A FEW WORDS ABOUT VIBRATION ISOLATORS AND INPUT FREQUENCY

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Vibration "Isolators"

We should use a different word than "isolator"

- hardware only ***reduces*** (but cannot ***eliminate***) vibrations
- some hardware reduces vibrations more than others
- reductions only happen at **some** frequencies
- **at other frequencies, the hardware acts as an *amplifier***

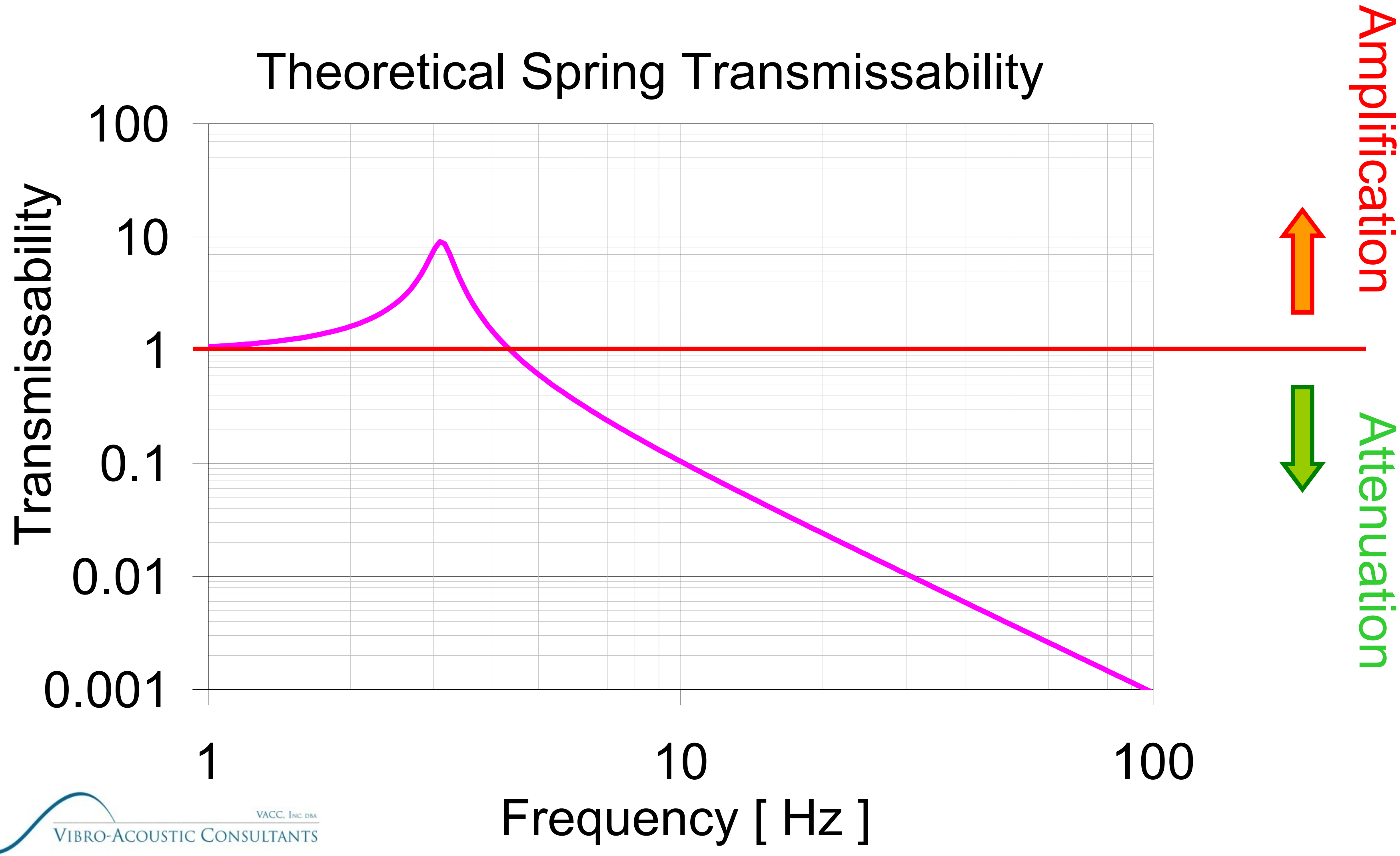
Vibration "Isolators"

Isolators work by presenting an impedance discontinuity. When driven at low frequencies, an isolator actually acts like an amplifier by matching impedances. When driven at high frequencies, the isolator will reduce vibration transmission.

