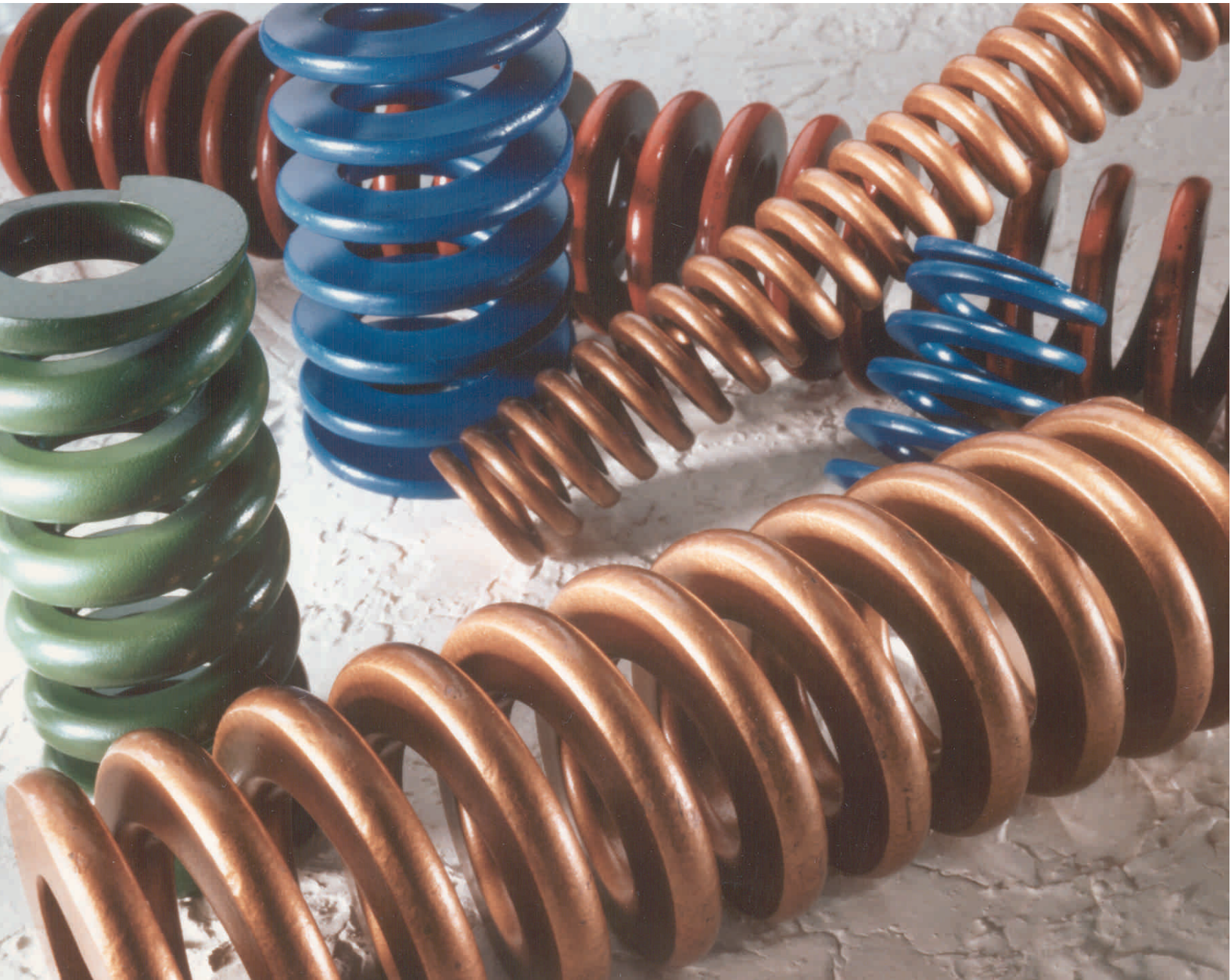


# Raymond<sup>®</sup>

## Die Springs



Associated Spring  
Raymond



BARNES<sup>®</sup>  
GROUP INC

## Selecting Die Springs

A general rule to observe in spring selection is to always use as many springs as the die will accommodate which will produce the required load with the least amount of deflection. This will increase the useful life of the spring, reduce the chances of spring failure and the resulting downtime, loss of production and increased maintenance cost.

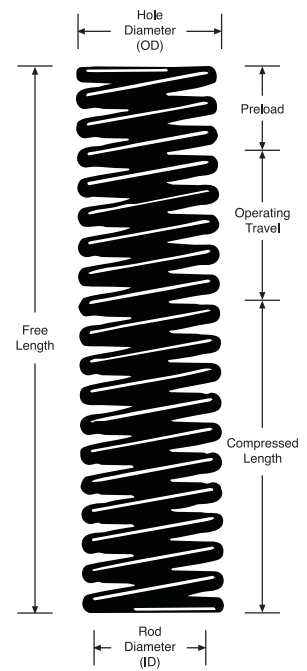
Die spring costs are a very small percentage of the total cost of the die. An effort to save a few cents on die springs is a misguided act that can cost many dollars in lost time and labor.

The more rapidly a spring works, the more attention must be paid to its fatigue limits. In slow moving dies or fixtures, it is possible to get good performance with springs operating near maximum deflection. As the working speed increases, the life expectancy of the spring at that deflection decreases.

Springs for strippers, pressure pads, and other die components can be selected from

the following pages. When selecting a die spring it is necessary to determine the type of performance required of the springs: short, normal, or long run. For short or normal run applications use the deflections tabulated in the long life columns. For long run applications use deflections based on optimum life. The recommended deflections for each spring based on the performance required are shown on pages 4 to 19.

Another approach when selecting a spring is to work back from the amount of operating travel the springs will be subjected to as indicated by the die layout. Select springs in the appropriate duty range which will operate efficiently at the required travel. Calculate the number of springs needed by dividing the load supplied by one spring into the total load required. Round the total number of springs to the next higher even number for balanced performance.



# Die Spring Features & Benefits

Raymond Die Springs Offer	Features	Benefits
<b>Superior Materials &amp; Wire Profile</b>	<ul style="list-style-type: none"> <li>• All Raymond die springs are made from vapor degassed high tensile strength chromium alloy steels (chrome silicon).</li> <li>• Optimal wire cross section.</li> <li>• Spring ends are ground square.</li> <li>• Superior wire finish before and after coiling.</li> <li>• Long cycle life.</li> </ul>	<ul style="list-style-type: none"> <li>• Inherent toughness to withstand heavy load demands.</li> <li>• Superior performance in high stress applications.</li> <li>• Heat resistance up to 475°F (250°C).</li> <li>• Readily available, cost efficient raw material.</li> <li>• Consistent controlled metallurgy.</li> <li>• Offers maximum design possibilities.</li> <li>• Wire cross section provides optimum deflection and protection against failure due to excessive stress build-up.</li> <li>• Square ends create reliable, flat, maximum load-bearing surface.</li> <li>• Specialty materials available to meet customer requirements.</li> </ul>
<b>Dimensional Consistency</b>	<ul style="list-style-type: none"> <li>• Dimensional requirements remain consistent and measurably the same from one batch of springs to the next.</li> </ul>	<ul style="list-style-type: none"> <li>• Provides uniform spring performance.</li> <li>• Insures consistent rate recordings.</li> <li>• Greater load accuracy at a given test height.</li> <li>• Certainty that OD will work freely in prescribed hole and ID will work freely over prescribed rod.</li> <li>• Raymond assurance of the highest production and quality standards.</li> <li>• Reliable performance engineered into every Raymond die spring.</li> </ul>
<b>Longer Spring Life</b>	<ul style="list-style-type: none"> <li>• Engineered to better withstand shock loading.</li> <li>• Designed to endure constant high-speed deflections.</li> <li>• Shot-peened to increase fatigue life.</li> <li>• Less downtime.</li> </ul>	<ul style="list-style-type: none"> <li>• Reliable, trouble-free performance.</li> <li>• Increased fatigue life by as much as 30%.</li> <li>• Reduced spring breakage.</li> <li>• Uniform performance over a longer lifetime.</li> <li>• More cost effective.</li> <li>• Extra performance margins.</li> </ul>
<b>Excellent Deflection</b>	<ul style="list-style-type: none"> <li>• Springs provide greater available travel to solid.</li> <li>• Each spring is preset during manufacture.</li> </ul>	<ul style="list-style-type: none"> <li>• More travel in each spring.</li> <li>• Higher load capacities.</li> <li>• Increased fatigue life.</li> <li>• Greater application flexibility.</li> <li>• More reliable performance.</li> <li>• Lower solid height.</li> <li>• No loss of free length in application.</li> </ul>

## Proper Die Spring Application

The most common die spring problems are generally the most basic — the result of improper selection and application. But trying to save a few pennies on die springs or a few minutes on selection can result in enormous expenses in terms of premature spring failure, increased maintenance costs and lost productivity. That's why making sure you have the best die spring for every application is truly a wise investment.



**DO make spring selection** a part of the early design function, and work within the spring's physical limits. It's best to determine which springs and how many are needed for the job before the die is built.



**DO preload each spring** into the assembled tool to prevent the possibility of shock loading, which causes a stress surge in the vibration frequency and may result in early spring failure.



**Do provide safeguards** from adverse external elements such as heat, corrosive atmosphere, metal chips and other obstructions



**DO provide proper guidance** on all springs to reduce the chance of buckling. As a general rule, if the free length is more than four times the mean diameter of the spring, it could have a buckling problem under compression. This is solved by using a guide rod, boring a pocket, or both.



**DO deepen spring pockets** proportionately when the die is sharpened to maintain the same spring travel and load level. Each spring pocket needs to have a flat bottom and square corners, so the spring will provide uniform stress on each coil as it is compressed.



**DO perform preventative maintenance** on a regularly scheduled basis. Keep records on the number of cycles each die performs, and replace all the die springs at predetermined intervals.



**DON'T replace only one spring**, or mix springs of assorted lengths and deflection ranges on a die. Instead of using an unbalanced, mixed assembly of old and new springs, replace all of the springs to distribute the load evenly.



**DON'T alter a die spring** by cutting off coils or grinding the inside or outside diameter. Altering a die spring causes early failure and creates the potential for damaging the die.



**DON'T expect maximum performance** life from a spring that is producing at maximum load. Although die springs are designed to produce maximum load, they are highly stressed when maximum loads are met.



**DON'T wait** — make spring selection a part of the early design function, and work within the spring's physical limits. It's best to determine which springs and how many are needed for the job before the die is built.



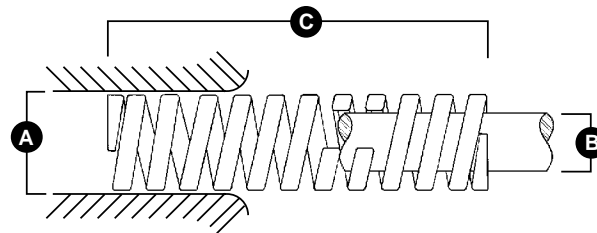
**DO call** — our knowledgeable customer service and engineering professionals are always available to assist you with everything from custom sizes and special materials to technical questions and unusual applications.



# Deflection To Compressed Length Conversion Tables

Die Springs - Inch Tables												
Free Length (in)	Medium Duty Compressed Length (in)			Medium Heavy Duty Compressed Length (in)			Heavy Duty Compressed Length (in)			Extra Heavy Duty Compressed Length (in)		
	Deflection in % free length			Deflection in % free length			Deflection in % free length			Deflection in % free length		
	25%	35%	40%	20%	25%	30%	15%	20%	25%	15%	17%	20%
1	0.75	0.65	0.60	0.80	0.75	0.70	0.85	0.80	0.75	0.85	0.83	0.80
1 1/4	0.94	0.81	0.75	1.00	0.94	0.88	1.06	1.00	0.94	1.06	1.04	1.00
1 1/2	1.13	0.98	0.90	1.20	1.13	1.05	1.28	1.20	1.13	1.28	1.25	1.20
1 3/4	1.31	1.14	1.05	1.40	1.31	1.23	1.49	1.40	1.31	1.49	1.45	1.40
2	1.50	1.30	1.20	1.60	1.50	1.40	1.70	1.60	1.50	1.70	1.66	1.60
2 1/2	1.88	1.63	1.50	2.00	1.88	1.75	2.13	2.00	1.88	2.13	2.08	2.00
3	2.25	1.95	1.80	2.40	2.25	2.10	2.55	2.40	2.25	2.55	2.49	2.40
3 1/2	2.63	2.28	2.10	2.80	2.63	2.45	2.98	2.80	2.63	2.98	2.91	2.80
4	3.00	2.60	2.40	3.20	3.00	2.80	3.40	3.20	3.00	3.40	3.32	3.20
4 1/2	3.38	2.93	2.70	3.60	3.38	3.15	3.83	3.60	3.38	3.83	3.74	3.60
5	3.75	3.25	3.00	4.00	3.75	3.50	4.25	4.00	3.75	4.25	4.15	4.00
5 1/2	4.13	3.58	3.30	4.40	4.13	3.85	4.68	4.40	4.13	4.68	4.57	4.40
6	4.50	3.90	3.60	4.80	4.50	4.20	5.10	4.80	4.50	5.10	4.98	4.80
6 1/2	4.88	4.23	3.90	5.20	4.88	4.55	5.53	5.20	4.88	5.53	5.40	5.20
7	5.25	4.55	4.20	5.60	5.25	4.90	5.95	5.60	5.25	5.95	5.81	5.60
7 1/2	5.63	4.88	4.50	6.00	5.63	5.25	6.38	6.00	5.63	6.38	6.23	6.00
8	6.00	5.20	4.80	6.40	6.00	5.60	6.80	6.40	6.00	6.80	6.64	6.40
10	7.50	6.50	6.00	8.00	7.50	7.00	8.50	8.00	7.50	8.50	8.30	8.00
12	9.00	7.80	7.20	9.60	9.00	8.40	10.20	9.60	9.00	10.20	9.96	9.60

Die Springs - Metric Tables												
Free Length (mm)	Medium Duty Compressed Length (mm)			Medium Heavy Duty Compressed Length (mm)			Heavy Duty Compressed Length (mm)			Extra Heavy Duty Compressed Length (mm)		
	Deflection in % free length			Deflection in % free length			Deflection in % free length			Deflection in % free length		
	25%	35%	40%	20%	25%	30%	15%	20%	25%	15%	17%	20%
25	19	17	15	20	19	18	22	20	19	22	21	20
32	24	21	19	25	24	22	27	25	24	27	26	25
38	29	25	23	30	29	27	32	30	29	32	32	30
44	33	29	27	36	33	31	38	36	33	38	37	36
51	38	33	30	41	38	36	43	41	38	43	42	41
64	48	41	38	51	48	44	54	51	48	54	53	51
76	57	50	46	61	57	53	65	61	57	65	63	61
89	67	58	53	71	67	62	76	71	67	76	74	71
102	76	66	61	81	76	71	86	81	76	86	84	81
114	86	84	69	91	86	80	97	91	86	97	95	91
127	95	83	76	102	95	89	108	102	95	108	105	102
140	105	91	84	112	105	98	119	112	105	119	116	112
152	114	99	91	122	114	107	130	122	114	130	126	122
165	124	107	99	132	124	116	140	132	124	140	137	132
178	133	116	107	142	133	124	151	142	133	151	148	142
191	143	124	114	152	143	133	162	152	143	162	158	152
203	152	132	122	163	152	142	173	163	152	173	169	163
254	191	165	152	203	191	178	216	203	191	216	211	203
305	229	198	183	244	229	213	259	244	229	259	253	244



