Lecture ON Braking systems Fitted On Passenger Coaches At Railway Staff College Lalbaug, Vadodara Feb 13th, 2008 A VERY WARM WELCOME FROM KNORR BREMSE INDIA
About Indian Railways

- Headquarters: New Delhi
- Railway Minister: Mr. Laloo Prasad Yadav
- Network: 84370 km
- Foundation: 1853
- Track Gauge: Broad, Metre, Narrow
- Revenue: Approx. INR 500 billion
- Total Wagons: 207,176 wagons,
- Coaches: 38,196
- Locomotives: 7,981
- Total Trains: Approx. 14,300 trains daily, including approx. 8,000 passenger trains.
- Railway Zones: 16
- Moves more than 1.5 million tonnes of Freight & 14 million Passengers per day.
About Indian Railways

- Indian Railways is the largest Rail network in Asia.

- Indian Railways is the Worlds second largest under a single management.

- Indian railways is the worlds largest with over 1.4 Million employees.
About Indian Railways

- Running Track Kilometers Electrified – 33540 kms
- Running Track Kilometers Total – 84370 kms
- Rolling stock (unit) Locomotives
  - Steam – 44 nos
  - Diesel – 4793 nos
  - Electric – 3188 nos
- Coaching Stock
  - Passenger coaches – 38196 nos
  - Electric multiple units – 5029 nos
  - Other coaching units – 5990 nos
  - Wagons – 207176 nos
Indian Railways is controlled by 16 Zonal offices.

1. Northern Railway – New Delhi
2. North Central Railway – Allahabad
3. North Western Railway – Jaipur
4. North East Frontier Railway – Guwahati
5. North East Railway – Gorakhpur
6. Central Railway – Mumbai
7. South Central Railway – Secundarabad
8. East Central Railway – Hajipur
9. South East Central Railway – Bilaspur
10. West Central Railway – Jabalpur
11. Eastern Railway – Kolkata
12. East Coast Railway – Bhubneshwar
13. Southern Railway – Chennai
14. South Western Railway – Hubli
15. South Eastern Railway – Kolkata
16. Western Railway – Mumbai
PRODUCTION UNITS

1. Chittaranjan Locomotive Works – West Bengal
2. Diesel Locomotive Works – Varanasi
3. Integral Coach Factory – Chennai
4. Rail Coach Factory – Kapurthala
5. Diesel Loco Modernization Works – Patiala
6. Rail wheel Factory – Bangalore
Continuous Maintenance, Breakdown repairs & Overhaulings of Locos, Coaches, Wagons, EMU’s etc is necessary to run such a Huge rolling & Coaching Stock.

Approx. nos of Railway C&W Workshops – 50 nos
Approx. nos of Primary maintenance Depots – 50 nos
Approx. Nos of EMU/MEMU/DEMU sheds – 30 nos
Approx. Nos of Loco Workshops – 65 nos
Delhi Metro Rail corporation Ltd – Delhi
Metro Railway – Kolkata
Chennai Metro Railway – Chennai
Mumbai Metro – Mumbai
Metro Railway – Bangalore
Hyderabad Metro Railway – Hyderabad
Kochi Metro - Kochi
**Freight Corridor**

- What is the ‘freight corridor’ route?
  - New Delhi – Mumbai and New Delhi – Howrah.
  - Total Estimated Length - 9,260 kms.

- What is the estimated project cost?
  - Total Estimated Cost - Rs 60,000 crore.
  - Japan to invest Rs 20,000 crore in phase I of the Corridor, the 2,800 km Delhi-Kolkata and Delhi-Mumbai section.
Knorr-Bremse
Mobility is the future.
We make it safer.
Mobility is the future. We make it safer.