But what are "low" and "high" frequencies?

"Low" frequencies are those input frequencies near f_o, the resonance of the system. "High" frequencies are those far above f_o. The resonance frequency f_o varies with system mass and isolator details.

Isolators: Attenuation vs. Amplification



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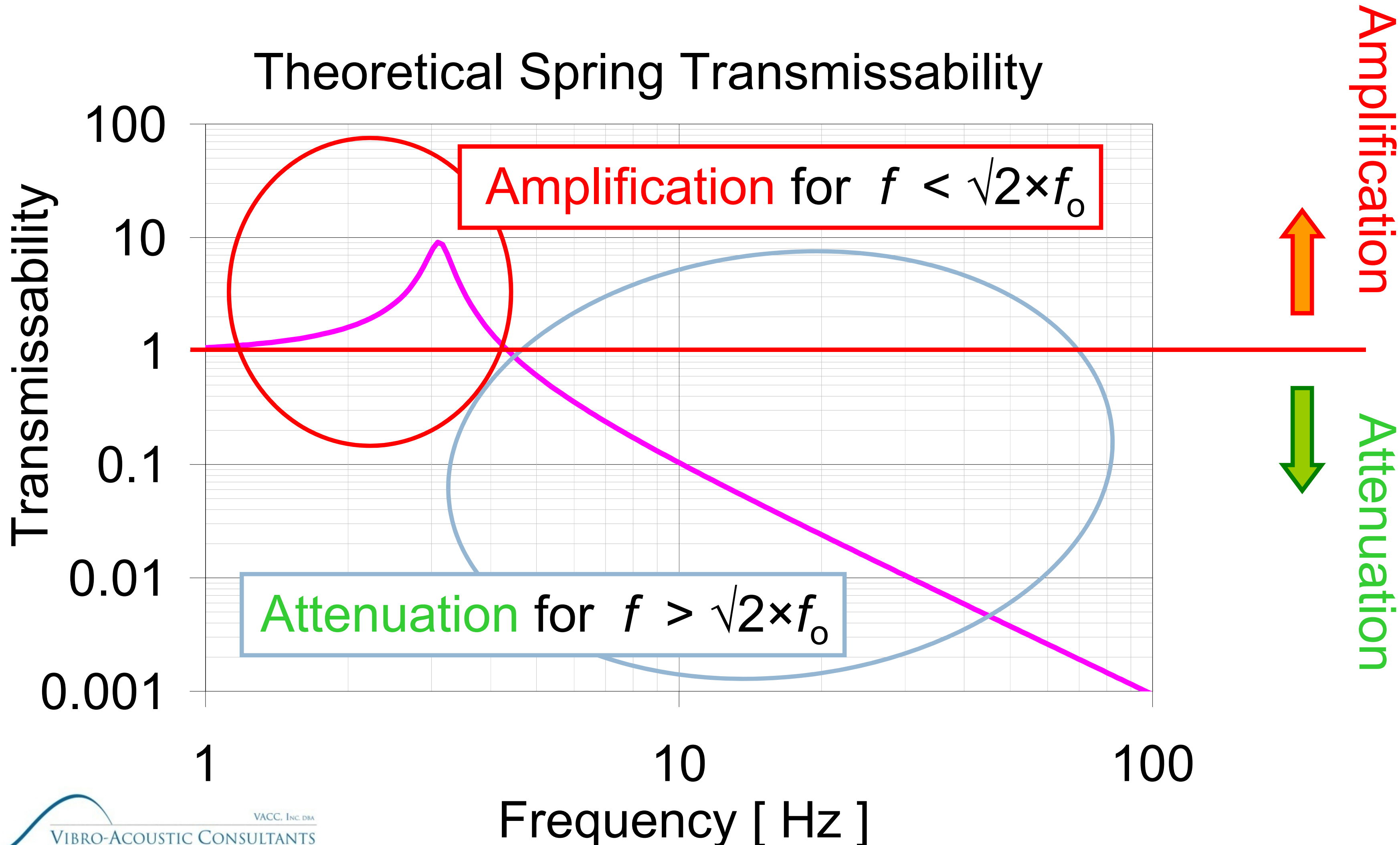
Isolators: Attenuation vs. Amplification



