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Resolving a Piping Vibration Problem by Installing Viscous Damper Supports

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Abstract : Preventing piping fatigue flow induced vibration in the Oil & Gas sector demands not only the constant development of engineering design methodologies based on available software packages, but also special piping support technologies for designing safe and reliable piping systems. The vast majority of piping vibration problems in the Oil & Gas industry are provoked by the process flow characteristics which are basically intrinsically related to the fluid properties, the type of service and its different operational scenarios. In general, the corrective actions recommended for flow induced vibration in piping systems can be grouped in two major areas: those which affect the excitation mechanisms typically associated to process variables, and those which affect the response mechanism of the pipework per se, and the pipework associated steel support structure. Where possible the first option is to try to solve the flow induced problem from the excitation mechanism perspective. However, in producing facilities the approach of changing process parameters might not always be convenient as it could lead to reduction of production rates or it may require the shutdown of the system in order to perform the required piping modification. That impediment might lead to a second option, which is to modify the response of the piping system to excitation generated by the type of process flow. In principle, the action of shifting the natural frequency of the system well above the frequency inherent to the process always favours the elimination, or considerably reduces, the level of vibration experienced by the piping system. Tightening up the clearances at the supports (ideally zero gap), and adding new static supports at the system, are typical ways of increasing the natural frequency of the piping system. However, only stiffening the piping system may not be sufficient to resolve the vibration problem, and in some cases, it might not be feasible to implement it at all, as the available piping layout could create limitations on adding supports due to thermal expansion/contraction requirements. In these cases, utilization of viscous damper supports could be recommended as these devices can allow relatively large quasi-static movement of piping while providing sufficient capabilities of dissipating the vibration. Therefore, when correctly selected and installed, viscous damper supports can provide a significant effect on the response of the piping system over a wide range of frequencies. Viscous dampers cannot be used to support sustained, static loads. This paper shows over a real case example, a methodology which allows to determine the selection of the viscous damper supports via a dynamic analysis model. By implementing this methodology, it was possible to resolve the piping vibration problem throughout redesigning adequately the existing static piping supports and by adding new viscous dampers supports. This was conducted on-stream at the oil crude pipeline in question without the necessity of reducing the production of the plant. Concluding that the application of the methodology of this paper can be applied to solve similar cases in a straightforward manner.

Keywords : dynamic analysis, flow induced vibration, piping supports, turbulent flow, slug flow, viscous damper
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