

ATTACHED IS A PART 21 REPORT FROM IE MAIL UNIT - ROOM 359E/W

PART 21 IDENTIFICATION NO. 80-195-004 COMPANY NAME ITT General

DATE OF LETTER 5/5/80 DOCKET NO. \_\_\_\_\_

DATE DISTRIBUTED 5/12/80 ORIGINAL REPORT  SUPPLEMENTARY

DISTRIBUTION:

REACTOR(R)

FUEL CYCLE &   
MATERIALS(M)

SAFEGUARDS(S)

NRR/DOR, DIRECTOR (2)  
NRR/DPM DIRECTOR (2)  
AD/ROI (2)  
AD/RCI  
REGIONS  
IE FILES  
CENTRAL FILES  
CENTRAL FILES (CHRON)  
PDR  
LPDR  
~~TERA~~  
LOEB/MPA MNB 5715  
AEOD MNB-7602

AD/FFMSI  
NMSS/FCMS  
REGIONS  
IE FILES  
PDR  
LPDR  
CENTRAL FILES-SS-396  
CENTRAL FILES(CHRON)  
(016)  
TERA  
LOEB/MPA MNB 5715  
AEOD - MNB-7602

AD/SG-IE  
AD/ROI  
REGIONS  
NRR/DOR, DIRECTOR  
NMSS/SG SS-881  
PDR  
LPDR  
TERA  
IE FILES (2)  
CENTRAL FILES 016  
CENTRAL FILES (CHRON)  
CENTRAL FILES - SS-396  
LOEB/MPA MNB 5715  
AEOD MNB-7602

ACTION:

PRELIMINARY EVALUATION OF THE ATTACHED REPORT INDICATES LEAD RESPONSIBILITY FOR FOLLOW-UP AS SHOWN BELOW:

IE

NRR

NMSS

OTHER

RCI  
ROI  
SG  
FFMSI



# ITT

GENERAL CONTROLS

801 Allen Avenue  
Glendale, California 91201  
(213) 842-6131

80-195-004

May 5, 1980

Director, Office of Inspection and Enforcement  
U.S. Nuclear Regulatory Commission  
Washington D. C. 20555

Dear Sir:

Attached are copies of information transmitted to two of our NH 90 actuator customers pursuant to their request.

The statistical data was prepared by ITT General Controls following our evaluation of the two 10CFR21 notifications initiated by ITT General Controls concerning defective springs and possible misinterpretation of the selection nomographs.

Please be advised that we are continuing our analysis and will advise you of any future developments.

Sincerely

R. L. Formella, Director  
Quality Assurance & Reliability

RLF:mms

cc: A. B. Bennett, NRC



## GENERAL CONTROLS

801 Allen Avenue  
Glendale, California 91201  
(213) 842-6131

April 21, 1980

Mr. Frank Neal  
Pacific Air Products Co.  
3133 W. Harvard  
Santa Ana, California 92704

Dear Frank:

The enclosed tables have been derived from actual test data and represent the statistical minimums of the actual output forces. This means that statistically at the 80% confidence level 98% of the units will have outputs at or in excess of the statistical minimum. In a practical sense the statistical minimum of the output forces should represent a number that can be compared to the desired or required actuator output including safety factors which were calculated during the design phase. This should allow a reasonable judgement to be made concerning the capability of the actuator to perform as expected. It should be pointed out that if the actuator output does not meet the requirement, an adjustment of the spring height may be necessary.

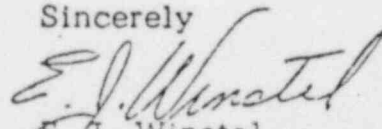
The tables cover all indirect or pull units. Data on direct or push units will be made available next week.

Our Engineering Department is preparing a complete report for the basis of these tables. This report will be available for you in a few weeks if you would like a copy.

This data covers all actuators that have been previously shipped to you. This includes those with #1 spring. We hope this will suffice to allow you to complete your analysis on all actuators you have received.

If there are any other questions, please let me know.

Sincerely

  
E. J. Winstel  
Rep Sales Manager

EJW:m

AH/NH 91 & 93  
 2 MINIMUM OUTPUT FORCE  
 AT BEGINNING OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 lb., 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	725	1266	X	X	X	-	1145	960	X	X	X
9.55	398	694	1208				1322	1176	1018			
9.80	378	663	1151				1342	1207	1075			
10.05	358	632	1093				1362	1238	1133			
10.30	338	601	1035				1382	1269	1191			
10.55	318	569	977				1402	1300	1249			
10.80	298	538	919				1422	1331	1307			
11.05	-	507	861				-	1362	1365			

Spring Installed Length	3000 lb., 3-1/2" Stroke											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	X	725	1266	-	2134	-	X	2984	2799	-	2365	-
9.55		694	1208	1708	2045	2546		3015	2857	2636	2454	2233
9.80		663	1151	1630	1957	2437		3046	2914	2714	2542	2342
10.05		632	1093	1552	1868	2328		3077	2972	2792	2631	2451
10.30		601	1035	1474	1780	2219		3108	3030	2870	2720	2560
10.55		569	977	1396	1691	2110		3139	3088	2948	2809	2669
10.80		538	919	1318	1602	2001		3170	3146	3026	2898	2778
11.05		507	861	1240	1513	1892		3201	3204	3104	2987	2887

Spring Installed Length	4000 lb., 4" Stroke											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55	X	X	1319	-	2204	-	X	X	3956	-	3566	-
9.80			1261	1775	2115	2629			4014	3821	3655	3462
10.05			1203	1697	2026	2520			4072	3899	3744	3571
10.30			1146	1619	1937	2411			4130	3977	3833	3680
10.55			1087	1541	1848	2302			4188	4055	3922	3789
10.80			1029	1463	1759	2193			4246	4133	4011	3898
11.05			971	1385	1670	2084			4304	4211	4100	4007

AH/NH91 & 93  
 2 ∅ MINIMUM OUTPUT FORCE  
 AT END OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb., 3-1/2" Stroke Spring No.											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	291	461				-	711	155			
9.55	118	260	403				1042	742	213			
9.80	98	229	346				1062	773	270			
10.05	78	198	288				1082	804	328			
10.30	58	167	230				1102	835	386			
10.55	38	136	172				1122	866	444			
10.80	18	105	114				1142	897	502			
11.05	-	74	56				-	928	560			

Spring Installed Length	3000 lb., 3-1/2" Stroke											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30		291	461	-	895	-		2550	1994	-	1126	-
9.55		260	403	623	806	1027		2581	2052	1551	1215	714
9.80		229	346	545	718	918		2612	2109	1629	1303	823
10.05		198	288	467	629	809		2643	2167	1707	1392	932
10.30		167	230	389	540	700		2674	2225	1785	1481	1041
10.55		136	172	311	451	591		2705	2283	1863	1570	1150
10.80		105	114	233	362	482		2736	2341	1941	1659	1259
11.05		74	56	155	273	373		2767	2399	2019	1748	1368

Spring Installed Length	4000 lb., 4" Stroke											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55			399	-	788	-			3036		2150	-
9.80			341	535	699	893			3094	2581	2239	1726
10.05			283	457	610	784			3152	2659	2328	1835
10.30			225	379	521	675			3210	2737	2417	1944
10.55			167	301	432	566			3268	2815	2506	2053
10.80			109	223	343	457			3326	2893	2595	2162
11.05			51	145	254	348			3384	2971	2684	2271

AH/NH 91 & 93  
MEAN OUTPUT FORCE  
AT BEGINNING OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb. 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	854	1340				-	1449	1251			
9.55	431	823	1282				1700	1480	1309			
9.80	411	792	1224				1720	1511	1367			
10.05	391	761	1166				1740	1542	1425			
10.30	371	730	1108				1760	1573	1483			
10.55	351	699	1050				1780	1604	1541			
10.80	331	668	992				1800	1635	1599			
11.05	311	637	934				1820	1666	1657			

