WHEEL SLIDE PROTECTION SYTEM

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28 June 2016

WHEEL SLIDE

- Higher braking force causes wheels to get locked and slide over rail and this phenomenon is called sliding.

- when braking torque exceeds the torque generated due to adhesive force, wheel starts sliding

- Insufficient adhesion between wheel and rail is cited as the main cause of wheel sliding

WHEEL SLIDE

- During wheel sliding, as a result of friction, large amount of heat is generated at the wheel rail interface.
- As a result wheel surface temperature increases tremendously (above lower critical temperature of steel i.e. 726 º C).
- This causes pearlite in the contact patch of the wheel material to transform to, martensite, which is brittle.

WHEEL SLIDE

- This change in material structure leads to localised expansion of material in the contact patch.

- Resulting high residual stresses, combined with rolling contact load cycles cause martensitic patches to break out of wheel tread causing series of elliptical damage patches on the wheel tread

WHEEL SLIDE

- During sliding, maximum temperature in wheels is reached in the first 50 to 100 ms. and then was constant throughout the duration of sliding

- Ferrite and martensite structures formed after cooling had strength lower than that of existing ferrite and pearlite structure. Therefore, it can easily become channel of crack initiation and propagation

WHEEL SLIDE

- During perlite to martensite transformation in the contact patch, 0.5% volume expansion is observed, which leads to setting up of residual stresses in the contact patch

- When these residual stresses combine with the rolling contact loading cycle, hard and brittle martensite breaks out of wheel tread.

SLIDING VELOCITY

- Refer PDF

RESEARCH CONCLUSIONS

- The wheel with the disc brake has a higher tendency to slide due to higher braking torque.
- Wheel is locked very fast (1-3 sec) during hard braking due to lower inertia of wheel set.
- Very high temperatures are rapidly developed when railway wheel slides on the rail (800-1300°C), followed by the rapid cooling resulting in material transformation in thermally affected zone.

RESEARCH CONCLUSIONS

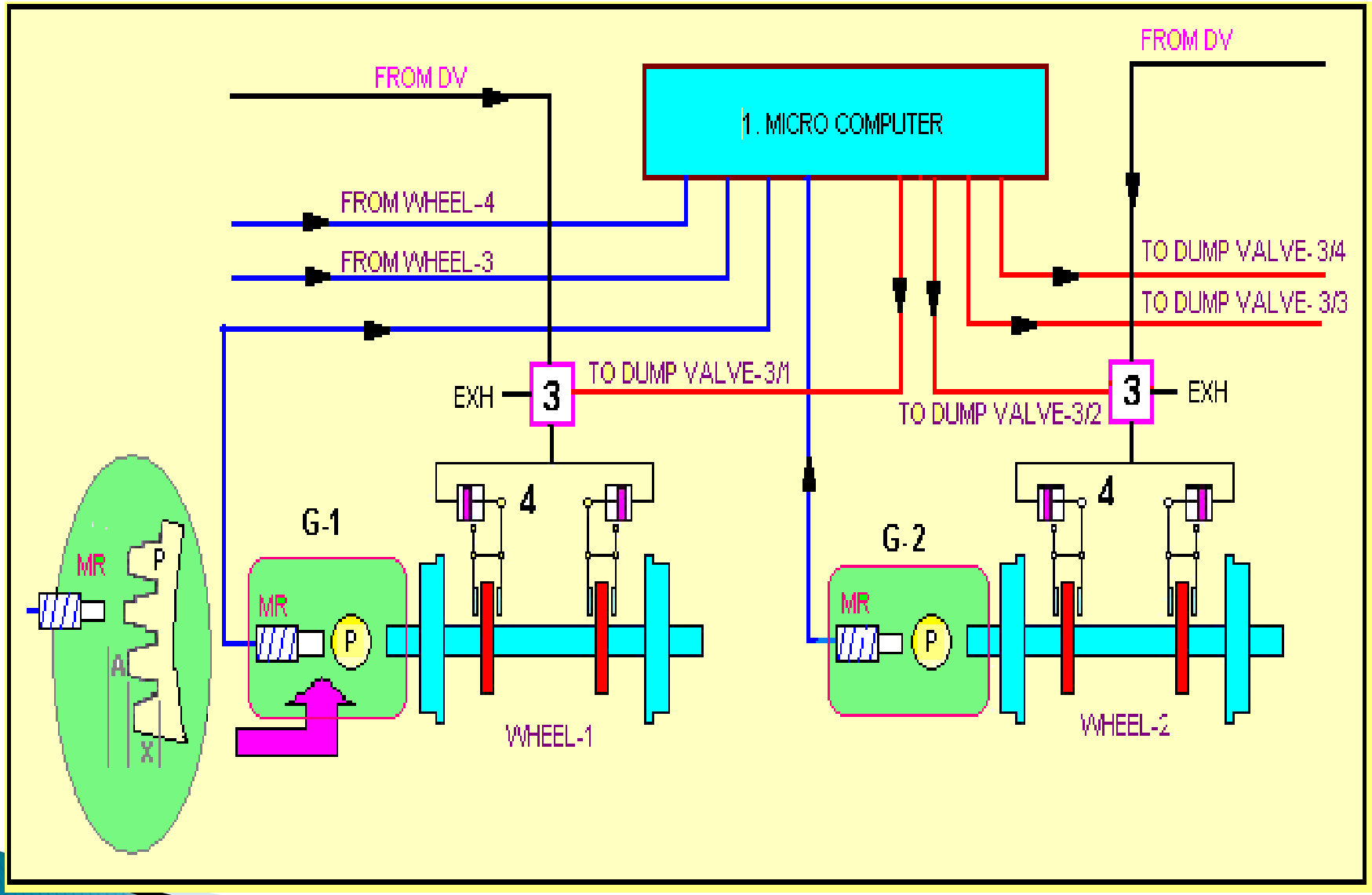
- Depth of TAZ increases with increase in saturation temperature, and sliding velocity.
- Surface cracks take years to appear, then grow deeper leading to an uncontrolled crack growth and finally result in wheel shelling.
- The extent of wear with the tread braking is higher than the crack propagation rate. Thus, surface cracks generated get cleaned off during tread braking.