**Raymond® MEDIUM DUTY DIE SPRINGS INCH DIMENSIONS BLUE**

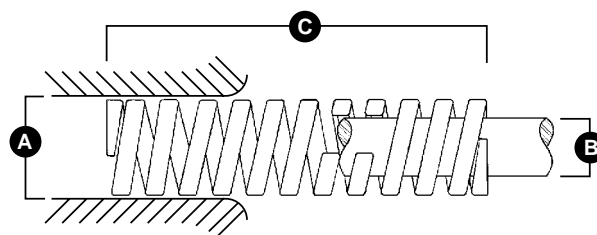
Hole Dia. (in)	Rod Dia. (in)	Free Length (in)	CATALOG NUMBER	Load at 1/10 in. Def. (lb)	LOAD DEFLECTION TABLE							
					For Optimum Life (25% of free length)		For Long Life (35% of free length)		Maximum Operating Def. (40% of free length)		*Maximum Deflection (50% of free length)	
					Load (lb)	Deflection (in)	Load (lb)	Deflection (in)	Load (lb)	Deflection (in)	Deflection (in)	
A	B	C										
3/8	3/16	1	103-104	6.0	15.0	0.25	21.0	0.35	24.0	0.40	0.50	
		1 1/4	103-105	5.4	16.9	0.31	23.6	0.44	27.0	0.50	0.63	
		1 1/2	103-106	4.0	15.0	0.38	21.0	0.53	24.0	0.60	0.75	
		1 3/4	103-107	3.4	14.9	0.44	20.8	0.61	23.8	0.70	0.88	
		2	103-108	2.8	14.0	0.50	19.6	0.70	22.4	0.80	1.00	
		2 1/2	103-110	2.4	15.0	0.63	21.0	0.88	24.0	1.00	1.25	
		3	103-112	2.1	15.8	0.75	22.0	1.05	25.2	1.20	1.50	
		12	103-148	0.6	18.0	3.00	25.2	4.20	28.8	4.80	6.00	
1/2	9/32	1	103-204	11.0	27.5	0.25	38.5	0.35	44.0	0.40	0.50	
		1 1/4	103-205	8.2	25.6	0.31	35.9	0.44	41.0	0.50	0.63	
		1 1/2	103-206	6.8	25.5	0.38	35.7	0.53	40.8	0.60	0.75	
		1 3/4	103-207	6.0	26.3	0.44	36.8	0.61	42.0	0.70	0.88	
		2	103-208	5.5	27.5	0.50	38.5	0.70	44.0	0.80	1.00	
		2 1/2	103-210	4.5	28.1	0.63	39.4	0.88	45.0	1.00	1.25	
		3	103-212	3.5	26.3	0.75	36.8	1.05	42.0	1.20	1.50	
		3 1/2	103-214	3.0	26.3	0.88	36.8	1.23	42.0	1.40	1.75	
		4 1/2	103-218	2.5	28.1	1.13	39.4	1.58	45.0	1.80	2.25	
		5 1/2	103-222	2.1	28.9	1.38	40.4	1.93	46.2	2.20	2.75	
		6 1/2	103-226	1.4	22.8	1.63	31.9	2.28	36.4	2.60	3.25	
		7 1/2	103-230	1.2	22.5	1.88	31.5	2.63	36.0	3.00	3.75	
12	103-248	0.7	21.0	3.00	29.4	4.20	33.6	4.80	6.00			
5/8	11/32	1	103-304	16.4	41.0	0.25	57.4	0.35	65.6	0.40	0.50	
		1 1/4	103-305	12.8	40.0	0.31	56.0	0.44	64.0	0.50	0.63	
		1 1/2	103-306	10.8	40.5	0.38	56.7	0.53	64.8	0.60	0.75	
		1 3/4	103-307	9.6	42.0	0.44	58.8	0.61	67.2	0.70	0.88	
		2	103-308	8.8	44.0	0.50	61.6	0.70	70.4	0.80	1.00	
		2 1/2	103-310	6.0	37.5	0.63	52.5	0.88	60.0	1.00	1.25	
		3	103-312	5.6	42.0	0.75	58.8	1.05	67.2	1.20	1.50	
		3 1/2	103-314	4.8	42.0	0.88	58.8	1.23	67.2	1.40	1.75	
		4	103-316	4.4	44.0	1.00	61.6	1.40	70.4	1.60	2.00	
		12	103-348	1.6	48.0	3.00	67.2	4.20	76.8	4.80	6.00	
3/4	3/8	1	103-404	31.2	78.0	0.25	109.2	0.35	124.8	0.40	0.50	
		1 1/4	103-405	25.6	80.0	0.31	112.0	0.44	128.0	0.50	0.63	
		1 1/2	103-406	20.0	75.0	0.38	105.0	0.53	120.0	0.60	0.75	
		1 3/4	103-407	17.6	77.0	0.44	107.8	0.61	123.2	0.70	0.88	
		2	103-408	14.4	72.0	0.50	100.8	0.70	115.2	0.80	1.00	
		2 1/2	103-410	12.0	75.0	0.63	105.0	0.88	120.0	1.00	1.25	
		3	103-412	9.6	72.0	0.75	100.8	1.05	115.2	1.20	1.50	
		3 1/2	103-414	8.0	70.0	0.88	98.0	1.23	112.0	1.40	1.75	
		4	103-416	7.2	72.0	1.00	100.8	1.40	115.2	1.60	2.00	
		4 1/2	103-418	6.4	72.0	1.13	100.8	1.58	115.2	1.80	2.25	
		5	103-420	6.0	75.0	1.25	105.0	1.75	120.0	2.00	2.50	
		5 1/2	103-422	5.5	75.6	1.38	105.9	1.93	121.0	2.20	2.75	
		6	103-424	5.0	75.0	1.50	105.0	2.10	120.0	2.40	3.00	
		6 1/2	103-426	4.5	73.1	1.63	102.4	2.28	117.0	2.60	3.25	
		7 1/2	103-430	3.8	71.3	1.88	99.8	2.63	114.0	3.00	3.75	
		12	103-448	2.4	72.0	3.00	100.8	4.20	115.2	4.80	6.00	

\* Deflection values shown represent compressed lengths near solid and are for design information only. The color blue is a registered trademark of Barnes Group Inc.



Raymond® MEDIUM DUTY DIE SPRINGS				INCH DIMENSIONS							BLUE
Hole Dia. (in)	Rod Dia. (in)	Free Length (in)	CATALOG NUMBER	Load at 1/10 in. Def. (lb)	LOAD DEFLECTION TABLE						
					For Optimum Life (25% of free length)		For Long Life (35% of free length)		Maximum Operating Def. (40% of free length)		*Maximum Deflection (50% of free length)
					Load (lb)	Deflection (in)	Load (lb)	Deflection (in)	Load (lb)	Deflection (in)	Deflection (in)
A	B	C									
1	1/2	1	103-504	55.0	137.5	0.25	192.5	0.35	220.0	0.40	0.50
		1 1/4	103-505	45.0	140.6	0.31	196.9	0.44	225.0	0.50	0.63
		1 1/2	103-506	35.0	131.3	0.38	183.8	0.53	210.0	0.60	0.75
		1 3/4	103-507	30.0	131.3	0.44	183.8	0.61	210.0	0.70	0.88
		2	103-508	26.0	130.0	0.50	182.0	0.70	208.0	0.80	1.00
		2 1/2	103-510	20.0	125.0	0.63	175.0	0.88	200.0	1.00	1.25
		3	103-512	16.5	123.8	0.75	173.3	1.05	198.0	1.20	1.50
		3 1/2	103-514	15.0	131.3	0.88	183.8	1.23	210.0	1.40	1.75
		4	103-516	12.0	120.0	1.00	168.0	1.40	192.0	1.60	2.00
		4 1/2	103-518	10.4	117.0	1.13	163.8	1.58	187.2	1.80	2.25
		5	103-520	9.6	120.0	1.25	168.0	1.75	192.0	2.00	2.50
		5 1/2	103-522	8.8	121.0	1.38	169.4	1.93	193.6	2.20	2.75
6	103-524	8.0	120.0	1.50	168.0	2.10	192.0	2.40	3.00		
7	103-528	7.2	126.0	1.75	176.4	2.45	201.6	2.80	3.50		
8	103-532	6.0	120.0	2.00	168.0	2.80	192.0	3.20	4.00		
12	103-548	4.0	120.0	3.00	168.0	4.20	192.0	4.80	6.00		
1 1/4	5/8	1 1/4	103-606	49.6	186.0	0.38	260.4	0.53	297.6	0.60	0.75
		1 3/4	103-607	42.4	185.5	0.44	259.7	0.61	296.8	0.70	0.88
		2	103-608	35.2	176.0	0.50	246.4	0.70	281.6	0.80	1.00
		2 1/2	103-610	28.8	180.0	0.63	252.0	0.88	288.0	1.00	1.25
		3	103-612	24.0	180.0	0.75	252.0	1.05	288.0	1.20	1.50
		3 1/2	103-614	20.0	175.0	0.88	245.0	1.23	280.0	1.40	1.75
		4	103-616	17.6	176.0	1.00	246.4	1.40	281.6	1.60	2.00
		4 1/2	103-618	16.0	180.0	1.13	252.0	1.58	288.0	1.80	2.25
		5	103-620	13.6	170.0	1.25	238.0	1.75	272.0	2.00	2.50
		5 1/2	103-622	12.8	176.0	1.38	246.4	1.93	281.6	2.20	2.75
		6	103-624	12.0	180.0	1.50	252.0	2.10	288.0	2.40	3.00
		7	103-628	10.4	182.0	1.75	254.8	2.45	291.2	2.80	3.50
8	103-632	8.8	176.0	2.00	246.4	2.80	281.6	3.20	4.00		
10	103-640	7.2	180.0	2.50	252.0	3.50	288.0	4.00	5.00		
12	103-648	6.0	180.0	3.00	252.0	4.20	288.0	4.80	6.00		
1 1/2	3/4	2	103-708	53.0	265.0	0.50	371.0	0.70	424.0	0.80	1.00
		2 1/2	103-710	45.0	281.3	0.63	393.8	0.88	450.0	1.00	1.25
		3	103-712	36.0	270.0	0.75	378.0	1.05	432.0	1.20	1.50
		3 1/2	103-714	30.0	262.5	0.88	367.5	1.23	420.0	1.40	1.75
		4	103-716	27.0	270.0	1.00	378.0	1.40	432.0	1.60	2.00
		4 1/2	103-718	23.0	258.8	1.13	362.3	1.58	414.0	1.80	2.25
		5	103-720	21.0	262.5	1.25	367.5	1.75	420.0	2.00	2.50
		5 1/2	103-722	18.5	254.4	1.38	356.1	1.93	407.0	2.20	2.75
		6	103-724	17.0	255.0	1.50	357.0	2.10	408.0	2.40	3.00
		7	103-728	14.5	253.8	1.75	355.3	2.45	406.0	2.80	3.50
		8	103-732	12.8	256.0	2.00	358.4	2.80	409.6	3.20	4.00
		10	103-740	10.0	250.0	2.50	350.0	3.50	400.0	4.00	5.00
12	103-748	8.0	240.0	3.00	336.0	4.20	384.0	4.80	6.00		
2	1	2 1/2	103-810	100.0	625.0	0.63	875.0	0.88	1000.0	1.00	1.25
		3	103-812	83.0	622.5	0.75	871.5	1.05	996.0	1.20	1.50
		3 1/2	103-814	64.8	567.0	0.88	793.8	1.23	907.2	1.40	1.75
		4	103-816	60.0	600.0	1.00	840.0	1.40	960.0	1.60	2.00
		4 1/2	103-818	53.0	596.3	1.13	834.8	1.58	954.0	1.80	2.25
		5	103-820	47.0	587.5	1.25	822.5	1.75	940.0	2.00	2.50
		5 1/2	103-822	39.2	539.0	1.38	754.6	1.93	862.4	2.20	2.75
		6	103-824	39.0	585.0	1.50	819.0	2.10	936.0	2.40	3.00
		7	103-828	31.2	546.0	1.75	764.4	2.45	873.6	2.80	3.50
		8	103-832	28.5	570.0	2.00	798.0	2.80	912.0	3.20	4.00
		10	103-840	20.8	520.0	2.50	728.0	3.50	832.0	4.00	5.00
		12	103-848	17.5	525.0	3.00	735.0	4.20	840.0	4.80	6.00

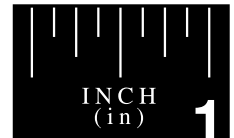
\* Deflection values shown represent compressed lengths near solid and are for design information only.  
The color blue is a registered trademark of Barnes Group Inc.



Raymond® MEDIUM HEAVY DUTY DIE SPRINGS					INCH DIMENSIONS						RED	
Hole Dia. (in)	Rod Dia. (in)	Free Length (in)	CATALOG NUMBER	Load at 1/10 in. Def. (lb)	LOAD DEFLECTION TABLE							
					For Optimum Life (20% of free length)		For Long Life (25% of free length)		Maximum Operating Def. (30% of free length)		*Maximum Deflection (37% of free length)	
					Load (lb)	Deflection (in)	Load (lb)	Deflection (in)	Load (lb)	Deflection (in)	Deflection (in)	
A	B	C										
3/8	3/16	1	104-104	9.0	18.0	0.20	22.5	0.25	27.0	0.30	0.37	
		1 1/4	104-105	7.3	18.3	0.25	22.8	0.31	27.4	0.38	0.46	
		1 1/2	104-106	6.7	20.1	0.30	25.1	0.38	30.2	0.45	0.56	
		1 3/4	104-107	5.8	20.3	0.35	25.4	0.44	30.5	0.53	0.65	
		2	104-108	5.0	20.0	0.40	25.0	0.50	30.0	0.60	0.74	
		2 1/2	104-110	4.2	21.0	0.50	26.3	0.63	31.5	0.75	0.93	
		3	104-112	3.0	18.0	0.60	22.5	0.75	27.0	0.90	1.11	
		12	104-148	0.9	21.6	2.40	27.0	3.00	32.4	3.60	4.44	
1/2	9/32	1	104-204	16.8	33.6	0.20	42.0	0.25	50.4	0.30	0.37	
		1 1/4	104-205	13.0	32.5	0.25	40.6	0.31	48.8	0.38	0.46	
		1 1/2	104-206	9.5	28.5	0.30	35.6	0.38	42.8	0.45	0.56	
		1 3/4	104-207	8.5	29.8	0.35	37.2	0.44	44.6	0.53	0.65	
		2	104-208	7.5	30.0	0.40	37.5	0.50	45.0	0.60	0.74	
		2 1/2	104-210	6.0	30.0	0.50	37.5	0.63	45.0	0.75	0.93	
		3	104-212	5.7	34.2	0.60	42.8	0.75	51.3	0.90	1.11	
		3 1/2	104-214	4.0	28.0	0.70	35.0	0.88	42.0	1.05	1.30	
5/8	11/32	1	104-304	30.0	60.0	0.20	75.0	0.25	90.0	0.30	0.37	
		1 1/4	104-305	21.5	53.8	0.25	67.2	0.31	80.6	0.38	0.46	
		1 1/2	104-306	19.0	57.0	0.30	71.3	0.38	85.5	0.45	0.56	
		1 3/4	104-307	16.8	58.8	0.35	73.5	0.44	88.2	0.53	0.65	
		2	104-308	14.8	59.2	0.40	74.0	0.50	88.8	0.60	0.74	
		2 1/2	104-310	11.5	57.5	0.50	71.9	0.63	86.3	0.75	0.93	
		3	104-312	10.0	60.0	0.60	75.0	0.75	90.0	0.90	1.11	
		3 1/2	104-314	8.5	59.5	0.70	74.4	0.88	89.3	1.05	1.30	
3/4	3/8	1	104-404	50.0	100.0	0.20	125.0	0.25	150.0	0.30	0.37	
		1 1/4	104-405	38.0	95.0	0.25	118.8	0.31	142.5	0.38	0.46	
		1 1/2	104-406	32.0	96.0	0.30	120.0	0.38	144.0	0.45	0.56	
		1 3/4	104-407	28.8	100.8	0.35	126.0	0.44	151.2	0.53	0.65	
		2	104-408	24.8	99.2	0.40	124.0	0.50	148.8	0.60	0.74	
		2 1/2	104-410	19.2	96.0	0.50	120.0	0.63	144.0	0.75	0.93	
		3	104-412	14.4	86.4	0.60	108.0	0.75	129.6	0.90	1.11	
		3 1/2	104-414	12.8	89.6	0.70	112.0	0.88	134.4	1.05	1.30	
3/4	3/8	4	104-416	12.0	96.0	0.80	120.0	1.00	144.0	1.20	1.48	
		4 1/2	104-418	11.2	100.8	0.90	126.0	1.13	151.2	1.35	1.67	
		5	104-420	9.0	90.0	1.00	112.5	1.25	135.0	1.50	1.85	
		5 1/2	104-422	8.0	88.0	1.10	110.0	1.38	132.0	1.65	2.04	
		6	104-424	7.5	90.0	1.20	112.5	1.50	135.0	1.80	2.22	
		12	104-448	3.6	86.4	2.40	108.0	3.00	129.6	3.60	4.44	

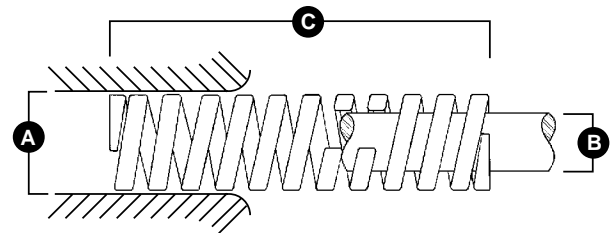
\* Deflection values shown represent compressed lengths near solid and are for design information only. The color red is a registered trademark of Barnes Group Inc.





