

EMU Pneumatic systems life extension assessment

Project and methodology

During 2008-9, PCMS worked in conjunction with the Train Owners and Operators of a 16 car fleet of 30 year old EMUs, on a project to assess the implications of extending the in-service life of this rolling stock.

One of the key elements within PCMS' remit was to undertake a fleet-wide condition assessment of the on-board pneumatic systems and make appropriate recommendations for ensuring future reliability.



The assessment was undertaken by PCMS, utilising a Wide array of condition measurement tools and technologies, including ultrasonics for leak detection, vibration analysis, stress wave testing, thermal profiling and oil sampling of the compressor as well as on-exception testing of pipe thickness and internal pipe inspection using borescope camera.

Based on their previous experience with condition assessment and monitoring programmes, PCMS engineers were able to select the optimum data collection points and combine the results of the different tests to select the most relevant data on which to undertake the subsequent analysis.

At the end of this assessment and analysis, a comprehensive report was submitted indicating the actions required to bring each car in the fleet up to a satisfactory level of operational performance, which could also be used as a base-line against which to monitor on-going condition.

Data analysis

Some of the main outcomes from the analysis were:-

- 62% of the fleet's compressors were found to be operating outside the Operator specified acceptable parameter of 20 cycles per hour. Undertaking a pressure drop test on the valve blocks on all vehicles revealed a reasonable co-relation between the volume of leaks and high compressor cycle times, however the main conclusion was that it was the severity of leaks that correlated strongly to units with the highest compressor times. Furthermore, the highest leakage rate occurred from the valves linked to the air suspension systems on the bogies. In general the majority of severe leaks were external rather than external
- Thermal analysis indicated that compressor cycle times had no adverse impact on compressor temperature and that compressor cooling was satisfactory on all units

- Vibration analysis revealed that 5 units had excessive vibration levels and required an examination and possible replacement of the mountings. The motor bearing on one unit required re-lubrication
- Testing of pipe thickness using ultrasound revealed wide variation of deterioration in pipe thicknesses between the three carriages in a 3-car unit
- Laboratory analysis of oil samples from the compressors were satisfactory in all but 3 cases, for which an oil change and analysis of further samples was recommended



Key Actions

- Excessive compressive cycle rates could be resolved by repair or replacement of the leaking valves and minor repairs to leaking joints
- PCMS could supply all parts required, carry out repairs and re test to specification

Conclusion

Based on the analysis undertaken, and subject to satisfactory implementation of the actions recommended, there appeared to be no reason that the pneumatic systems on this fleet would not be capable of supporting a life extension as desired by the Trains Owner and Operator.