INFERENCE

- WHEEL SLIDE PROTECTION SYSTEM IS ESSENTIAL TO REDUCE WHEEL SLIDE IN ORDER TO REDUCE SHELLING

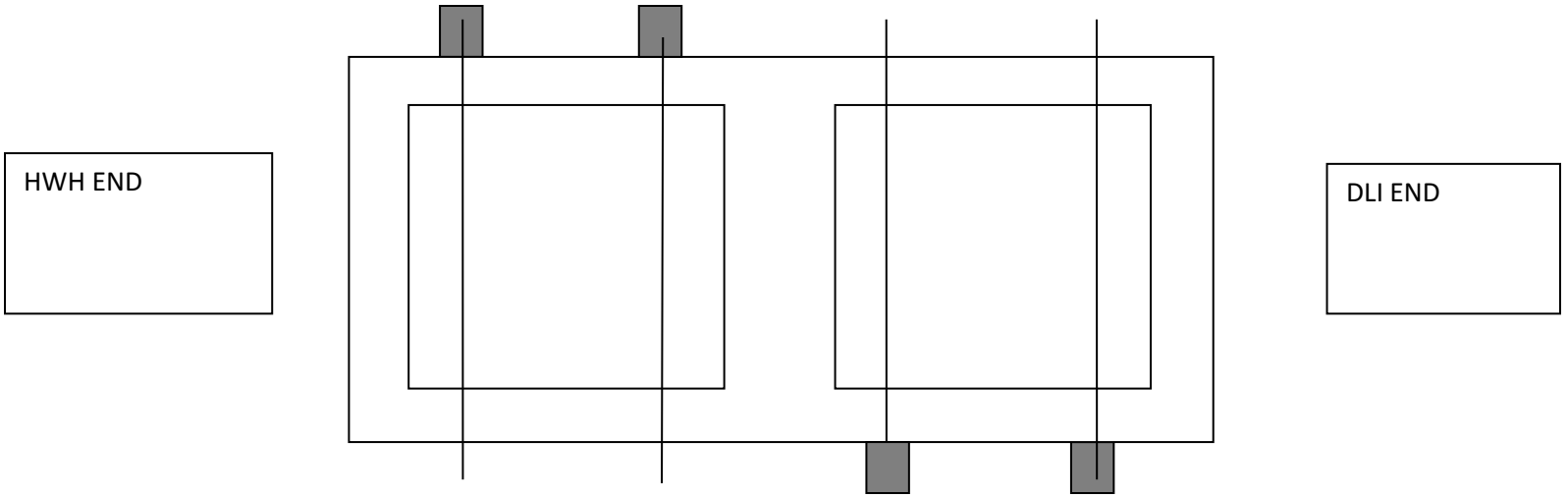
OBJECTIVE OF WSP SYSTEM

- In LHB coaches Air brake System with Disc brakes is used. During brake application, factors like variation of co-efficient of friction (due to composition of brake blocks and disc) and adhesion between rail and wheels may cause difference in rotation of axles on the same coach. This may lead to wheel skidding/ flat tyres. To prevent this, a Wheel Slide Protection (WSP) device is provided in these coaches.

