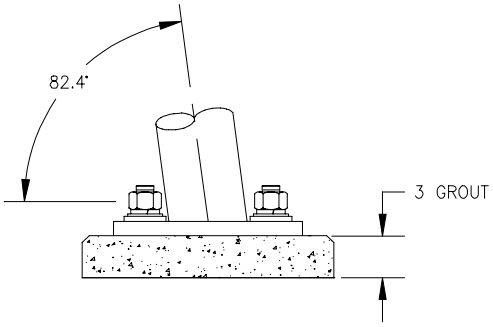
DETAIL A
AZIMUTH TRUNNION INSTALLATION



SEC B–B
LOWER AZIMUTH PINTLE BEARING



VIEW C–C
LEG INSTALLATION



DETAIL D
LEG INSTALLATION

NOTE: ALL DIMENSIONS ARE IN INCHES.

AZIMUTH JACK LOAD COEFFICIENTS
VertexRSI 4.8-Meter KPKA 120° Azimuth Travel Antenna

Azimuth Angle (Deg)	Azimuth Jack X-Coeff	Azimuth Jack Y-Coeff
-60	-0.9847	-0.1743
-55	-0.9564	-0.2920
-50	-0.9249	-0.3803
-45	-0.8964	-0.4433
-40	-0.8737	-0.4865
-35	-0.8574	-0.5146
-30	-0.8471	-0.5314
-25	-0.8420	-0.5395
-20	-0.8410	-0.5410
-15	-0.8435	-0.5372
-10	-0.8486	-0.5290
-5	-0.8557	-0.5174
0	-0.8644	-0.5028
5	-0.8742	-0.4856
10	-0.8847	-0.4662
15	-0.8956	-0.4449
20	-0.9067	-0.4218
25	-0.9177	-0.3972
30	-0.9286	-0.3712
35	-0.9390	-0.3439
40	-0.9489	-0.3156
45	-0.9582	-0.2862
50	-0.9667	-0.2559
55	-0.9744	-0.2248
60	-0.9812	-0.1931

To calculate the X and Y components of the load acting on the azimuth jack foundation mounts, multiply the azimuth jack load by the appropriate X and Y coefficients from the tables above.

FOUNDATION INTERFACE LOADS
VertexRSI 4.8-Meter KPKA 120° Azimuth Travel Antenna
30 mph Wind Gusting to 45 mph, Dead Weight Excluded

Azimuth Angle (deg)	Elev. Angle (deg)	Wind Angle (deg)	Azimuth Jack Axial Load (lb)	Lower Pintle Loads				Axial Leg Loads		
				Px (lb)	Py (lb)	Pr (lb)	Pz (lb)	Leg #1 (lb)	Leg #2 (lb)	Leg #3 (lb)
-60	0	135	1313	1195	419	1266	6	211	972	-901
-60	20	30	-377	-175	-258	311	-361	452	-2042	1212
60	0	135	1309	1458	253	1480	6	757	-806	37
60	0	30	-364	-744	-265	790	-16	-2391	946	1102
-35	20	135	590	519	550	756	75	686	751	-1095
-5	0	30	-189	-150	-532	552	-16	-1524	-1658	2426
60	0	135	1309	1458	253	1480	6	757	-806	37
-60	80	150	213	139	224	263	218	178	653	-634
-60	60	0	-10	-118	48	128	-801	200	-677	364
50	20	180	-29	235	199	308	108	1566	-282	-978
-50	0	15	-141	186	-354	400	-16	316	-2461	1635
0	0	15	-116	-126	-492	508	-16	-1667	-1516	2427
0	20	180	-18	-4	325	325	108	1028	998	-1545

Notes: 1) Pr is the Vector Resultant of Px and Py.
2) Relative maximum loads for each interface are shown in reverse print.

FOUNDATION INTERFACE LOADS
VertexRSI 4.8-Meter KPKA 120° Azimuth Travel Antenna
45 mph Wind Gusting to 60 mph, Dead Weight Excluded

Azimuth Angle (deg)	Elev. Angle (deg)	Wind Angle (deg)	Azimuth Jack Axial Load (lb)	Lower Pintle Loads				Axial Leg Loads		
				Px (lb)	Py (lb)	Pr (lb)	Pz (lb)	Leg #1 (lb)	Leg #2 (lb)	Leg #3 (lb)
-60	0	135	2626	2390	837	2532	13	422	1943	-1803
-60	20	30	-753	-350	-515	623	-721	903	-4083	2424
60	0	135	2618	2915	506	2959	13	1514	-1612	75
60	0	30	-729	-1488	-530	1579	-32	-4783	1891	2204
-35	20	135	1180	1038	1099	1512	150	1371	1502	-2190
-5	0	30	-377	-300	-1063	1104	-32	-3048	-3315	4851
60	0	135	2618	2915	506	2959	13	1514	-1612	75
-60	80	150	427	278	448	527	436	356	1306	-1268
-60	60	0	-20	-236	97	255	-1603	401	-1355	727
50	20	180	-58	471	398	616	216	3131	-564	-1957
-50	0	15	-281	373	-707	800	-32	632	-4921	3270
0	0	15	-233	-253	-984	1016	-32	-3334	-3032	4853
0	20	180	-36	-9	650	650	216	2056	1997	-3090

Notes: 1) Pr is the Vector Resultant of Px and Py.
2) Relative maximum loads for each interface are shown in reverse print.

