



KNORR-BREMSE
Systems for Rail Vehicles



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.**
-



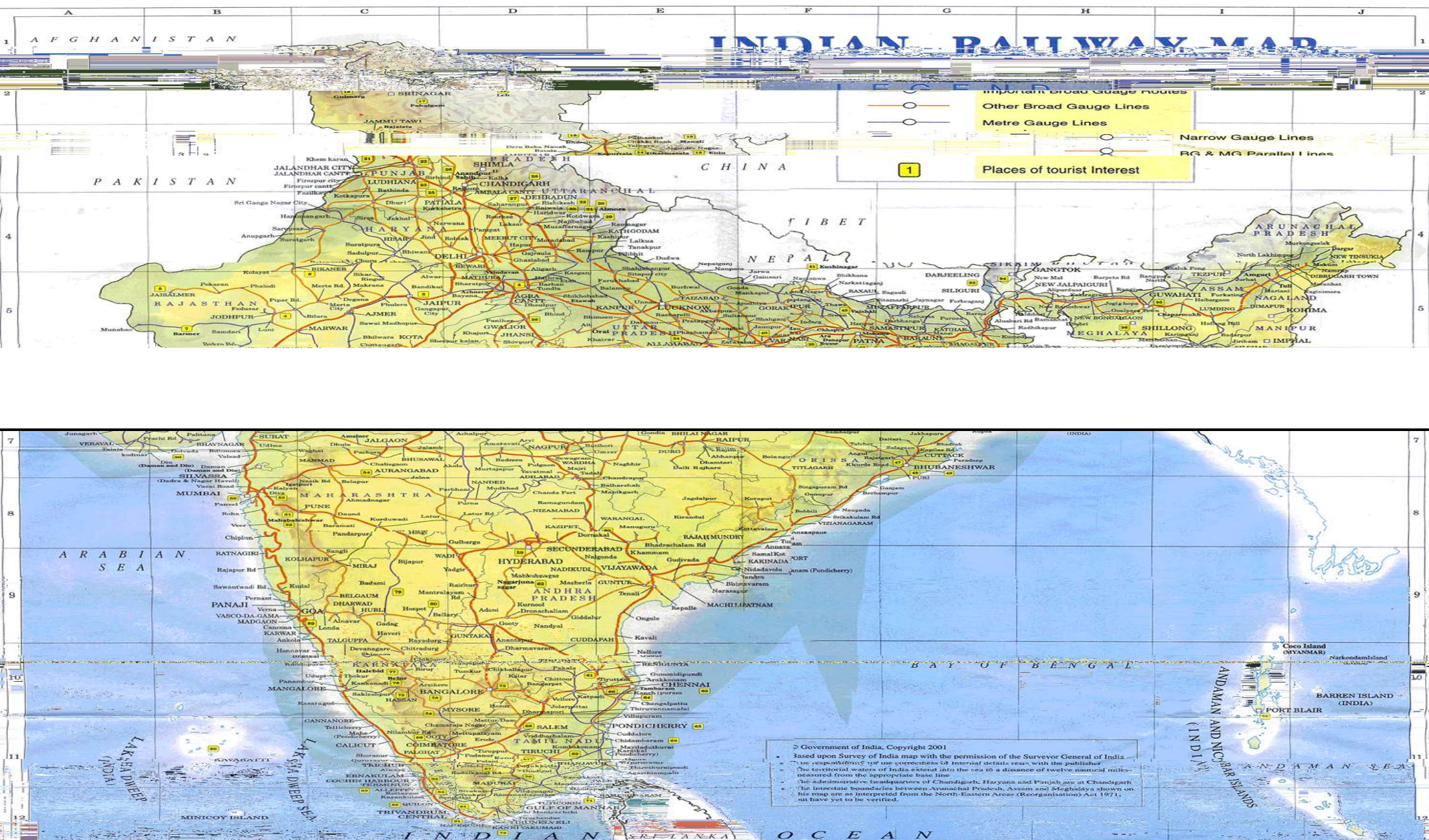
About Indian Railways

- ▶ 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
-

About Indian Railways

► **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 – Secunderabad
 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
-



© Government of India, Copyright 2001

- Based upon Survey of India map with the permission of the Surveyor General of India.
- The vertical and horizontal lines are correct as far as they go.
- The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.
- The administrative boundaries of Chandigarh, Haryana and Punjab are at Chandigarh.
- The interstate boundaries between Arunachal Pradesh, Assam and Meghalaya shown on this map are as interpreted from the North-Eastern Areas (Reorganisation) Act 1971, but have yet to be verified.