Spring Installed Length	3000 Lb. 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
	9.30		854	1340	-	2208	-		3429	3244	-	2810
9.55		823	1282	1732	2119	2620		3460	3302	3081	2899	2678
9.80		792	1224	1654	2031	2511		3491	3360	3159	2988	2787
10.05		761	1166	1576	1941	2402		3522	3418	3237	3077	2896
10.30		730	1108	1498	1852	2293		3553	3476	3315	3166	3005
10.55		699	1050	1420	1763	2184		3584	3534	3393	3255	3114
10.80		668	992	1342	1674	2075		3615	3592	3471	3344	3223
11.05		637	934	1264	1585	1966		3646	3650	3549	3433	3332

Spring Installed Length	4000 Lb. 4" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
	9.55			1393	-	2278	-			4704	-	4314
9.80			1335	1849	2189	2703			4762	4569	4403	4210
10.05			1277	1771	2100	2594			4820	4647	4492	4319
10.30			1219	1693	2011	2485			4878	4725	4581	4428
10.55			1161	1615	1922	2376			4936	4803	4670	4537
10.80			1103	1537	1833	2267			4994	4881	4759	4646
11.05			1045	1459	1744	2158			5052	4959	4848	4755

91.93-4

AH/NH 91 & 93  
MEAN OUTPUT FORCE  
AT END OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb., 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	420	535	X	X	X	-	1015	446	X	X	X
9.55	151	389	477				1420	1046	504			
9.80	131	358	419				1440	1077	562			
10.05	111	327	361				1460	1108	620			
10.30	91	296	303				1480	1139	678			
10.55	71	265	245				1500	1170	736			
10.80	51	234	187				1520	1201	794			
11.05	31	203	129				1540	1232	852			

Spring Installed Length	3000 Lb, 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	X	420	535	-	969	-	X	2995	2439	-	1571	-
9.55		389	477	697	880	1101		3026	2497	1996	1660	1159
9.80		358	419	619	791	992		3057	2555	2074	1749	1268
10.05		327	361	541	702	883		3088	2613	2152	1838	1377
10.30		296	303	463	613	774		3119	2671	2230	1927	1486
10.55		265	245	385	524	665		3150	2729	2308	2016	1595
10.80		234	187	307	435	556		3181	2787	2386	2105	1704
11.05		203	129	229	346	447		3212	2845	2464	2194	1813

Spring Installed Length	4000 Lb, 4" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55	X	X	473	-	862	-	X	X	3784	-	2898	-
9.80			415	609	773	967			3842	3329	2987	2474
10.05			357	531	684	858			3900	3407	3076	2583
10.30			299	453	595	749			3958	3485	3165	2692
10.55			241	375	506	640			4016	3563	3254	2801
10.80			183	297	417	531			4074	3641	3343	2910
11.05			125	219	328	422			4132	3719	3432	3019

AH/NH92, 94  
20 MINIMUM OUTPUT FORCE  
AT BEGINNING OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb, 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	-	-				-	-	-			
9.55	-	725	-				-	844	-			
9.80	416	694	1151				1038	875	699			
10.05	396	663	1093				1058	906	757			
10.30	376	632	1035				1078	937	815			
10.55	355	601	977				1098	968	873			
10.80	336	569	919				1118	999	931			
11.05	316	538	861				1138	1030	989			

Spring Installed Length	3000 lb, 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30		-	1266	-	-	-		-	2168	-	-	-
9.55		725	1208	-	2078	-		2430	2226	-	1704	-
9.80		694	1151	-	1989	-		2461	2284	-	1793	-
10.05		663	1093	1590	1900	2397		2492	2342	2068	1882	1612
10.30		632	1035	1512	1811	2288		2523	2400	2146	1971	1721
10.55		601	977	1434	1722	2179		2554	2453	2224	2060	1830
10.80		569	919	1356	1633	2070		2585	2516	2302	2149	1939
11.05		538	861	1278	1594	1961		2616	2574	2380	2238	2048

Spring Installed Length	4000 Lb, 4" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55			1319	-	-	-			3174	-	-	-
9.80			1261	-	2146	-			3232	-	2753	-
10.05			1203	-	2057	-			3290	-	2842	-
10.30			1146	1657	1968	2480			3348	3100	2931	2686
10.55			1087	1579	1879	2371			3406	3178	3020	2795
10.80			1029	1501	1790	2262			3464	3256	3109	2904
11.05			971	1423	1701	2153			3522	3334	3199	3013



AH/NH 92, 94  
 2Ø MINIMUM OUTPUT FORCE  
 AT END OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb, 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	-	-				-	-	-			
9.55	-	291	-				-	470	-			
9.80	136	260	345				796	501	5			
10.05	116	229	288				816	532	63			
10.30	96	198	230				836	563	121			
10.55	76	167	172				856	594	179			
10.80	56	136	114				876	625	237			
11.05	36	105	56				896	656	295			

Spring Installed Length	3000 Lb, 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30		-	461	-	-	-		-	1474	-	-	-
9.55		291	403	-	838	-		2056	1532	-	636	-
9.80		260		-	749	-		2087	1590	-	725	-
10.05		229	288	505	660	878		2118	1648	1133	814	822
10.30		198	230	427	571	769		2149	1706	1211	903	931
10.55		167	172	349	482	660		2180	1764	1289	992	1040
10.80		136	114	271	393	551		2211	1822	1367	1081	1149
11.05		105	56	193	304	442		2242	1880	1445	1170	1258

Spring Installed Length	4000 Lb, 4" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55			399	-	-	-			2381	-	-	-
9.80			341	-	730	-			2439	-	1532	-
10.05			283	-	641	-			2497	-	1621	-
10.30			225	417	552	744			2555	2031	1710	1190
10.55			167	339	463	635			2613	2109	1799	1298
10.80			109	261	374	526			2671	2187	1888	1408
11.05			51	183	285	417			2729	2265	1977	1517

AH/NH 92, 94  
MEAN OUTPUT FORCE  
AT BEGINNING OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb, 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	-	1340	X	X	X	-	-	835	X	X	X
9.55	-	854	1282				-	1107	893			
9.80	449	823	1224				1364	1138	951			
10.05	429	792	1166				1384	1169	1009			
10.30	409	761	1108				1404	1200	1067			
10.55	389	730	1050				1424	1231	1125			
10.80	369	699	992				1444	1262	1183			
11.05	349	668	934				1464	1293	1241			

Spring Installed Length	3000 Lb, 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	X	-	1340	-	-	-	X	-	2553	-	-	-
9.55		854	1282	-	2150	-		2813	2611	2295	-	1777
9.80		823	1224	-	2061	-		2844	2669	2373	-	1886
10.05		792	1166	1614	1972	2471		2875	2727	2451	2267	1995
10.30		761	1108	1536	1883	2362		2906	2785	2529	2356	2104
10.55		730	1050	1458	1794	2253		2937	2843	2607	2445	2213
10.80		699	992	1380	1705	2144		2968	2901	2685	2534	2322
11.05		668	934	1302	1616	2035		2999	2959	2763	2623	2431

Spring Installed Length	4000 Lb, 4" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55	X	X	1393	-	-	-	X	X	3819	-	-	-
9.80			1335	-	2220	-			3877	-	3398	-
10.05			1277	-	2131	-			3935	-	3487	-
10.30			1219	1731	2042	2554			3993	3765	3576	3331
10.55			1161	1653	1953	2445			4051	3843	3665	3440
10.80			1103	1575	1864	2336			4109	3921	3754	3549
11.05			1045	1497	1775	2227			4167	3979	3843	3658