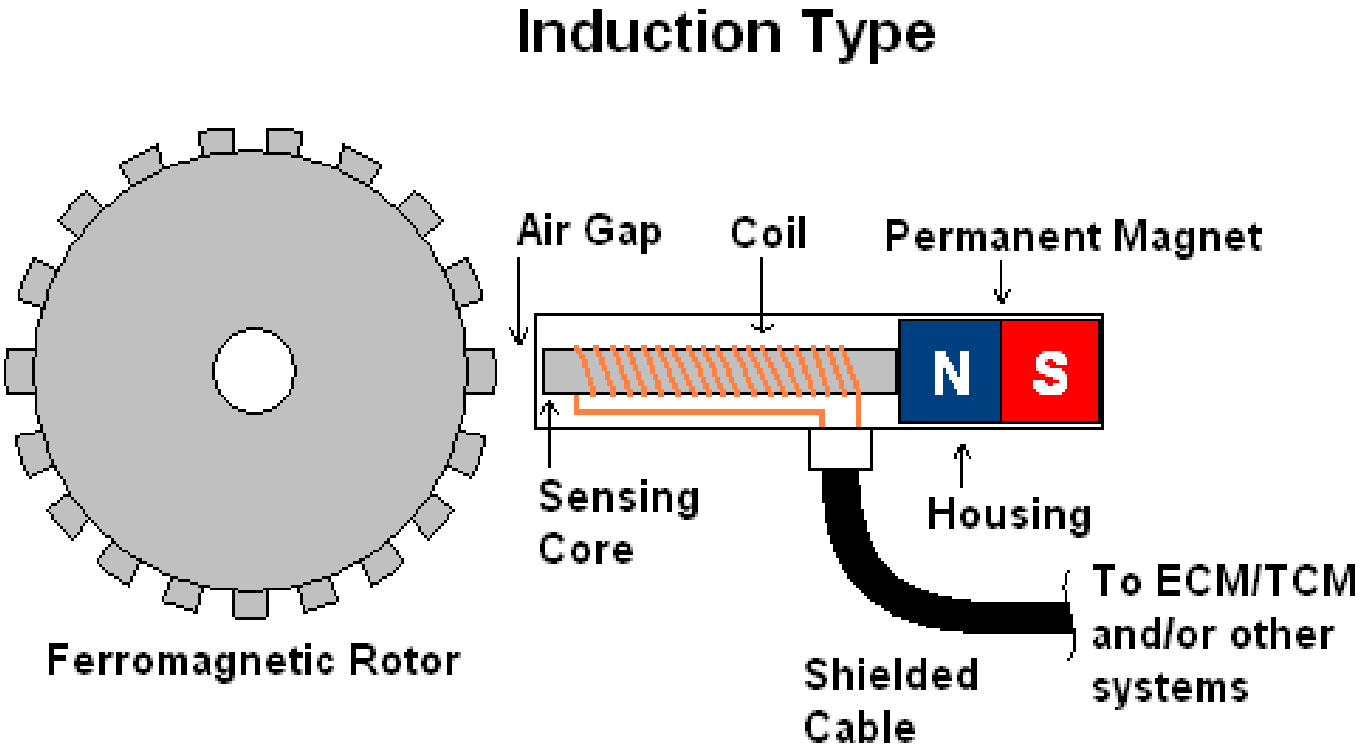

FROM DV
1. MICRO COMPUTER
FROM DV
FROM WHEEL-4
FROM WHEEL-3
TO DUMP VALVE- 3/4
TO DUMP VALVE- 3/3
EXH
3
TO DUMP VALVE-3/1
TO DUMP VALVE-3/2
3
EXH
4
4
G-1
G-2
MR
P
MR
P
MR
P
A
X
WHEEL-1
WHEEL-2

SPEED SENSOR FUNCTION

- AT EACH AXLE SPEED PROBE UNIT IS MOUNTED WHICH TRANSMITS WHEEL SPEED SIGNAL TO ELECTRONIC DEVICE.