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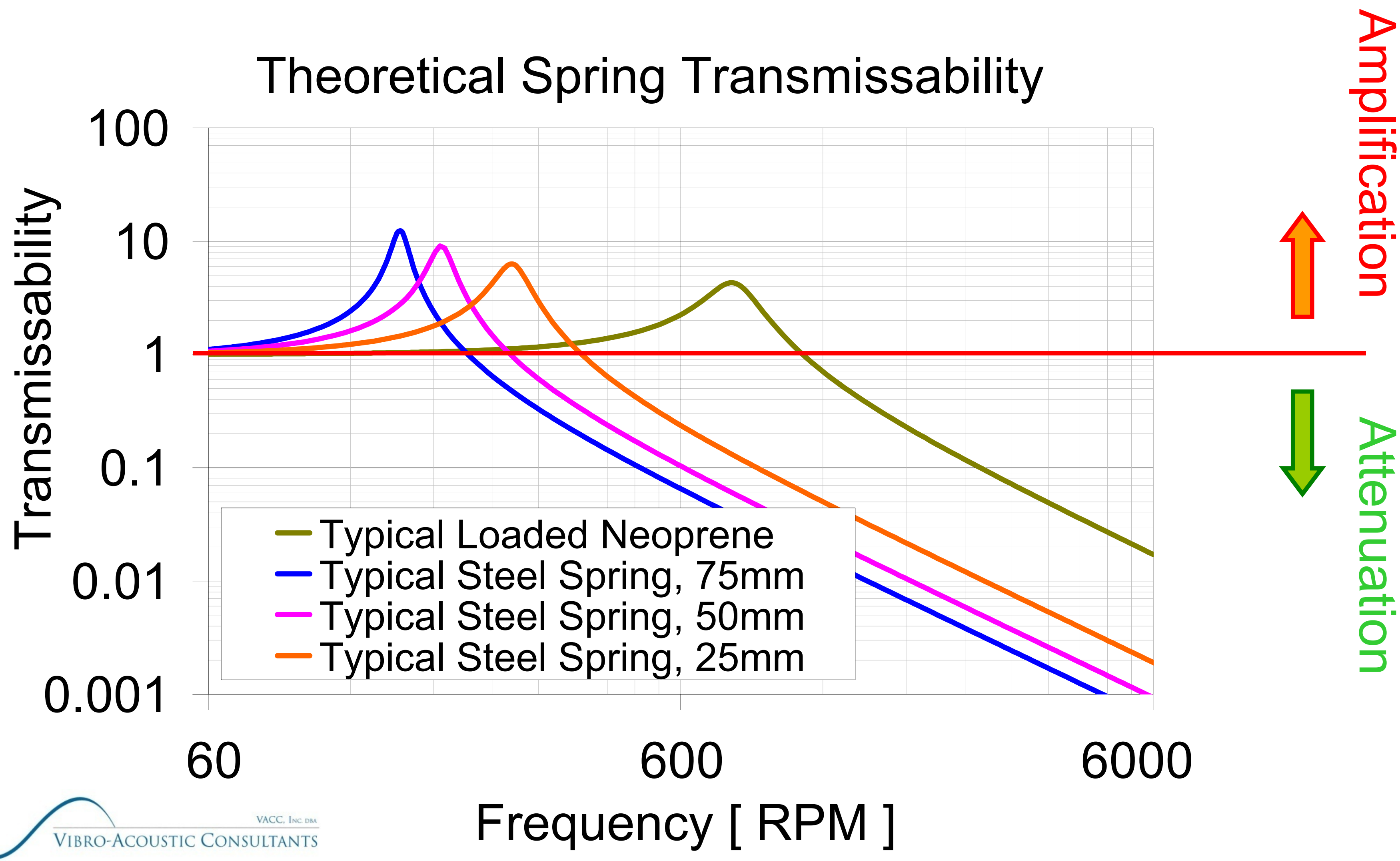