Raymond® MEDIUM HEAVY DUTY DIE SPRINGS					INCH DIMENSIONS						RED	
Hole Dia. (in)	Rod Dia. (in)	Free Length (in)	CATALOG NUMBER	Load at 1/10 in. Def. (lb)	LOAD DEFLECTION TABLE							
					For Optimum Life (20% of free length)		For Long Life (25% of free length)		Maximum Operating Def. (30% of free length)		*Maximum Deflection (37% of free length)	
					Load (lb)	Deflection (in)	Load (lb)	Deflection (in)	Load (lb)	Deflection (in)	Deflection (in)	
A	B	C										
1	1/2	1	104-504	76.0	152.0	0.20	190.0	0.25	228.0	0.30	0.37	
		1 1/4	104-505	62.4	156.0	0.25	195.0	0.31	234.0	0.38	0.46	
		1 1/2	104-506	49.6	148.8	0.30	186.0	0.38	223.2	0.45	0.56	
		1 3/4	104-507	44.0	154.0	0.35	192.5	0.44	231.0	0.53	0.65	
		2	104-508	40.0	160.0	0.40	200.0	0.50	240.0	0.60	0.74	
		2 1/2	104-510	31.0	155.0	0.50	193.8	0.63	232.5	0.75	0.93	
		3	104-512	25.0	150.0	0.60	187.5	0.75	225.0	0.90	1.11	
		3 1/2	104-514	21.6	151.2	0.70	189.0	0.88	226.8	1.05	1.30	
		4	104-516	18.4	147.2	0.80	184.0	1.00	220.8	1.20	1.48	
		4 1/2	104-518	17.0	153.0	0.90	191.3	1.13	229.5	1.35	1.67	
		5	104-520	14.4	144.0	1.00	180.0	1.25	216.0	1.50	1.85	
		5 1/2	104-522	12.8	140.8	1.10	176.0	1.38	211.2	1.65	2.04	
6	104-524	12.0	144.0	1.20	180.0	1.50	216.0	1.80	2.22			
7	104-528	10.0	140.0	1.40	175.0	1.75	210.0	2.10	2.59			
8	104-532	8.8	140.8	1.60	176.0	2.00	211.2	2.40	2.96			
12	104-548	6.2	148.8	2.40	186.0	3.00	223.2	3.60	4.44			
1 1/4	5/8	1 1/2	104-606	114.4	343.2	0.30	429.0	0.38	514.8	0.45	0.56	
		1 3/4	104-607	100.8	352.8	0.35	441.0	0.44	529.2	0.53	0.65	
		2	104-608	86.4	345.6	0.40	432.0	0.50	518.4	0.60	0.74	
		2 1/2	104-610	62.4	312.0	0.50	390.0	0.63	468.0	0.75	0.93	
		3	104-612	51.2	307.2	0.60	384.0	0.75	460.8	0.90	1.11	
		3 1/2	104-614	44.0	308.0	0.70	385.0	0.88	462.0	1.05	1.30	
		4	104-616	36.8	294.4	0.80	368.0	1.00	441.6	1.20	1.48	
		4 1/2	104-618	32.0	288.0	0.90	360.0	1.13	432.0	1.35	1.67	
		5	104-620	29.0	290.0	1.00	362.5	1.25	435.0	1.50	1.85	
		5 1/2	104-622	26.4	290.4	1.10	363.0	1.38	435.6	1.65	2.04	
		6	104-624	25.0	300.0	1.20	375.0	1.50	450.0	1.80	2.22	
		7	104-628	20.0	280.0	1.40	350.0	1.75	420.0	2.10	2.59	
8	104-632	18.4	294.4	1.60	368.0	2.00	441.6	2.40	2.96			
10	104-640	14.5	290.0	2.00	362.5	2.50	435.0	3.00	3.70			
12	104-648	12.4	297.6	2.40	372.0	3.00	446.4	3.60	4.44			
1 1/2	3/4	2	104-708	108.0	432.0	0.40	540.0	0.50	648.0	0.60	0.74	
		2 1/2	104-710	85.6	428.0	0.50	535.0	0.63	642.0	0.75	0.93	
		3	104-712	62.4	374.4	0.60	468.0	0.75	561.6	0.90	1.11	
		3 1/2	104-714	52.8	369.6	0.70	462.0	0.88	554.4	1.05	1.30	
		4	104-716	48.0	384.0	0.80	480.0	1.00	576.0	1.20	1.48	
		4 1/2	104-718	43.2	388.8	0.90	486.0	1.13	583.2	1.35	1.67	
		5	104-720	36.8	368.0	1.00	460.0	1.25	552.0	1.50	1.85	
		5 1/2	104-722	34.4	378.4	1.10	473.0	1.38	567.6	1.65	2.04	
		6	104-724	30.4	364.8	1.20	456.0	1.50	547.2	1.80	2.22	
		7	104-728	26.4	369.6	1.40	462.0	1.75	554.4	2.10	2.59	
		8	104-732	22.0	352.0	1.60	440.0	2.00	528.0	2.40	2.96	
		10	104-740	17.6	352.0	2.00	440.0	2.50	528.0	3.00	3.70	
12	104-748	14.4	345.6	2.40	432.0	3.00	518.4	3.60	4.44			
2	1	2 1/2	104-810	118.4	592.0	0.50	740.0	0.63	888.0	0.75	0.93	
		3	104-812	96.0	576.0	0.60	720.0	0.75	864.0	0.90	1.11	
		3 1/2	104-814	80.0	560.0	0.70	700.0	0.88	840.0	1.05	1.30	
		4	104-816	66.4	531.2	0.80	664.0	1.00	796.8	1.20	1.48	
		4 1/2	104-818	60.0	540.0	0.90	675.0	1.13	810.0	1.35	1.67	
		5	104-820	56.0	560.0	1.00	700.0	1.25	840.0	1.50	1.85	
		5 1/2	104-822	50.4	554.4	1.10	693.0	1.38	831.6	1.65	2.04	
		6	104-824	47.2	566.4	1.20	708.0	1.50	849.6	1.80	2.22	
		7	104-828	40.0	560.0	1.40	700.0	1.75	840.0	2.10	2.59	
		8	104-832	35.2	563.2	1.60	704.0	2.00	844.8	2.40	2.96	
		10	104-840	26.0	520.0	2.00	650.0	2.50	780.0	3.00	3.70	
		12	104-848	22.4	537.6	2.40	672.0	3.00	806.4	3.60	4.44	

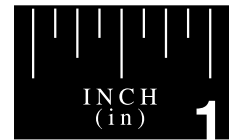
\* Deflection values shown represent compressed lengths near solid and are for design information only.  
The color red is a registered trademark of Barnes Group Inc.



**Raymond® HEAVY DUTY DIE SPRINGS INCH DIMENSIONS GOLD**

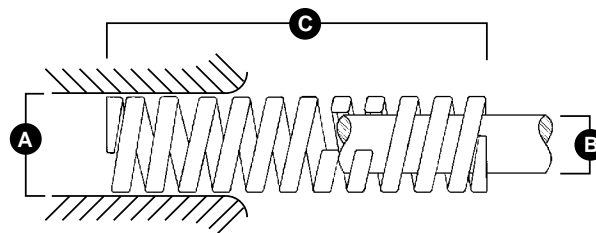
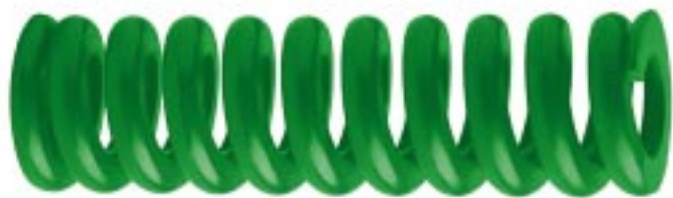
Hole Dia. (in)	Rod Dia. (in)	Free Length (in)	CATALOG NUMBER	Load at 1/10 in. Def. (lb)	LOAD DEFLECTION TABLE						
					For Optimum Life (15% of free length)		For Long Life (20% of free length)		Maximum Operating Def. (25% of free length)		*Maximum Deflection (30% of free length)
					Load (lb)	Deflection (in)	Load (lb)	Deflection (in)	Load (lb)	Deflection (in)	Deflection (in)
3/8	3/16	1	105-104	11.0	16.5	0.15	22.0	0.20	27.5	0.25	0.30
		1 1/4	105-105	9.8	18.4	0.19	24.5	0.25	30.6	0.31	0.38
		1 1/2	105-106	8.0	18.0	0.23	24.0	0.30	30.0	0.38	0.45
		1 3/4	105-107	8.4	22.1	0.26	29.4	0.35	36.8	0.44	0.53
		2	105-108	7.2	21.6	0.30	28.8	0.40	36.0	0.50	0.60
		2 1/2	105-110	5.5	20.6	0.38	27.5	0.50	34.4	0.63	0.75
		3	105-112	4.2	18.9	0.45	25.2	0.60	31.5	0.75	0.90
		12	105-148	1.2	21.6	1.80	28.8	2.40	36.0	3.00	3.60
		1/2	9/32	1	105-204	23.6	35.4	0.15	47.2	0.20	59.0
1 1/4	105-205			18.6	34.9	0.19	46.5	0.25	58.1	0.31	0.38
1 1/2	105-206			15.5	34.9	0.23	46.5	0.30	58.1	0.38	0.45
1 3/4	105-207			13.8	36.2	0.26	48.3	0.35	60.4	0.44	0.53
2	105-208			11.0	33.0	0.30	44.0	0.40	55.0	0.50	0.60
2 1/2	105-210			8.4	31.5	0.38	42.0	0.50	52.5	0.63	0.75
3	105-212			7.4	33.3	0.45	44.4	0.60	55.5	0.75	0.90
3 1/2	105-214			6.0	31.5	0.53	42.0	0.70	52.5	0.88	1.05
12	105-248			1.6	28.8	1.80	38.4	2.40	48.0	3.00	3.60
5/8	11/32	1	105-304	42.4	63.6	0.15	84.8	0.20	106.0	0.25	0.30
		1 1/4	105-305	29.6	55.5	0.19	74.0	0.25	92.5	0.31	0.38
		1 1/2	105-306	27.2	61.2	0.23	81.6	0.30	102.0	0.38	0.45
		1 3/4	105-307	24.0	63.0	0.26	84.0	0.35	105.0	0.44	0.53
		2	105-308	20.8	62.4	0.30	83.2	0.40	104.0	0.50	0.60
		2 1/2	105-310	17.0	63.8	0.38	85.0	0.50	106.3	0.63	0.75
		3	105-312	14.4	64.8	0.45	86.4	0.60	108.0	0.75	0.90
		3 1/2	105-314	12.2	64.1	0.53	85.4	0.70	106.8	0.88	1.05
		4	105-316	10.8	64.8	0.60	86.4	0.80	108.0	1.00	1.20
12	105-348	3.0	54.0	1.80	72.0	2.40	90.0	3.00	3.60		
3/4	3/8	1	105-404	108.0	162.0	0.15	216.0	0.20	270.0	0.25	0.30
		1 1/4	105-405	88.0	165.0	0.19	220.0	0.25	275.0	0.31	0.38
		1 1/2	105-406	65.6	147.6	0.23	196.8	0.30	246.0	0.38	0.45
		1 3/4	105-407	60.0	157.5	0.26	210.0	0.35	262.5	0.44	0.53
		2	105-408	49.6	148.8	0.30	198.4	0.40	248.0	0.50	0.60
		2 1/2	105-410	40.0	150.0	0.38	200.0	0.50	250.0	0.63	0.75
		3	105-412	34.0	153.0	0.45	204.0	0.60	255.0	0.75	0.90
		3 1/2	105-414	28.0	147.0	0.53	196.0	0.70	245.0	0.88	1.05
		4	105-416	25.0	150.0	0.60	200.0	0.80	250.0	1.00	1.20
		4 1/2	105-418	22.0	148.5	0.68	198.0	0.90	247.5	1.13	1.35
		5	105-420	19.5	146.3	0.75	195.0	1.00	243.8	1.25	1.50
		5 1/2	105-422	17.0	140.3	0.83	187.0	1.10	233.8	1.38	1.65
		6	105-424	16.0	144.0	0.90	192.0	1.20	240.0	1.50	1.80
		12	105-448	8.0	144.0	1.80	192.0	2.40	240.0	3.00	3.60

\* Deflection values shown represent compressed lengths near solid and are for design information only. The color gold is a registered trademark of Barnes Group Inc.



Raymond® HEAVY DUTY DIE SPRINGS					INCH DIMENSIONS						GOLD	
Hole Dia. (in)	Rod Dia. (in)	Free Length (in)	CATALOG NUMBER	Load at 1/10 in. Def. (lb)	LOAD DEFLECTION TABLE							
					For Optimum Life (15% of free length)		For Long Life (20% of free length)		Maximum Operating Def. (25% of free length)		*Maximum Deflection (30% of free length)	
					Load (lb)	Deflection (in)	Load (lb)	Deflection (in)	Load (lb)	Deflection (in)	Deflection (in)	
A	B	C										
1	1/2	1	105-504	208.0	312.0	0.15	416.0	0.20	520.0	0.25	0.30	
		1 1/4	105-505	171.2	321.0	0.19	428.0	0.25	535.0	0.31	0.38	
		1 1/2	105-506	118.4	266.4	0.23	355.2	0.30	444.0	0.38	0.45	
		1 3/4	105-507	104.0	273.0	0.26	364.0	0.35	455.0	0.44	0.53	
		2	105-508	90.0	270.0	0.30	360.0	0.40	450.0	0.50	0.60	
		2 1/2	105-510	68.0	255.0	0.38	340.0	0.50	425.0	0.63	0.75	
		3	105-512	54.4	244.8	0.45	326.4	0.60	408.0	0.75	0.90	
		3 1/2	105-514	45.6	239.4	0.53	319.2	0.70	399.0	0.88	1.05	
		4	105-516	40.0	240.0	0.60	320.0	0.80	400.0	1.00	1.20	
		4 1/2	105-518	35.2	237.6	0.68	316.8	0.90	396.0	1.13	1.35	
		5	105-520	31.2	234.0	0.75	312.0	1.00	390.0	1.25	1.50	
		5 1/2	105-522	28.8	237.6	0.83	316.8	1.10	396.0	1.38	1.65	
6	105-524	25.6	230.4	0.90	307.2	1.20	384.0	1.50	1.80			
7	105-528	22.4	235.2	1.05	313.6	1.40	392.0	1.75	2.10			
8	105-532	19.2	230.4	1.20	307.2	1.60	384.0	2.00	2.40			
12	105-548	12.0	216.0	1.80	288.0	2.40	360.0	3.00	3.60			
1 1/4	5/8	1 1/2	105-606	212.0	477.0	0.23	636.0	0.30	795.0	0.38	0.45	
		1 3/4	105-607	181.6	476.7	0.26	635.6	0.35	794.5	0.44	0.53	
		2	105-608	149.6	448.8	0.30	598.4	0.40	748.0	0.50	0.60	
		2 1/2	105-610	117.6	441.0	0.38	588.0	0.50	735.0	0.63	0.75	
		3	105-612	95.2	428.4	0.45	571.2	0.60	714.0	0.75	0.90	
		3 1/2	105-614	75.2	394.8	0.53	526.4	0.70	658.0	0.88	1.05	
		4	105-616	66.4	398.4	0.60	531.2	0.80	664.0	1.00	1.20	
		4 1/2	105-618	58.4	394.2	0.68	525.6	0.90	657.0	1.13	1.35	
		5	105-620	53.0	397.5	0.75	530.0	1.00	662.5	1.25	1.50	
		5 1/2	105-622	47.2	389.4	0.83	519.2	1.10	649.0	1.38	1.65	
		6	105-624	42.4	381.6	0.90	508.8	1.20	636.0	1.50	1.80	
		7	105-628	36.8	386.4	1.05	515.2	1.40	644.0	1.75	2.10	
8	105-632	32.8	393.6	1.20	524.8	1.60	656.0	2.00	2.40			
10	105-640	25.6	384.0	1.50	512.0	2.00	640.0	2.50	3.00			
12	105-648	20.8	374.4	1.80	499.2	2.40	624.0	3.00	3.60			
1 1/2	3/4	2	105-708	190.4	571.2	0.30	761.6	0.40	952.0	0.50	0.60	
		2 1/2	105-710	155.0	581.3	0.38	775.0	0.50	968.8	0.63	0.75	
		3	105-712	130.0	585.0	0.45	780.0	0.60	975.0	0.75	0.90	
		3 1/2	105-714	106.4	558.6	0.53	744.8	0.70	931.0	0.88	1.05	
		4	105-716	91.2	547.2	0.60	729.6	0.80	912.0	1.00	1.20	
		4 1/2	105-718	78.4	529.2	0.68	705.6	0.90	882.0	1.13	1.35	
		5	105-720	71.2	534.0	0.75	712.0	1.00	890.0	1.25	1.50	
		5 1/2	105-722	64.0	528.0	0.83	704.0	1.10	880.0	1.38	1.65	
		6	105-724	58.4	525.6	0.90	700.8	1.20	876.0	1.50	1.80	
		7	105-728	49.6	520.8	1.05	694.4	1.40	868.0	1.75	2.10	
		8	105-732	43.2	518.4	1.20	691.2	1.60	864.0	2.00	2.40	
		10	105-740	34.4	516.0	1.50	688.0	2.00	860.0	2.50	3.00	
12	105-748	28.8	518.4	1.80	691.2	2.40	864.0	3.00	3.60			
2	1	2 1/2	105-810	260.0	975.0	0.38	1300.0	0.50	1625.0	0.63	0.75	
		3	105-812	200.0	900.0	0.45	1200.0	0.60	1500.0	0.75	0.90	
		3 1/2	105-814	170.0	892.5	0.53	1190.0	0.70	1487.5	0.88	1.05	
		4	105-816	150.0	900.0	0.60	1200.0	0.80	1500.0	1.00	1.20	
		4 1/2	105-818	120.0	810.0	0.68	1080.0	0.90	1350.0	1.13	1.35	
		5	105-820	110.0	825.0	0.75	1100.0	1.00	1375.0	1.25	1.50	
		5 1/2	105-822	100.0	825.0	0.83	1100.0	1.10	1375.0	1.38	1.65	
		6	105-824	94.0	846.0	0.90	1128.0	1.20	1410.0	1.50	1.80	
		7	105-828	82.0	861.0	1.05	1148.0	1.40	1435.0	1.75	2.10	
		8	105-832	73.0	876.0	1.20	1168.0	1.60	1460.0	2.00	2.40	
		10	105-840	55.0	825.0	1.50	1100.0	2.00	1375.0	2.50	3.00	
		12	105-848	42.0	756.0	1.80	1008.0	2.40	1260.0	3.00	3.60	

\* Deflection values shown represent compressed lengths near solid and are for design information only.  
The color gold is a registered trademark of Barnes Group Inc.