Speed Sensor– Working Principle



Speed Sensor– Working Principle

- MAGNETIC SENSORS CONSIST OF A ROD MAGNET ON TOP OF A MAGNETIC PIN THAT IS SURROUNDED BY A FIXED COIL. THIS SENSOR IS MOUNTED AT FIXED DISTANCE FROM A FERROMAGNETIC ROTOR WITH TEETH(PHONIC WHEEL).

- AS THE ROTOR TURNS AND A TOOTH COMES INTO THE PROXIMITY OF THE ROD, THE MAGNETIC FLUX IN THE COIL CHANGES. THIS CHANGE IN FLUX RESULTS IN A VOLTAGE PULSE ACROSS THE COIL. THE CONTROL UNIT COUNTS THESE VOLTAGE PULSES AND COMPUTES THE SPEED.

Speed Sensor – Phonic Wheel





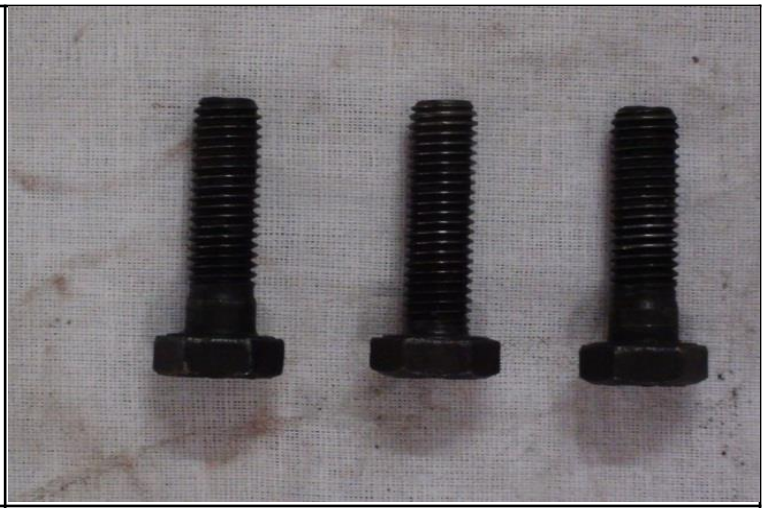
Speed Sensor

		
SPEED SENSOR (FAIVELEY)P.L. NO. 33501476		**SPEED SENSOR (KNORR BREMSE)P.L. NO. 33501464**

Speed Sensor – Probe & Bolts



M-8 X 35 X 22 BOLT GRADE 10.9 (TVS/UNBRAKO/LPS)



M-16 X 45 BOLT GRADE 10.9 (TVS/UNBRAKO/LPS



PROBE OF SPEED SENSOR

Speed Sensor – Maintenance

- After dismantling, phonic wheel is cleaned using Kerosene oil, then visually checked for any mark or damage on wheel or teeth; if any damage, replace by new phonic wheel
- Holes in phonic wheel checked by thread plug gauge
- Visual checking of box cover for any dent/crack
- Visual check of probe face for any damage
- All used bolts are scrapped

Speed Sensor – Fitment Sequence –1



VIEW OF SECURITY DISC BEFORE FITMENT OF PHONIC WHEEL TO AXLE

Speed Sensor – Fitment Sequence –2



INNER VIEW OF PHONIC WHEEL FITTED TO AXLE

Speed Sensor – Fitment Sequence –3



21 N-M TORQUE APPLICATION FOR SECURING PHONIC TO AXLE

Speed Sensor – Fitment Sequence –4



FITMENT OF AXLE END COVER 170 Nm TORQUE

Speed Sensor – Fitment Sequence –5



FITMENT OF SPEED SENSOR

Speed Sensor – Fitment Sequence –6



VIEW OF SPEED SENSOR AFTER FINAL FITMENT

Speed Sensor – Fitment Sequence –7



CHECKING OF GAP BETWEEN SENSOR AND PHONIC
BY FILLER GAUGES

Speed Sensor –

- After fitment, air gap between phonic wheel and speed sensor is checked
  - KB : 0.9 – 1.4 mm
  - FV : 1.5 ± 0.5 mm
- If gap not in permissible range, steel gasket of 0.5 mm thickness is used to maintain gap

THANKS