

# CASE STUDY

United States of America

## **Allied Motion Technologies, Inc. Motor Products Corporation PULSE™ – Noise and Vibration Testing**

Automotive, Industrial Products, Marine Applications

PULSE, Transducers

*Motor Products Corporation specialises in the design, development and manufacture of low voltage DC motors. The company has earned a worldwide reputation for its production of high-quality, fractional-horsepower, permanent-magnet DC motors. Its products are sold in a number of core markets including the specialty automotive and marine industries, heavy truck construction equipment and industrial applications.*

*With an increasing focus on the noise and vibration parameters of its motors, and to satisfy constantly increasing customer demands, Motor Products uses a PULSE™ system in R&D applications to ensure compliance with the product's specifications.*



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## **Allied Motion Technologies, Inc. – Motor Products Corporation**

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The company was established in 1936 as Redmond Motors. In 1975, Redmond was purchased by The Owosso Corporation and became known as Motor Products Owosso Corporation. The company was acquired by Allied Motion Technologies in August, 2002.

Always using the latest state-of-the art technology, Motor Products has earned a worldwide reputation for the design, development and manufacture of high-quality, fractional-horsepower, permanent-magnet DC motors.

Based in Owosso, 90 miles (144 km) northwest of Detroit, Michigan, the company has about 200 employees. It specialises in the manufacture of DC, low-voltage (12 and 24 v) brush motors. The product range covers from fractional horsepower to 1 hp, and in 2½, 3 and 4 inch diameters.

Motor Products motors are used in a wide variety of industries. Its core markets include:

- specialty automotive
- construction equipment
- marine applications (including inboard and outboard motor tilt and trim mechanisms)
- recreational vehicles (motor homes and camping trailers)
- Industrial products – pumps, linear actuators, etc.
- heavy truck manufacturers

The company manufactures about 1½ million motors each year using six production lines, currently on a two-shift basis. Motor Products is accredited to ISO 9001:2000.

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## Product Development

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**Fig. 1**  
*Bob Colwell is Director of Product Development. He has worked at Motor Products for seven years*



Bob Colwell is Director of Product Development. He has more than 20 years experience in the electric motor industry and has worked for major companies including Universal Electric, Ford and Fasco DC Motors. Bob has a degree in electrical engineering from Michigan Technological University and has worked at Motor Products for seven years. Bob was closely involved in the decision to buy a Brüel&Kjær PULSE system in 1997.

In addition to its wide range of standard motors, customised motors are also developed for specific customer applications.

Bob says, “We can produce a sample of a new design in as little as three to four weeks, and bulk supplies in about 10 weeks from sample approval”.

He continues, “The order quantity can range from as few as 100 motors up to 50 000 per year. Some of our products are used in noise-sensitive applications. In these cases, we discuss and agree on the noise and vibration limits with our customers”.

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## Competitive Advantage

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**Fig. 2**  
*The company is highly vertically integrated – most components are made in-house*



Bob explains “Noise and vibration are increasingly important to us and our customers. We want to give our products competitive advantage, and noise has an increasing focus with constantly tighter customer demands. We use our PULSE system for R&D applications when developing new products and it’s extensively used every day.”

**Fig. 3**  
*The assembly lines at Motor Products are highly manual – the wide product range and variable order quantities suits this type of operation*



Because of the wide range of standard and customised products, the six assembly lines at Motor Products are highly manual. The company is very vertically integrated and, using highly automated state-of the art production technology, most components are made in-house.

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## Testing

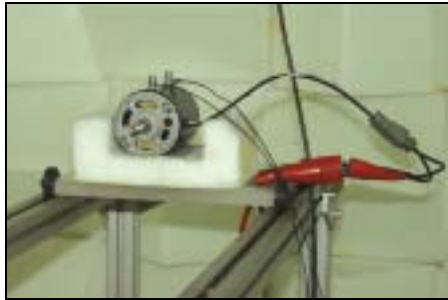
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**Fig. 4**  
*Jim Hathaway is Life Test Technician in Motor Products' R&D laboratory*



Jim Hathaway is Life Test Technician in the R&D laboratory. He has worked at Motor Products for nearly four years and is studying for a degree in electrical engineering. Jim says, "Noise and vibration testing on motors is carried out in a specially built 72 × 72 × 72 inches (1.83 × 1.83 × 1.83 m) anechoic test chamber. In addition to Brüel&Kjær's PULSE system, we also exclusively use their transducers and calibrators – a Type 4231 for the microphones and a Type 4294 for the accelerometers. We calibrate our transducers at least once a month"

**Fig. 5**  
*Testing is carried out in a specially built anechoic chamber*



Jim explains, "The vibration from the motor bearings is tested periodically during a simulated life cycle test. We use four motors to ensure that we get consistent data. Bearing defects show up at about 500 Hz. It only takes between six and ten seconds to make a test.

