
1.0 Instruction:

GM Locomotives are fitted with 3 phase AC traction motor of Siemens design. It is experienced that in case intrusion of foreign particle, scarcity of Lubrication oil etc. the bearing of pinion end fails / damages resulting on line Traction Motor failure. Such failure not only result financial loss but also affect safety aspect. It has been decided that Traction Motor bearing Condition Monitoring System shall be provided in WDG4/WDP4 locomotives for early fault detection, prevention etc. to improve reliability and performance of the bearings mounted on AC traction motors of GM locomotives.

2.0 Objectives:

This specification covers the general requirement, technical requirement, Operational & Performance requirement of the system required for monitoring condition / health of bearing mounted on drive end side on AC Traction Motor.

This system shall generally comprise of On Board Sensor and Processor panel etc. that can able to capture, process and communicate data with other communication protocols. Further the system shall be capable to communicate to ‘remote monitoring and management of locomotive system’ (REMLOT) through GPRS installed in the locomotives at common web server for transferring and processing of data. This system shall be capable of giving prior intimation of bearing deterioration / health to the loco driver and also to the operator stationed at the central server system. This central server system is installed for detailed study to diagnose the health / condition of the bearing well in advance for proactive action.

The offered equipment shall be designed to comply the latest issues of appropriate international standards or Indian Standards (BIS) to get reliable and accurate technology based equipments and calculation for determining the actual condition of bearing. The same shall be indicated in the offer and relevant references are to be submitted. The firm shall have earlier experience of supply and commissioning to different rotating equipment. The details shall be submitted at the time of offer.

3.0 Scope of Supply:

This specification defines the supply, installation & commissioning and validation etc. of the system on the loco. The same shall be complied by successful tenderer(s).

3.1 General Requirement:

.1 Microprocessor based control system shall be capable to analyze the captured data to determine condition / health of bearing and at the same time capable of transmitting data to ‘central server system’ for detailed parameterization through GSM/GPRS/CDMA. It is the responsibility of the firm to ensure that interference (disturbances) on the actual signal superimposed if any, does not take into account while processing the data for evaluation of condition of bearing and these disturbances shall be separated out and their probable source of generation may be indicated in calculation.

.2 The system shall be capable to connect and transferring of data (Microprocessor based control system) from with the existing REMLOT System. The system shall be equipped with ‘real time synchronization facility’. Ports to be provided for Ethernet / Modbus in communication device of the system. Firm shall provide necessary relay contacts for hooter/alarm along with Interconnecting cables and sensor for vibration measurement.
The software installed in ‘central server system’ shall be capable of processing and monitoring of data of at least 200 locomotives individually and in addition to this software shall have following facilities as listed below.

a) Digital display of vibration values  
b) Multiple alarm configuration support  
c) Machine diagnostic expert system  
d) Spectrum analysis  
e) Time Waveform  
f) Orbit Plots  
g) Polar Plots  
h) Bode Plots  
i) Bearing database  
j) Digital Peak Enveloping Technique  
k) Time Waveform Analysis  
l) Order Tracking Analysis  
m) Data logging  
n) Customized report generation

3.2 Functional Requirements:

.1 Loco Control System shall be capable of doing self diagnostic feature if any sensor or component gets fail or malfunction it should give indication to the operator (stationed at remote) for necessary action.

.2 If the bearing vibration goes excessively high or deterioration of the bearing happens it should give prior indication to system / operator. System shall be capable of giving alarm / hooter in case high vibration is sensed.

.3 System shall log all the event in the system with date and time along with locomotive sl.no.

.4 System shall able to diagnose the processed data with recommendations about the condition of the bearing.

4.0 Technical Requirements:

4.1 Input Power supply available in the locomotive is 72 V DC to drive the system.

4.2 Analog inputs should able to accept vibration and temperature both type of signal and capable of further processing of data to indicate bearing condition.

- Sensor shall be of Independent / Dependent power supply ( Tenderer may indicate in their offer)
- Sensor output shall be of 0-25V

4.3 The system shall have relay output for alarming and system status. In addition system shall have a provision of speed input which also may be exhausted in next phase after successful completion of this project.

4.4 Requirements of Signal Measurement : The requirement of signal measurement are as follows:

.1 Analogue measurement for Vibration/Temperature:

- 24-bit AD conversion that enables continuous transient capture
- True simultaneous sampling of all 12 vibration channels (no multiplexing)
• Simultaneous sampling of different channels with different sampling rates
• Frequency range of system: From DC to 40 kHz
• Accuracy amplitude: \( \pm 2\% \), phase \( \pm 3^\circ \) (up to 100 Hz)

.2 Digital measurement

• Frequency range: 0.1 Hz to 20 kHz
• Accuracy frequency: 0.01%
• Pulse counting

.3 Signal processing:

• Intelligent Control System shall have built feature BHD (Bogie Hunting Detection) according to TSI requirements (for future Upgradation)
• Watchdog and self testing
• Time waveform
• Vector analysis with circular alarms
• FFT: 100 to 6400 lines
• DPE & Acceleration Enveloping
• Integration / derivation in frequency domain
• Window function: Hanning (Tenderer can offer some other customisation)
• Customer formulated mathematical equations
• Dynamic alarm levels, active range determined on multiple parameters
• Data storage on time, event, or alarm condition
• Data buffering in flash memory when communication link is down
• Detection of sensor and cable fault

.4 Interface

• Ethernet: 100 Mbit RJ45, TCP / IP
• RS 232 service interface
• RS 485 / Modbus

5.0 Environmental Requirements

• Unit should be compact and dimension shall be not more than 4.5X9.5X10.5 inches.
• Ambient temperature in loco is 55 deg C.
• EMC according to EN 50121-3-2 or IEC 60068, Part 2-27, 2-6 and 2-64
• Vibration and Shock - 60g
• Encapsulation IP 65

6.0 Experience:

Vendor should have earlier experience for on board diagnostics system and their technology should be based on international standards or BIS. Vendor should furnish compliance of the document and their previous supply details / commissioning to this office.