Hz. When the machine is installed on five linear isolators with rubber flexible elements selected in accordance with the manufacturer's recommendations, different for different mounting points (line 2, f_n = 15 Hz), the maximum amplitude of the relative vibrations (resulting in waviness of the ground surface) was 0.35 μm. However, when the grinder was installed on five indentical CNF isolators with rubber flexible elements (line 1, f_n = 20 Hz, or about two times stiffer than the linear isolators), the maximum relative vibration amplitudes was 0.25 μm, about 30% lower.

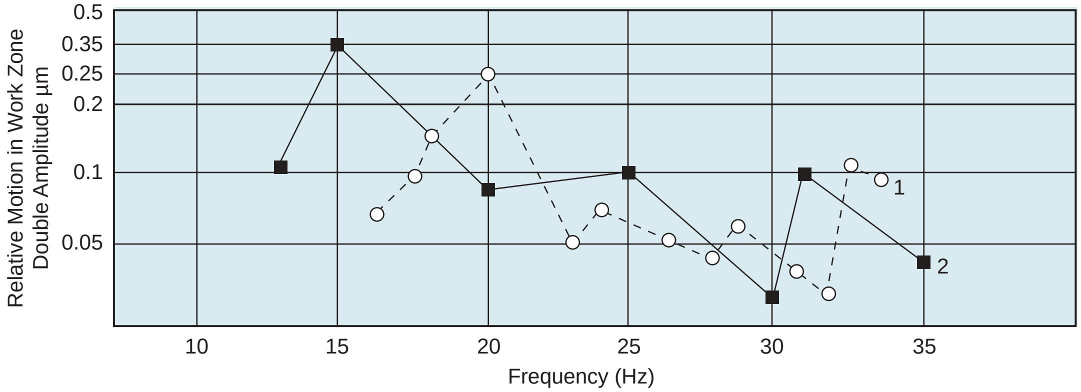

Figure 33 Amplitude of Relative Motion in Work Zone with: 1 - Regular (Linear) Isolators; 2 - CNF Isolators

7.0 CONNECTIONS OF SPRING ELEMENTS

7.1 Springs in Parallel

These combine like electrical resistance in series. This is the case when several springs support a single load, as shown in Figure 34. The springs are equivalent to a single spring, the spring constant of which is equal to the sum of the spring constants of the constituent springs. The spring constant k of the single equivalent spring is given by:

$$k = k_1 + k_1 + k_1. \qquad (27)$$

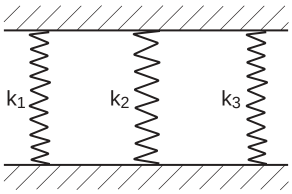

Figure 34 Parallel Connection of Springs

7.2 Springs in Series

The series connected springs in Figure 35 combine like electrical resistances in parallel. The equivalent single spring is softer than any of the component springs. The spring constant k of the equivalent single spring is given by:

$$\frac{1}{k} = \frac{1}{k_1} + \frac{1}{k_2}. \qquad (28)$$

If n springs are in series, this formula is readily extended to:

$$\frac{1}{k} = \frac{1}{k_1} + \frac{1}{k_2} + \frac{1}{k_3} + ... + \frac{1}{k_n}. \qquad (29)$$

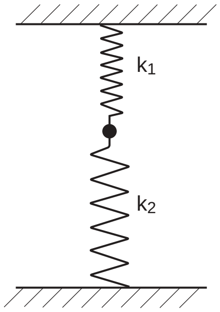

Figure 35 Series Connection of Springs

7.3 Spring Connected Partly in Parallel and Partly in Series

Obtain equivalent spring constants for each set of parallel or series springs separately and then combine. For example, in Figure 36, the springs k_1 and k_2 are equivalent to a single spring, the spring constant of which, k_{e1}, is given by:

$$\frac{1}{k_{e1}} = \frac{1}{k_1} + \frac{1}{k_2} = \frac{k_1 + k_2}{k_1 k_2} \quad \text{or} \quad k_{e1} = \frac{k_1 k_2}{k_1 + k_2} \qquad (30a)$$

The three springs, k_3, k_4, k_5 in parallel, are equivalent to a single spring, the spring constant of which, k_{e2}, is given by:

$$k_{e2} = k_3 + k_4 + k_5 \qquad (30b)$$

Now equivalent springs k_{e1} and k_{e2} are in series. Hence, the spring constant k of the equivalent spring for the entire system is:

$$\frac{1}{k} = \frac{1}{k_{e1}} + \frac{1}{k_{e2}} \quad \text{or} \quad k = \frac{(k_1 k_2)(k_3 + k_4 + k_5)}{k_1 k_2 + (k_1 + k_2)(k_3 + k_4 + k_5)} \qquad (30c)$$

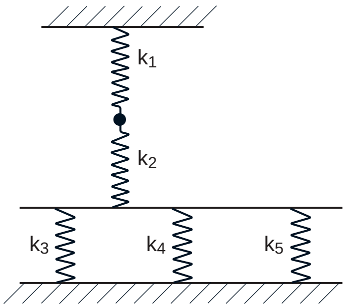

Figure 36 Mixed Connection of Springs