

# Rohm & Haas Uses Automated Vibration Monitoring and Transient Analysis to Improve Startup of Refrigeration Compressor

## RESULTS

- Solved 3 complex interrelated problems to prevent damage to critical refrigeration equipment and maintain productivity
- Identified the cause of startup problems
- Discovered critical vibration level within normal operating range



## APPLICATION

Commissioning of a new 7500-ton refrigeration train in which a steam turbine made by one manufacturer was coupled with a refrigeration compressor built by another company.

## CUSTOMER

Rohm & Haas Corporation is one of the largest manufacturers of specialty materials in the world and the developer of acrylic technology. Acrylics are widely used in coatings, plastics additives, adhesives, and super absorbent polymers. Today, the Rohm & Haas plant in Deer Park, Texas, is the largest producer of acrylic and methacrylic monomers in the world.

## CHALLENGE

Little difficulty was anticipated when a steam driven turbine made by one manufacturer was matched on paper to a compressor built by another company. Solo operation of the turbine was extremely smooth with maximum vibration amplitude of less than ¼ mil. A shop test of the compressor went equally well. In addition, the intended coupling was checked and double-checked by a highly regarded coupling manufacturer.

Despite the careful design and early precautions, the unit shut down completely from high vibration during the first startup attempt. That unexpected beginning triggered an investigation as to what had happened and why. As it turned out, there were at least three problems, which added to the complexity of the commissioning issue.

*“Without the continuous data from the system with transient capability, and AMS Machinery Manager we might not have known the critical vibration level was within the machine’s operating range. That knowledge forced us to go back and see what was wrong with the design.”*

**Orlando Venegas**  
Vibration Specialist

### SOLUTION

On checking the coupling installation against the drawings, engineers found a miscalculation in the measurement between the shafts. The coupling had been installed 100 mils in compression when it should have been close to neutral. That problem was corrected, followed by a successful start of the turbine/compressor train. Vibration was within acceptable levels—with the highest amplitude at about 1-1/2 mils on startup and less than one mil at normal operating temperatures. Rohm & Haas thought the problem was solved, but it wasn't yet.

Analysis of waveform and orbit plots in AMS Machinery Manager, generated by diagnostic information from the Emerson online monitoring system, revealed a critical vibration spike at about 3000 RPM, well within the normal operating range of the machine of 2900 to 4000 RPM. Since this peak vibration would amplify any wear or misalignment problems developing in the future, the Rohm & Haas engineers decided to go back to the drawing board and determine what could be done to “move the critical.”

This “hidden” design flaw might never have been found had it not been for the availability of continuous “transient” data provided by the permanently installed system. According to Rohm & Haas vibration specialist Orlando Venegas, “The live data presentations painted a picture of exactly what was happening within the machine. This information is especially useful during critical transient operations, such as startup and shutdown, when expensive precision machinery such as this must be watched carefully for the slightest sign of trouble. Continuous online monitoring of essential turbomachinery represents technology well beyond periodic vibration monitoring systems that provide only snapshots of a machine's operation.”

Venegas determined the problem could be solved by either stiffening the coupling or adding weight to it. By watching data generated by the system as changes were made, he was able to tell the engineers when the critical vibration level had been successfully moved to about 2400 RPM.

Venegas later identified a run out problem, which was corrected by rotating one of the shafts 180 degrees and reconnecting. The refrigeration unit has been running smoothly ever since, he said recently.

***“A serious problem might have developed if the critical vibration level had been allowed to remain within the machine's normal speed range.”***

**Orlando Venegas**  
Vibration Specialist

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