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



Workshops & sheds

Continuous Maintenance, Breakdown repairs & Overhauls of Locomotives, Coaches, Wagons, EMUs 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



KNORR-BREMSE

Systems for Rail Vehicles

METRO RAILWAYS

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.
 - Proposed corridors : Howrah – Mumbai, Howrah – Chennai, Mumbai – Chennai & New Delhi – Chennai.
 - 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
Systems for Rail Vehicles

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



Knorr-Bremse - the System Supplier

Brake Command

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

Air Supply

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

Brake Control

- Brake panels
- Distributor valve
- Pressure transformer
- Load brake valve
- Relay valve
- Magnet valve
- Auxiliary pneumatic equipment
- Pressure reducing valve

Bogie Equipment

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

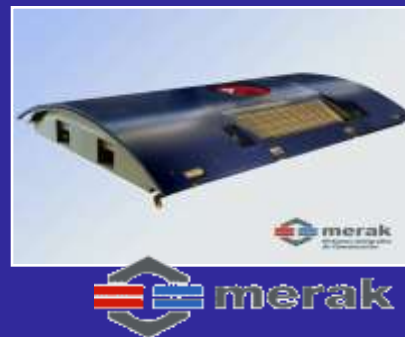
Knorr-Bremse is a supplier for 25,000 units and 160,000 parts

On-Board Systems for Rail Vehicles - Product Overview

Door Systems



HVAC



Power Supply



Braking Resistor

Disconnecter



Platform Door Systems



WESTINGHOUSE
platform screen doors

Toilets / Electronics



Frensisistemi

Signaling / Power Supply



Electronic
Voltage
Converter



Knorr Bremse India (P) Ltd , Faridabad



► MILESTONES OF KB - INDIA

- 1993 Formation of Company in Faridabad.
 - 1994 Plant & Machinery set up for manufacturing of Air Brakes.
 - 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.
 - 1998 Introduction of CCB system for WAG-9 & G.M. Locomotives.
 - 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.
 - 2001 Re-certification of ISO 9002.
 - Qualified as regular supplier for Dampers.
 - 2002 Regular supplier status for Air Dryer.
 - Supply of Bogie Mounted Brake Systems for wagons commenced.
 - 2003 Approval of aluminium body DV for passenger stock from RDSO.
 - 2004 Partially indigenised CCB system for GM locomotives supplied to DLW.
 - 2005 EST crash buffer introduced to Indian Railways.
-

- **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**
-



KNORR-BREMSE
Systems for Rail Vehicles

A faint, light blue line drawing of an axle-mounted disc brake system is visible in the background. It shows two wheels on an axle, each with a disc brake assembly. Various mechanical components like calipers, pistons, and hydraulic lines are depicted in a technical, schematic style.

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 :