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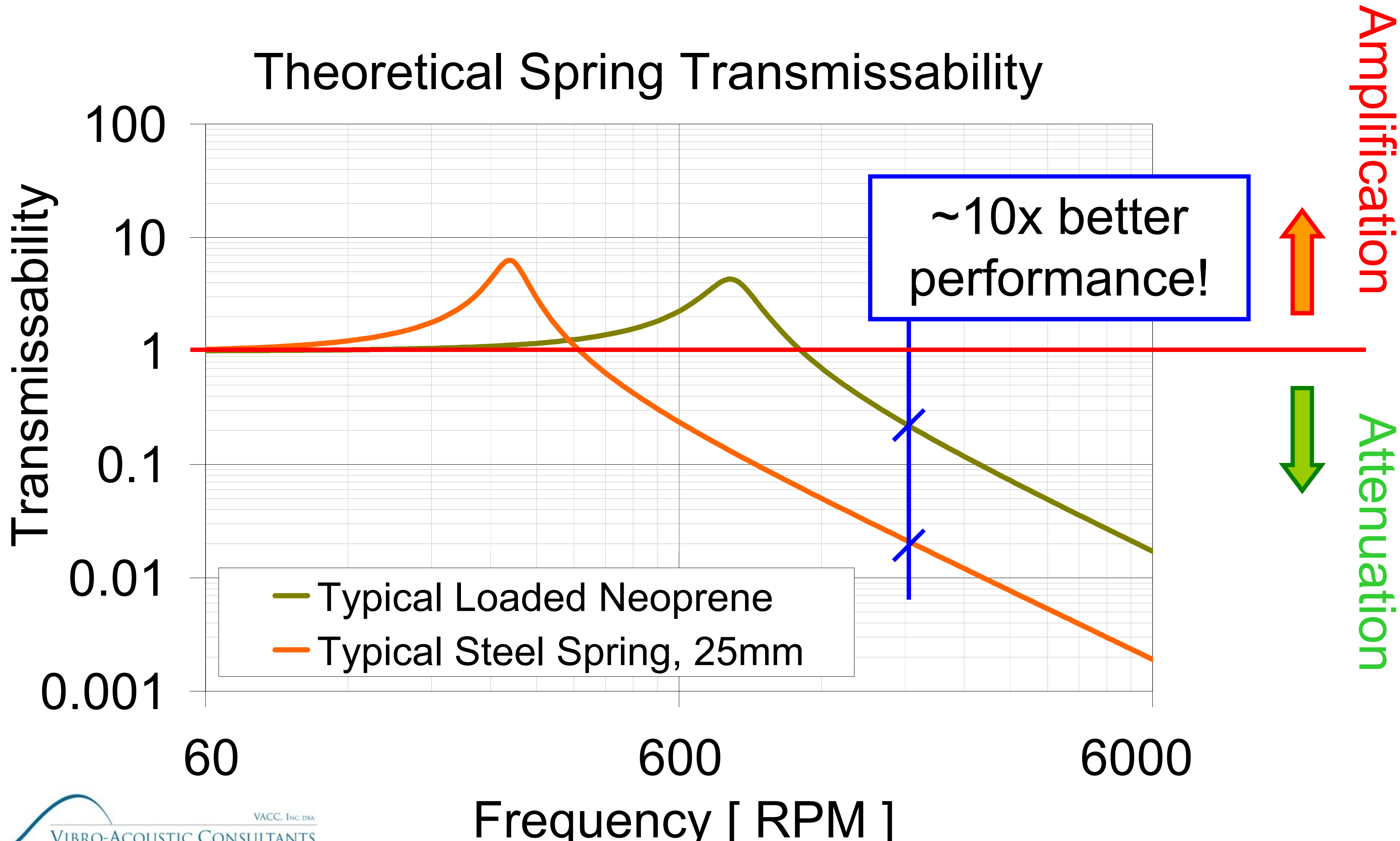