AH/NH 92, 94  
MEAN OUTPUT FORCE  
AT BEGINNING OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb, 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	-	1340				-	-	835			
9.55	-	854	1282				-	1107	893			
9.80	449	823	1224				1364	1138	951			
10.05	429	792	1166				1384	1169	1009			
10.30	409	761	1108				1404	1200	1067			
10.55	389	730	1050				1424	1231	1125			
10.80	369	699	992				1444	1262	1183			
11.05	349	668	934				1464	1293	1241			

Spring Installed Length	3000 Lb, 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30		-	1340	-	-	-		-	2553	-	-	-
9.55		854	1282	-	2150	-		2813	2611	2295	-	1777
9.80		823	1224	-	2061	-		2844	2669	2373	-	1886
10.05		792	1166	1614	1972	2471		2875	2727	2451	2267	1995
10.30		761	1108	1536	1883	2362		2906	2785	2529	2356	2104
10.55		730	1050	1458	1794	2253		2937	2843	2607	2445	2213
10.80		699	992	1380	1705	2144		2968	2901	2685	2534	2322
11.05		668	934	1302	1616	2035		2999	2959	2763	2623	2431

Spring Installed Length	4000 Lb, 4" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55			1393	-	-	-			3819	-	-	-
9.80			1335	-	2220	-			3877	-	3398	-
10.05			1277	-	2131	-			3935	-	3487	-
10.30			1219	1731	2042	2554			3993	3765	3576	3331
10.55			1161	1653	1953	2445			4051	3843	3665	3440
10.80			1103	1575	1864	2336			4109	3921	3754	3549
11.05			1045	1497	1775	2227			4167	3979	3843	3658

AH/NH 92,94  
MEAN OUTPUT FORCE  
AT END OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb, 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	-	535				-	-	141			
9.55	-	420	477				-	732	199			
9.80	169	389	419				1122	763	257			
10.05	149	358	361				1142	794	315			
10.30	129	327	303				1162	825	373			
10.55	109	296	245				1182	856	431			
10.80	89	265	187				1202	887	489			
11.05	69	234	129				1222	918	547			

Spring Installed Length	3000 Lb., 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30		-	535	-	-	-		-	1859	-	932	-
9.55		420	477	-	911	-		2439	1917	-	1021	-
9.80		389	419	-	822	-		2470	1975	-	1110	-
10.05		358	361	579	733	952		2501	2033	1516	1199	686
10.30		327	303	501	644	843		2532	2091	1594	1288	795
10.55		296	245	423	555	734		2563	2149	1672	1377	904
10.80		265	187	345	466	625		2594	2207	1750	1466	1013
11.05		234	129	267	377	516		2625	2265	1828	1555	1122

Spring Installed Length	4000 Lb, 4" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55			473	-	-	-			3026	-	-	-
9.80			415	-	804	-			3084	-	2177	-
10.05			357	-	715	-			3142	-	2266	-
10.30			299	491	626	818			3200	2676	2355	1835
10.55			241	413	537	709			3258	2754	2444	1944
10.80			183	335	448	600			3316	2832	2533	2053
11.05			125	257	359	491			3374	2910	2622	2162

AH/NH95, 97 & 98  
 2 Ø MINIMUM OUTPUT FORCE  
 AT BEGINNING OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 lb., 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	756	1284				-	1165	993			
9.55	437	725	1226				1335	1196	1051			
9.80	417	694	1169				1355	1227	1108			
10.05	397	663	1111				1375	1258	1166			
10.30	377	632	1053				1395	1289	1224			
10.55	357	601	995				1415	1320	1282			
10.80	337	570	937				1435	1351	1340			
11.05	317	539	879				1455	1382	1398			

Spring Installed Length	3000 lb., 3-1/2" Stroke											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30		756	1284	-	2132	-		3004	2461	-		-
9.55		725	1226	1714	2043	2531		3035	2519	2682	2507	2299
9.80		694	1169	1636	1955	2422		3066	2577	2760	2596	2408
10.05		663	1111	1558	1866	2313		3097	2635	2838	2685	2517
10.30		632	1053	1480	1777	2204		3128	2693	2916	2774	2626
10.55		601	995	1402	1688	2095		3159	2751	2994	2863	2735
10.80		570	937	1324	1599	1985		3190	2809	3072	2952	2844
11.05		539	879	1246	1510	1877		3221	2867	3150	3041	2953

Spring Installed Length	4000 lb., 4" Stroke											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55			1357	-	2236	-			3968	-	3585	-
9.80			1299	1810	2147	2657			4026	3838	3674	3486
10.05			1241	1732	2058	2548			4084	3916	3763	3595
10.30			1183	1654	1969	2439			4142	3994	3852	3704
10.55			1125	1576	1880	2330			4200	4072	3941	3813
10.80			1067	1498	1791	2221			4258	4150	4030	3982
11.05			1009	1420	1702	2112			4316	4228	4119	4031

95.97.96-2

AH/NH95, 97 & 98  
 2  $\phi$  MINIMUM OUTPUT FORCE  
 AT END OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 lb., 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	322	479				-	731	188			
9.55	157	291	421				1055	762	246			
9.80	137	260	364				1075	793	303			
10.05	117	229	306				1095	824	361			
10.30	97	198	248				1115	855	419			
10.55	77	167	190				1135	886	477			
10.80	57	136	132				1155	917	535			
11.05	37	105	74				1175	948	593			

Spring Installed Length	3000 lb., 3-1/2" Stroke											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30		322	479	-	893	-		2570	2027	-	1179	-
9.55		291	421	629	804	1012		2601	2085	1597	1268	780
9.80		260	364	551	716	903		2632	2142	1675	1356	889
10.05		229	306	473	627	794		2663	2200	1753	1445	998
10.30		198	248	395	538	685		2694	2258	1831	1534	1107
10.55		167	190	317	449	576		2725	2316	1909	1623	1216
10.80		136	132	239	360	467		2756	2374	1987	1712	1325
11.05		105	74	161	271	358		2787	2432	2065	1801	1434

Spring Installed Length	4000 lb., 4" Stroke											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55			437	-	820	-			3048	-	2169	-
9.80			379	570	731	921			3106	2598	2258	1750
10.05			321	492	642	812			3164	2676	2347	1859
10.30			263	414	553	703			3222	2754	2436	1968
10.55			205	336	464	594			3280	2832	2525	2077
10.80			147	258	375	485			3338	2910	2614	2186
11.05			89	180	286	376			3396	2988	2703	2296

AH/NH 95, 97 & 98  
MEAN OUTPUT FORCE  
AT BEGINNING OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb, 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	885	1358	X	X	X	-	1469	1284	X	X	X
9.55	470	854	1300				1713	1500	1342			
9.80	450	823	1242				1733	1531	1400			
10.05	430	792	1184				1753	1562	1458			
10.30	410	761	1126				1773	1593	1516			
10.55	390	730	1068				1793	1624	1574			
10.80	370	699	1010				1813	1655	1632			
11.05	350	668	952				1833	1686	1690			
Spring Installed Length	3000 Lb, 3-1/2" Stroke Spring Number											
3	2	1	4	5	6	3	2	1	4	5	6	
9.30	X	885	1358	-	2206	-	X	3449	3277	-	2863	-
9.55		854	1300	1788	2117	2605		3480	3335	3127	2952	2744
9.80		823	1242	1710	2028	2490		3511	3393	3205	3041	2853
10.05		792	1184	1632	1939	2387		3542	3451	3283	3130	2962
10.30		761	1126	1554	1850	2278		3573	3509	3361	3219	3071
10.55		730	1068	1476	1761	2169		3604	3567	3439	3308	3180
10.80		699	1010	1398	1672	2060		3635	3625	3517	3397	3289
11.05		668	952	1320	1583	1951		3666	3683	3595	3486	3398
Spring Installed Length	4000 Lb., 4" Stroke Spring Number											
3	2	1	4	5	6	3	2	1	4	5	6	
9.55	X	1431	-	2310	X	4716	-	4333	-	X	X	
9.80		1373	1884	2221		2731	4774	4586	4422			4234
10.05		1315	1806	2132		2622	4832	4664	4511			4343
10.30		1257	1728	2043		2513	4890	4742	4600			4452
10.55		1199	1650	1954		2404	4948	4820	4689			4561
10.80		1141	1572	1865		2295	5006	4898	4778			4670
11.05		1083	1494	1776		2186	5064	4976	4867			4779