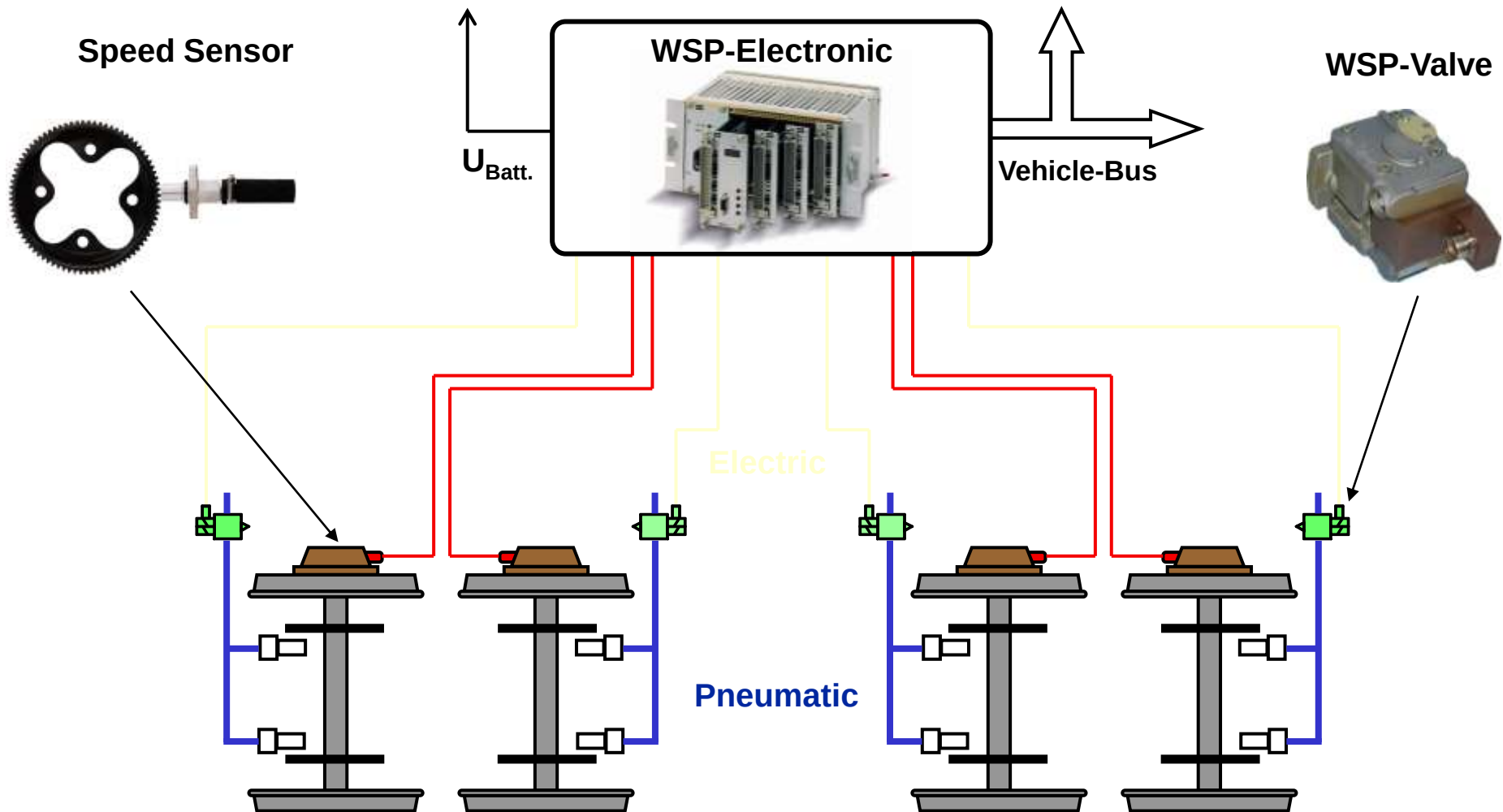
- ▶ **Microprocessor Control Unit.**
 - ▶ **Speed Sensors**
 - ▶ **Rapid Discharge (Dump) Valves.**
 - ▶ **Toothed Wheels.**
 - ▶ **Junction Boxes.**
 - ▶ **Set of Connecting Cables and Connectors.**
 - ▶ **Speed Sensor Protection Cases.**
-