FOUNDATION INTERFACE LOADS
VertexRSI 4.8-Meter KPKA 120° Azimuth Travel Antenna
125 mph Wind, Dead Weight Excluded

Azimuth Angle (deg)	Elev. Angle (deg)	Wind Angle (deg)	Azimuth Jack Axial Load (lb)	Lower Pintle Loads				Axial Leg Loads		
				Px (lb)	Py (lb)	Pr (lb)	Pz (lb)	Leg #1 (lb)	Leg #2 (lb)	Leg #3 (lb)
-60	0	135	16092	14644	5129	15517	79	2583	11907	-11046
-60	20	30	-4615	-2144	-3156	3815	-4418	5536	-25019	14853
60	0	135	16039	17864	3100	18131	79	9279	-9879	458
60	0	30	-4464	-9118	-3245	9678	-197	-29305	11590	13505
-35	20	135	7228	6358	6737	9263	921	8402	9202	-13421
-5	0	30	-2311	-1837	-6514	6768	-197	-18677	-20315	29725
60	0	135	16039	17864	3100	18131	79	9279	-9879	458
-60	80	150	2614	1701	2743	3228	2670	2184	8004	-7767
-60	60	0	-121	-1449	592	1565	-9821	2456	-8302	4456
50	20	180	-355	2884	2436	3775	1323	19186	-3458	-11991
-50	0	15	-1723	2285	-4335	4900	-197	3871	-30155	20038
0	0	15	-1428	-1548	-6032	6227	-197	-20428	-18581	29739
0	20	180	-222	-55	3983	3984	1323	12600	12235	-18933

Notes: 1) Pr is the Vector Resultant of Px and Py.
2) Relative maximum loads for each interface are shown in reverse print.

FOUNDATION INTERFACE LOADS
VertexRSI 4.8-Meter KPKA 120° Azimuth Travel Antenna
125 mph Wind Plus Dead Weight

Azimuth Angle (deg)	Elev. Angle (deg)	Wind Angle (deg)	Azimuth Jack Axial Load (lb)	Lower Pintle Loads				Axial Leg Loads		
				Px (lb)	Py (lb)	Pr (lb)	Pz (lb)	Leg #1 (lb)	Leg #2 (lb)	Leg #3 (lb)
-60	0	135	16092	13792	5621	14894	-2671	2004	13600	-11895
-60	20	30	-4615	-2967	-2681	3999	-7168	4976	-23384	14033
60	0	135	16039	18716	3592	19058	-2671	10972	-10459	-391
60	0	30	-4464	-8266	-2753	8712	-2947	-27611	11011	12655
-30	20	135	7064	5935	7557	9609	-1829	9602	9851	-14830
-5	0	30	-2311	-1922	-5533	5858	-2947	-17681	-19091	28033
60	0	135	16039	18716	3592	19058	-2671	10972	-10459	-391
-60	60	0	-121	-2146	994	2365	-12571	1983	-6918	3762
50	20	180	-355	3612	3047	4725	-1427	20848	-3737	-13045
-50	0	15	-1723	1531	-3702	4006	-2947	3582	-28434	18946
0	0	15	-1428	-1548	-5047	5279	-2947	-19314	-17467	28040
0	20	180	-222	-55	4934	4934	-1427	13676	13311	-20573

Notes: 1) Pr is the Vector Resultant of Px and Py.
2) Relative maximum loads for each interface are shown in reverse print.

FOUNDATION INTERFACE LOADS
VertexRSI 4.8-Meter KPKA 120° Azimuth Travel Antenna
Dead Weight Only

Azimuth Angle (deg)	Elev. Angle (deg)	Wind Angle (deg)	Azimuth Jack Axial Load (lb)	Lower Pintle Loads				Axial Leg Loads		
				Px (lb)	Py (lb)	Pr (lb)	Pz (lb)	Leg #1 (lb)	Leg #2 (lb)	Leg #3 (lb)
-60	0	0	0	-852	492	984	-2750	-579	1693	-849
60	90	0	0	574	332	663	-2750	1141	-390	-572
0	0	0	0	0	984	984	-2750	1114	1114	-1698
60	0	0	0	852	492	984	-2750	1693	-579	-849
-50	0	0	0	-754	633	984	-2750	-289	1721	-1092
0	0	0	0	0	984	984	-2750	1114	1114	-1698

Notes: 1) Pr is the Vector Resultant of Px and Py.
2) Relative maximum loads for each interface are shown in reverse print.