AH/NH 95, 97 & 98  
MEAN OUTPUT FORCE  
AT END OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb, 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	451	553				-	1035	479			
9.55	190	420	495				1433	1066	537			
9.80	170	389	437				1453	1097	595			
10.05	150	358	379				1473	1128	653			
10.30	130	327	321				1493	1159	711			
10.55	110	296	263				1513	1190	769			
10.80	90	265	205				1533	1221	827			
11.05	70	234	147				1553	1252	885			

Spring Installed Length	3 000 Lb, 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
	9.30		451	553	-	967	-		3015	2472	-	1624
9.55		420	495	703	878	1086		3046	2530	2042	1713	1225
9.80		389	437	625	789	977		3077	2588	2120	1802	1334
10.05		358	379	547	700	868		3108	2646	2198	1891	1443
10.30		327	321	469	611	759		3139	2704	2276	1980	1552
10.55		296	263	391	522	650		3170	2762	2354	2069	1661
10.80		265	205	313	433	541		3201	2820	2432	2158	1770
11.05		234	147	235	344	432		3232	2878	2510	2247	1879

Spring Installed Length	4000 Lb, 4" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
	9.55			511	-	894	-			3796	-	2917
9.80			453	644	805	995			3854	3346	3006	2498
10.05			395	566	716	886			3912	3424	3095	2607
10.30			337	488	627	777			3970	3502	3184	2716
10.55			279	410	538	668			4028	3580	3273	2825
10.80			221	332	449	559			4086	3658	3362	2934
11.05			163	254	360	450			4144	3736	3451	3043



AH/NH 96  
2 $\sigma$  MINIMUM OUTPUT FORCE  
AT BEGINNING OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb, 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	787	-	X	X	X	-	831	611	X	X	X
9.55	-	756	-				-	862	669			
9.80	455	725	1169				1048	893	727			
10.05	435	694	1111				1068	924	785			
10.30	415	663	1053				1088	955	843			
10.55	395	632	995				1108	986	901			
10.80	375	601	937				1128	1017	959			
11.05	355	570	879	1148	1048	1017						

Spring Installed Length	3000 Lb, 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	X	787	1284	-	2164	-	X	2416	1878	-	1662	-
9.55		756	1226	-	2075	-		2447	1936	-	1751	-
9.80		725	1169	1674	1985	2491		2478	1994	2030	1840	1560
10.05		694	1111	1596	1897	2382		2509	2052	2108	1929	1669
10.30		663	1053	1518	1808	2273		2540	2110	2186	2018	1778
10.55		632	995	1440	1719	2164		2571	2168	2264	2107	1887
10.80		601	937	1362	1630	2055		2602	2226	2342	2196	1996
11.05	570	879	1284	1541	1946	2633	2284	2420	2285	2105		

Spring Installed Length	4000 Lb, 4" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55	X	X	1357	-	-	-	X	X	3185	-	-	-
9.80			1299	-	2178	-			3243	-	2769	-
10.05			1241	-	208	-			3301	-	2858	-
10.30			1183	1692	2000	2508			3359	3115	2947	2707
10.55			1125	1614	1911	2399			3417	3193	3036	2816
10.80			1067	1536	1822	2290			3475	3271	3125	2925
11.05			1009	1458	1733	2181			3533	3349	3214	3034

AH/NH 96  
 2  $\phi$  MINIMUM OUTPUT FORCE  
 AT END OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb. 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	353	-	/	/	/	-	457	-	/	/	/
9.55	-	322	-	/	/	/	-	488	-	/	/	/
9.80	175	291	364	/	/	/	808	519	33	/	/	/
10.05	155	260	306	/	/	/	828	550	91	/	/	/
10.30	135	229	248	/	/	/	848	581	149	/	/	/
10.55	115	198	190	/	/	/	868	612	207	/	/	/
10.80	95	167	132	/	/	/	888	643	265	/	/	/
11.05	75	136	74	/	/	/	908	674	323	/	/	/
3000 Lb, 3-1/2" Stroke Spring Number												
Spring Installed Length	3	2	1	4	5	6	3	2	1	4	5	6
9.30	/	353	479	-	925	-	/	2042	1503	-	593	-
9.55	/	322	421	-	836	-	/	2073	1561	-	682	-
9.80	/	291	364	589	747	972	/	2104	1619	1094	771	250
10.05	/	260	306	511	658	863	/	2135	1677	1172	860	359
10.30	/	229	248	433	569	754	/	2166	1735	1250	949	468
10.55	/	198	190	355	480	645	/	2197	1793	1328	1038	577
10.80	/	167	132	277	391	536	/	2228	1851	1406	1127	686
11.05	/	136	74	199	302	427	/	2259	1909	1484	1216	795
4000 Lb, 4" Stroke Spring Number												
Spring Installed Length	3	2	1	4	5	6	3	2	1	4	5	6
9.55	/	/	437	-	-	-	/	/	2392	-	-	-
9.80	/	/	379	-	762	-	/	/	2450	-	1548	-
10.05	/	/	321	-	673	-	/	/	2508	-	1638	-
10.30	/	/	263	452	584	772	/	/	2566	2046	1727	1211
10.55	/	/	205	374	495	663	/	/	2624	2124	1816	1320
10.80	/	/	147	296	406	554	/	/	2682	2202	1905	1429
11.05	/	/	89	218	317	445	/	/	2740	2280	1994	1538

AH/NH 96  
MEAN OUTPUT FORCE  
AT BEGINNING OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb., 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	916	1358	X	X	X	-	1096	863	X	X	X
9.55	-	885	1300				-	1127	921			
9.80	488	854	1242				1375	1158	979			
10.05	468	823	1184				1395	1189	1037			
10.30	448	792	1126				1415	1220	1095			
10.55	428	761	1068				1435	1251	1153			
10.80	408	730	1010				1455	1282	1211			
11.05	388	699	952				1475	1313	1269			

Spring Installed Length	3000 Lb., 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	X	916	1358	-	2237	-	X	2800	2581	-	2046	-
9.55		885	1300	-	2148	-		2831	2639	-	2135	-
9.80		854	1242	1748	2059	2565		2862	2697	2413	2224	1943
10.05		823	1184	1670	1970	2456		2893	2755	2491	2313	2052
10.30		792	1126	1592	1881	2347		2924	2813	2569	2402	2161
10.55		761	1068	1514	1792	2238		2955	2871	2647	2491	2270
10.80		730	1010	1436	1703	2129		2986	2929	2725	2580	2379
11.05		699	952	1358	1614	2020		3017	2987	2803	2669	2488