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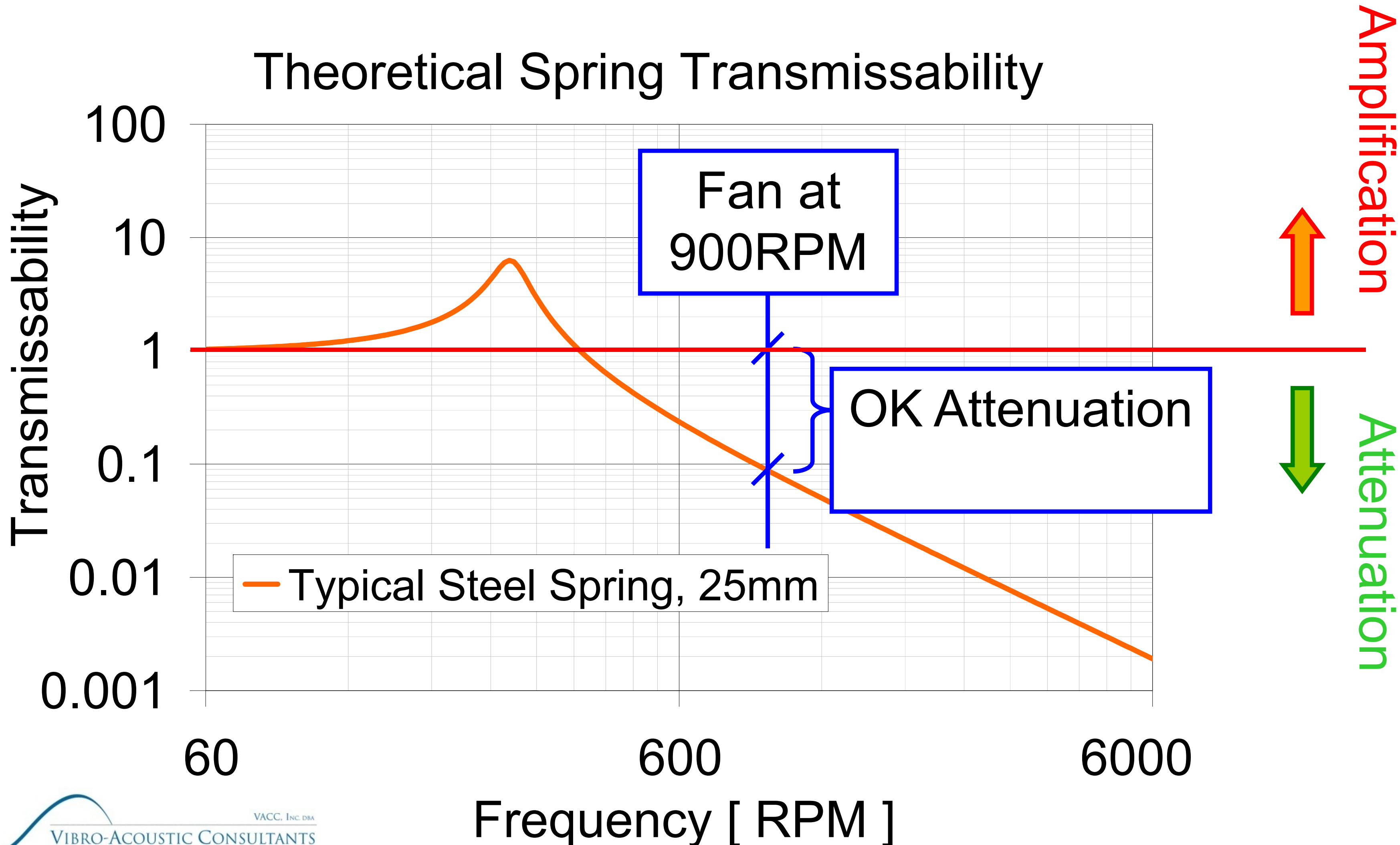

