Polytec

Vibration Testing on Vacuum Cleaner Motors

Understanding Dynamics for Production Control

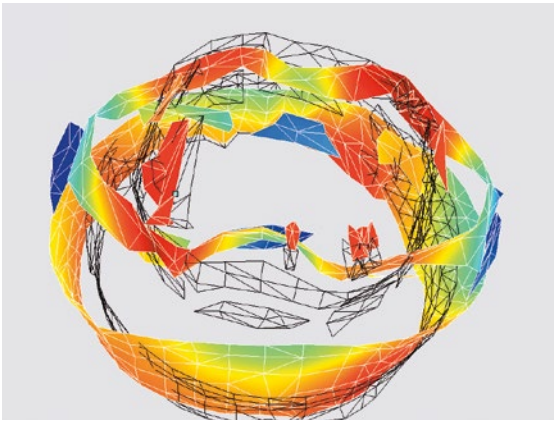
Application Note

Acoustics and long service life are quality criteria which consumers value particularly in house-hold appliances for daily use.

For this reason 100% of the vacuum cleaner motors by Vorwerk (see cover picture) are subject to final testing during production. This test is carried out using three laser vibrometers, which measure the vibrations at three characteristic locations. A PASS/FAIL decision is made based on a comparison of measured spectra with reference spectra.

To achieve meaningful results in production and to minimize false rejects, it is important to find suitable measurement points. To optimize the testing process, the motors that have already been optimized during the development phase with respect to their vibration behavior are measured using a 3D Scanning Vibrometer. The measuring system determines and visualizes the operational deflection shape (Fig. 1), based on which the suitable test points can then be identified.

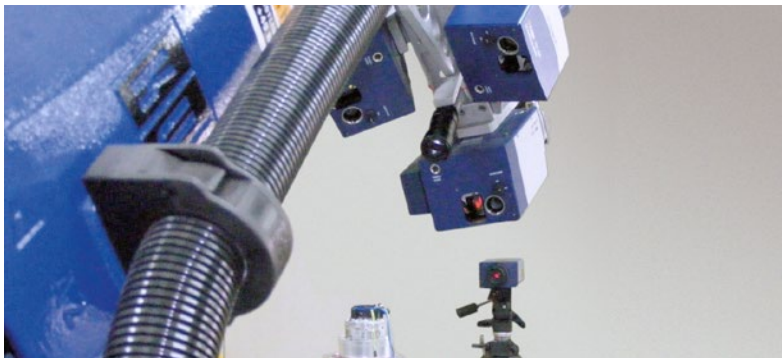
To take into account variations between motors, it was decided that a series of nine motors would be measured. Since the vibration profile was to be determined around the entire periphery as well as in the axial direction on the motor's front side, the RoboVib® Structural Test Station (Fig. 2) appeared to be particularly well suited for this task. Because the motors are geometrically identical, the geometry, the robot program and the other settings need only be ad just ed once; thereafter all of the motors can be tested with the same settings, resulting in low cost, and in particular, high reproducibility (Fig. 3).



1
Operational deflection shape

2
RoboVib®
Test Station

Using this measurement data, Vorwerk can now define suitable measurement points for the 100% final testing of motors.



3
Vibration measurement on a vacuum cleaner motor

Measurement Sequence

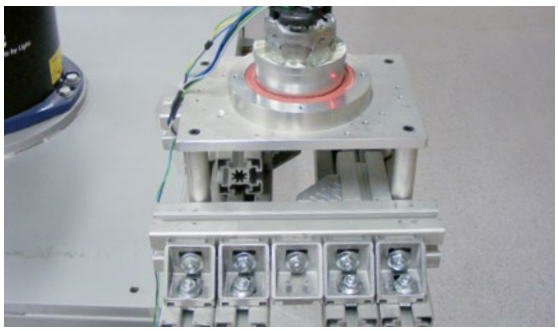
A robot program is defined after the assembly and positioning of the motors that are inserted in a mounting. This program contains various robot positions, from which it is possible to reach all points or surfaces to be measured with the vibrometer lasers (Fig. 4).