- More than one billion people put their trust in the safety of Knorr-Bremse Systems...
  - ... every day
  - ... worldwide in more than 100 countries
  - ... in Light Rail Vehicles, Metros, Commuter Trains and High Speed Trains
  - ... in Buses, Coaches and Commercial Vehicles
Knorr-Bremse at a glance

- Founded: 1905
- Experience: 100 years of Innovation
- Independence: Family owned
- Employees: > 13,000*
- Sales: EUR 3.1 bn.*
- R&D: 5% of sales*
- Investments: EUR 135 mil. (incl. leasing)*
- Locations: More than 60 locations in 25 countries
- Two Main Divisions: Systems for Rail and Commercial Vehicles

Number one worldwide

- Brake Systems for Rail Vehicles + On-Board Systems
- Brake Systems for Commercial Vehicles + Dampers

Source: Preliminary Annual Report 2006
Knorr-Bremse is a supplier for 25,000 units and 160,000 parts

**Air Supply**
- Compressor
- Air dryer
- Oil separator
- Filter
- Air reservoir

**Bogie Equipment**
- Brake cylinder
- Slack adjuster
- Tread brake unit
- Disc brake
- Electro-magnetic track brake
- Eddy-current brake

**Brake Command**
- Drivers brake valve
- Electronic brake control system
- Electro-pneumatic control
- Brake manifold

**Brake Control**
- Brake panels
- Distributor valve
- Pressure transformer
- Load brake valve
- Relay valve
- Magnet valve
- Auxiliary pneumatic equipment
- Pressure reducing valve
On-Board Systems for Rail Vehicles - Product Overview

Door Systems

Platform Door Systems

HVAC

Toilets / Electronics

Power Supply

Signaling / Power Supply

Electronic Voltage Converter

Disconnected

Braking Resistor
Knorr Bremse India (P) Ltd, Faridabad
MILESTONES OF KB - INDIA

- 1993  Formation of Company in Faridabad.
- 1995  Commercial production of Air Brakes for Wagons started.
- 1996  Commercial production of Air Brakes for Coaches started.
- 1997  Introduction of Disc Brake System for high speed coaches of IR.
  - Indigenous development of first prototype of TBU (PC-7)
  - 1999  Export of KE Valve castings to KB-Germany.
  - Certification of ISO 9002.
  - Commercial production of Dampers for Coaches.
  - Brake containers for new series LHB coaches for IR.
- 2000  Commercial production of Dampers for Locomotives started.
- 2002  Regular supplier status for Air Dryer.
- 2004  Approval of aluminium body DV for passenger stock from RDSO.
- 2005  EST crash buffer introduced to Indian Railways.
- 2006  Partly indigenised CCB system for GM locomotives supplied to DLW.
PRODUCT OFFERING BY KNORR-BREMSE INDIA:

- Air Brake Sets for Wagons & Coaches.
- Tread Brake Unit PC 7 for Diesel Locomotives.
- Shock Absorber for Locomotive & Coaches.
- Panel Mounted Brake System for Loco & Coaches.
- Brake Accessories.
- Bogie Mounted Brake System for wagons.
- Air Dryers.
- Air compressors.
- CCB system for GM Loco & Electric Loco ADTRANZ.
- TBU’s for Delhi Metro.
- Disc Brake system for LHB coaches.
- Wiper equipment for electric locomotives.
- Brake System for Kolkatta Metro (Type KBR XIE).
- Brake system for 140 Tonnes Gotwald cranes.
- Air suspension control system for main line coaches.
- Door system for Delhi Metro.
- KBGMP microprocessor controlled EP brake system for Delhi metro.
PRODUCT MANUFACTURED BY KNORR–BREMSE INDIA

- Air Brake Sets for Wagons & Coaches (KE Valve – Cast Iron & Aluminum)
- Shock Absorber for Locomotives, Passenger Cars & EMUs / DEMUs.
- Bogie Mounted Brake System for freight cars.
- Air Dryers for Diesel, Electric Locomotives & EMUs / DEMUs.
- CCB 1 for EMD/DLW Locomotives.
PRODUCT MANUFACTURED BY KNORR–BREMSE INDIA