**Raymond® EXTRA HEAVY DUTY DIE SPRINGS INCH DIMENSIONS GREEN**

Hole Dia. (in)	Rod Dia. (in)	Free Length (in)	CATALOG NUMBER	Load at 1/10 in. Def. (lb)	LOAD DEFLECTION TABLE						
					For Optimum Life (15% of free length)		For Long Life (17% of free length)		Maximum Operating Def. (20% of free length)		*Maximum Deflection (25% of free length)
					Load (lb)	Deflection (in)	Load (lb)	Deflection (in)	Load (lb)	Deflection (in)	Deflection (in)
3/8	3/16	1	106-104	22.0	33.0	0.15	37.4	0.17	44.0	0.20	0.25
		1 1/4	106-105	16.0	30.0	0.19	34.0	0.21	40.0	0.25	0.31
		1 1/2	106-106	12.5	28.1	0.23	31.9	0.26	37.5	0.30	0.38
		1 3/4	106-107	11.5	30.2	0.26	34.2	0.30	40.3	0.35	0.44
		2	106-108	9.0	27.0	0.30	30.6	0.34	36.0	0.40	0.50
		2 1/2	106-110	7.0	26.3	0.38	29.8	0.43	35.0	0.50	0.63
		3	106-112	6.5	29.3	0.45	33.2	0.51	39.0	0.60	0.75
		12	106-148	1.5	27.0	1.80	30.6	2.04	36.0	2.40	3.00
		1/2	9/32	1	106-204	32.0	48.0	0.15	54.4	0.17	64.0
1 1/4	106-205			24.0	45.0	0.19	51.0	0.21	60.0	0.25	0.31
1 1/2	106-206			20.0	45.0	0.23	51.0	0.26	60.0	0.30	0.38
1 3/4	106-207			17.0	44.6	0.26	50.6	0.30	59.5	0.35	0.44
2	106-208			14.0	42.0	0.30	47.6	0.34	56.0	0.40	0.50
2 1/2	106-210			11.5	43.1	0.38	48.9	0.43	57.5	0.50	0.63
3	106-212			9.0	40.5	0.45	45.9	0.51	54.0	0.60	0.75
3 1/2	106-214			8.0	42.0	0.53	47.6	0.60	56.0	0.70	0.88
12	106-248			2.5	45.0	1.80	51.0	2.04	60.0	2.40	3.00
5/8	11/32	1	106-304	63.0	94.5	0.15	107.1	0.17	126.0	0.20	0.25
		1 1/4	106-305	47.0	88.1	0.19	99.9	0.21	117.5	0.25	0.31
		1 1/2	106-306	38.0	85.5	0.23	96.9	0.26	114.0	0.30	0.38
		1 3/4	106-307	32.0	84.0	0.26	95.2	0.30	112.0	0.35	0.44
		2	106-308	29.0	87.0	0.30	98.6	0.34	116.0	0.40	0.50
		2 1/2	106-310	22.0	82.5	0.38	93.5	0.43	110.0	0.50	0.63
		3	106-312	19.0	85.5	0.45	96.9	0.51	114.0	0.60	0.75
		3 1/2	106-314	16.0	84.0	0.53	95.2	0.60	112.0	0.70	0.88
		12	106-348	4.5	81.0	1.80	91.8	2.04	108.0	2.40	3.00
3/4	3/8	1	106-404	140.0	210.0	0.15	238.0	0.17	280.0	0.20	0.25
		1 1/4	106-405	110.0	206.3	0.19	233.8	0.21	275.0	0.25	0.31
		1 1/2	106-406	89.0	200.3	0.23	227.0	0.26	267.0	0.30	0.38
		1 3/4	106-407	75.0	196.9	0.26	223.1	0.30	262.5	0.35	0.44
		2	106-408	68.0	204.0	0.30	231.2	0.34	272.0	0.40	0.50
		2 1/2	106-410	50.0	187.5	0.38	212.5	0.43	250.0	0.50	0.63
		3	106-412	40.5	182.3	0.45	206.6	0.51	243.0	0.60	0.75
		3 1/2	106-414	34.5	181.1	0.53	205.3	0.60	241.5	0.70	0.88
		4	106-416	30.0	180.0	0.60	204.0	0.68	240.0	0.80	1.00
		4 1/2	106-418	26.5	178.9	0.68	202.7	0.77	238.5	0.90	1.13
		5	106-420	23.5	176.3	0.75	199.8	0.85	235.0	1.00	1.25
		5 1/2	106-422	21.5	177.4	0.83	201.0	0.94	236.5	1.10	1.38
		6	106-424	19.5	175.5	0.90	198.9	1.02	234.0	1.20	1.50
		12	106-448	9.5	171.0	1.80	193.8	2.04	228.0	2.40	3.00

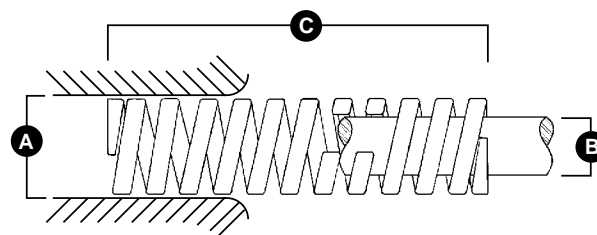
\* Deflection values shown represent compressed lengths near solid and are for design information only. The color green is a registered trademark of Barnes Group Inc.



Raymond® EXTRA HEAVY DUTY DIE SPRINGS					INCH DIMENSIONS GREEN								
Hole Dia. (in)	Rod Dia. (in)	Free Length (in)	CATALOG NUMBER	Load at 1/10 in. Def. (lb)	LOAD DEFLECTION TABLE								
					For Optimum Life (15% of free length)		For Long Life (17% of free length)		Maximum Operating Def. (20% of free length)		*Maximum Deflection (25% of free length)		
					Load (lb)	Deflection (in)	Load (lb)	Deflection (in)	Load (lb)	Deflection (in)	Deflection (in)		
A	B	C											
1	1/2	1 1/2	106-506	160.0	360.0	0.23	408.0	0.26	480.0	0.30	0.38		
		2	106-508	116.0	348.0	0.30	394.4	0.34	464.0	0.40	0.50		
		2 1/2	106-510	89.6	336.0	0.38	380.8	0.43	448.0	0.50	0.63		
		3	106-512	73.6	331.2	0.45	375.4	0.51	441.6	0.60	0.75		
		3 1/2	106-514	62.4	327.6	0.53	371.3	0.60	436.8	0.70	0.88		
		4	106-516	55.2	331.2	0.60	375.4	0.68	441.6	0.80	1.00		
		4 1/2	106-518	48.8	329.4	0.68	373.3	0.77	439.2	0.90	1.13		
		5	106-520	43.2	324.0	0.75	367.2	0.85	432.0	1.00	1.25		
		6	106-524	36.0	324.0	0.90	367.2	1.02	432.0	1.20	1.50		
		12	106-548	17.6	316.8	1.80	359.0	2.04	422.4	2.40	3.00		
		1 1/4	5/8	2	106-608	192.0	576.0	0.30	652.8	0.34	768.0	0.40	0.50
				2 1/2	106-610	144.0	540.0	0.38	612.0	0.43	720.0	0.50	0.63
3	106-612			118.4	532.8	0.45	603.8	0.51	710.4	0.60	0.75		
3 1/2	106-614			100.8	529.2	0.53	599.8	0.60	705.6	0.70	0.88		
4	106-616			84.0	504.0	0.60	571.2	0.68	672.0	0.80	1.00		
4 1/2	106-618			78.4	529.2	0.68	599.8	0.77	705.6	0.90	1.13		
5	106-620			68.0	510.0	0.75	578.0	0.85	680.0	1.00	1.25		
6	106-624			56.0	504.0	0.90	571.2	1.02	672.0	1.20	1.50		
8	106-632			41.6	499.2	1.20	565.8	1.36	665.6	1.60	2.00		
10	106-640			33.6	504.0	1.50	571.2	1.70	672.0	2.00	2.50		
12	106-648			26.4	475.2	1.80	538.6	2.04	633.6	2.40	3.00		
1 1/2	3/4			2	106-708	376.0	1128.0	0.30	1278.4	0.34	1504.0	0.40	0.50
		2 1/2	106-710	294.4	1104.0	0.38	1251.2	0.43	1472.0	0.50	0.63		
		3	106-712	231.2	1040.4	0.45	1179.1	0.51	1387.2	0.60	0.75		
		3 1/2	106-714	196.0	1029.0	0.53	1166.2	0.60	1372.0	0.70	0.88		
		4	106-716	171.2	1027.2	0.60	1164.2	0.68	1369.6	0.80	1.00		
		4 1/2	106-718	148.0	999.0	0.68	1132.2	0.77	1332.0	0.90	1.13		
		5	106-720	136.0	1020.0	0.75	1156.0	0.85	1360.0	1.00	1.25		
		6	106-724	110.4	993.6	0.90	1126.1	1.02	1324.8	1.20	1.50		
		8	106-732	80.8	969.6	1.20	1098.9	1.36	1292.8	1.60	2.00		
		10	106-740	67.2	1008.0	1.50	1142.4	1.70	1344.0	2.00	2.50		
		12	106-748	54.4	979.2	1.80	1109.8	2.04	1305.6	2.40	3.00		
		2	1	2 1/2	106-810	381.6	1431.0	0.38	1621.8	0.43	1908.0	0.50	0.63
3	106-812			312.0	1404.0	0.45	1591.2	0.51	1872.0	0.60	0.75		
3 1/2	106-814			254.4	1335.6	0.53	1513.7	0.60	1780.8	0.70	0.88		
4	106-816			220.0	1320.0	0.60	1496.0	0.68	1760.0	0.80	1.00		
4 1/2	106-818			188.8	1274.4	0.68	1444.3	0.77	1699.2	0.90	1.13		
5	106-820			172.8	1296.0	0.75	1468.8	0.85	1728.0	1.00	1.25		
6	106-824			141.6	1274.4	0.90	1444.3	1.02	1699.2	1.20	1.50		
8	106-832			100.0	1200.0	1.20	1360.0	1.36	1600.0	1.60	2.00		
10	106-840			84.0	1260.0	1.50	1428.0	1.70	1680.0	2.00	2.50		
12	106-848			71.2	1281.6	1.80	1452.5	2.04	1708.8	2.40	3.00		

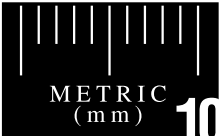
\* Deflection values shown represent compressed lengths near solid and are for design information only. The color green is a registered trademark of Barnes Group Inc.





Raymond® MEDIUM DUTY DIE SPRINGS					METRIC DIMENSIONS						BLUE	
Hole Dia. (mm)	Rod Dia. (mm)	Free Length (mm)	CATALOG NUMBER	Load at 1 mm Def. (N)	LOAD DEFLECTION TABLE							
					For Optimum Life (25% of free length)		For Long Life (35% of free length)		Maximum Operating Def. (40% of free length)		*Maximum Deflection (50% of free length)	
					Load (N)	Deflection (mm)	Load (N)	Deflection (mm)	Load (N)	Deflection (mm)	Deflection (mm)	
A	B	C										
9.53	4.76	25.40	103-104	10.5	67	6.4	93	8.9	107	10.2	12.7	
		31.75	103-105	9.5	75	7.9	105	11.1	120	12.7	15.9	
		38.10	103-106	7.0	67	9.5	93	13.3	107	15.2	19.1	
		44.45	103-107	6.0	66	11.1	93	15.6	106	17.8	22.2	
		50.80	103-108	4.9	62	12.7	87	17.8	100	20.3	25.4	
		63.50	103-110	4.2	67	15.9	93	22.2	107	25.4	31.8	
		76.20	103-112	3.7	70	19.1	98	26.7	112	30.5	38.1	
		304.80	103-148	1.1	80	76.2	112	106.7	128	121.9	152.4	
12.70	7.14	25.40	103-204	19.3	122	6.4	171	8.9	196	10.2	12.7	
		31.75	103-205	14.4	114	7.9	160	11.1	182	12.7	15.9	
		38.10	103-206	11.9	113	9.5	159	13.3	181	15.2	19.1	
		44.45	103-207	10.5	117	11.1	163	15.6	187	17.8	22.2	
		50.80	103-208	9.6	122	12.7	171	17.8	196	20.3	25.4	
		63.50	103-210	7.9	125	15.9	175	22.2	200	25.4	31.8	
		76.20	103-212	6.1	117	19.1	163	26.7	187	30.5	38.1	
		88.90	103-214	5.3	117	22.2	163	31.1	187	35.6	44.5	
		114.30	103-218	4.4	125	28.6	175	40.0	200	45.7	57.2	
		139.70	103-222	3.7	128	34.9	180	48.9	205	55.9	69.9	
		165.10	103-226	2.5	101	41.3	142	57.8	162	66.0	82.6	
		190.50	103-230	2.1	100	47.6	140	66.7	160	76.2	95.3	
304.80	103-248	1.2	93	76.2	131	106.7	149	121.9	152.4			
15.88	8.73	25.40	103-304	28.7	182	6.4	255	8.9	292	10.2	12.7	
		31.75	103-305	22.4	178	7.9	249	11.1	285	12.7	15.9	
		38.10	103-306	18.9	180	9.5	252	13.3	288	15.2	19.1	
		44.45	103-307	16.8	187	11.1	262	15.6	299	17.8	22.2	
		50.80	103-308	15.4	196	12.7	274	17.8	313	20.3	25.4	
		63.50	103-310	10.5	167	15.9	234	22.2	267	25.4	31.8	
		76.20	103-312	9.8	187	19.1	262	26.7	299	30.5	38.1	
		88.90	103-314	8.4	187	22.2	262	31.1	299	35.6	44.5	
		101.60	103-316	7.7	196	25.4	274	35.6	313	40.6	50.8	
		304.80	103-348	2.8	214	76.2	299	106.7	342	121.9	152.4	
19.05	9.53	25.40	103-404	54.6	347	6.4	486	8.9	555	10.2	12.7	
		31.75	103-405	44.8	356	7.9	498	11.1	569	12.7	15.9	
		38.10	103-406	35.0	334	9.5	467	13.3	534	15.2	19.1	
		44.45	103-407	30.8	342	11.1	479	15.6	548	17.8	22.2	
		50.80	103-408	25.2	320	12.7	448	17.8	512	20.3	25.4	
		63.50	103-410	21.0	334	15.9	467	22.2	534	25.4	31.8	
		76.20	103-412	16.8	320	19.1	448	26.7	512	30.5	38.1	
		88.90	103-414	14.0	311	22.2	436	31.1	498	35.6	44.5	
		101.60	103-416	12.6	320	25.4	448	35.6	512	40.6	50.8	
		114.30	103-418	11.2	320	28.6	448	40.0	512	45.7	57.2	
		127.00	103-420	10.5	334	31.8	467	44.5	534	50.8	63.5	
		139.70	103-422	9.6	336	34.9	471	48.9	538	55.9	69.9	
		152.40	103-424	8.8	334	38.1	467	53.3	534	61.0	76.2	
		165.10	103-426	7.9	325	41.3	455	57.8	520	66.0	82.6	
		190.50	103-430	6.7	317	47.6	444	66.7	507	76.2	95.3	
		304.80	103-448	4.2	320	76.2	448	106.7	512	121.9	152.4	

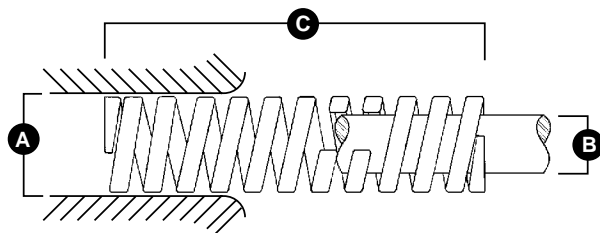
\* Deflection values shown represent compressed lengths near solid and are for design information only.  
The color blue is a registered trademark of Barnes Group Inc.



**Raymond® MEDIUM DUTY DIE SPRINGS METRIC DIMENSIONS BLUE**

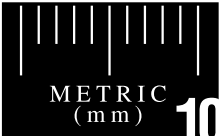
Hole Dia. (mm)	Rod Dia. (mm)	Free Length (mm)	CATALOG NUMBER	Load at 1 mm Def. (N)	LOAD DEFLECTION TABLE								
					For Optimum Life (25% of free length)		For Long Life (35% of free length)		Maximum Operating Def. (40% of free length)		*Maximum Deflection (50% of free length)		
					Load (N)	Deflection (mm)	Load (N)	Deflection (mm)	Load (N)	Deflection (mm)	Deflection (mm)		
A	B	C											
25.40	12.70	25.40	103-504	96.3	612	6.4	856	8.9	979	10.2	12.7		
		31.75	103-505	78.8	626	7.9	876	11.1	1001	12.7	15.9		
		38.10	103-506	61.3	584	9.5	817	13.3	934	15.2	19.1		
		44.45	103-507	52.5	584	11.1	817	15.6	934	17.8	22.2		
		50.80	103-508	45.5	578	12.7	810	17.8	925	20.3	25.4		
		63.50	103-510	35.0	556	15.9	778	22.2	890	25.4	31.8		
		76.20	103-512	28.9	550	19.1	771	26.7	881	30.5	38.1		
		88.90	103-514	26.3	584	22.2	817	31.1	934	35.6	44.5		
		101.60	103-516	21.0	534	25.4	747	35.6	854	40.6	50.8		
		114.30	103-518	18.2	520	28.6	729	40.0	833	45.7	57.2		
		127.00	103-520	16.8	534	31.8	747	44.5	854	50.8	63.5		
		139.70	103-522	15.4	538	34.9	753	48.9	861	55.9	69.9		
		152.40	103-524	14.0	534	38.1	747	53.3	854	61.0	76.2		
		177.80	103-528	12.6	560	44.5	785	62.2	897	71.1	88.9		
		203.20	103-532	10.5	534	50.8	747	71.1	854	81.3	101.6		
		304.80	103-548	7.0	534	76.2	747	106.7	854	121.9	152.4		
31.75	15.88	38.10	103-606	86.9	827	9.5	1158	13.3	1324	15.2	19.1		
		44.45	103-607	74.3	825	11.1	1155	15.6	1320	17.8	22.2		
		50.80	103-608	61.6	783	12.7	1096	17.8	1253	20.3	25.4		
		63.50	103-610	50.4	801	15.9	1121	22.2	1281	25.4	31.8		
		76.20	103-612	42.0	801	19.1	1121	26.7	1281	30.5	38.1		
		88.90	103-614	35.0	778	22.2	1090	31.1	1245	35.6	44.5		
		101.60	103-616	30.8	783	25.4	1096	35.6	1253	40.6	50.8		
		114.30	103-618	28.0	801	28.6	1121	40.0	1281	45.7	57.2		
		127.00	103-620	23.8	756	31.8	1059	44.5	1210	50.8	63.5		
		139.70	103-622	22.4	783	34.9	1096	48.9	1253	55.9	69.9		
		152.40	103-624	21.0	801	38.1	1121	53.3	1281	61.0	76.2		
		177.80	103-628	18.2	810	44.5	1133	62.2	1295	71.1	88.9		
		203.20	103-632	15.4	783	50.8	1096	71.1	1253	81.3	101.6		
		254.00	103-640	12.6	801	63.5	1121	88.9	1281	101.6	127.0		
		304.80	103-648	10.5	801	76.2	1121	106.7	1281	121.9	152.4		
		38.10	19.05	50.80	103-708	92.8	1179	12.7	1650	17.8	1886	20.3	25.4
63.50	103-710			78.8	1251	15.9	1751	22.2	2002	25.4	31.8		
76.20	103-712			63.0	1201	19.1	1681	26.7	1922	30.5	38.1		
88.90	103-714			52.5	1168	22.2	1635	31.1	1868	35.6	44.5		
101.60	103-716			47.3	1201	25.4	1681	35.6	1922	40.6	50.8		
114.30	103-718			40.3	1151	28.6	1611	40.0	1841	45.7	57.2		
127.00	103-720			36.8	1168	31.8	1635	44.5	1868	50.8	63.5		
139.70	103-722			32.4	1131	34.9	1584	48.9	1810	55.9	69.9		
152.40	103-724			29.8	1134	38.1	1588	53.3	1815	61.0	76.2		
177.80	103-728			25.4	1129	44.5	1580	62.2	1806	71.1	88.9		
203.20	103-732			22.4	1139	50.8	1594	71.1	1822	81.3	101.6		
254.00	103-740			17.5	1112	63.5	1557	88.9	1779	101.6	127.0		
304.80	103-748			14.0	1068	76.2	1495	106.7	1708	121.9	152.4		
50.80	25.40			63.50	103-810	175.1	2780	15.9	3892	22.2	4448	25.4	31.8
				76.20	103-812	145.3	2769	19.1	3876	26.7	4430	30.5	38.1
				88.90	103-814	113.5	2522	22.2	3531	31.1	4035	35.6	44.5
		101.60	103-816	105.1	2669	25.4	3736	35.6	4270	40.6	50.8		
		114.30	103-818	92.8	2652	28.6	3713	40.0	4243	45.7	57.2		
		127.00	103-820	82.3	2613	31.8	3658	44.5	4181	50.8	63.5		
		139.70	103-822	68.6	2397	34.9	3356	48.9	3836	55.9	69.9		
		152.40	103-824	68.3	2602	38.1	3643	53.3	4163	61.0	76.2		
		177.80	103-828	54.6	2429	44.5	3400	62.2	3886	71.1	88.9		
		203.20	103-832	49.9	2535	50.8	3550	71.1	4057	81.3	101.6		
		254.00	103-840	36.4	2313	63.5	3238	88.9	3701	101.6	127.0		
		304.80	103-848	30.6	2335	76.2	3269	106.7	3736	121.9	152.4		

\* Deflection values shown represent compressed lengths near solid and are for design information only. The color blue is a registered trademark of Barnes Group Inc.