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.**
-

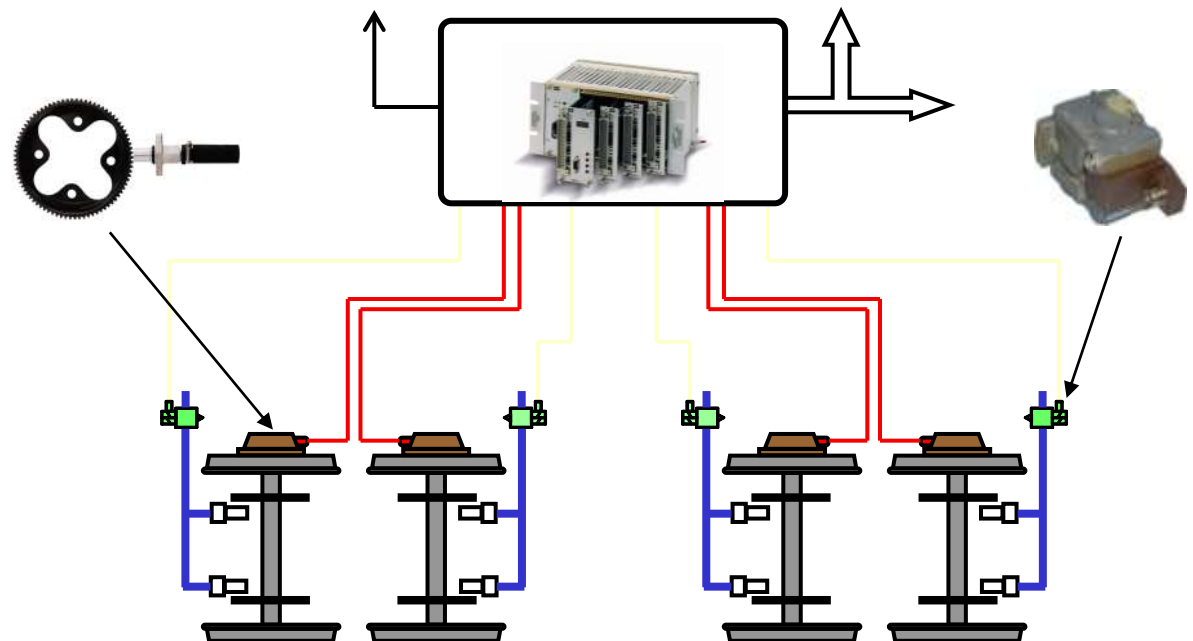
MGS2 - Wheelslide Protection System