**Fig. 6**  
*Motor Products purchased its PULSE system, transducers and calibrators in 1997*



The motor is generally tested at its idling speed and is not loaded. However, a load can be applied to the motor in the test chamber if required".

The noise test using the microphone is made in the frequency range of 30 Hz to 16 kHz, although the frequency range of interest is up to 5 kHz. Brush noise from a motor generally occurs around 3 kHz to 5 kHz, depending on the speed of the motor.

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## PULSE

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Jim says, "Our range of tests is fairly limited at present. We use the PULSE task notes and found it very easy to set up our own task list and write a customised set of help instructions from the on-line help provided. With PULSE, it's easy to set up the test templates and to update the software. PULSE has been completely reliable and we would recommend it to others. The service from Brüel & Kjær is always excellent".

Bob adds, “The investment in PULSE was a good decision because the system has proved to be user friendly. We are not noise and vibration experts and therefore we wanted a Windows<sup>®</sup>-based analyzer that was simple to use. We really like the PC-based analyzer approach. We want to develop an advanced in-house sound and vibration expertise and we’ll use Brüel & Kjær training courses to add to our existing knowledge”.

He continues, “We are also considering investing in a shaker system. Some of our customers, such as Caterpillar, demand that our motors are subjected to shaker testing and the vibration response of a motor provides a great deal of useful information”.

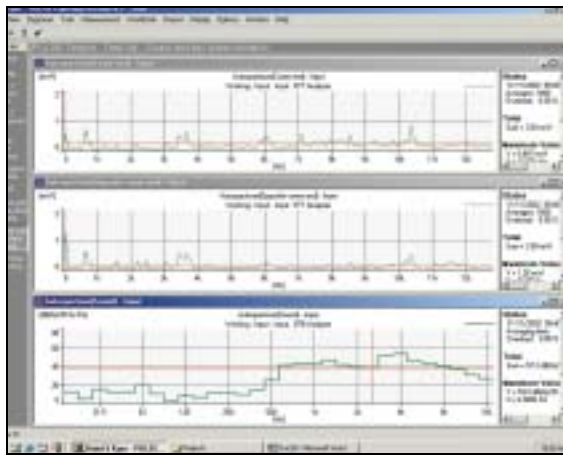
“All our motors are electrically tested when they come off the production lines. In the future, on certain motors where noise and vibration are critical, we are considering doing end-of-line noise and vibration testing”, Bob concludes.

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## Data and Reporting

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**Fig. 7**  
*PULSE display. This test setup uses two accelerometers (FFT analysis) and a microphone (CPB analysis). The task list, on the left hand side of the display, is easily customised*



The PULSE data is saved on the PC’s hard disk. The built-in report generation facility is used to export the test results to Microsoft<sup>®</sup> Word and the customised test report is then printed. This is used both internally and also made available to customers to confirm that the noise and vibration parameters are according to the motor’s specification. Future plans include the creation of a database to archive the test data and PULSE Data Manager will enable Motor Products to easily save, retrieve and compare test results.

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## Key Facts

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- Motor Products Owosso Corporation specialises in the design, development and manufacture of low voltage DC motors
- Its products are sold in a number of core markets including the specialty automotive industry, heavy trucks, R.V.s, marine applications, pumps and linear actuators
- The company manufactures about 1½ million motors each year
- Motor Products is accredited to ISO 9001
- In addition to its wide range of standard motors, customised motors are also developed for specific customer applications
- “Noise and vibration are increasingly important – we want to give our products competitive advantage, and noise has an increasing focus with constantly tighter customer demands”
- PULSE is used in R&D applications – it’s extensively used every day
- “PULSE has been completely reliable and we would recommend it to others”
- “We’ll use Brüel & Kjær training courses to add to our existing knowledge”