- TBU (PEC7) for Delhi Metro Project.
- Air Suspension Control Equipments for EMUs/DEMUs & Passenger cars.
- KE-DV sub-assemblies & components for export market (KB-Berlin, Vietnam)
NEW PROJECTS (FOR LOCALIZATION)

- Disc Brake System for high speed trains.
- PEC7 TBU’s for ADTRANZ/CLW Locomotives.
- Contactors for IR EMUs (Siemens order on *Microelettrica Scientifica S.p.A.* for GP-194 & MRVC projects)
- EST Crash Buffers.
Trainings imparted by Knorr – Bremse India

- KB as a group believes in Imparting Training & sharing product Knowledge with our esteemed customers.

- KBI has an exclusive team of about 30 service personnel all over India.

- Engineers are generally based at major locations where Knorr product holding is more.

- Our Field Engineers impart On - Job trainings to Railway personnel at sites / workshops / Sick lines / loco sheds / EMU sheds etc.

- In addition to the above KBI provides Free of Cost Training to Railway personnel at KB India Faridabad factory.
Brakes

- Brakes are an effective means of controlling, stopping, retarding speeds as & when desired within a reasonable short distance and time.

- The brake system not only retards the speeds or stops the train but also allows to negotiate turnings & gradients with considerable safety.

- Safety is an important parameter while braking.

- To effectively control the speed, Force must be applied in opposite direction to the movement of the train. These are Frictional Forces & are called brakes.
Types of Brakes

- Mechanical – used in narrow & small gauge trains

- Hydraulic – Good potential especially for high speed trains, but not used in Indian Railways due to high initial & operating cost.

- Electrical – Also called dynamic brakes. This system is used in conjunction with Pneumatic, hydraulic or magnetic brakes.

- Pneumatic – These are broadly classified as Vacuum Brakes & Compressed Air Brakes. Vacuum brakes is an old system & is almost completely superseded by Compressed Air brakes.
Advantages of Compressed Air brakes over Vacuum Brakes

- Reduction of Braking distance for same force as compared to vacuum brakes.
- No brake power deterioration as compared to approx. 6 to 16% in 400 km for vacuum brakes.
- Brake power almost constant throughout the train length & hence more coaches / wagons can be used in each Rake. In vacuum brakes approx. 10 to 20% reduction in Brake Power from first coach to last coach.
- No Brake overheating while descending with heavy loads.
- Propagation rate is approx. 300 m/sec as compared to 100m/sec for vacuum brakes.
- Application & release time is less due to fast propagation rate as compared to Vacuum brakes.
- Attention & time required is almost negligible during the course of running of the train from start to end of journey.
- Reduction of weight for brake system is almost 50% as compared to vacuum brakes.
Major Parts used in Air brake System

- Single pipe system / twin pipe system with fittings
- Distributor valve
- Brake cylinder
- Air reservoir
- Cut off Angle cocks
- Check valve
- Isolating cock
Testing equipment for Air Brake System

- **DV Test Bench:**
  - To test the DV for leakage
  - Charging time
  - Brake application / Release time
  - Sensitivity & insensitivity

- **SCTR / SWTR**
  - To test the complete brake system of a Single coach / Wagon
  - without Locomotive

- **RTR**
  - To test the complete brake system of a rake without Locomotive
Guidelines for Maintenance

- Careful Handling during transportation & storage
- Protection from Contamination, dust & water ingress.
- Provision of protective covers to prevent damages from ballast hits.
- Cleaning of pipes to avoid oil, rust, dust, water ingress into Air brake system parts.
- Checking leakage in Pipe joints with Soap solution.
- Regular drainage of condensate.
- Trip schedule, Quarterly schedule, Half yearly schedule, IOH & POH Overhauling schedule as per manufacturers recommendation
- Replacements of original spares in form of kits.
- Hanging of BP / FP couplings on supports
- Timely replacements of all wear out parts like brake blocks / pads etc
AXLE MOUNTED DISC BRAKE SYSTEM
USED IN RAJDHANI & SHATABDI COACHES FOR
INDIAN RAILWAYS
NEW PRODUCT OFFERING BY KNORR-BREMSE INDIA