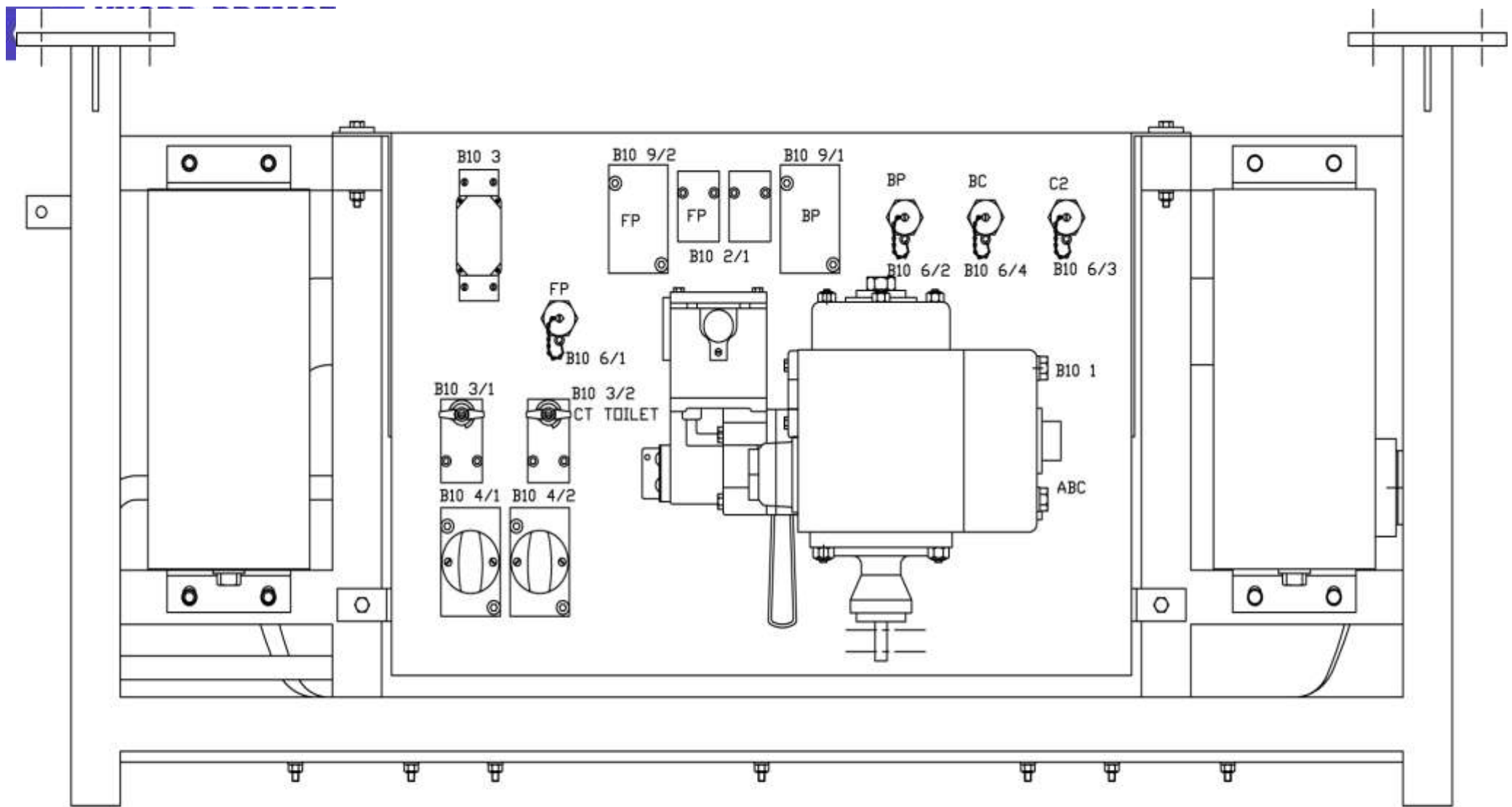


MGS2 - Wheelslide Protection System

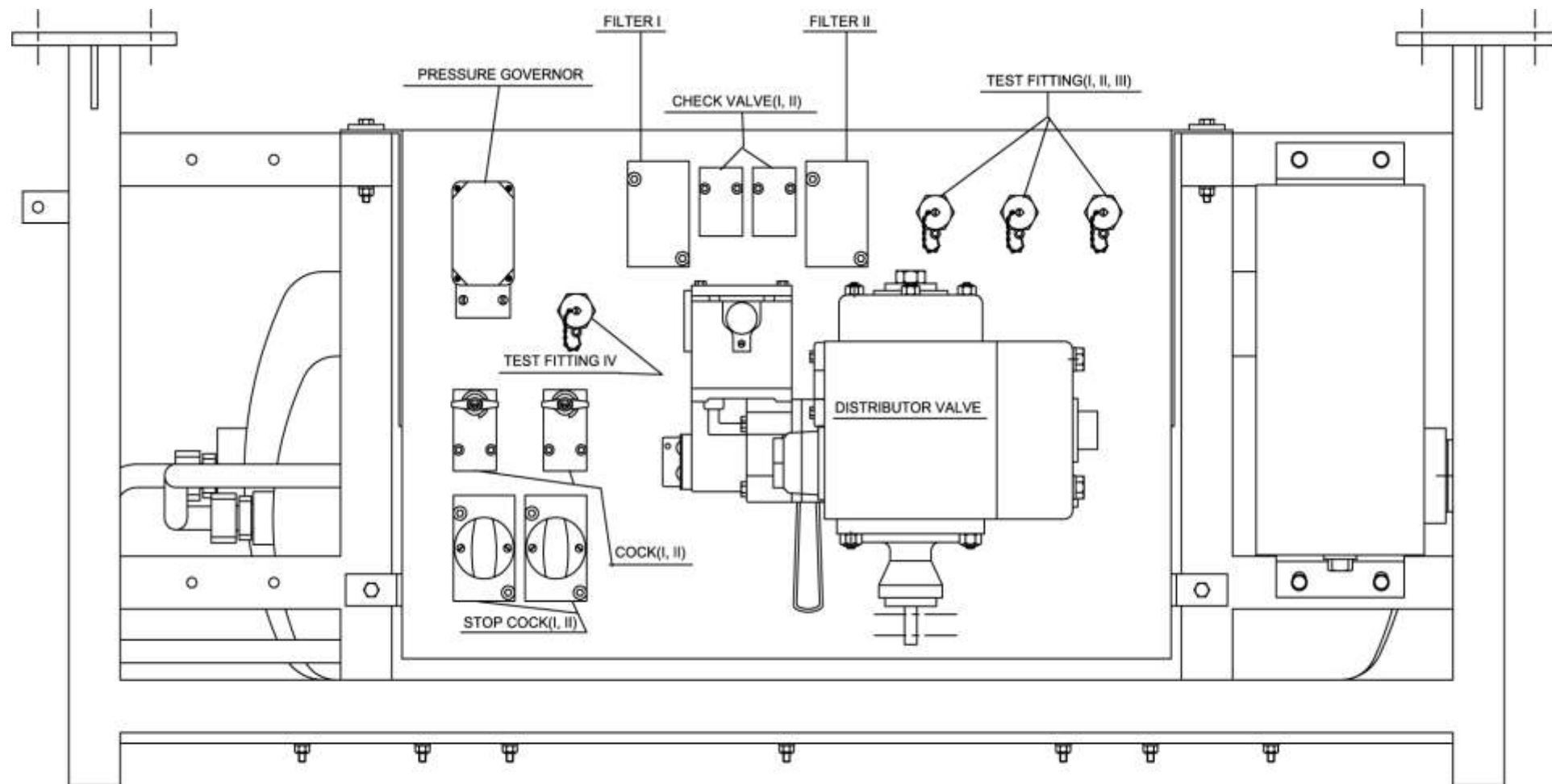
Advantages

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