As several motors were going to be measured sequentially, the mounting was designed so that a quick changeover and identical positioning was possible. After defining the robot program, the geometry of the motor is measured at the desig-nated measurement points. To do this the robot travels to each measuring position. The function "VideoTriangulation®" is used to achieve high accuracy with this relatively small measurement object (80 mm diameter).

This function is used to optimize geometric measurement and beam super position. Before the measurement starts at the first scanning point, the laser positions on the measurement object are optimized so that all three laser beams are perfectly superimposed. The 3D coordinates are then determined by triangulation and updated in the geometry. After scanning the surface from each robot position, the vibration measurement results as well as the geometry are available for all measured points. The geometry data are then imported for all other motors.

Clear Increase in Efficiency

Because the measurement can be repeated so easily, it was possible to measure 12 motors completely within 3 days instead of the planned series of 9 motors. Without robot support the high-resolution measurement during the development phase would have lasted a full two days for one motor alone, including the preparation work. Here RoboVib® brought about a clear increase in efficiency. Using this measurement data, Vorwerk can now define suitable measurement points for the 100% final testing of motors. As mentioned above, Vorwerk's quality control test stands also use laser vibrometers so that the motors can be inspected and classified in a contact-free manner.



4
Measurement beam of the laser vibrometer

Summary

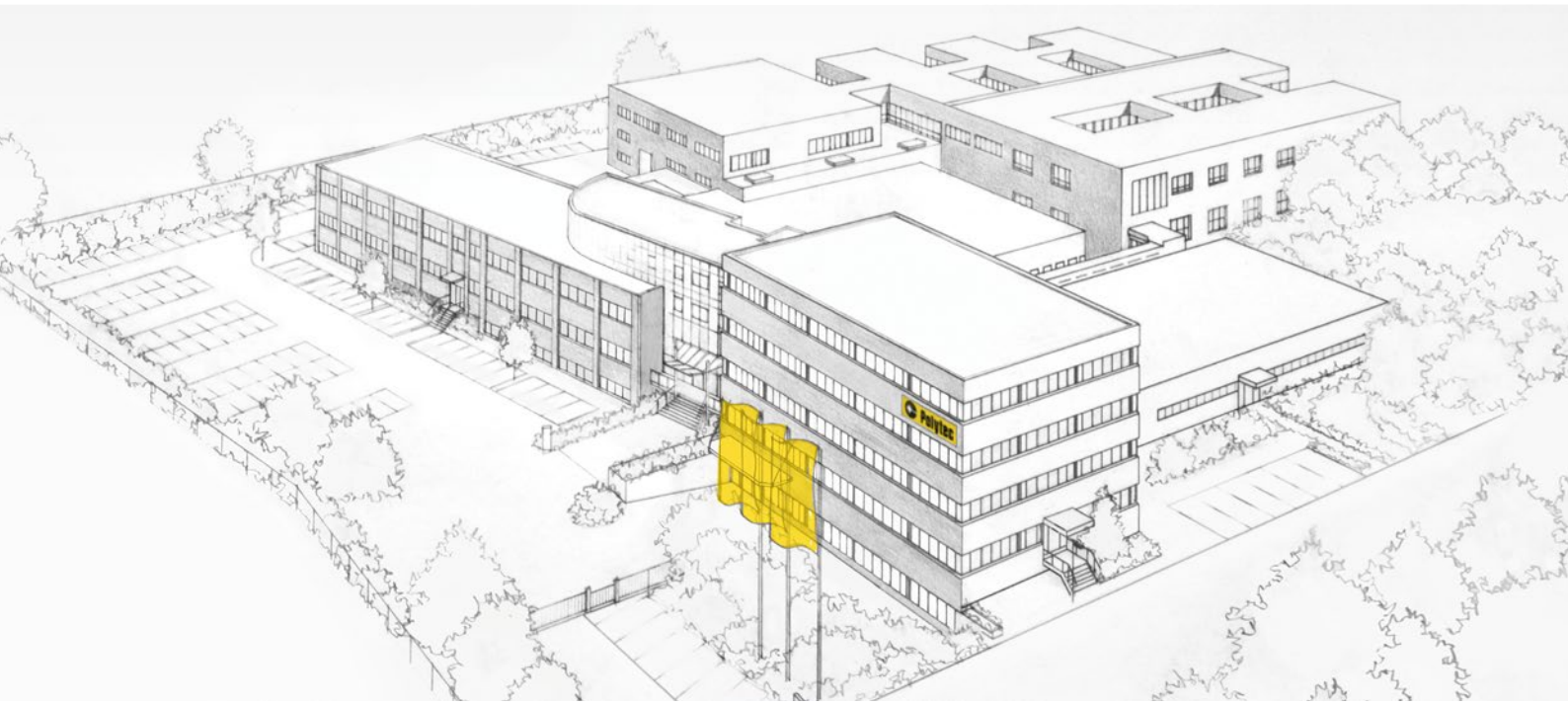
To prepare a meaningful 100% check of vibration parameters, it is essential to have a precise understanding of the overall vibration behavior of a component and of course the error indicators in the vibration spectrum. The contact-free measurement approach described here is very efficient, both for the identification of measurement points and for the test stand. The qualification of a series of parts, taking into consideration scatter, is particularly time efficient using the automated RoboVib® method, and can be achieved with high reproducibility. The system needs to undergo only one learning procedure to deliver high-resolution operating vibration shapes for the entire series. The end result of the process is high quality vacuum cleaner motors and consequently many satisfied customers.