Raymond® MEDIUM HEAVY DUTY DIE SPRINGS					METRIC DIMENSIONS						RED	
Hole Dia. (mm)	Rod Dia. (mm)	Free Length (mm)	CATALOG NUMBER	Load at 1 mm Def. (N)	LOAD DEFLECTION TABLE							
					For Optimum Life (20% of free length)		For Long Life (25% of free length)		Maximum Operating Def. (30% of free length)		*Maximum Deflection (37% of free length)	
					Load (N)	Deflection (mm)	Load (N)	Deflection (mm)	Load (N)	Deflection (mm)	Deflection (mm)	
A	B	C										
9.53	4.76	25.40	104-104	15.8	80	5.1	100	6.4	120	7.6	9.4	
		31.75	104-105	12.8	81	6.4	101	7.9	122	9.5	11.7	
		38.10	104-106	11.7	89	7.6	112	9.5	134	11.4	14.1	
		44.45	104-107	10.2	90	8.9	113	11.1	135	13.3	16.4	
		50.80	104-108	8.8	89	10.2	111	12.7	133	15.2	18.8	
		63.50	104-110	7.4	93	12.7	117	15.9	140	19.1	23.5	
		76.20	104-112	5.3	80	15.2	100	19.1	120	22.9	28.2	
		304.80	104-148	1.6	96	61.0	120	76.2	144	91.4	112.8	
12.70	7.14	25.40	104-204	29.4	149	5.1	187	6.4	224	7.6	9.4	
		31.75	104-205	22.8	145	6.4	181	7.9	217	9.5	11.7	
		38.10	104-206	16.6	127	7.6	158	9.5	190	11.4	14.1	
		44.45	104-207	14.9	132	8.9	165	11.1	198	13.3	16.4	
		50.80	104-208	13.1	133	10.2	167	12.7	200	15.2	18.8	
		63.50	104-210	10.5	133	12.7	167	15.9	200	19.1	23.5	
		76.20	104-212	10.0	152	15.2	190	19.1	228	22.9	28.2	
		88.90	104-214	7.0	125	17.8	156	22.2	187	26.7	32.9	
304.80	104-248	2.1	128	61.0	160	76.2	192	91.4	112.8			
15.88	8.73	25.40	104-304	52.5	267	5.1	334	6.4	400	7.6	9.4	
		31.75	104-305	37.7	239	6.4	299	7.9	359	9.5	11.7	
		38.10	104-306	33.3	254	7.6	317	9.5	380	11.4	14.1	
		44.45	104-307	29.4	262	8.9	327	11.1	392	13.3	16.4	
		50.80	104-308	25.9	263	10.2	329	12.7	395	15.2	18.8	
		63.50	104-310	20.1	256	12.7	320	15.9	384	19.1	23.5	
		76.20	104-312	17.5	267	15.2	334	19.1	400	22.9	28.2	
		88.90	104-314	14.9	265	17.8	331	22.2	397	26.7	32.9	
304.80	104-348	4.7	288	61.0	360	76.2	432	91.4	112.8			
19.05	9.53	25.40	104-404	87.6	445	5.1	556	6.4	667	7.6	9.4	
		31.75	104-405	66.5	423	6.4	528	7.9	634	9.5	11.7	
		38.10	104-406	56.0	427	7.6	534	9.5	641	11.4	14.1	
		44.45	104-407	50.4	448	8.9	560	11.1	673	13.3	16.4	
		50.80	104-408	43.4	441	10.2	552	12.7	662	15.2	18.8	
		63.50	104-410	33.6	427	12.7	534	15.9	641	19.1	23.5	
		76.20	104-412	25.2	384	15.2	480	19.1	576	22.9	28.2	
		88.90	104-414	22.4	399	17.8	498	22.2	598	26.7	32.9	
		101.60	104-416	21.0	427	20.3	534	25.4	641	30.5	37.6	
		114.30	104-418	19.6	448	22.9	560	28.6	673	34.3	42.3	
		127.00	104-420	15.8	400	25.4	500	31.8	600	38.1	47.0	
		139.70	104-422	14.0	391	27.9	489	34.9	587	41.9	51.7	
		152.40	104-424	13.1	400	30.5	500	38.1	600	45.7	56.4	
		304.80	104-448	6.3	384	61.0	480	76.2	576	91.4	112.8	

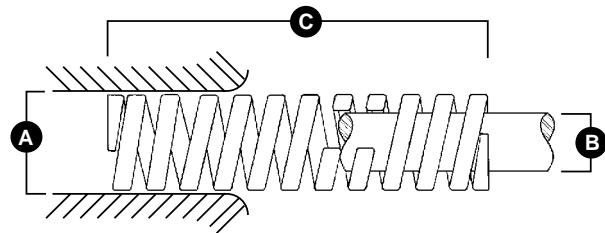
\* Deflection values shown represent compressed lengths near solid and are for design information only. The color red is a registered trademark of Barnes Group Inc.



**Raymond® MEDIUM HEAVY DUTY DIE SPRINGS METRIC DIMENSIONS RED**

Hole Dia. (mm)	Rod Dia. (mm)	Free Length (mm)	CATALOG NUMBER	Load at 1 mm Def. (N)	LOAD DEFLECTION TABLE								
					For Optimum Life (20% of free length)		For Long Life (25% of free length)		Maximum Operating Def. (30% of free length)		*Maximum Deflection (37% of free length)		
					Load (N)	Deflection (mm)	Load (N)	Deflection (mm)	Load (N)	Deflection (mm)	Deflection (mm)		
A	B	C											
25.40	12.70	25.40	104-504	133.1	676	5.1	845	6.4	1014	7.6	9.4		
		31.75	104-505	109.3	694	6.4	867	7.9	1041	9.5	11.7		
		38.10	104-506	86.9	662	7.6	827	9.5	993	11.4	14.1		
		44.45	104-507	77.1	685	8.9	856	11.1	1027	13.3	16.4		
		50.80	104-508	70.0	712	10.2	890	12.7	1068	15.2	18.8		
		63.50	104-510	54.3	689	12.7	862	15.9	1034	19.1	23.5		
		76.20	104-512	43.8	667	15.2	834	19.1	1001	22.9	28.2		
		88.90	104-514	37.8	673	17.8	841	22.2	1009	26.7	32.9		
		101.60	104-516	32.2	655	20.3	818	25.4	982	30.5	37.6		
		114.30	104-518	29.8	681	22.9	851	28.6	1021	34.3	42.3		
		127.00	104-520	25.2	641	25.4	801	31.8	961	38.1	47.0		
		139.70	104-522	22.4	626	27.9	783	34.9	939	41.9	51.7		
		152.40	104-524	21.0	641	30.5	801	38.1	961	45.7	56.4		
		177.80	104-528	17.5	623	35.6	778	44.5	934	53.3	65.8		
		203.20	104-532	15.4	626	40.6	783	50.8	939	61.0	75.2		
		304.80	104-548	10.9	662	61.0	827	76.2	993	91.4	112.8		
31.75	15.88	38.10	104-606	200.3	1527	7.6	1908	9.5	2290	11.4	14.1		
		44.45	104-607	176.5	1569	8.9	1962	11.1	2354	13.3	16.4		
		50.80	104-608	151.3	1537	10.2	1922	12.7	2306	15.2	18.8		
		63.50	104-610	109.3	1388	12.7	1735	15.9	2082	19.1	23.5		
		76.20	104-612	89.7	1366	15.2	1708	19.1	2050	22.9	28.2		
		88.90	104-614	77.1	1370	17.8	1712	22.2	2055	26.7	32.9		
		101.60	104-616	64.4	1309	20.3	1637	25.4	1964	30.5	37.6		
		114.30	104-618	56.0	1281	22.9	1601	28.6	1922	34.3	42.3		
		127.00	104-620	50.8	1290	25.4	1612	31.8	1935	38.1	47.0		
		139.70	104-622	46.2	1292	27.9	1615	34.9	1938	41.9	51.7		
		152.40	104-624	43.8	1334	30.5	1668	38.1	2002	45.7	56.4		
		177.80	104-628	35.0	1245	35.6	1557	44.5	1868	53.3	65.8		
		203.20	104-632	32.2	1309	40.6	1637	50.8	1964	61.0	75.2		
		254.00	104-640	25.4	1290	50.8	1612	63.5	1935	76.2	94.0		
		304.80	104-648	21.7	1324	61.0	1655	76.2	1986	91.4	112.8		
		38.10	19.05	50.80	104-708	189.1	1922	10.2	2402	12.7	2882	15.2	18.8
63.50	104-710			149.9	1904	12.7	2380	15.9	2856	19.1	23.5		
76.20	104-712			109.3	1665	15.2	2082	19.1	2498	22.9	28.2		
88.90	104-714			92.5	1644	17.8	2055	22.2	2466	26.7	32.9		
101.60	104-716			84.1	1708	20.3	2135	25.4	2562	30.5	37.6		
114.30	104-718			75.7	1729	22.9	2162	28.6	2594	34.3	42.3		
127.00	104-720			64.4	1637	25.4	2046	31.8	2455	38.1	47.0		
139.70	104-722			60.2	1683	27.9	2104	34.9	2525	41.9	51.7		
152.40	104-724			53.2	1623	30.5	2028	38.1	2434	45.7	56.4		
177.80	104-728			46.2	1644	35.6	2055	44.5	2466	53.3	65.8		
203.20	104-732			38.5	1566	40.6	1957	50.8	2349	61.0	75.2		
254.00	104-740			30.8	1566	50.8	1957	63.5	2349	76.2	94.0		
304.80	104-748			25.2	1537	61.0	1922	76.2	2306	91.4	112.8		
50.80	25.40			63.50	104-810	207.3	2633	12.7	3292	15.9	3950	19.1	23.5
				76.20	104-812	168.1	2562	15.2	3203	19.1	3843	22.9	28.2
				88.90	104-814	140.1	2491	17.8	3114	22.2	3736	26.7	32.9
		101.60	104-816	116.3	2363	20.3	2953	25.4	3544	30.5	37.6		
		114.30	104-818	105.1	2402	22.9	3002	28.6	3603	34.3	42.3		
		127.00	104-820	98.1	2491	25.4	3114	31.8	3736	38.1	47.0		
		139.70	104-822	88.3	2466	27.9	3082	34.9	3699	41.9	51.7		
		152.40	104-824	82.7	2519	30.5	3149	38.1	3779	45.7	56.4		
		177.80	104-828	70.0	2491	35.6	3114	44.5	3736	53.3	65.8		
		203.20	104-832	61.6	2505	40.6	3131	50.8	3758	61.0	75.2		
		254.00	104-840	45.5	2313	50.8	2891	63.5	3469	76.2	94.0		
		304.80	104-848	39.2	2391	61.0	2989	76.2	3587	91.4	112.8		

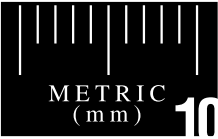
\* Deflection values shown represent compressed lengths near solid and are for design information only. The color red is a registered trademark of Barnes Group Inc.



Raymond® HEAVY DUTY DIE SPRINGS				METRIC DIMENSIONS						GOLD		
Hole Dia. (mm)	Rod Dia. (mm)	Free Length (mm)	CATALOG NUMBER	Load at 1 mm Def. (N)	LOAD DEFLECTION TABLE							
					For Optimum Life (15% of free length)		For Long Life (20% of free length)		Maximum Operating Def. (25% of free length)		*Maximum Deflection (30% of free length)	
					Load (N)	Deflection (mm)	Load (N)	Deflection (mm)	Load (N)	Deflection (mm)	Deflection (mm)	
A	B	C										
9.53	4.76	25.40	105-104	19.3	73	3.8	98	5.1	122	6.4	7.6	
		31.75	105-105	17.2	82	4.8	109	6.4	136	7.9	9.5	
		38.10	105-106	14.0	80	5.7	107	7.6	133	9.5	11.4	
		44.45	105-107	14.7	98	6.7	131	8.9	163	11.1	13.3	
		50.80	105-108	12.6	96	7.6	128	10.2	160	12.7	15.2	
		63.50	105-110	9.6	92	9.5	122	12.7	153	15.9	19.1	
		76.20	105-112	7.4	84	11.4	112	15.2	140	19.1	22.9	
		304.80	105-148	2.1	96	45.7	128	61.0	160	76.2	91.4	
12.70	7.14	25.40	105-204	41.3	157	3.8	210	5.1	262	6.4	7.6	
		31.75	105-205	32.6	155	4.8	207	6.4	259	7.9	9.5	
		38.10	105-206	27.1	155	5.7	207	7.6	259	9.5	11.4	
		44.45	105-207	24.2	161	6.7	215	8.9	269	11.1	13.3	
		50.80	105-208	19.3	147	7.6	196	10.2	245	12.7	15.2	
		63.50	105-210	14.7	140	9.5	187	12.7	234	15.9	19.1	
		76.20	105-212	13.0	148	11.4	197	15.2	247	19.1	22.9	
		88.90	105-214	10.5	140	13.3	187	17.8	234	22.2	26.7	
304.80	105-248	2.8	128	45.7	171	61.0	214	76.2	91.4			
15.88	8.73	25.40	105-304	74.3	283	3.8	377	5.1	471	6.4	7.6	
		31.75	105-305	51.8	247	4.8	329	6.4	411	7.9	9.5	
		38.10	105-306	47.6	272	5.7	363	7.6	454	9.5	11.4	
		44.45	105-307	42.0	280	6.7	374	8.9	467	11.1	13.3	
		50.80	105-308	36.4	278	7.6	370	10.2	463	12.7	15.2	
		63.50	105-310	29.8	284	9.5	378	12.7	473	15.9	19.1	
		76.20	105-312	25.2	288	11.4	384	15.2	480	19.1	22.9	
		88.90	105-314	21.4	285	13.3	380	17.8	475	22.2	26.7	
101.60	105-316	18.9	288	15.2	384	20.3	480	25.4	30.5			
304.80	105-348	5.3	240	45.7	320	61.0	400	76.2	91.4			
19.05	9.53	25.40	105-404	189.1	721	3.8	961	5.1	1201	6.4	7.6	
		31.75	105-405	154.1	734	4.8	979	6.4	1223	7.9	9.5	
		38.10	105-406	114.9	657	5.7	875	7.6	1094	9.5	11.4	
		44.45	105-407	105.1	701	6.7	934	8.9	1168	11.1	13.3	
		50.80	105-408	86.9	662	7.6	882	10.2	1103	12.7	15.2	
		63.50	105-410	70.0	667	9.5	890	12.7	1112	15.9	19.1	
		76.20	105-412	59.5	681	11.4	907	15.2	1134	19.1	22.9	
		88.90	105-414	49.0	654	13.3	872	17.8	1090	22.2	26.7	
		101.60	105-416	43.8	667	15.2	890	20.3	1112	25.4	30.5	
		114.30	105-418	38.5	661	17.1	881	22.9	1101	28.6	34.3	
		127.00	105-420	34.1	651	19.1	867	25.4	1084	31.8	38.1	
		139.70	105-422	29.8	624	21.0	832	27.9	1040	34.9	41.9	
		152.40	105-424	28.0	641	22.9	854	30.5	1068	38.1	45.7	
		304.80	105-448	14.0	641	45.7	854	61.0	1068	76.2	91.4	

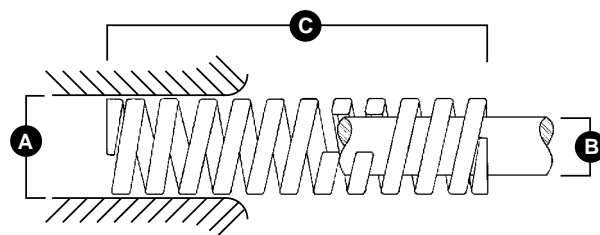
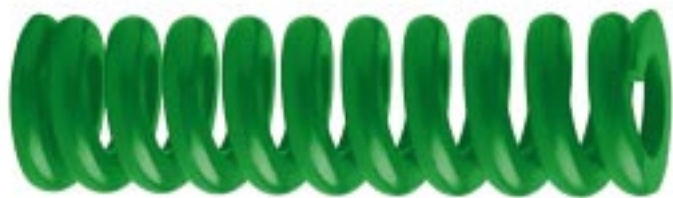
\* Deflection values shown represent compressed lengths near solid and are for design information only. The color gold is a registered trademark of Barnes Group Inc.