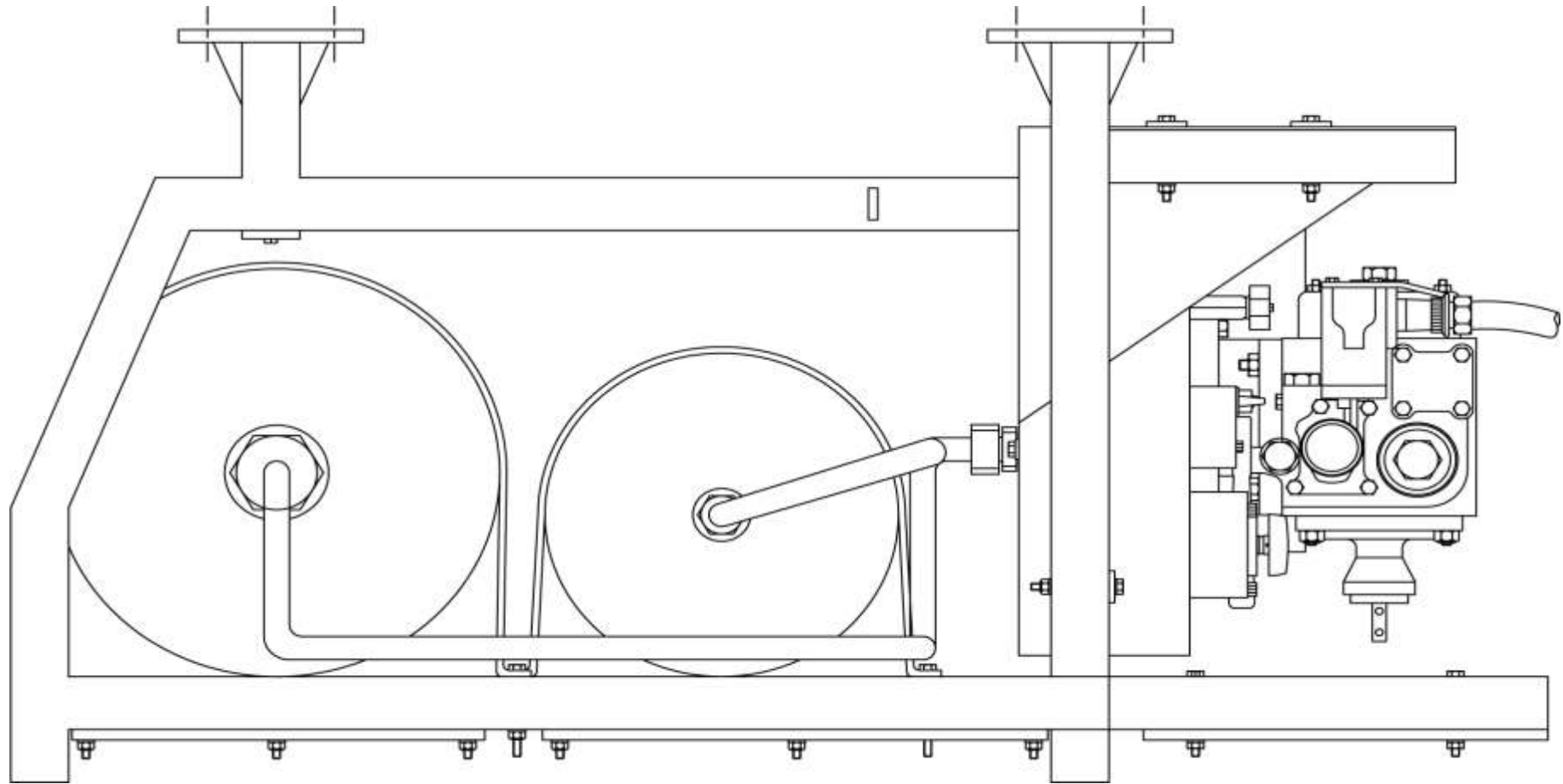




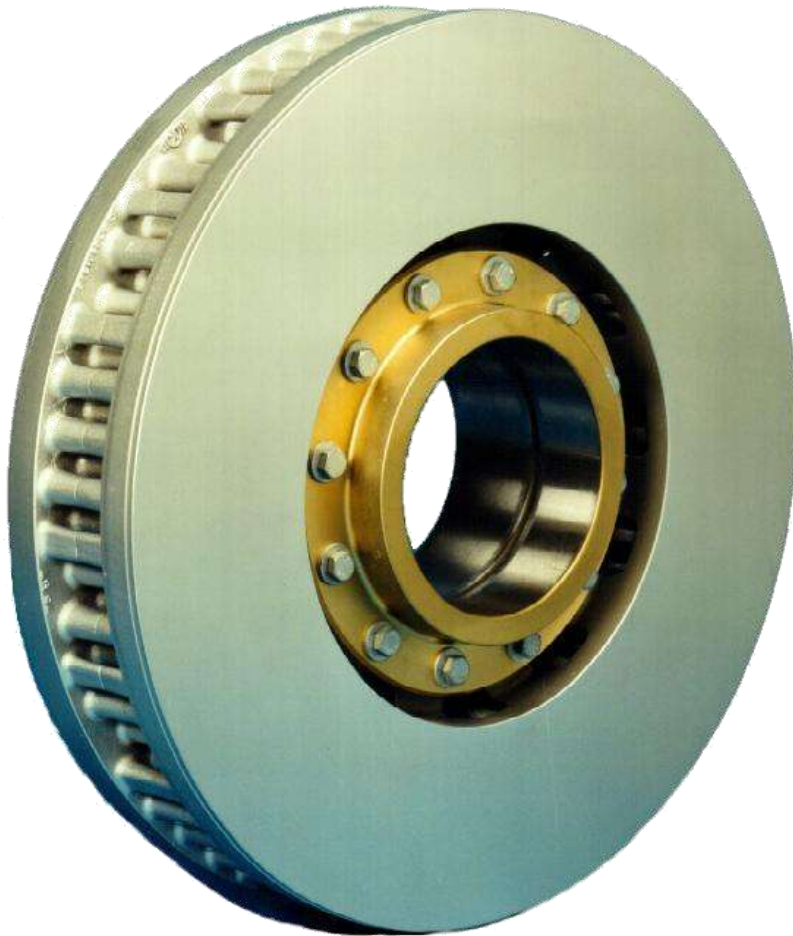
CONTROL PANEL FOR GENERATOR CAR



CONTROL PANEL FOR PASSENGER CAR