Panel Mounted Brake System for Coaches & Locomotives

LHB Coach
Axle Mounted Disc Brake System

MAIN COMPONENTS

- Control Panel
- Bogie Equipments
- Anti-skid system.
- Flexball cable arrangement (for parking brakes)
  (used only for Generator & SLR coaches).
Axle Mounted Disc Brake System

CONTROL PANEL CONSISTS OF:

- Distributor valve.
- Control reservoir.
- Air reservoirs – 2 nos. - 125 litres : for Air Brake
  - 75 litres : for Toilet System
- Stop cock – 2 nos. (For Bogie isolation)
- Isolating cock – 2 nos. (For F.P. & Toilet circuits)
- Filter (Dirt Collector) – 2 nos.
- Check valve.
- Test fitting – 4 nos (B.P.,F.P., B.C. & C.R.)
- Pressure switch.
Axle Mounted Disc Brake System

BOGIE EQUIPMENT CONSISTS OF:

- Brake Disc.
- Brake Calliper Unit comprising of - Brake Cylinder.
  - Brake Calliper.
  - Brake Pads.
- Indicators
- Emergency Brake Accelerators.
- Emergency brake cable pull box.
- Emergency brake valve.
- Angle cock
- Brake hose coupling (F.P. & B.P.).
Axle Mounted Disc Brake System

ANTI-SKID SYSTEM CONSISTING OF:

- Microprocessor Control Unit.
- Speed Sensors
- Rapid Discharge (Dump) Valves.
- Toothed Wheels.
- Junction Boxes.
- Set of Connecting Cables and Connectors.
- Speed Sensor Protection Cases.
Axle Mounted Disc Brake System

FLEXBALL CABLE ARRANGEMENT CONSISTING OF:

- Flexball cables of suitable lengths.
- Connecting part for flexball 125 on brake cylinder.
- Brake calipers with parking brake arrangements.
- Roller lever valve.
- Pressure tank (6 litres)
- Indicators.
- Check valve.
MGS2 - Wheelslide Protection System

Speed Sensor

WSP-Electronic

WSP-Valve

Vehicle-Bus

U_{Batt.}

Electric

Pneumatic
MGS2 - Wheelslide Protection System

**Advantages**

- safe protection of all wheelsets from locking
- optimal use of the wheel/rail adhesion
- short stopping distances
- low air consumption
- low power consumption
Axle Mounted Brake Discs

Wheel Mounted Brake Discs
High-Performance Axle Mounted Brake Disc

- 60% weight reduction (compared to cast steel)
- max. temperature approx. 1000°C
Conventional Caliper Units - Compact Caliper Units
BRAKE SYSTEM

GREEN : RELEASED
RED    : APPLIED

AIR BRAKE BOGIE 2
BOGIE 1       HAND BRAKE
BRAKE SYSTEM

GREEN : RELEASED
RED : APPLIED

HAND BRAKE
AIR BRAKE
BOGIE 1
BOGIE 2
Computer Controlled Brakes

- Latest innovative Technical design for Indian Railways GM locos provided only by Knorr – Bremse
CCB major parts

- Microprocesser
- Brake control unit complete with DV fitted on a panel
- Analog convertor
- Magnet valves
- Check valves
- Brake controller
AMC

- Since Disc Brakes & Computer Controlled brakes are New technologies hence Indian Railways have requested OEM’s to provide AMC for such products.

- Knorr Bremse has already accepted the AMC contract for Rajdhani trains in Mumbai & Kolkotta.

- In Mumbai, Knorr - Bremse has started AMC & deputed staff exclusively for Overhaulings & maintenance of Rajdhani rakes at Mumbai. AMC will be started very soon at Kolkotta also.

- In a very short time we plan to undertake AMC for CCB’s also.
THANK YOU