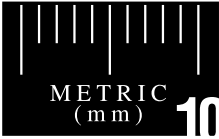
Raymond®		HEAVY DUTY DIE SPRINGS			METRIC DIMENSIONS						GOLD		
Hole Dia. (mm)	Rod Dia. (mm)	Free Length (mm)	CATALOG NUMBER	Load at 1 mm Def. (N)	LOAD DEFLECTION TABLE								
					For Optimum Life (15% of free length)		For Long Life (20% of free length)		Maximum Operating Def. (25% of free length)		*Maximum Deflection (30% of free length)		
					Load (N)	Deflection (mm)	Load (N)	Deflection (mm)	Load (N)	Deflection (mm)	Deflection (mm)		
A	B	C											
25.40	12.70	25.40	105-504	364.2	1388	3.8	1850	5.1	2313	6.4	7.6		
		31.75	105-505	299.8	1428	4.8	1904	6.4	2380	7.9	9.5		
		38.10	105-506	207.3	1185	5.7	1580	7.6	1975	9.5	11.4		
		44.45	105-507	182.1	1214	6.7	1619	8.9	2024	11.1	13.3		
		50.80	105-508	157.6	1201	7.6	1601	10.2	2002	12.7	15.2		
		63.50	105-510	119.1	1134	9.5	1512	12.7	1890	15.9	19.1		
		76.20	105-512	95.3	1089	11.4	1452	15.2	1815	19.1	22.9		
		88.90	105-514	79.9	1065	13.3	1420	17.8	1775	22.2	26.7		
		101.60	105-516	70.0	1068	15.2	1423	20.3	1779	25.4	30.5		
		114.30	105-518	61.6	1057	17.1	1409	22.9	1761	28.6	34.3		
		127.00	105-520	54.6	1041	19.1	1388	25.4	1735	31.8	38.1		
		139.70	105-522	50.4	1057	21.0	1409	27.9	1761	34.9	41.9		
		152.40	105-524	44.8	1025	22.9	1366	30.5	1708	38.1	45.7		
		177.80	105-528	39.2	1046	26.7	1395	35.6	1744	44.5	53.3		
		203.20	105-532	33.6	1025	30.5	1366	40.6	1708	50.8	61.0		
304.80	105-548	21.0	961	45.7	1281	61.0	1601	76.2	91.4				
31.75	15.88	38.10	105-606	371.3	2122	5.7	2829	7.6	3536	9.5	11.4		
		44.45	105-607	318.0	2120	6.7	2827	8.9	3534	11.1	13.3		
		50.80	105-608	262.0	1996	7.6	2662	10.2	3327	12.7	15.2		
		63.50	105-610	205.9	1962	9.5	2615	12.7	3269	15.9	19.1		
		76.20	105-612	166.7	1906	11.4	2541	15.2	3176	19.1	22.9		
		88.90	105-614	131.7	1756	13.3	2341	17.8	2927	22.2	26.7		
		101.60	105-616	116.3	1772	15.2	2363	20.3	2953	25.4	30.5		
		114.30	105-618	102.3	1753	17.1	2338	22.9	2922	28.6	34.3		
		127.00	105-620	92.8	1768	19.1	2357	25.4	2947	31.8	38.1		
		139.70	105-622	82.7	1732	21.0	2309	27.9	2887	34.9	41.9		
		152.40	105-624	74.3	1697	22.9	2263	30.5	2829	38.1	45.7		
		177.80	105-628	64.4	1719	26.7	2292	35.6	2865	44.5	53.3		
		203.20	105-632	57.4	1751	30.5	2334	40.6	2918	50.8	61.0		
		254.00	105-640	44.8	1708	38.1	2277	50.8	2847	63.5	76.2		
		304.80	105-648	36.4	1665	45.7	2220	61.0	2776	76.2	91.4		
38.10	19.05	50.80	105-708	333.4	2541	7.6	3388	10.2	4234	12.7	15.2		
		63.50	105-710	271.4	2585	9.5	3447	12.7	4309	15.9	19.1		
		76.20	105-712	227.7	2602	11.4	3469	15.2	4337	19.1	22.9		
		88.90	105-714	186.3	2485	13.3	3313	17.8	4141	22.2	26.7		
		101.60	105-716	159.7	2434	15.2	3245	20.3	4057	25.4	30.5		
		114.30	105-718	137.3	2354	17.1	3139	22.9	3923	28.6	34.3		
		127.00	105-720	124.7	2375	19.1	3167	25.4	3959	31.8	38.1		
		139.70	105-722	112.1	2349	21.0	3131	27.9	3914	34.9	41.9		
		152.40	105-724	102.3	2338	22.9	3117	30.5	3896	38.1	45.7		
		177.80	105-728	86.9	2317	26.7	3089	35.6	3861	44.5	53.3		
		203.20	105-732	75.7	2306	30.5	3074	40.6	3843	50.8	61.0		
		254.00	105-740	60.2	2295	38.1	3060	50.8	3825	63.5	76.2		
		304.80	105-748	50.4	2306	45.7	3074	61.0	3843	76.2	91.4		
		50.80	25.40	63.50	105-810	455.3	4337	9.5	5782	12.7	7228	15.9	19.1
				76.20	105-812	350.2	4003	11.4	5338	15.2	6672	19.1	22.9
88.90	105-814			297.7	3970	13.3	5293	17.8	6616	22.2	26.7		
101.60	105-816			262.7	4003	15.2	5338	20.3	6672	25.4	30.5		
114.30	105-818			210.1	3603	17.1	4804	22.9	6005	28.6	34.3		
127.00	105-820			192.6	3670	19.1	4893	25.4	6116	31.8	38.1		
139.70	105-822			175.1	3670	21.0	4893	27.9	6116	34.9	41.9		
152.40	105-824			164.6	3763	22.9	5017	30.5	6272	38.1	45.7		
177.80	105-828			143.6	3830	26.7	5106	35.6	6383	44.5	53.3		
203.20	105-832			127.8	3896	30.5	5195	40.6	6494	50.8	61.0		
254.00	105-840			96.3	3670	38.1	4893	50.8	6116	63.5	76.2		
304.80	105-848			73.5	3363	45.7	4484	61.0	5604	76.2	91.4		

\* Deflection values shown represent compressed lengths near solid and are for design information only.  
The color gold is a registered trademark of Barnes Group Inc.



Raymond® EXTRA HEAVY DUTY DIE SPRINGS					METRIC DIMENSIONS						GREEN	
Hole Dia. (mm)	Rod Dia. (mm)	Free Length (mm)	CATALOG NUMBER	Load at 1 mm Def. (N)	LOAD DEFLECTION TABLE							
					For Optimum Life (15% of free length)		For Long Life (17% of free length)		Maximum Operating Def. (20% of free length)		*Maximum Deflection (25% of free length)	
					Load (N)	Deflection (mm)	Load (N)	Deflection (mm)	Load (N)	Deflection (mm)	Deflection (mm)	
A	B	C										
9.53	4.76	25.40	106-104	38.5	147	3.8	166	4.3	196	5.1	6.4	
		31.75	106-105	28.0	133	4.8	151	5.4	178	6.4	7.9	
		38.10	106-106	21.9	125	5.7	142	6.5	167	7.6	9.5	
		44.45	106-107	20.1	134	6.7	152	7.6	179	8.9	11.1	
		50.80	106-108	15.8	120	7.6	136	8.6	160	10.2	12.7	
		63.50	106-110	12.3	117	9.5	132	10.8	156	12.7	15.9	
		76.20	106-112	11.4	130	11.4	147	13.0	173	15.2	19.1	
		304.80	106-148	2.6	120	45.7	136	51.8	160	61.0	76.2	
12.70	7.14	25.40	106-204	56.0	214	3.8	242	4.3	285	5.1	6.4	
		31.75	106-205	42.0	200	4.8	227	5.4	267	6.4	7.9	
		38.10	106-206	35.0	200	5.7	227	6.5	267	7.6	9.5	
		44.45	106-207	29.8	198	6.7	225	7.6	265	8.9	11.1	
		50.80	106-208	24.5	187	7.6	212	8.6	249	10.2	12.7	
		63.50	106-210	20.1	192	9.5	217	10.8	256	12.7	15.9	
		76.20	106-212	15.8	180	11.4	204	13.0	240	15.2	19.1	
		88.90	106-214	14.0	187	13.3	212	15.1	249	17.8	22.2	
304.80	106-248	4.4	200	45.7	227	51.8	267	61.0	76.2			
15.88	8.73	25.40	106-304	110.3	420	3.8	476	4.3	560	5.1	6.4	
		31.75	106-305	82.3	392	4.8	444	5.4	523	6.4	7.9	
		38.10	106-306	66.5	380	5.7	431	6.5	507	7.6	9.5	
		44.45	106-307	56.0	374	6.7	423	7.6	498	8.9	11.1	
		50.80	106-308	50.8	387	7.6	439	8.6	516	10.2	12.7	
		63.50	106-310	38.5	367	9.5	416	10.8	489	12.7	15.9	
		76.20	106-312	33.3	380	11.4	431	13.0	507	15.2	19.1	
		88.90	106-314	28.0	374	13.3	423	15.1	498	17.8	22.2	
101.60	106-316	23.6	360	15.2	408	17.3	480	20.3	25.4			
304.80	106-348	7.9	360	45.7	408	51.8	480	61.0	76.2			
19.05	9.53	25.40	106-404	245.2	934	3.8	1059	4.3	1245	5.1	6.4	
		31.75	106-405	192.6	917	4.8	1040	5.4	1223	6.4	7.9	
		38.10	106-406	155.9	891	5.7	1009	6.5	1188	7.6	9.5	
		44.45	106-407	131.3	876	6.7	992	7.6	1168	8.9	11.1	
		50.80	106-408	119.1	907	7.6	1028	8.6	1210	10.2	12.7	
		63.50	106-410	87.6	834	9.5	945	10.8	1112	12.7	15.9	
		76.20	106-412	70.9	811	11.4	919	13.0	1081	15.2	19.1	
		88.90	106-414	60.4	806	13.3	913	15.1	1074	17.8	22.2	
		101.60	106-416	52.5	801	15.2	907	17.3	1068	20.3	25.4	
		114.30	106-418	46.4	796	17.1	902	19.4	1061	22.9	28.6	
		127.00	106-420	41.2	784	19.1	888	21.6	1045	25.4	31.8	
		139.70	106-422	37.7	789	21.0	894	23.7	1052	27.9	34.9	
		152.40	106-424	34.1	781	22.9	885	25.9	1041	30.5	38.1	
		304.80	106-448	16.6	761	45.7	862	51.8	1014	61.0	76.2	

\* Deflection values shown represent compressed lengths near solid and are for design information only. The color green is a registered trademark of Barnes Group Inc.



Raymond® EXTRA HEAVY DUTY DIE SPRINGS					METRIC DIMENSIONS						GREEN	
Hole Dia. (mm)	Rod Dia. (mm)	Free Length (mm)	CATALOG NUMBER	Load at 1 mm Def. (N)	LOAD DEFLECTION TABLE							
					For Optimum Life (15% of free length)		For Long Life (17% of free length)		Maximum Operating Def. (20% of free length)		*Maximum Deflection (25% of free length)	
					Load (N)	Deflection (mm)	Load (N)	Deflection (mm)	Load (N)	Deflection (mm)	Deflection (mm)	
A	B	C										
25.40	12.70	38.10	106-506	280.2	1601	5.7	1815	6.5	2135	7.6	9.5	
		50.80	106-508	203.1	1548	7.6	1754	8.6	2064	10.2	12.7	
		63.50	106-510	156.9	1495	9.5	1694	10.8	1993	12.7	5.9	
		76.20	106-512	128.9	1473	11.4	1670	13.0	1964	15.2	19.1	
		88.90	106-514	109.3	1457	13.3	1651	15.1	1943	17.8	22.2	
		101.60	106-516	96.7	1473	15.2	1670	17.3	1964	20.3	25.4	
		114.30	106-518	85.5	1465	17.1	1661	19.4	1954	22.9	28.6	
		127.00	106-520	75.7	1441	19.1	1633	21.6	1922	25.4	31.8	
		152.40	106-524	63.0	1441	22.9	1633	25.9	1922	30.5	38.1	
		304.80	106-548	30.8	1409	45.7	1597	51.8	1879	61.0	76.2	
31.75	15.88	50.80	106-608	336.2	2562	7.6	2904	8.6	3416	10.2	12.7	
		63.50	106-610	252.2	2402	9.5	2722	10.8	3203	12.7	15.9	
		76.20	106-612	207.3	2370	11.4	2686	13.0	3160	15.2	19.1	
		88.90	106-614	176.5	2354	13.3	2668	15.1	3139	17.8	22.2	
		101.60	106-616	147.1	2242	15.2	2541	17.3	2989	20.3	25.4	
		114.30	106-618	137.3	2354	17.1	2668	19.4	3139	22.9	28.6	
		127.00	106-620	119.1	2268	19.1	2571	21.6	3025	25.4	31.8	
		152.40	106-624	98.1	2242	22.9	2541	25.9	2989	30.5	38.1	
		203.20	106-632	72.8	2220	30.5	2517	34.5	2961	40.6	50.8	
		254.00	106-640	58.8	2242	38.1	2541	43.2	2989	50.8	63.5	
304.80	106-648	46.2	2114	45.7	2396	51.8	2818	61.0	76.2			
38.10	19.05	50.80	106-708	658.4	5017	7.6	5686	8.6	6690	10.2	12.7	
		63.50	106-710	515.5	4911	9.5	5565	10.8	6547	12.7	15.9	
		76.20	106-712	404.9	4628	11.4	5245	13.0	6170	15.2	19.1	
		88.90	106-714	343.2	4577	13.3	5187	15.1	6103	17.8	22.2	
		101.60	106-716	299.8	4569	15.2	5178	17.3	6092	20.3	25.4	
		114.30	106-718	259.2	4444	17.1	5036	19.4	5925	22.9	28.6	
		127.00	106-720	238.2	4537	19.1	5142	21.6	6049	25.4	31.8	
		152.40	106-724	193.3	4420	22.9	5009	25.9	5893	30.5	38.1	
		203.20	106-732	141.5	4313	30.5	4888	34.5	5750	40.6	50.8	
		254.00	106-740	117.7	4484	38.1	5081	43.2	5978	50.8	63.5	
304.80	106-748	95.3	4355	45.7	4936	51.8	5807	61.0	76.2			
50.80	25.40	63.50	106-810	668.3	6365	9.5	7214	10.8	8487	12.7	15.9	
		76.20	106-812	546.4	6245	11.4	7078	13.0	8327	15.2	19.1	
		88.90	106-814	445.5	5941	13.3	6733	15.1	7921	17.8	22.2	
		101.60	106-816	385.3	5871	15.2	6654	17.3	7828	20.3	25.4	
		114.30	106-818	330.6	5669	17.1	6424	19.4	7558	22.9	28.6	
		127.00	106-820	302.6	5765	19.1	6533	21.6	7686	25.4	31.8	
		152.40	106-824	248.0	5669	22.9	6424	25.9	7558	30.5	38.1	
		203.20	106-832	175.1	5338	30.5	6049	34.5	7117	40.6	50.8	
		254.00	106-840	147.1	5604	38.1	6352	43.2	7473	50.8	63.5	
		304.80	106-848	124.7	5701	45.7	6461	51.8	7601	61.0	76.2	

\* Deflection values shown represent compressed lengths near solid and are for design information only. The color green is a registered trademark of Barnes Group Inc.



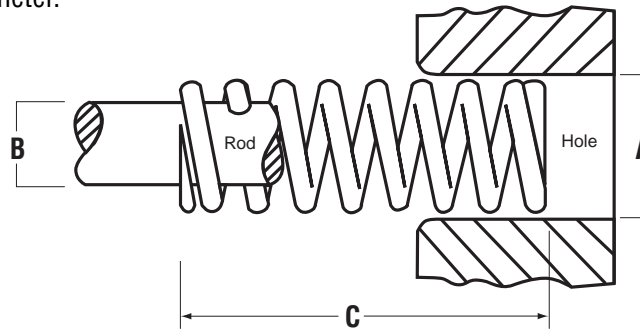
Square Wire Die Springs				Plain End Springs - 12" Length		
New Part Number	Old Part Number	Hole Size (in)	Rod Size (in)	Square Wire Size (in)	Space Between Coils (in)	Unit Pack
108-000-001	SR-0	3/8	3/16	0.063	0.047	12
108-001-100	SR-1A	7/16	1/4	0.063	0.079	12
108-001-200	SR-1B	1/2	1/4	0.094	0.079	12
108-001-000	SR-1	9/16	5/16	0.094	0.094	12
108-004-000	SR-4	9/16	1/4	0.125	0.063	12
108-002-000	SR-2	11/16	7/16	0.094	0.125	12
108-005-000	SR-5	11/16	3/8	0.125	0.094	12
108-010-000	SR-10	11/16	5/16	0.156	0.063	12
108-003-000	SR-3	13/16	9/16	0.094	0.125	12
108-006-000	SR-6	13/16	1/2	0.125	0.109	12
108-011-000	SR-11	13/16	7/16	0.156	0.109	12
108-016-000	SR-16	13/16	3/8	0.188	0.094	12
108-007-000	SR-7	15/16	5/8	0.125	0.125	12
108-012-000	SR-12	15/16	9/16	0.156	0.109	12
108-017-000	SR-17	15/16	1/2	0.188	0.094	12
108-008-000	SR-8	1 1/16	3/4	0.125	0.188	6
108-013-000	SR-13	1 1/16	11/16	0.156	0.172	6
108-018-000	SR-18	1 1/16	5/8	0.188	0.156	6
108-023-000	SR-23	1 1/16	7/16	0.250	0.109	6
108-009-000	SR-9	1 3/16	7/8	0.125	0.250	6
108-014-000	SR-14	1 3/16	13/16	0.156	0.188	6
108-019-000	SR-19	1 3/16	3/4	0.188	0.188	6
108-024-000	SR-24	1 3/16	9/16	0.250	0.125	6
108-015-000	SR-15	1 5/16	15/16	0.156	0.250	6
108-020-000	SR-20	1 5/16	7/8	0.188	0.188	6
108-025-000	SR-25	1 5/16	11/16	0.250	0.156	6
108-021-000	SR-21	1 7/16	1	0.188	0.312	6
108-026-000	SR-26	1 7/16	13/16	0.250	0.172	6
108-022-000	SR-22	1 9/16	1 1/8	0.188	0.312	6
108-027-000	SR-27	1 9/16	15/16	0.250	0.203	6
108-031-000	SR-31	1 9/16	13/16	0.312	0.188	6
108-028-000	SR-28	1 13/16	1 3/16	0.250	0.344	6
108-032-000	SR-32	1 13/16	1 1/16	0.312	0.250	6
108-029-000	SR-29	2 1/16	1 7/16	0.250	0.438	6
108-033-000	SR-33	2 1/16	1 5/16	0.312	0.297	6
108-030-000	SR-30	2 5/16	1 11/16	0.250	0.531	6
108-034-000	SR-34	2 5/16	1 9/16	0.312	0.406	6
108-035-000	SR-35	2 9/16	1 13/16	0.312	0.438	6

Raymond® Round Wire Die Springs are optimally engineered to ensure maximum fatigue life when using proper die spring application techniques.