Axle Mounted Brake Discs

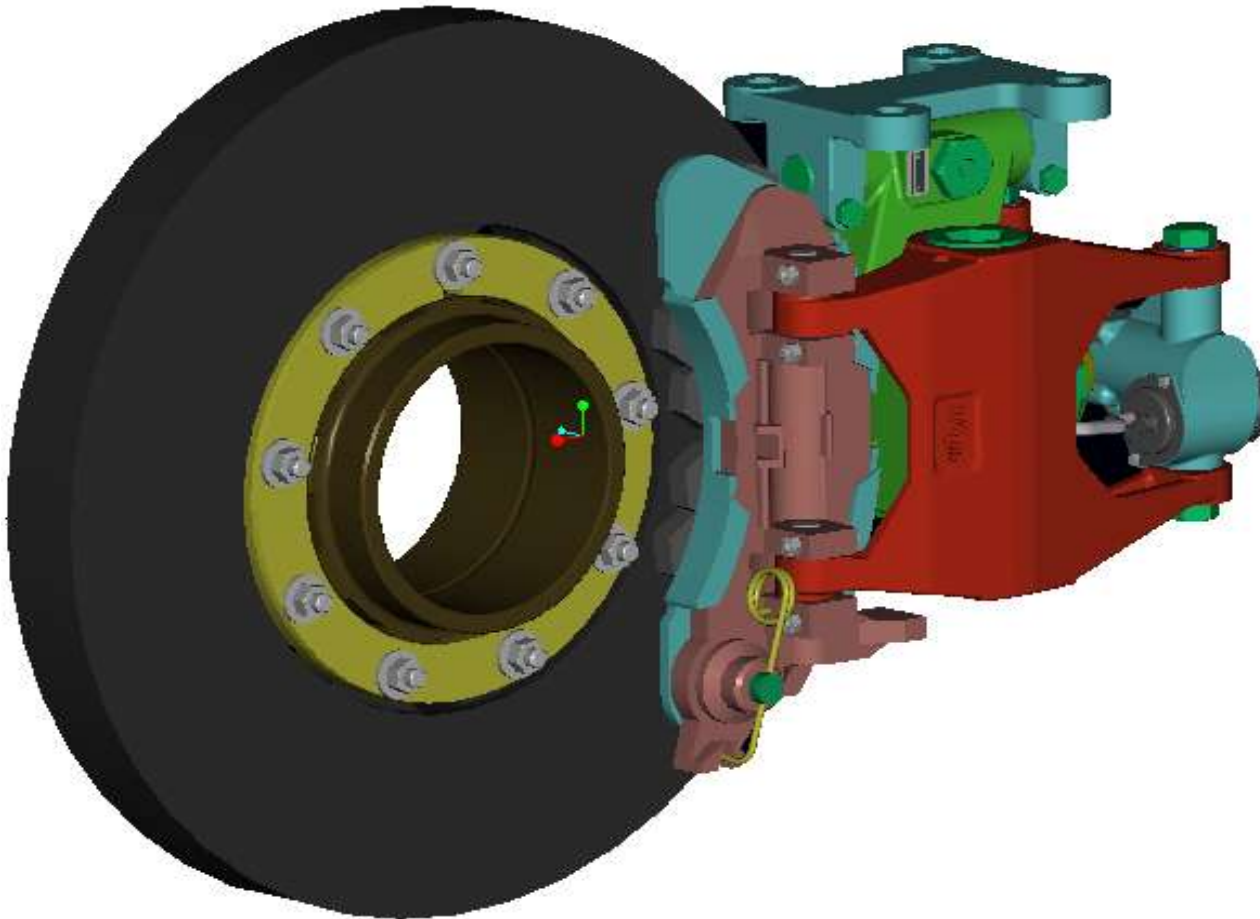


Wheel Mounted Brake Discs

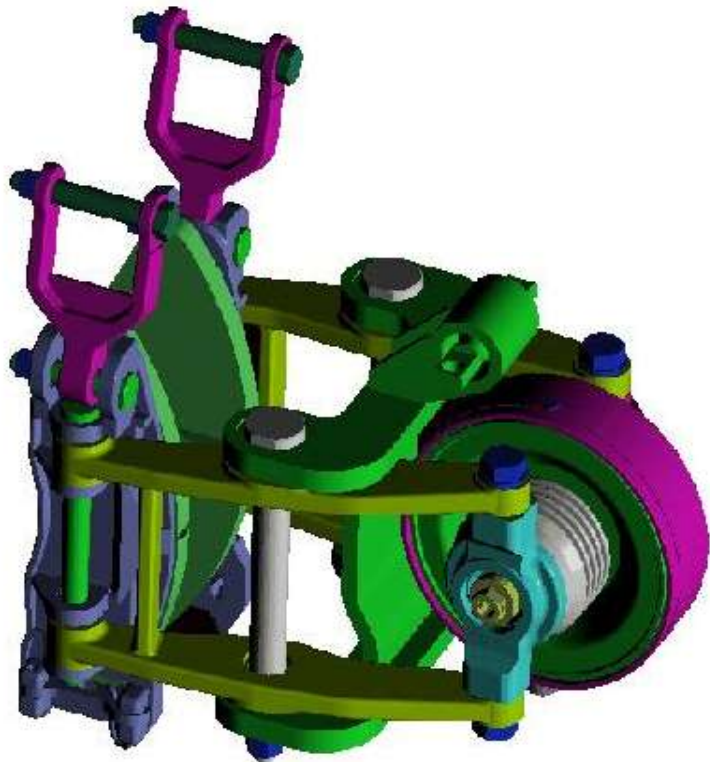