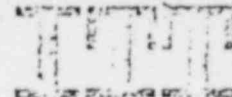
Spring Installed Length	4000 Lb., 4" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55	X	X	1431	-	-	-	X	X	3830	-	-	-
9.80			1373	-	2252	-			3888	-	3414	-
10.05			1315	-	2163	-			3946	-	3503	-
10.30			1257	1766	2074	2582			4004	3760	3592	3352
10.55			1199	1688	1985	2473			4062	3838	3681	3461
10.80			1141	1610	1896	2364			4120	3916	3770	3570
11.05			1083	1532	1807	2255			4178	3994	3859	3679

AH/NH 96  
MEAN OUTPUT FORCE  
AT END OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb., 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	482	553				-	719	169			
9.55	-	451	495				-	750	227			
9.80	208	420	437				1133	781	285			
10.05	188	389	379				1153	812	343			
10.30	168	358	321				1173	843	401			
10.55	148	327	263				1193	874	459			
10.80	128	296	205				1213	905	517			
11.05	108	265	147				1233	936	575			

Spring Installed Length	3000 Lb., 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30		482	553	-	998	-		2426	2263	-	978	-
9.55		451	495	-	909	-		2457	2321	-	1067	-
9.80		420	437	663	820	1046		2488	2379	1478	1156	634
10.05		389	379	585	731	937		2519	2437	1556	1245	
10.30		358	321	507	642	828		2550	2495	1634	1334	852
10.55		327	263	429	553	719		2581	2553	1712	1423	961
10.80		296	205	351	464	610		2612	2611	1790	1512	1070
11.05		265	147	273	375	501		2643	2669	1868	1601	1179

Spring Installed Length	4000 Lb., 4" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55			511	-	-	-			3037	-	-	-
9.80			453	-	836	-			3095	-	2193	-
10.05			395	-	747	-			3153	-	2282	-
10.30			337	526	658	846			3211	2691	2371	1855
10.55			279	448	569	737			3269	2769	2460	1964
10.80			221	370	480	628			3327	2847	2549	2073
11.05			163	292	391	519			3385	2925	2638	2182



## GENERAL CONTROLS

201 Allen Avenue  
Glendale, California 91201  
(213) 842-6131

April 18, 1980

Mr. Ray Alley  
American Warming & Ventilating  
1310 Indian Wood Circle  
P.O. Box 279  
Maumee, OH 43537

Dear Ray:

The enclosed tables have been derived from actual test data and represent the statistical minimums of the actual output forces. This means that statistically at the 80% confidence level, 98% of the units will have outputs at or in excess of the statistical minimum. In a practical sense the statistical minimum of the output forces should represent a number that can be compared to the desired or required actuator output including safety factors which were calculated during the design phase. This should allow a reasonable judgment to be made concerning the capability of the actuator to perform as expected. It should be pointed out that if the actuator output does not meet the requirement, an adjustment of the spring height may be necessary.

The tables cover all indirect or pull units. Data on direct or push units will be made available next week.

Our Engineering Department is preparing a complete report for the basis of these tables. This report will be available for you in a few weeks if you would like a copy.

I hope that this data will suffice to allow you to complete your analysis of these actuators which you have received.

If there are any other questions, please let me know.

Very truly yours,

E. J. Winstel

Representative Sales Man.

AH/NH 91 & 93  
 20 MINIMUM OUTPUT FORCE  
 AT BEGINNING OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 lb., 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	725	1266	X	X	X	-	1145	960	X	X	X
9.55	398	694	1208				1322	1176	1018			
9.80	378	663	1151				1342	1207	1075			
10.05	358	632	1093				1362	1238	1133			
10.30	338	601	1035				1382	1269	1191			
10.55	318	569	977				1402	1300	1249			
10.80	298	538	919				1422	1331	1307			
11.05	-	507	861				-	1362	1365			
Spring Installed Length	3000 lb., 3-1/2" Stroke											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	X	725	1266	-	2134	-	X	2984	2799	-	2365	-
9.55		694	1208	1708	2045	2546		3015	2857	2636	2454	2233
9.80		663	1151	1630	1957	2437		3046	2914	2714	2542	2342
10.05		632	1093	1552	1868	2328		3077	2972	2792	2631	2451
10.30		601	1035	1474	1780	2219		3108	3030	2870	2720	2560
10.55		569	977	1396	1691	2110		3139	3088	2948	2809	2669
10.80		538	919	1318	1602	2001		3170	3146	3026	2898	2778
11.05		507	861	1240	1513	1892		3201	3204	3104	2987	2887
Spring Installed Length	4000 lb., 4" Stroke											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55	X	X	1319	-	2204	-	X	X	3956	-	3566	-
9.80			1261	1775	2115	2629			4014	3821	3655	3462
10.05			1203	1697	2026	2520			4072	3899	3744	3571
10.30			1146	1619	1937	2411			4130	3977	3833	3680
10.55			1087	1541	1848	2302			4188	4055	3922	3789
10.80			1029	1463	1759	2193			4246	4133	4011	3898
11.05			971	1385	1670	2084			4304	4211	4100	4007

AH/NH91 & 93  
 2  $\sigma$  MINIMUM OUTPUT FORCE  
 AT END OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb., 3-1/2" Stroke Spring No.											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	291	461	X	X	X	-	711	155	X	X	X
9.55	118	260	403	X	X	X	1042	742	213	X	X	X
9.80	98	229	346	X	X	X	1062	773	270	X	X	X
10.05	78	198	288	X	X	X	1082	804	328	X	X	X
10.30	58	167	230	X	X	X	1102	835	386	X	X	X
10.55	38	136	172	X	X	X	1122	866	444	X	X	X
10.80	18	105	114	X	X	X	1142	897	502	X	X	X
11.05	-	74	56	X	X	X	-	928	560	X	X	X

Spring Installed Length	3000 lb., 3-1/2" Stroke											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	X	291	461	-	895	-	X	2550	1994	-	1126	-
9.55	X	260	403	623	806	1027	X	2581	2052	1551	1215	714
9.80	X	229	346	545	718	918	X	2612	2109	1629	1303	823
10.05	X	198	288	467	629	809	X	2643	2167	1707	1392	932
10.30	X	167	230	389	540	700	X	2674	2225	1785	1481	1041
10.55	X	136	172	311	451	591	X	2705	2283	1863	1570	1150
10.80	X	105	114	233	362	482	X	2736	2341	1941	1659	1259
11.05	X	74	56	155	273	373	X	2767	2399	2019	1748	1368

Spring Installed Length	4000 lb., 4" Stroke											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55	X	X	399	-	788	-	X	X	3036	-	2150	-
9.80	X	X	341	535	699	893	X	X	3094	2581	2239	1726
10.05	X	X	283	457	610	784	X	X	3152	2659	2328	1835
10.30	X	X	225	379	521	675	X	X	3210	2737	2417	1944
10.55	X	X	167	301	432	566	X	X	3268	2815	2506	2053
10.80	X	X	109	223	343	457	X	X	3326	2893	2595	2162
11.05	X	X	51	145	254	348	X	X	3384	2971	2684	2271