For maximum operating life always pre-load the springs and prevent exceeding the maximum recommended deflection.

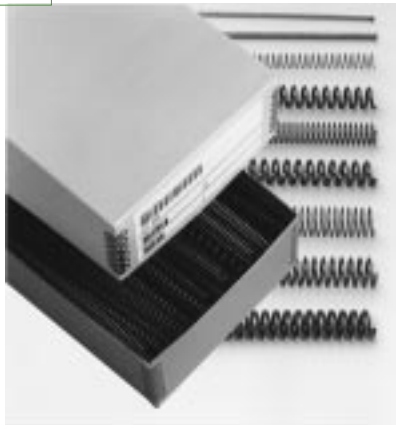
### Product Characteristics

- Material: Music Wire ASTM-A228 or AMS-5112 or Chrome Silicon ASTM-A401
- Spring Rate: Spring Rate is reference only and can be calculated from the table shown below.
- Load @ Max. Def.: Defined as the load at maximum deflection and is held to +/- 10%.
- Free Length: The overall length of the spring in a free state condition.
- Hole Dia.: Each spring is manufactured to fit into the indicated hole size and is actually less than the hole diameter.
- Rod Dia.: Each spring is manufactured to fit over the indicated rod size and is actually greater than the rod diameter.



Raymond® Round Wire Die Springs												
KEY CHARACTERISTICS			LIGHT LOAD (GREEN)			MEDIUM LOAD (BLUE)			HEAVY LOAD (RED)			PACKAGING
A Hole Dia. (in.)	B Rod Dia. (in.)	C Free Length (in.)	Max. Deflection (in.)	Load @ Max. Deflection (lbs.)	Part No.	Max. Deflection (in.)	Load @ Max. Deflection (lbs.)	Part No.	Max. Deflection (in.)	Load @ Max. Deflection (lbs.)	Part No.	Standard Box Quantity
3/8	3/16	1.00	0.40	10.08	903-104	0.37	25.90	904-104	0.30	35.40	905-104	200
3/8	3/16	1.25	0.50	9.80	903-105	0.46	24.98	904-105	0.38	34.50	905-105	200
3/8	3/16	1.50	0.60	9.54	903-106	0.56	24.59	904-106	0.45	33.30	905-106	100
3/8	3/16	1.75	0.70	9.45	903-107	0.65	24.15	904-107	0.53	32.55	905-107	100
3/8	3/16	2.00	0.80	9.52	903-108	0.74	23.83	904-108	0.60	33.00	905-108	100
3/8	3/16	2.50	1.00	9.30	903-110	0.93	23.59	904-110	0.75	32.85	905-110	100
3/8	3/16	3.00	1.20	9.12	903-112	1.11	23.31	904-112	0.90	32.31	905-112	100
3/8	3/16	12.00	4.80	8.64	903-148	4.44	22.64	904-148	3.60	31.32	905-148	50
1/2	9/32	1.00	0.40	19.52	903-204	0.37	45.88	904-204	0.30	64.20	905-204	100
1/2	9/32	1.25	0.50	18.55	903-205	0.46	44.40	904-205	0.38	61.88	905-205	100
1/2	9/32	1.50	0.60	18.24	903-206	0.56	43.85	904-206	0.45	60.30	905-206	100
1/2	9/32	1.75	0.70	18.48	903-207	0.65	42.74	904-207	0.53	58.80	905-207	100
1/2	9/32	2.00	0.80	17.36	903-208	0.74	42.18	904-208	0.60	59.40	905-208	100
1/2	9/32	2.50	1.00	16.80	903-210	0.93	41.26	904-210	0.75	57.75	905-210	50
1/2	9/32	3.00	1.20	17.16	903-212	1.11	40.63	904-212	0.90	57.60	905-212	50
1/2	9/32	3.50	1.40	17.08	903-214	1.30	41.57	904-214	1.05	56.70	905-214	50
1/2	9/32	12.00	4.80	16.32	903-248	4.44	39.07	904-248	3.60	54.72	905-248	50
5/8	11/32	1.00	0.40	40.80	903-304	0.37	67.34	904-304	0.30	139.80	905-304	100
5/8	11/32	1.25	0.50	38.50	903-305	0.46	63.36	904-305	0.38	131.25	905-305	100
5/8	11/32	1.50	0.60	36.00	903-306	0.56	61.61	904-306	0.45	128.25	905-306	50
5/8	11/32	1.75	0.70	35.00	903-307	0.65	59.57	904-307	0.53	122.33	905-307	50
5/8	11/32	2.00	0.80	34.64	903-308	0.74	58.46	904-308	0.60	121.80	905-308	50
5/8	11/32	2.50	1.00	33.80	903-310	0.93	56.43	904-310	0.75	119.25	905-310	50
5/8	11/32	3.00	1.20	32.76	903-312	1.11	55.50	904-312	0.90	117.00	905-312	50
5/8	11/32	3.50	1.40	32.34	903-314	1.30	55.17	904-314	1.05	117.60	905-314	50
5/8	11/32	4.00	1.60	32.16	903-316	1.48	55.20	904-316	1.20	116.40	905-316	50
5/8	11/32	12.00	4.80	30.72	903-348	4.44	52.84	904-348	3.60	111.24	905-348	50

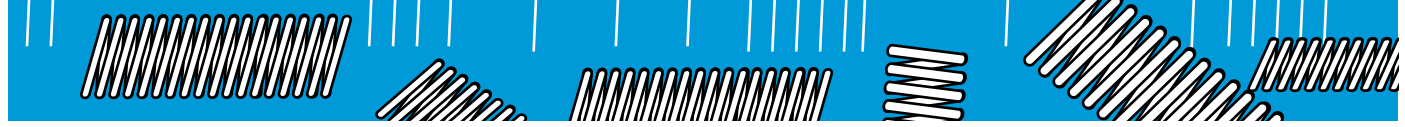




## Compression Spring Assortment Kit: No. 111-840 & 111-845 Plain End Springs - 10" Length

Part Number	Hole Size (in)	Wire Diameter (in)	Spring Rate (lb/in)	Approx. Solid Height (in)	Unit Pack
107-010	3/32	0.010	0.11	2.80	12
107-011	3/32	0.014	0.48	3.99	12
107-020	1/8	0.012	0.09	3.00	12
107-021	1/8	0.016	0.35	4.00	12
107-030	3/16	0.014	0.09	2.17	12
107-031	3/16	0.018	0.24	2.52	12
107-032	3/16	0.026	1.34	3.43	12
107-033	3/16	0.035	3.30	6.65	12
107-040	1/4	0.018	0.14	1.71	12
107-041	1/4	0.022	0.26	2.53	12
107-042	1/4	0.026	0.67	2.55	12
107-043	1/4	0.031	1.37	3.10	12
107-044	1/4	0.035	1.73	4.73	12
107-045	1/4	0.041	5.40	3.69	12
107-046	1/4	0.047	9.17	4.70	12
107-050	5/16	0.022	0.15	2.24	12
107-051	5/16	0.031	0.57	3.41	12
107-052	5/16	0.037	1.27	4.07	12
107-053	5/16	0.041	2.70	3.28	12
107-054	5/16	0.047	5.45	3.53	12
107-055	5/16	0.055	10.27	4.40	12
107-060	3/8	0.031	0.32	3.41	12
107-061	3/8	0.035	0.58	3.50	12
107-062	3/8	0.043	2.06	3.01	12
107-063	3/8	0.047	2.52	4.00	12
107-064	3/8	0.055	7.29	3.30	12
107-065	3/8	0.062	11.29	4.03	12
107-066	3/8	0.075	30.57	5.25	12
107-070	7/16	0.035	0.54	2.45	12
107-071	7/16	0.047	1.81	3.29	12
107-072	7/16	0.055	4.12	3.30	12
107-073	7/16	0.062	6.45	4.03	12
107-074	7/16	0.075	18.18	4.13	12
107-075	7/16	0.085	30.19	5.10	12
107-080	1/2	0.035	0.26	3.15	12
107-081	1/2	0.047	1.06	3.53	12
107-082	1/2	0.055	2.25	3.85	12
107-083	1/2	0.062	6.77	2.48	12
107-084	1/2	0.075	14.35	3.38	12
107-085	1/2	0.091	30.81	4.55	12
107-086	1/2	0.115	87.36	6.33	12

111-840 or R-40 Assortment consists of 1 of each spring listed above  
 111-845 or R-45 Assortment consists of 2 of each spring listed above



**Compression & Extension Spring Assortment** No. 020-811-440

Part Number	Free Length (in)	Type	Outside Diameter (in)	Wire Diameter (in)	Spring Rate (lb/in)	Approximate Load @ Ref. Extension (in)	Assortment Quantity	Unit Pack
020-042	1	Ext.	0.188	0.014	0.19	0.2 lbs. @ 1.50	12	12
020-040	1 1/8	Ext.	0.234	0.020	0.75	0.6 lbs. @ 1.63	12	12
020-039	1 1/8	Ext.	0.300	0.040 Brass	5.25	2.0 lbs. @ 1.20	12	12
020-037	1 7/16	Ext.	0.344	0.048	15.00	10.0 lbs. @ 1.81	12	12
020-034	1 5/8	Ext.	0.500	0.080	74.93	23.0 lbs. @ 1.88	12	12
020-095	2	Ext.	0.718	0.107	90.86	51.0 lbs. @ 2.50	12	12
020-035	2 1/16	Ext.	0.156	0.020 Brass	0.50	8.5 lbs. @ 2.81	12	12
020-032	2 19/32	Ext.	0.750	0.105	46.00	29.5 lbs. @ 2.97	12	12
020-033	2 21/32	Ext.	0.750	0.080	10.30	12.5 lbs. @ 3.66	12	12
020-019	3 1/4	Ext.	0.375	0.041	1.90	5.2 lbs. @ 5.25	12	12
020-020	4	Ext.	0.250	0.028	0.81	1.9 lbs. @ 6.00	12	12
020-024	4	Ext.	0.719	0.105	30.78	36.5 lbs. @ 5.00	12	12
020-023	4 1/16	Ext.	0.734	0.063	1.73	4.3 lbs. @ 6.03	12	12
020-022	4 1/2	Ext.	0.484	0.063	5.23	14.0 lbs. @ 6.50	12	12
020-026	5	Ext.	0.312	0.041	1.91	3.1 lbs. @ 6.50	12	12
020-028	5 1/4	Ext.	0.438	0.063	6.50	16.0 lbs. @ 7.25	12	12
020-025	5 1/4	Ext.	0.531	0.062	5.00	8.5 lbs. @ 6.25	12	12
020-018	5 11/32	Ext.	0.250	0.041	4.30	8.0 lbs. @ 5.84	12	12
020-027	5 3/8	Ext.	0.344	0.048	2.60	6.2 lbs. @ 7.38	12	12
020-014	5 1/2	Ext.	0.375	0.054	4.00	10.0 lbs. @ 7.50	12	12
020-013	5 1/2	Ext.	0.562	0.080	10.50	24.5 lbs. @ 7.00	12	12
020-012	5 5/8	Ext.	0.547	0.080	10.00	24.0 lbs. @ 7.63	12	12
020-017	5 3/4	Ext.	0.250	0.028	0.59	1.6 lbs. @ 7.75	12	12
020-015	5 3/4	Ext.	0.297	0.048	4.40	9.3 lbs. @ 7.75	12	12
020-029	6	Ext.	0.875	0.120	18.50	26.5 lbs. @ 7.00	6	6
020-016	6 1/8	Ext.	0.266	0.035	1.10	4.0 lbs. @ 8.13	12	12
020-009	6 7/16	Ext.	0.438	0.048	1.10	4.2 lbs. @ 8.44	12	12
020-010	6 1/2	Ext.	0.328	0.035	0.58	2.2 lbs. @ 8.50	12	12
020-011	6 5/8	Ext.	0.156	0.026	1.18	2.2 lbs. @ 8.63	12	12
020-030	8	Ext.	1.062	0.135	13.48	38.0 lbs. @ 10.00	6	6
020-007	8 1/8	Ext.	0.344	0.048	1.60	6.3 lbs. @ 10.13	12	12
020-031	8 1/2	Ext.	1.000	0.105	3.96	16.8 lbs. @ 10.25	6	3
020-008	9 1/16	Ext.	0.172	0.029	1.00	3.5 lbs. @ 10.13	12	12
020-005	10	Ext.	0.359	0.054	2.30	6.2 lbs. @ 13.00	12	12
020-006	10	Ext.	0.375	0.047	1.32	5.5 lbs. @ 13.00	12	12
020-004	10	Ext.	0.500	0.062	2.09	10.2 lbs. @ 12.00	12	12
020-003	10	Ext.	0.625	0.072	2.10	8.8 lbs. @ 13.00	6	6
020-002	10	Ext.	0.812	0.072	0.75	5.6 lbs. @ 12.00	6	3
020-001	10	Ext.	0.875	0.092	2.50	11.5 lbs. @ 13.00	6	3

## Compression & Extension Spring Assortment (continued) No. 020-811-440

Part Number	Type	Outside Diameter (in)	Free Length (in)	Wire Diameter (in)	Spring Rate (lb/in)	Solid Height (in)	Assortment Quantity	Unit Pack
020-077	Comp	0.172	0.22	0.012	1.15	0.12	12	12
020-078	Conical	0.281 x 0.156	0.50	0.013	0.68	0.12	12	12
020-074	Comp	0.078	0.53	0.012	5.67	0.26	12	12
020-073	Comp	0.078	0.56	0.011	3.90	0.23	12	12
020-086	Comp	0.375	0.78	0.042 Brass	7.40	0.38	12	12
020-076	Comp	0.109	0.81	0.018	12.00	0.34	12	12
020-085	Comp	0.312	0.88	0.025 Ph. Brz.	2.60	0.20	12	12
020-075	Comp	0.109	0.91	0.018	9.30	0.41	12	12
020-087	Conical	0.531 x 0.281	0.91	0.072	56.00	0.52	12	12
020-084	Comp	0.188	0.94	0.012	0.32	0.24	12	12
020-057	Conical	0.656 x 0.938	0.94	0.058 Ph. Brz.	5.08	0.36	12	12
020-060	Comp	0.500	0.97	0.072 Ph. Brz.	52.00	0.61	12	12
020-058	Conical	0.625 x 0.750	1.00	0.080 Brass	33.45	0.44	12	12
020-059	Comp	0.531	1.03	0.105	436.00	0.95	12	12
020-070	Comp	0.844	1.10	0.080 Brass	21.50	0.36	12	12
020-080	Comp	0.281	1.25	0.040	18.00	0.64	12	12
020-079	Comp	0.281	1.31	0.040	21.05	0.54	12	12
020-081	Comp	0.312	1.97	0.022	0.65	0.53	12	12
020-093	Comp	0.438	2.00	0.054	15.40	0.97	12	12
020-065	Comp	0.875	2.00	0.120	110.00	0.96	12	12
020-088	Comp	0.375	2.03	0.048	11.00	1.00	12	12
020-063	Comp	0.938	2.03	0.080	16.00	0.64	12	12
020-092	Comp	0.500	2.06	0.048	5.60	0.81	12	12
020-069	Comp	0.590	2.19	0.040	3.55	0.38	12	12
020-094	Comp	0.375	2.21	0.063	42.00	1.15	12	12
020-083	Comp	0.312	2.44	0.028	1.00	0.67	12	12
020-082	Comp	0.312	2.44	0.032	1.30	0.77	12	12
020-090	Comp	0.469	2.50	0.053	12.00	0.92	12	12
020-091	Comp	0.500	2.50	0.063	18.00	1.00	12	12
020-071	Comp	0.438	2.56	0.041	2.60	1.12	12	12
020-062	Comp	1.015	2.56	0.120	56.00	1.15	12	12
020-066	Comp	0.859	2.59	0.135	154.00	1.49	12	12
020-089	Comp	0.438	2.63	0.048	7.20	0.95	12	12
020-072	Comp	0.750	2.63	0.106	75.00	1.17	12	12
020-068	Comp	0.625	2.84	0.080	30.00	1.08	12	12
020-064	Comp	0.875	3.06	0.092	21.50	1.10	12	12
020-061	Barrel	0.531 x 1.031 x 0.85	3.50	0.051	1.83	0.72	12	12
020-067	Comp	0.688	4.02	0.105	58.00	1.95	12	12
020-056	Comp	0.176	10.00	0.014	0.15	2.25	12	12
020-055	Comp	0.250	10.00	0.022	0.26	2.49	12	12
020-054	Comp	0.312	10.00	0.022	0.19	2.27	12	12
020-048	Comp	0.875	10.00	0.080	3.20	3.00	6	3
020-052	Comp	0.375	11.50	0.047	2.71	4.24	12	12
020-050	Comp	0.625	11.50	0.054	1.22	3.56	12	6
020-053	Comp	0.359	12.00	0.048	2.20	5.27	12	12
020-051	Comp	0.516	12.00	0.063	2.80	5.44	12	12
020-049	Comp	0.734	12.00	0.080	3.80	4.88	6	3
020-047	Comp	0.875	12.00	0.105	8.00	5.17	6	3



## Compression Spring Assortment Kit No. 111-850 Plain End Springs - 18" Length

Part Number	Hole Size* (in)	Wire Diameter (in)	Spring Rate (lb/in)	Approx. Solid Height (in)	Assortment Quantity	Unit Pack
107-509-000	1/2	0.041	0.60	3.32	1	12
107-509-100	1/2	0.054	1.98	3.89	1	12
107-509-200	9/16	0.062	1.84	6.45	1	12
107-509-300	9/16	0.072	5.10	5.18	1	12
107-510-000	5/8	0.054	1.31	2.92	1	12
107-510-100	11/16	0.062	1.82	3.35	1	12
107-510-200	11/16	0.072	3.03	4.25	1	12
107-510-300	11/16	0.068	2.24	4.28	1	12
107-511-000	13/16	0.062	1.30	2.79	1	12
107-511-100	13/16	0.080	3.50	3.60	1	12
107-511-200	7/8	0.098	7.79	4.02	1	12
107-511-300	15/16	0.125	15.00	6.25	1	12
107-512-000	1 1/8	0.125	7.57	6.25	1	6
107-512-100	15/16	0.080	2.52	3.60	1	12
107-512-200	1	0.098	5.69	3.53	1	6
107-512-300	1 1/16	0.125	12.73	4.50	1	6
107-512-400	1 1/8	0.135	10.78	7.29	1	6
107-513-000	1 1/16	0.085	2.06	3.49	1	6
107-513-100	1 3/16	0.125	9.00	4.50	1	6
107-514-000	1 3/16	0.090	2.45	2.88	1	6
107-514-100	1 3/8	0.148	12.73	4.74	1	6
107-515-000	1 5/8	0.148	8.60	4.00	1	6
107-516-000	1 7/8	0.148	4.44	4.74	1	6

\*Hole Size refers to the diameter of the hole that the spring will fit into.