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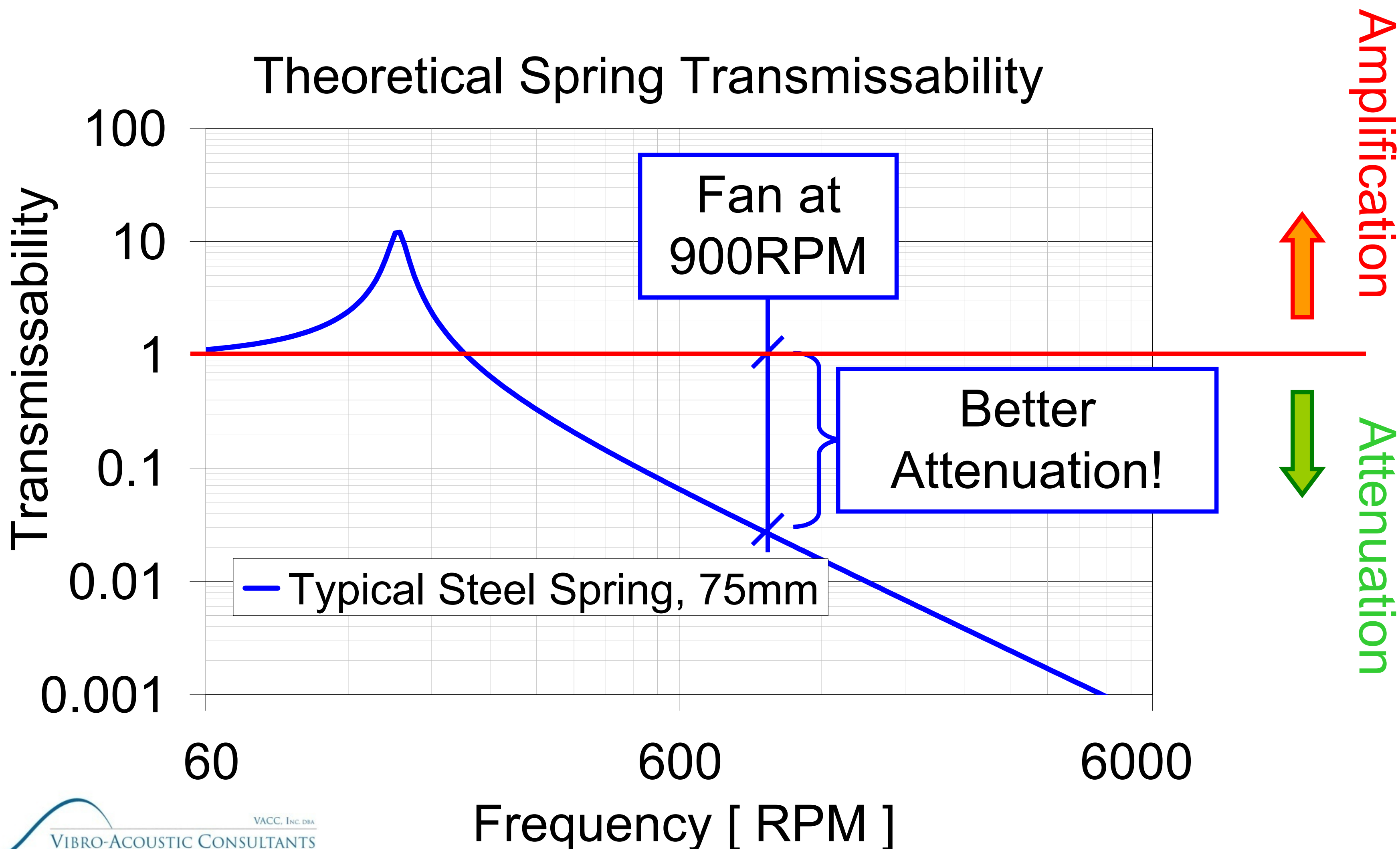
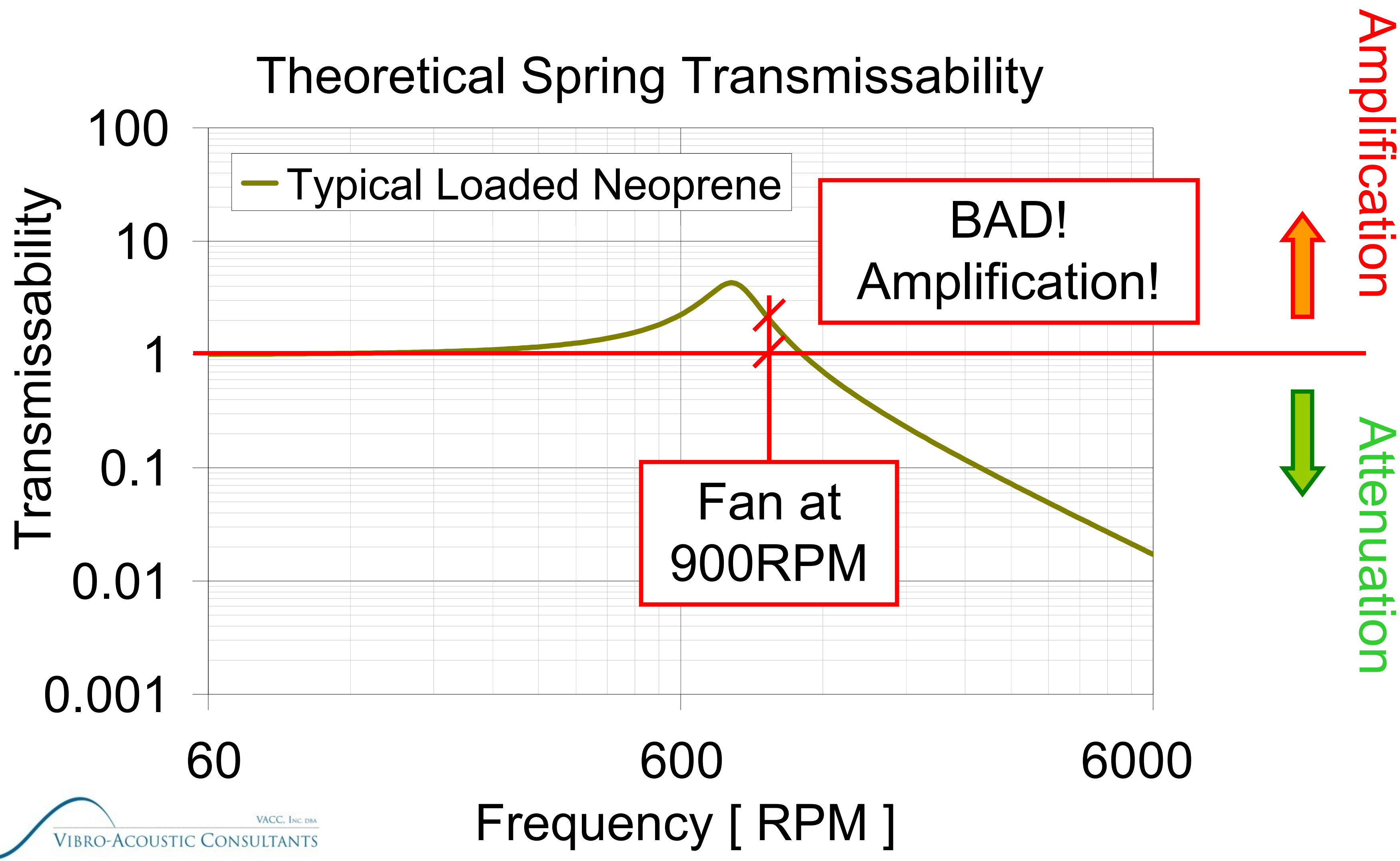
Isolators: Attenuation vs. Amplification