AH/NH 91 & 93  
MEAN OUTPUT FORCE  
AT BEGINNING OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb, 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	854	1340	/	/	/	-	1449	1251	/	/	/
9.55	431	823	1282	/	/	/	1700	1480	1309	/	/	/
9.80	411	792	1224	/	/	/	1720	1511	1367	/	/	/
10.05	391	761	1166	/	/	/	1740	1542	1425	/	/	/
10.30	371	730	1108	/	/	/	1760	1573	1483	/	/	/
10.55	351	699	1050	/	/	/	1780	1604	1541	/	/	/
10.80	331	668	992	/	/	/	1800	1635	1599	/	/	/
11.05	311	637	934	/	/	/	1820	1666	1657	/	/	/
3000 Lb, 3-1/2" Stroke Spring Number												
Spring Installed Length	3	2	1	4	5	6	3	2	1	4	5	6
9.30	/	854	1340	-	2208	-	/	3429	3244	-	2810	-
9.55	/	823	1282	1732	2119	2620	/	3460	3302	3081	2899	2678
9.80	/	792	1224	1654	2031	2511	/	3491	3360	3159	2988	2787
10.05	/	761	1166	1576	1941	2402	/	3522	3418	3237	3077	2896
10.30	/	730	1108	1498	1852	2293	/	3553	3476	3315	3166	3005
10.55	/	699	1050	1420	1763	2184	/	3584	3534	3393	3255	3114
10.80	/	668	992	1342	1674	2075	/	3615	3592	3471	3344	3223
11.05	/	637	934	1264	1585	1966	/	3646	3650	3549	3433	3332
4000 Lb, 4" Stroke Spring Number												
Spring Installed Length	3	2	1	4	5	6	3	2	1	4	5	6
9.55	/	/	1393	-	2278	-	/	/	4704	-	4314	-
9.80	/	/	1335	1849	2189	2703	/	/	4762	4569	4403	4210
10.05	/	/	1277	1771	2100	2594	/	/	4820	4647	4492	4319
10.30	/	/	1219	1693	2011	2485	/	/	4878	4725	4581	4428
10.55	/	/	1161	1615	1922	2376	/	/	4936	4803	4670	4537
10.80	/	/	1103	1537	1833	2267	/	/	4994	4881	4759	4646
11.05	/	/	1045	1459	1744	2158	/	/	5052	4959	4848	4755



AH/NH 91 & 93  
MEAN OUTPUT FORCE  
AT END OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb., 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	420	535				-	1015	446			
9.55	151	389	477				1420	1046	504			
9.80	131	358	419				1440	1077	562			
10.05	111	327	361				1460	1108	620			
10.30	91	296	303				1480	1139	678			
10.55	71	265	245				1500	1170	736			
10.80	51	234	187				1520	1201	794			
11.05	31	203	129				1540	1232	852			

Spring Installed Length	3000 Lb, 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30		420	535	-	969	-		2995	2439	-	1571	-
9.55		389	477	697	880	1101		3026	2497	1996	1660	1159
9.80		358	419	619	791	992		3057	2555	2074	1749	1268
10.05		327	361	541	702	883		3088	2613	2152	1838	1377
10.30		296	303	463	613	774		3119	2671	2230	1927	1486
10.55		265	245	385	524	665		3150	2729	2308	2016	1595
10.80		234	187	307	435	556		3181	2787	2386	2105	1704
11.05		203	129	229	346	447		3212	2845	2464	2194	1813

Spring Installed Length	4000 Lb, 4" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55			473	-	862	-			3784	-	2898	-
9.80			415	609	773	967			3842	3329	2987	2474
10.05			357	531	684	858			3900	3407	3076	2583
10.30			299	453	595	749			3958	3485	3165	2692
10.55			241	375	506	640			4016	3563	3254	2801
10.80			183	297	417	531			4074	3641	3343	2910
11.05			125	219	328	422			4132	3719	3432	3019

AH/NH92, 94  
 20 MINIMUM OUTPUT FORCE  
 AT BEGINNING OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb, 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	-	-	X	X	X	-	-	-	X	X	X
9.55	-	725	-				-	844	-			
9.80	416	694	1151				1038	875	699			
10.05	396	663	1093				1058	906	757			
10.30	376	632	1035				1078	937	815			
10.55	356	601	977				1098	968	873			
10.80	335	569	919				1118	999	931			
11.05	316	538	861				1138	1030	989			

Spring Installed Length	3000 lb, 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	X	-	1266	-	-	-	X	-	2168	-	-	-
9.55		725	1208	-	2078	-		2430	2226	-	1704	-
9.80		694	1151	-	1989	-		2461	2284	-	1793	-
10.05		663	1093	1590	1900	2397		2492	2342	2068	1882	1612
10.30		632	1035	1512	1811	2288		2523	2400	2146	1971	1721
10.55		601	977	1434	1722	2179		2554	2458	2224	2060	1830
10.80		569	919	1356	1633	2070		2585	2516	2302	2149	1939
11.05		538	861	1278	1594	1961		2616	2574	2380	2238	2048

Spring Installed Length	4000 Lb, 4" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55	X	X	1319	-	-	-	X	X	3174	-	-	-
9.80			1261	-	2146	-			3232	-	2753	-
10.05			1203	-	2057	-			3290	-	2842	-
10.30			1146	1657	1968	2480			3348	3100	2931	2686
10.55			1087	1579	1879	2371			3406	3178	3020	2795
10.80			1029	1501	1790	2262			3464	3256	3109	2904
11.05			971	1423	1701	2153			3522	3334	3198	3013

AH/NH 92, 94  
20 MINIMUM OUTPUT FORCE  
AT END OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb, 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	-	-	X	X	X	-	-	-	X	X	X
9.55	-	291	-				-	470	-			
9.80	136	260	346				796	501	5			
10.05	116	229	288				816	532	63			
10.30	96	198	230				836	563	121			
10.55	76	167	172				856	594	179			
10.80	56	136	114				876	625	237			
11.05	36	105	56				896	656	295			

Spring Installed Length	3000 Lb, 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	X	-	461	-	-	-	X	-	1474	-	-	-
9.55		291	403	-	838	-		2056	1532	-	636	-
9.80		260	-	-	749	-		2087	1590	-	725	-
10.05		229	288	505	660	878		2118	1648	1133	814	822
10.30		198	230	427	571	769		2149	1706	1211	903	931
10.55		167	172	349	482	660		2180	1764	1289	992	1040
10.80		136	114	271	393	551		2211	1822	1367	1081	1149
11.05		105	56	193	304	442		2242	1880	1445	1170	1258

Spring Installed Length	4000 Lb, 4" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55	X	X	399	-	-	-	X	X	2381	-	-	-
9.80			341	-	730	-			2439	-	1532	-
10.05			283	-	641	-			2497	-	1621	-
10.30			225	417	552	744			2555	2031	1710	1190
10.55			167	339	463	635			2613	2109	1799	1298
10.80			109	261	374	526			2671	2187	1888	1408
11.05			51	183	285	417			2729	2265	1977	1517

AH/NH 92, 94  
MEAN OUTPUT FORCE  
AT BEGINNING OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb, 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	-	1340				-	-	835			
9.55	-	854	1282				-	1107	893			
9.80	449	823	1224				1364	1138	951			
10.05	429	792	1166				1384	1169	1009			
10.30	409	761	1108				1404	1200	1067			
10.55	389	730	1050				1424	1231	1125			
10.80	369	699	992				1444	1262	1183			
11.05	349	668	934				1464	1293	1241			

Spring Installed Length	3000 Lb, 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30		-	1340	-	-	-		-	2553	-	-	-
9.55		854	1282	-	2150	-		2813	2611	2295	-	1777
9.80		823	1224	-	2061	-		2844	2669	2373	-	1886
10.05		792	1166	1614	1972	2471		2875	2727	2451	2267	1995
10.30		761	1108	1536	1883	2362		2906	2785	2529	2356	2104
10.55		730	1050	1458	1794	2253		2937	2843	2607	2445	2213
10.80		699	992	1380	1705	2144		2968	2901	2685	2534	2322
11.05		668	934	1302	1616	2035		2999	2959	2763	2623	2431

Spring Installed Length	4000 Lb, 4" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55			1393	-	-	-			3819	-	-	-
9.80			1335	-	2220	-			3877	-	3398	-
10.05			1277	-	2131	-			3935	-	3487	-
10.30			1219	1731	2042	2354			398	3765	3576	3331
10.55			1161	1653	1953	2443			4051	3843	3665	3440
10.80			1103	1575	1864	2336			4109	3921	3754	3549
11.05			1045	1497	1775	2227			4167	3979	3843	3658

