Designing for Vibrasnub Snubbers

Situation #1: A hot stack is found to vibrate excessively and is also subject to considerable thermal movement.

Problem: Eliminate excessive vibration of hot stack and provide for thermal movement during heat-up and cool-down.

Solution: Predetermined Facts:

Total vibration load ..... 8000 lbs (35.6kN)
Piston travel due to
thermal movements ..... 5 inches (127mm)
Heat-up and cool-down time ..... 20 minutes
Frequency of vibration..... 60 cycles/min.
Total allowable vibration movement
at point of snubber attachment
without damage to stack ..... .125 inches (3.2mm)

From the specifications table, it is seen that one 2 1/2" (65mm) "Vibrasnub" with a maximum allowable load of 12,000lbs (53.4kN) is sufficient. However, two are recommended for better installation (see Typical Installations).

In this example, the required rate of piston travel is 5" (127mm) in 20 minutes or 1/4" (6.4mm) per minute. Graph #1 shows that the resistance to movement is less than 200lbs (.9kN) for each unit (the point of intersection with the slanting rate line is off the graph) and is negligible.

Graph #2 shows that the total vibration movement permited by a 2 1/2" (65mm) "Vibrasnub" snubber (using 2 units, each with 4000lbs (17.8kN) load at 60 cycles/min.) is approximately .08" (2.03mm). That movement is well below the stated allowable movement of .125" (3.2mm). If the frequency of vibration had been 30 cycles/min. the total allowable movement would then be approximately .18" (4.6mm) which is greater than that allowed for a 2 1/2" (65mm) unit. A 4" (100mm) "Vibrasnub" would be required.

Situation #2: A hot process vessel is developing excessive vibration in a large pipe that leads horizontally out of the vessel and then is directed upwards.

Problem: Eliminate excessive vibration in the pipe and provide for differential thermal movement of the pipe and vessel.

Solution: Predetermined facts:

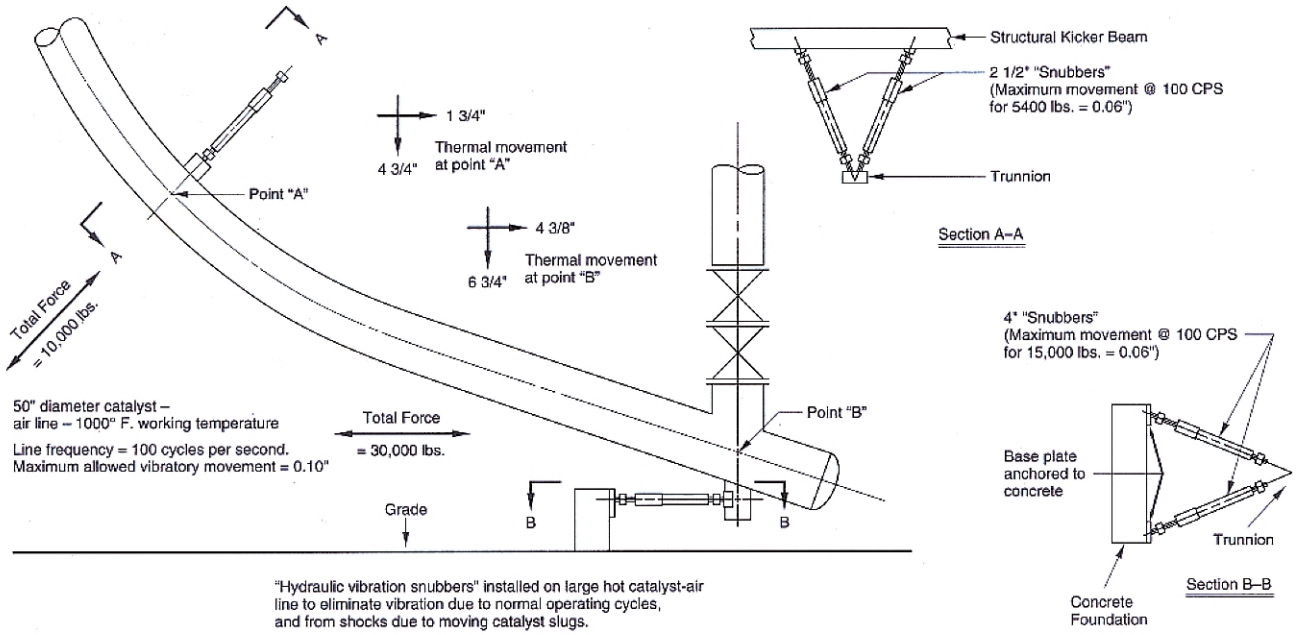
Total vibration load ..... 40,000 lbs(178kN)
Piston travel due to
thermal movements ..... 5 inches (127mm)
Heat-up time..... 10 minutes
Frequency of induced vibration..... 120 cycles/min.
Total allowable vibration
movement without damage
to pipe ..... .15inches (3.8mm)

From the specifications table, the maximum allowable load for a 2 1/2" (65mm) "Vibrasnub" is 12,000lbs (53.4kN). A 4" (100mm) snubber can accommodate 30,000lbs (133.5kN). By using two (2) 4" (100mm) "Vibrasnub" snubbers, the vibration load on each one is 20,000lbs (89kN), well below the maxium load allowed.

The required rate of piston travel is 5" (127mm) in 10 minutes, or 1/2" (13mm) per minute. Graph #1 shows the resistance shows the resistance to thermal movement at 1/2" (13mm) per minute is less than 300lbs (1.34kN) for each snubber unit (the point of intersection with the graph is actualy off the graph, to the left). This low resistance would impart no undue strain on the piping system.

From Graph #3 it is seen that the total movemetn permitted by a 4" (100mm) "Vibrasnub" under 20,000lbs (89kN) vibration load, at a rate of 120 cycles/min., is approximately 0.04" (1.0mm). This is much less than the allowable movement of .15" (3.8mm).

It is possible to use four (4) 2 1/2" (65mm) snubbers. But it is more practical to install only two (2) 4" (100mm) snubbers and this is the proper solution.



"Hydraulic vibration snubbers" installed on large hot catalyst-air line to eliminate vibration due to normal operating cycles, and from shocks due to moving catalyst slugs.