## Heavy Duty Extension Springs

Part Number	Free Length (in)	Outside Diameter (in)	Wire Size (in)	Spring Rate (lb/in)	Approx. Load @ Ref. Extension (in)	Unit Pack
020-099	3 7/8	11/16	0.105	32.8	40 lb @ 5.0"	6
020-029	6	7/8	0.120	18.5	26.5 lb @ 7.0"	6
020-030	8	1 1/16	0.135	13.5	38 lb @ 10.0"	6
020-100	10	1 1/8	0.148	14.0	48 lb @ 13.0"	6
020-101	12	1 1/4	0.162	12.6	66 lb @ 15.0"	6
020-102	14	1 3/8	0.177	13.9	74 lb @ 18.0"	6
020-103	16	1 9/16	0.207	16.5	100 lb @ 21.0"	6



Compression Springs				Ends Squared and Ground		
Part Number	Free Length (in)	Hole Diameter (in)	Wire Size (in)	Spring Rate (lb/in)	Approx. Solid Height (in)	Unit Pack
107-100-000	1			20.0	1.44	12
107-101-000	1 1/2			14.0	1.65	12
107-102-000	2	3/8	0.042	12.0	1.84	12
107-103-000	2 1/2			8.0	1.03	12
107-104-000	3			6.0	1.21	12
107-105-000	1			58.0	0.49	12
107-106-000	1 1/2			42.0	0.69	12
107-107-000	2	1/2	0.062	32.0	0.92	12
107-108-000	2 1/2			25.0	1.05	12
107-109-000	3			24.0	1.24	12
107-110-000	3 1/2			18.0	1.50	12
107-111-000	1			57.0	0.42	12
107-112-000	1 1/2			34.0	0.59	12
107-113-000	2			32.0	0.81	12
107-114-000	2 1/2	5/8	0.072	26.0	0.92	12
107-115-000	3			20.0	1.07	12
107-116-000	3 1/2			18.0	1.28	12
107-117-000	4			16.0	1.60	12



Extension Spring Assortment No. 020-835							
Part Number	Free Length (in)	Outside Diameter (in)	Wire Diameter (in)	Spring Rate (lb/in)	Approx. Load @ Ref. Extension (in)	Assortment Quantity	Unit Pack
020-037	1 7/16	11/32	0.048	15.00	10 lbs @ 1.81"	2	12
020-022	4 1/2	31/64	0.063	5.23	14 lbs @ 6.50"	2	12
020-028	5 1/4	7/16	0.063	6.50	16 lbs @ 7.25"	2	12
020-018	5 11/32	1/4	0.041	4.30	8 lbs @ 5.84"	2	12
020-027	5 3/8	11/32	0.048	2.60	6.2 lbs @ 7.38"	2	12
020-014	5 1/2	3/8	0.054	4.00	10 lbs @ 7.50"	2	12
020-012	5 5/8	35/64	0.080	10.00	24 lbs @ 7.62"	2	12
020-017	5 3/4	1/4	0.028	0.59	1.6 lbs @ 7.75"	5	12
020-015	5 3/4	19/64	0.048	4.40	9.3 lbs @ 7.75"	2	12
020-009	6 7/16	7/16	0.048	1.10	4.2 lbs @ 8.44"	2	12
020-010	6 1/2	21/64	0.035	0.58	2.2 lbs @ 8.62"	4	12
020-011	6 5/8	5/32	0.026	1.18	2.2 lbs @ 8.62"	2	12
020-007	8 1/8	11/32	0.048	1.60	6.3 lbs @ 10.12"	2	12
020-008	9 1/16	11/64	0.029	1.00	3.5 lbs @ 10.13"	2	12
020-005	10	23/64	0.054	2.30	6.2 lbs @ 13.00"	2	12



# Problems and Answers

## Problems & Answers

Most problems that arise in the use of die springs usually result from improper application... failure to take advantage of and protect the features engineered into the spring.

### Spring Failure

Raymond die springs are produced under such careful controls that manufacturing problems have virtually been eliminated. Die spring failure is usually due to either poor spring design and manufacture or incorrect application of the spring. The most common problem source is the use of die springs too close to, or beyond, the springs' physical limitations. The solution, of course, lies with the designer's and user's careful selection of springs for each application.

Other solutions to common spring problems are as follows:

### Spring Guidance

Raymond die springs are manufactured with ends squared and ground so that they stand on their own base and compress evenly under load. There is a positive relationship between the spring's outside diameter and total length which determines whether or not a spring will buckle under load.

Curve For Finding Critical Buckling Conditions

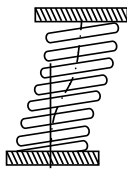
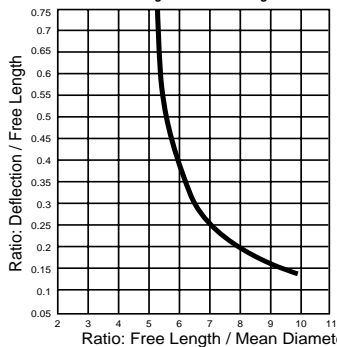


FIG. A

FIG. A

Generally, if the free length is more than four times the mean diameter of the spring, it could have a buckling problem under compression. This is solved by providing guidance by a pocket, a rod, or both to reduce buckling. It is always recommended to provide guidance for any die spring.

Figure A provides information as to whether a specific spring with squared, ground ends is subject to buckling. The curve indicates that buckling may occur to a squared-and-ground spring, both ends of which are compressed against parallel plates, if the values fall above and to the right of the curve.

### Holes and Rods

Holes or pockets provided in the die for springs must be the specified size listed on pages 4 to 19. Springs increase in diameter as they are compressed. If the hole is undersized, a wearing or binding action will produce early spring failure.

Holes also must have flat bottoms with square corners. This will allow the spring to work on a flat surface and provide uniform stress on the coils when the spring is compressed.

Working a spring over a rod also provides good protection against buckling. Care should be taken to be sure the rod is smooth. If the rod is shorter than the spring, it should have a tapered nose so that there is no danger of the spring coils coming in contact with a sharp edge.

### Alignment

Care should be taken to make certain that whatever device is used to contain or guide the spring is properly aligned on both sides of the die. Holes or rods that do not match can cause problems that create spring failure and damage to the tool.

### Temperature

Heat is a frequently ignored factor in spring failure or load loss. The maximum rated service temperature for chromium alloy steel is 475°F (250°C). Figure B shows the percentage of load-loss due to heat and stress combinations. Thought should be given to the heat generated by the working die which can be significant in many applications. Heat absorbed by the tool can be transferred to the springs resulting in a loss of load and premature spring failure.

### Deflection

Deflection beyond the manufacturer's recommendation can cause early spring failure. Check the press or die travel to be sure of the actual deflection to which the spring will be subjected. If it is beyond a safe limit, changes should be made without delay.

### Spring Alteration

Each Raymond die spring is carefully engineered to perform within specific areas of work. Altering the spring such as reducing its length or number of coils, grinding the inside or outside diameter, or placing restrictions on the movement of the coils can cause early spring failure. Trying to alter a spring by grinding down its ends can change the temper of the material and negatively affect spring performance.

Altering springs from their manufactured state almost invariably leads to problems and failure. Don't gamble an expensive die for the small amount saved on a cheap alteration.

### Corrosion

Frequently, spring failure can be traced to corrosive elements. Reduction of material or pitting of the spring will reduce its useful life. Be alert to conditions that may effect the spring's surface such as rust, lubricants, soaps, chemicals, etc. Clean, protected springs give the best job performance.

### Load Loss vs. Temperature

INITIAL STRESS P.S.I./bar	CARBON STEEL			CHROMIUM ALLOY		
	Approximate Percent Loss of Load			Approximate Percent Loss of Load		
	Degrees F/C°			Degrees F/C°		
	250/121°	350/177°	400/204°	250/121°	350/177°	450/232°
40,000/2,760	2.0	3.5	4.5	1.0	2.0	5.0
50,000/3,450	2.0	4.0	5.0	1.0	2.0	5.0
60,000/4,400	2.5	4.5	5.5	1.0	2.0	5.5
70,000/4,830	3.0	5.5	6.5	1.0	2.5	6.0
80,000/5,515	3.0	6.0	8.0	1.5	2.5	6.0
90,000/6,205	4.0	8.0	9.0	1.5	3.0	7.0
100,000/6,895	4.5	9.5	10.5	2.0	4.0	8.0
110,000/7,585	7.0	11.5	14.0	2.0	5.0	10.0
120,000/8,275	9.5	13.0	17.5	3.5	8.0	13.0

FIG. B

## Raymond® Nitrogen Gas Springs



## High Force Long Life High Cycle Rate

Raymond offers more than 20 unique models with strokes ranging from .24" (6mm) to 11.8" (300mm), initial contact forces from 15 lbs. (66 N) to 41,000 lbs. (182,000 N), and diameters as small as 0.5" (12 mm).

If you are designing a new product, or making improvements to an existing one, a Raymond nitrogen gas spring may be the answer. Call Associated Spring Raymond technical assistance to discuss new application ideas. Current applications include valve actuators, shock absorbing bumpers, mountain bike suspensions, etc.

If your application calls for a custom spring such as a special stroke length, shorter overall length, smaller diameter, high cycle rates or other differentiating specifications, call our technical assistance department and let us customize a spring or spring system for you.

## Technical Features

- High initial force
- Low force increase through stroke
- Pressure medium: Nitrogen gas
- Range of operating temperature: -25°F to 180°F (-32°C to 82°C)
- Maximum piston rod speed: 115 ft/min (35 meters/minute)
- Component type mounting fixtures
- Manufacturer is ISO 9001 certified
- Strict testing and quality control

**CALL US AT 1 (800) 228-1156 OR FAX AT (419) 891-9192 FOR OUR COMPLETE CATALOG OF SPECIFICATIONS. ASK FOR HEAVY DUTY GAS SPRING CATALOG, FORM R100.**

## Common Die Spring Terminology

**OUTER DIAMETER** This identifies the outside diameter (OD) of the die spring.

**INNER DIAMETER** This is a nominal identification of the inside diameter (ID) of the die spring.

**FREE LENGTH** The length of a die spring before it is subject to any operating force or load.

**PRELOAD** The distance the free length of the die spring is reduced by the pressure of assembled tool.

**OPERATING TRAVEL** The distance which is subtracted from the spring length after operating force has been applied.

**DEFLECTION** The amount of change in spring length after operating force has been applied. The compressed length is computed by subtracting the initial compression and the operating travel from the free length.

**SOLID HEIGHT** The length of a spring when it is compressed by enough load to bring all the coils into contact with each other.

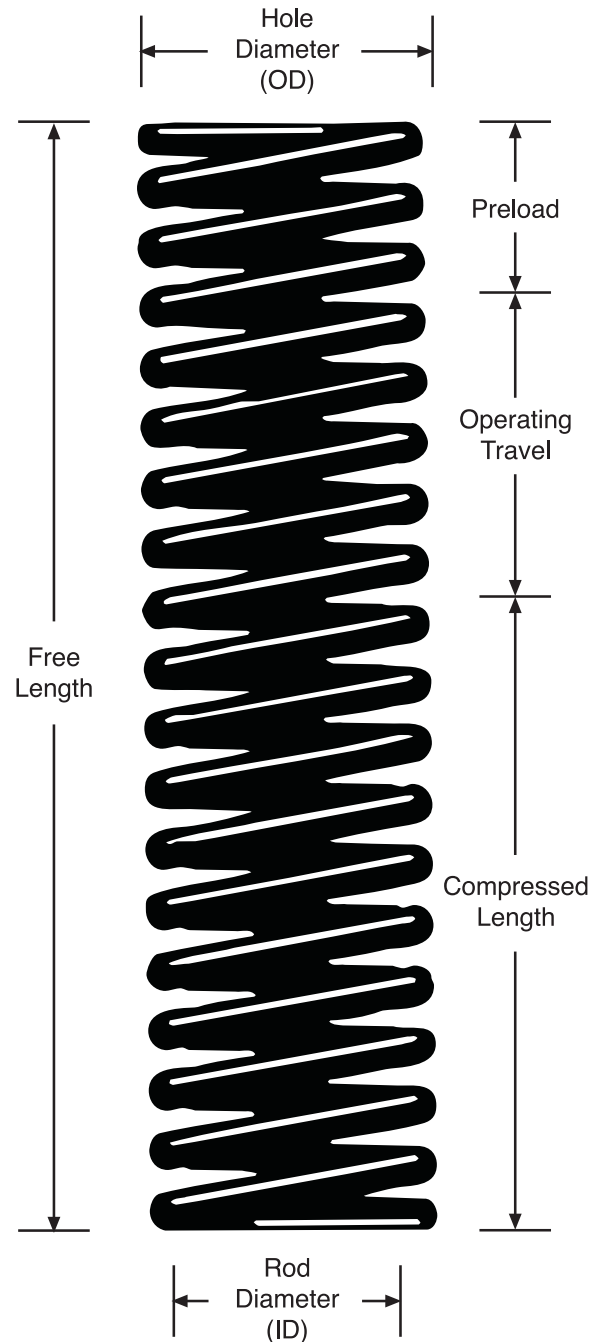
**REMOVE SET** The manufacturing process of closing a compression spring to solid to eliminate load loss in operation.

**PERMANENT SET** This happens when the elastic limits are exceeded and the spring does not return to its original length when the load is released.

**ELASTIC LIMIT** The maximum compression stress that a die spring can endure without taking permanent set.

**LOAD** This is the force built up by compressing the spring. Load is expressed in terms of total Newtons, which is the load on the spring per a specific unit of deflection. Load is generated and stress on the coils increases.

**STRESS** In a spring, this describes the internal force that resists deflection under load. This force is equal to, and in the opposite direction of, the external load. Stress is expressed in Newtons per square millimeter of sectional area.



# Raymond® m-Struts®



Associated Spring Raymond now offers a proprietary line of mechanical coil spring struts. We designed our struts to meet demanding, maintenance free applications where conventional gas struts fail. Made of corrosion-resistant stainless steel, and unlike gas and pneumatic models, our struts have no internal gases or seals to fail.



Whether it is resistance against environmental contamination, high temperature (400°F/ 205°C+), high humidity, corrosion, or simply life cycle, our struts offer unmatched performance.

**Separate lines are currently offered, with various load and stroke options:**

- Standard Mechanical Spring Struts: Stainless steel construction, stainless steel springs, and M6 threaded ends
- High Load Mechanical Spring Struts: Stainless steel construction, carbon steel springs, and M8 threaded ends.
- A full line of Extension, Dampening and Self-Centering models is now available.

**All of our models are available with various end configurations.**

Associated Spring Raymond will work with your specifications to custom design and produce the mechanical strut that you need, including the brackets and adjoining hardware.



**Typical Applications:**

- Food Preparation & Processing
- Heating, Ventilation & Aeration
- Motion Control & Dampening
- Clean Room

**Typical Industries:**

- Automotive
- Medical, Pharmaceutical & Chemical
- Marine
- Defense
- Nuclear
- Agriculture & Construction

For further information, or should you need application design support, please contact us at [struts@asraymond.com](mailto:struts@asraymond.com), or call us at 1-800-646-6416.

\*Patents 6,773,002, 7,066,455 and 7,174,804

For product literature, technical assistance or order information, see your local Raymond distributor . . . or call us toll-free for the name of the Associated Spring Raymond distributor nearest you.

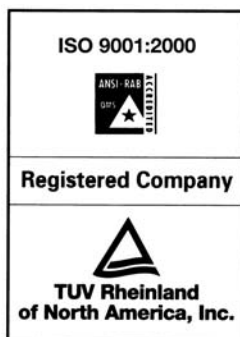


1705 Indian Wood Circle, Suite 210  
Maumee, OH 43537-4046

Toll Free Number: 1-800-458-0867

FAX Number: (419) 891-9192

On the Internet: [www.asraymond.com](http://www.asraymond.com)



Raymond is a trademark of Barnes Group Inc.  
©2007 Barnes Group Inc. Printed in U.S.A.

Form 300  
2M/BL/0607