AH/NH 92,94  
MEAN OUTPUT FORCE  
AT END OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb, 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	-	535				-	-	141			
9.55	-	420	477				-	732	199			
9.80	169	389	419				1122	763	257			
10.05	149	358	361				1142	794	315			
10.30	129	327	303				1162	825	373			
10.55	109	296	245				1182	856	431			
10.80	89	265	187				1202	887	489			
11.05	69	234	129				1222	918	547			

Spring Installed Length	3000 Lb., 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30		-	535	-	-	-		-	1859	-	932	-
9.55		420	477	-	911	-		2439	1917	-	1021	-
9.80		389	419	-	822	-		2470	1975	-	1110	-
10.05		358	361	579	733	952		2501	2033	1516	1199	686
10.30		327	303	501	644	843		2532	2091	1594	1288	795
10.55		296	245	423	555	734		2563	2149	1672	1377	904
10.80		265	187	345	466	625		2594	2207	1750	1466	1013
11.05		234	129	267	377	516		2625	2265	1828	1555	1122

Spring Installed Length	4000 Lb, 4" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55			473	-	-	-			3026	-	-	-
9.80			415	-	804	-			3084	-	2177	-
10.05			357	-	715	-			3142	-	2266	-
10.30			299	491	626	818			3200	2676	2355	1835
10.55			241	413	537	709			3258	2754	2444	1944
10.80			183	335	448	600			3316	2832	2533	2053
11.05			125	257	359	491			3374	2910	2622	2162

AH/NH95, 97 & 98  
 2  $\sigma$  MINIMUM OUTPUT FORCE  
 AT BEGINNING OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 lb., 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	756	1284				-	1165	993			
9.55	437	725	1226				1335	1196	1051			
9.80	417	694	1169				1355	1227	1108			
10.05	397	663	1111				1375	1258	1166			
10.30	377	632	1053				1395	1289	1224			
10.55	357	601	995				1415	1320	1282			
10.80	337	570	937				1435	1351	1340			
11.05	317	539	879				1455	1382	1398			

Spring Installed Length	3000 lb., 3-1/2" Stroke											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30		756	1284	-	2132	-		3004	2461	-		-
9.55		725	1226	1714	2043	2531		3035	2519	2682	2507	2299
9.80		694	1169	1636	1955	2422		3066	2577	2760	2596	2408
10.05		663	1111	1558	1866	2313		3097	2635	2838	2685	2517
10.30		632	1053	1480	1777	2204		3128	2693	2916	2774	2626
10.55		601	995	1402	1688	2095		3159	2751	2994	2863	2735
10.80		570	937	1324	1599	1985		3190	2809	3072	2952	2844
11.05		539	879	1246	1510	1877		3221	2867	3150	3041	2953

Spring Installed Length	4000 lb., 4" Stroke											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55			1357	-	2236	-			3968	-	3585	-
9.80			1299	1810	2147	2657			4026	3838	3674	3486
10.05			1241	1732	2058	2548			4084	3916	3763	3595
10.30			1183	1654	1969	2439			4142	3994	3852	3704
10.55			1125	1576	1880	2330			4200	4072	3941	3813
10.80			1067	1498	1791	2221			4258	4150	4030	3982
11.05			1009	1420	1702	2112			4316	4228	4119	4031

AH/NH95, 97 & 98  
 2  $\phi$  MINIMUM OUTPUT FORCE  
 AT END OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 lb., 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	322	479				-	731	188			
9.55	157	291	421				1055	762	246			
9.80	137	260	364				1075	793	303			
10.05	117	229	306				1095	824	361			
10.30	97	198	248				1115	855	419			
10.55	77	167	190				1135	886	477			
10.80	57	136	132				1155	917	535			
11.05	37	105	74				1175	948	593			

Spring Installed Length	3000 lb., 3-1/2" Stroke											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30		322	479	-	893	-		2570	2027	-	1179	-
9.55		291	421	629	804	1012		2601	2085	1597	1268	780
9.80		260	364	551	716	903		2632	2142	1675	1356	889
10.05		229	306	473	627	794		2663	2200	1753	1445	998
10.30		198	248	395	538	685		2694	2258	1831	1534	1107
10.55		167	190	317	449	576		2725	2316	1909	1623	1216
10.80		136	132	239	360	467		2756	2374	1987	1712	1325
11.05		105	74	161	271	358		2787	2432	2065	1801	1434

Spring Installed Length	4000 lb., 4" Stroke											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55			437	-	820	-			3048	-	2169	-
9.80			379	570	731	921			3106	2598	2258	1750
10.05			321	492	642	812			3164	2676	2347	1859
10.30			263	414	553	703			3222	2754	2436	1968
10.55			205	336	464	594			3280	2832	2525	2077
10.80			147	258	375	485			3338	2910	2614	2186
11.05			89	180	286	376			3396	2988	2703	2296

AH/NH 95, 97 & 98  
MEAN OUTPUT FORCE  
AT BEGINNING OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb, 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	885	1358	X	X	X	-	1460	1284	X	X	X
9.55	470	854	1300				1713	1500	1342			
9.80	450	823	1242				1733	1531	1400			
10.05	430	792	1184				1753	1562	1458			
10.30	410	761	1126				1773	1593	1516			
10.55	390	730	1068				1793	1624	1574			
10.80	370	699	1010				1813	1655	1632			
11.05	350	668	952				1833	1686	1690			
Spring Installed Length	3000 Lb, 3-1/2" Stroke Spring Number											
9.30	X	885	1358	-	2206	-	X	3449	3277	-	2863	-
9.55		854	1300	1788	2117	2605		3480	3335	3127	2952	2744
9.80		823	1242	1710	2028	2496		3511	3393	3205	3041	2853
10.05		792	1184	1632	1939	2387		3542	3451	3283	3130	2962
10.30		761	1126	1554	1850	2278		3573	3509	3361	3210	3071
10.55		730	1068	1476	1761	2169		3604	3567	3439	3318	3180
10.80		699	1010	1398	1672	2060		3635	3625	3517	3387	3250
11.05		668	952	1320	1583	1951		3666	3683	3595	3486	3398
Spring Installed Length	4000 Lb., 4" Stroke Spring Number											
9.55	X	X	1431	-	2310	X	X	4716	-	4333	-	
9.80			1373	1884	2221			2731	4774	4586	4422	4234
10.05			1315	1806	2132			2622	4832	4664	4511	4343
10.30			1257	1728	2043			2513	4890	4742	4600	4452
10.55			1199	1650	1954			2404	4948	4820	4689	4561
10.80			1141	1572	1865			2295	5006	4898	4778	4670
11.05			1083	1494	1776			2186	5064	4976	4867	4779



AH/NH 95, 97 & 98  
MEAN OUTPUT FORCE  
AT END OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb, 3-1/2 Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	451	553				-	1035	479			
9.55	190	420	495				1433	1066	537			
9.80	170	389	437				1453	1097	595			
10.05	150	358	379				1473	1128	653			
10.30	130	327	321				1493	1159	711			
10.55	110	296	263				1513	1190	769			
10.80	90	265	205				1533	1221	827			
11.05	70	234	147				1553	1252	885			

Spring Installed Length	3 000 Lb, 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30		451	553	-	967	-		3015	2472	-	1624	-
9.55		420	495	703	878	1086		3046	2530	2042	1713	1225
9.80		389	437	625	789	977		3077	2588	2120	1802	1334
10.05		358	379	547	700	868		3108	2646	2198	1891	1443
10.30		327	321	469	611	759		3139	2704	2276	1980	1552
10.55		296	263	391	522	650		3170	2762	2354	2069	1661
10.80		265	205	313	433	541		3201	2820	2432	2158	1770
11.05		234	147	235	344	432		3232	2878	2510	2247	1879

