Manufacturing Wheelchairs

Ensuring a Smooth, Quiet Ride Every Time

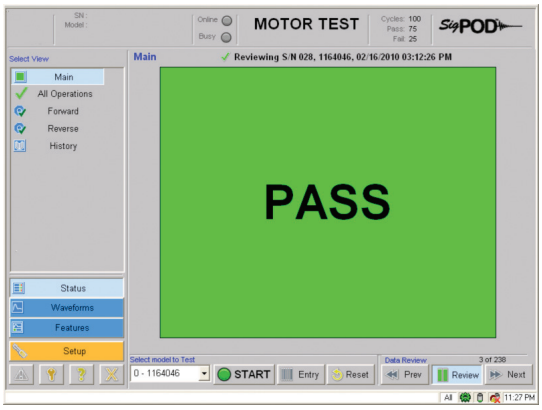
NOISE & VIBRATION APPLICATION NOTE SERIES

Wheelchairs must reliably operate in a myriad of environments. Smooth, quiet operation is essential for patients who spend many hours of their day performing routine tasks in a wheelchair. Subtle noises or vibrations can quickly become irritating to the patient, and often result in the unit being returned to the factory. Wheelchair manufacturers require a consistent method for ensuring that the defects that cause these undesirable characteristics are caught before they are shipped to a customer.

Challenge

A typical wheelchair has two drive motors, each coupled to a right angle gearbox output drive shaft. Even a small nick on a gear can cause a "lumpy" drive, while poor gear finish can generate a variety of objectionable noises. The challenge faced by the manufacturer is to develop a method for measuring the noise and vibration produced by the motor assembly, along with a set of criteria that can accurately and repeatably identify unacceptable characteristics.

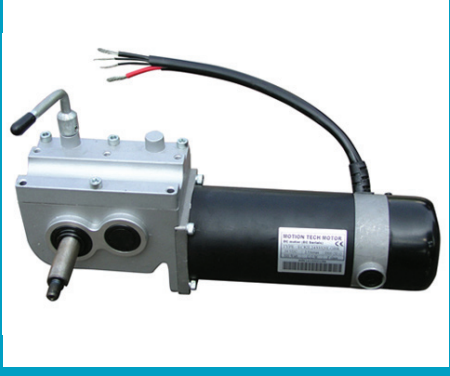
Solution



Sciemetric's sigPOD PSV multi-channel measurement platform can be configured to fully characterize the noise and vibration characteristics of each motor assembly. High resolution time-domain measurements of strategically located accelerometers and microphones are combined with rotary encoder data to generate a series of complex waveforms. These waveforms contain characteristic features that are associated with the different types of defects. Using PSV's extensive library of time and frequency domain analysis tools, the various defect signatures can then be isolated and identified. Additional features, such as the ability to "listen" to accelerometer data, can also assist in identifying more subtle features associated with defective parts.

BENEFITS

- Built-in time and frequency domain analysis functions
- On-board storage enables historical comparison of waveforms and features
- Configurable test setup accommodates different combinations of accelerometers and microphones
- Reliably detects subtle defects



the science of quality

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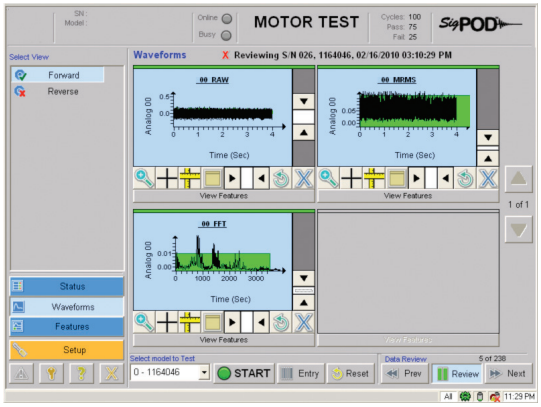
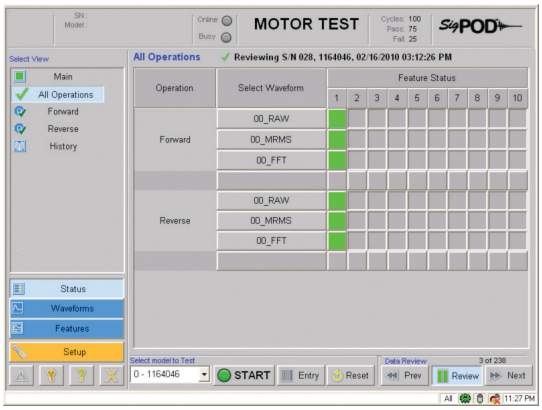
Achievement

To establish the criteria for the defective parts, units returned by patients were tested and analyzed, both in the forward and reverse direction. The signatures from these units were then analyzed to identify the defect signatures associated with the undesirable characteristics reported by the patients. Meanwhile, waveforms were also collected from production units and stored in Sciemetric's QualityWorX database for analysis. This provided a baseline for comparison to ensure that the defect signatures could be consistently distinguished from the general population.





Once these features were identified, automated production screens were implemented to separate the defective parts from the rest of the population. As the majority of the defects were located within the motor assembly, it was possible to apply the tests prior to assembling them onto the wheelchair. Eventually, once the effectiveness of the screen was well established, similar tests were implemented at the gear supplier, enabling them to identify and eliminate defective parts even before they were shipped for integration into the motor assembly. This produced significant cost savings for both the wheelchair manufacturer and the gear supplier, who no longer had to absorb the costs associated with returning and repairing the defective gears.

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