Authors

Dr. Roland Kraus,
Research + Development / Dept. TEP
Vorwerk Elektrowerke GmbH & Co. KG

Mélanie Gerard, Jörg Sauer
Polytec GmbH

Quelle: Polytec InFocus



Polytec GmbH (Germany)
Polytec-Platz 1-7
76337 Waldbronn
Tel. +49 7243 604-0
info@polytec.de

Polytec GmbH (Germany) Vertriebs- und Beratungsbüro
Schwarzschildstraße 1
12489 Berlin
Tel. +49 30 6392-5140

Polytec, Inc. (USA)
North American Headquarters
16400 Bake Parkway
Suites 150 & 200
Irvine, CA 92618
Tel. +1 949 943-3033
info@polytec.com

Central Office
1046 Baker Road
Dexter, MI 48130
Tel. +1 734 253-9428

East Coast Office
1 Cabot Road
Suites 101 & 102
Hudson, MA 01749
Tel. +1 508 417-1040

Polytec Ltd. (Great Britain)
Lambda House
Batford Mill
Harpenden, Herts AL5 5BZ
Tel. +44 1582 711670
info@polytec-ltd.co.uk

Polytec France S.A.S.
Technosud II
Bâtiment A
99, Rue Pierre Semard
92320 Châtillon
Tel. +33 1 496569-00
info@polytec.fr

Polytec Japan
Arena Tower, 13th floor
3-1-9, Shinyokohama
Kohoku-ku, Yokohama-shi
Kanagawa 222-0033
Tel. +81 45 478-6980
info@polytec.co.jp

Polytec South-East Asia Pte Ltd
Blk 4010 Ang Mo Kio Ave 10
#06-06 TechPlace 1
Singapore 569626
Tel. +65 64510886
info@polytec-sea.com

Polytec China Ltd.
Room 402, Tower B
Minmetals Plaza
No. 5 Chaoyang North Ave
Dongcheng District
100010 Beijing
Tel. +86 10 65682591
info-cn@polytec.com

www.polytec.com

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