

INFORMATION TO PREVENT EXCESSIVE BEARING WEAR AND PISTON ROD COLUMN FAILURES

TABLE 1

"L" INCHES	MINIMUM STOP TUBE LENGTH (INCHES)	*MAXIMUM STOP TUBE LENGTH (INCHES)	"L" INCHES	MINIMUM STOP TUBE LENGTH (INCHES)	*MAXIMUM STOP TUBE LENGTH (INCHES)
5-10		1	161-170	13	17
11-20		2	171-180	14	18
21-30		3	181-190	15	19
31-40		4	191-200	16	20
41-50	1	5	201-210	17	21
51-60	2	6	211-220	18	22
61-70	3	7	221-230	19	23
71-80	4	8	231-240	20	24
81-90	5	9	241-250	21	25
91-100	6	10	251-260	22	26
101-110	7	11	261-270	23	27
111-120	8	12	271-280	24	28
121-130	9	13	281-290	25	29
131-140	10	14	291-300	26	30
141-150	11	15	301-310	27	31
151-160	12	16			

\*NOTE: USING STOP TUBE LENGTHS GREATER THAN "MAXIMUM STOP TUBE" HAS DIMINISHING EFFECT ON REDUCING BEARING LOADS.

TABLE 2  
VALUE OF "L" IN INCHES

Axial Thrust "T" Against Rod End in Lbs. Force	MINIMUM PISTON ROD DIAMETER											
	0.63	1.00	1.38	1.75	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50
50	67											
100	59	110										
150	53	103										
250	43	94										
400	37	83	134	186								
700	30	68	118	168	202	275						
1,000	27	60	105	155	190	257						
1,400	24	53	92	142	174	244	308	385				
1,800	23	48	82	127	160	230	294	366	440			
2,400	19	45	75	114	145	213	281	347	415	488		
3,200	16	41	67	103	130	194	262	329	400	461		
4,000	13	38	63	94	119	175	240	310	378	446		
5,000	9	34	60	87	110	163	225	289	360	426	494	
6,000		30	56	82	102	152	209	274	342	411	476	
8,000		26	50	76	93	137	186	245	310	375	447	
10,000		21	45	70	89	125	172	222	279	349	412	482
12,000		17	41	65	84	118	155	210	269	326	388	455
16,000			34	57	75	110	141	188	235	291	350	421
20,000			28	52	68	103	136	172	218	270	326	384
30,000				39	55	87	120	156	189	232	285	330
40,000				22	43	74	108	142	177	210	248	294
50,000					30	66	97	130	165	201	234	269
60,000						57	88	119	154	190	225	256
80,000						36	71	104	137	170	204	240
100,000							56	90	120	154	189	224
120,000							45	77	108	140	175	207
140,000								64	98	129	160	194
160,000								47	86	118	148	182
200,000									67	98	131	160
250,000										72	109	143
300,000											86	120
350,000											52	100
400,000												71

Values of "L" less than those shown have a slenderness ratio (length ÷ radius of gyration which is length ÷ ¼ diameter of piston rod) of less than 50. Thus, the compressive strength formula ( $s = \text{thrust} \div \text{rod area}$ ) is used rather than the column strength formula on which Table 2 is based. For very low slenderness ratios (below 20), compressive strength formulae with a 2 to 1 factor of safety are satisfactory. For slenderness ratios between 20 and 50, use compressive strength formulae with proportionate factors between 2 to 1 and 5 to 1.