Spring Installed Length	4000 Lb, 4" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55			511	-	894	-			3796	-	2917	-
9.80			453	644	805	995			3854	3346	3006	2498
10.05			395	566	716	886			3912	3424	3095	2607
10.30			337	488	627	777			3970	3502	3184	2716
10.55			279	410	538	668			4028	3580	3273	2825
10.80			221	332	449	559			4086	3658	3362	2934
11.05			163	254	360	450			4144	3736	3451	3043

AH/NH 96  
 20 MINIMUM OUTPUT FORCE  
 AT BEGINNING OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb, 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	787	-	X	X	X	-	831	611	X	X	X
9.55	-	756	-				-	862	669			
9.80	455	725	1169				1048	893	727			
10.05	435	694	1111				1068	924	785			
10.30	415	663	1053				1088	955	843			
10.55	395	632	995				1108	986	901			
10.80	375	601	937				1128	1017	959			
11.05	355	570	879				1148	1048	1017			

Spring Installed Length	3000 Lb, 3-1/2" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	X	787	1284	-	2164	-	X	2416	1878	-	1662	-
9.55		756	1226	-	2075	-		2447	1936	-	1751	-
9.80		725	1169	1674	1986	2491		2478	1994	2030	1840	1560
10.05		694	1111	1596	1897	2382		2509	2052	2108	1929	1669
10.30		663	1053	1518	1808	2273		2540	2110	2186	2018	1778
10.55		632	995	1440	1719	2164		2571	2168	2264	2107	1887
10.80		601	937	1362	1630	2055		2602	2226	2342	2196	1996
11.05		570	879	1284	1541	1946		2633	2284	2420	2285	2105

Spring Installed Length	4000 Lb, 4" Stroke											
	Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55	X	X	1357	-	-	-	X	X	3185	-	-	-
9.80			1299	-	2178	-			3243	-	2769	-
10.05			1241	-	2089	-			3301	-	2858	-
10.30			1183	1692	2000	2508			3359	3115	2947	2707
10.55			1125	1614	1911	2399			3417	3193	3036	2816
10.80			1067	1536	1822	2290			3475	3271	3125	2925
11.05			1009	1458	1733	2181			3533	3349	3214	3034

AH/NH 96  
 2  $\square$  MINIMUM OUTPUT FORCE  
 AT END OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb. 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	353	-	/	/	/	-	457	-	/	/	/
9.55	-	322	-	/	/	/	-	488	-	/	/	/
9.80	175	291	364	/	/	/	808	519	33	/	/	/
10.05	155	260	306	/	/	/	828	550	91	/	/	/
10.30	135	229	248	/	/	/	848	581	149	/	/	/
10.55	115	198	190	/	/	/	868	612	207	/	/	/
10.80	95	167	132	/	/	/	888	643	265	/	/	/
11.05	75	136	74	/	/	/	908	674	323	/	/	/

Spring Installed Length	3000 Lb, 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	/	353	479	-	925	-	/	2042	1503	-	593	-
9.55	/	322	421	-	836	-	/	2073	1561	-	682	-
9.80	/	291	364	589	747	972	/	2104	1619	1094	771	250
10.05	/	260	306	511	658	863	/	2135	1677	1172	860	359
10.30	/	229	248	433	569	754	/	2166	1735	1250	949	468
10.55	/	198	190	355	480	645	/	2197	1793	1328	1038	577
10.80	/	167	132	277	391	536	/	2228	1851	1406	1127	686
11.05	/	136	74	199	302	427	/	2259	1909	1484	1216	795

Spring Installed Length	4000 Lb, 4" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.55	/	/	437	-	-	-	/	/	2392	-	-	-
9.80	/	/	379	-	762	-	/	/	2450	-	1548	-
10.05	/	/	321	-	673	-	/	/	2508	-	1638	-
10.30	/	/	263	452	584	772	/	/	2566	2046	1727	1211
10.55	/	/	205	374	495	663	/	/	2624	2124	1816	1320
10.80	/	/	147	296	406	554	/	/	2682	2202	1905	1429
11.05	/	/	89	218	317	445	/	/	2740	2280	1994	1538

AH/NH 96  
MEAN OUTPUT FORCE  
AT BEGINNING OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb., 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	916	1358				-	1096	863			
9.55	-	885	1300				-	1127	921			
9.80	488	854	1242				1375	1158	979			
10.05	468	823	1184				1395	1189	1037			
10.30	448	792	1126				1415	1220	1095			
10.55	428	761	1068				1435	1251	1153			
10.80	408	730	1010				1455	1282	1211			
11.05	388	699	952				1475	1313	1269			

Spring Installed Length	3000 Lb., 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
	9.30		916	1358	-	2237	-		2800	2581	-	2046
9.55		885	1300	-	2148	-		2831	2639	-	2135	-
9.80		854	1242	1748	2059	2565		2862	2697	2413	2224	1943
10.05		823	1184	1670	1970	2456		2893	2755	2491	2313	2052
10.30		792	1126	1592	1881	2347		2924	2813	2569	2402	2161
10.55		761	1068	1514	1792	2238		2955	2871	2647	2491	2270
10.80		730	1010	1436	1703	2129		2986	2929	2725	2580	2379
11.05		699	952	1358	1614	2020		3017	2987	2803	2669	2488

Spring Installed Length	4000 Lb., 4" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
	9.55			1431	-	-	-			3830	-	-
9.80			1373	-	2252	-			3888	-	3414	-
10.05			1315	-	2163	-			3946	-	3503	-
10.30			1257	1766	2074	2582			4004	3760	3592	3352
10.55			1199	1688	1985	2473			4062	3838	3681	3461
10.80			1141	1610	1896	2364			4120	3916	3770	3570
11.05			1083	1532	1807	2255			4178	3994	3859	3679

AH/NH 96  
MEAN OUTPUT FORCE  
AT END OF STROKE

Spring Installed Length	Spring Return Direction						Hydraulic Power Direction					
	1000/1500 Lb., 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
9.30	-	482	553				-	719	169			
9.55	-	451	495				-	750	227			
9.80	208	420	437				1133	781	285			
10.05	188	389	379				1153	812	343			
10.30	168	358	321				1173	843	401			
10.55	142	327	263				1193	874	459			
10.80	128	296	205				1213	905	517			
11.05	108	265	147				1233	936	575			

Spring Installed Length	3000 Lb., 3-1/2" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
	9.30		482	553	-	998	-		2426	2263	-	978
9.55		451	495	-	909	-		2457	2321	-	1067	-
9.80		420	437	663	820	1046		2488	2379	1478	1156	634
10.05		389	379	585	731	937		2519	2437	1556	1245	
10.30		358	321	507	642	828		2550	2495	1634	1334	852
10.55		327	263	429	553	719		2581	2553	1712	1423	961
10.80		296	205	351	464	610		2612	2611	1790	1512	1070
11.05		265	147	273	375	501		2643	2669	1868	1601	1179

Spring Installed Length	4000 Lb., 4" Stroke Spring Number											
	3	2	1	4	5	6	3	2	1	4	5	6
	9.55			511	-	-	-			3037	-	-
9.80			453	-	836	-			3095	-	2193	-
10.05			395	-	747	-			3153	-	2282	-
10.30			337	526	658	846			3211	2691	2371	1855
10.55			279	448	569	737			3269	2769	2460	1964
10.80			221	370	480	628			3327	2847	2549	2073
11.05			163	292	391	519			3385	2925	2638	2182