Isolators: Attenuation vs. Amplification



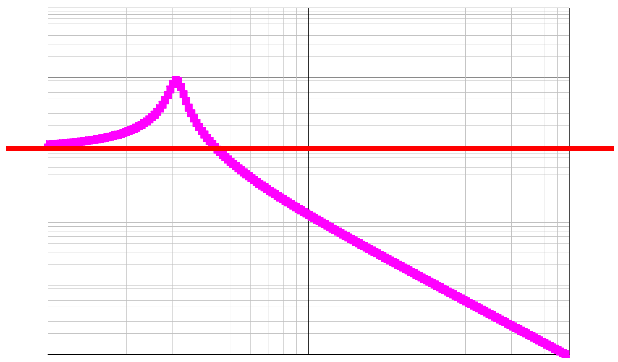
Vibration Isolators / Summary

- isolators can only ***reduce***, not ***eliminate*** forces
- isolators provide attenuation above critical frequency
- below the critical frequency, the isolator ***amplifies***!
- neoprene doesn't work for piping and ducting
- **isolator selection is not arbitrary!**

Amplification for $f < \sqrt{2} \times f_o$

No effect for $f \approx \sqrt{2} \times f_o$

Attenuation for $f > \sqrt{2} \times f_o$



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Vibration Isolators / Summary

This means that isolator selection is not arbitrary!

A neoprene-type mount with $f_o \approx 12$Hz would be a terrible choice for a fan operating at 900RPM (15Hz). At this shaft speed, the isolator is *increasing* vibration transmission into the structure.

On the other hand, that same isolator might be a reasonable choice for a pump operating at 1800RPM (30Hz). At this higher shaft speed, the isolator is operating at moderate efficiency.

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