

The JETS Challenge

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Challenge 78 – The Isolator Challenge

Problem:

Rotating devices like pumps and fans can cause structures to vibrate wildly with possible catastrophic results. Isolators are installed to prevent this from happening. The first step is to identify the natural vibration frequency (f_n) of the device in Hertz (Hz) or cycles per second. Generally this equals the rotating speed (revolutions per minute or rpm) divided by 60 seconds/minute. From that value the nominal static deflection (δ_{st} in inches) of the isolator can be determined from

$$f_n = 31.3 \sqrt{\frac{1}{\delta_{st}}}$$

Find the nominal static deflection required to isolate a large motor that is operating at 3500 rpm.

Solution:

Find δ_{st}

$$F_n = \frac{3,500 \text{ rpm}}{60 \text{ secs/min}} = 58.\bar{3} \text{ Hz}$$

$$\text{so } 58.\bar{3} = 3.13 \sqrt{\frac{1}{\delta_{st}}}$$

$$\frac{58.\bar{3}}{3.13} = \frac{1}{\sqrt{\delta_{st}}} \Rightarrow \sqrt{\delta_{st}} = \frac{3.13}{58.\bar{3}}$$

$$\delta_{st} = \left(\frac{3.13}{58.\bar{3}} \right)^2$$

$$= .00288 \text{ inches}$$

