



AFTERMARKET

Smart Oil Plug® gearbox monitoring. Data sheet.



Transceiver	
Communication	Bluetooth, GPS, GSM
Power	5-110V DC, 10W
Size	210 x 126 x 76 mm
Weight	1.8 kg
Smart Oil Plug	
Power	Internal 3 year battery
Communication	Bluetooth
Size, thread, magnets	Matched to plug design

Operation

The Smart Oil Plug® communicates locally via low-power Bluetooth to the transceiver, which is powered from the train power supply. This transceiver can include high-accuracy GPS location and train direction, or medium-accuracy GSM mast location. Data is streamed from the plug, via the transceiver, to the Global Data Network, where it can be viewed and manipulated remotely by the client.

The wireless nature of the Smart Oil Plug® allows for continuous under-train axle-mounted operation, without fear of damage from flying ballast or vegetation. The plug is tested and approved for axle-mounted operation and associated environment. In addition to the powerful gearbox diagnostic capabilities, the Smart Oil Plug® allows gross ride monitoring to take place across the whole network on a regular basis, which provides a mapping of track-quality, which gives operators data to provide to infrastructure owners to target faults and resolve track issues.

Debris monitoring relies on magnets used in many standard oil plugs, inserted into the body of the plug to collect ferrous debris. The image below shows a plug removed from an in-service gearbox, with debris clearly shown collected on the magnet. In this application a rapid onset of oil debris indicated critical condition generating an instant alarm. This sensor also provides instantaneous notification in the event of oil loss.



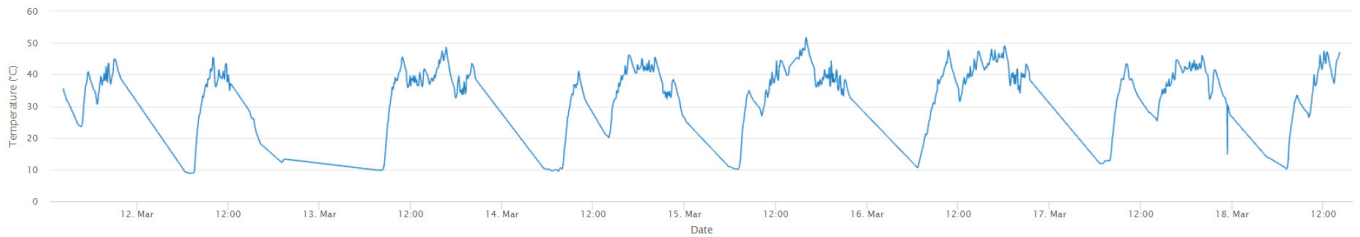
Powered by



Data analysis

The data analytics process combines advanced input from engineering know-how and experience with intelligent pattern recognition. By measuring acceleration in three axes, with aggregate sampling frequency of 19.2 kHz, the Smart Oil Plug® allows refined FFT analysis to identify any deviations from normal operation. This includes capability of detecting the onset of pitting, scuffing, tooth failure, and faults developed in bearings. The addition of temperature measurement and ferromagnetic oil debris particles allows fleet-wide statistical comparisons to be deployed. Any deviations from fleet statistics will generate an alarm to the key stakeholders, indicating an exception requiring attention.

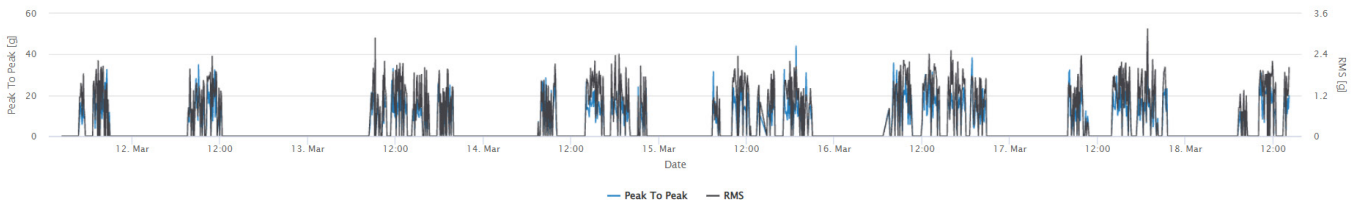
Temperature



Oil debris



Acceleration



Testing

In addition to data from the field, extensive testing of oil plugs using R&D bench test rigs as well as the ZF Nottingham test rig has demonstrated their capability to accurately monitor temperature, debris, and vibration precisely.

Testing Standards	
EMC and EMI compatibility	BS:EN 50121-3-2:2016 BS:EN 301489-1 V2.1.1 BS EN 301-17 V3.2.0
Environmental suitability	BS:EN 50155:2017
Shock and Vibration	BS:EN 61373:2010



Installation

An example of Smart Oil Plug® installation on Class 156 vehicles is shown below.

- Each installation is tailored specifically to the vessel
- The plug replaces the original oil plug
- The control unit has to be placed approx. 5 m from the plug.



1 X Transceiver per bogie

1 x ZF Smart Oil Plug® per bogie