High-Performance Axle Mounted Brake Disc

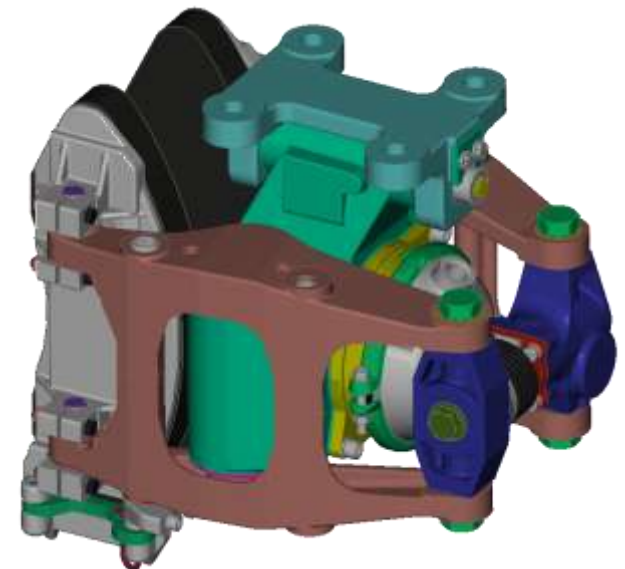
- ▶ 60% weight reduction (compared to cast steel)
- ▶ max. temperature approx. 1000°C

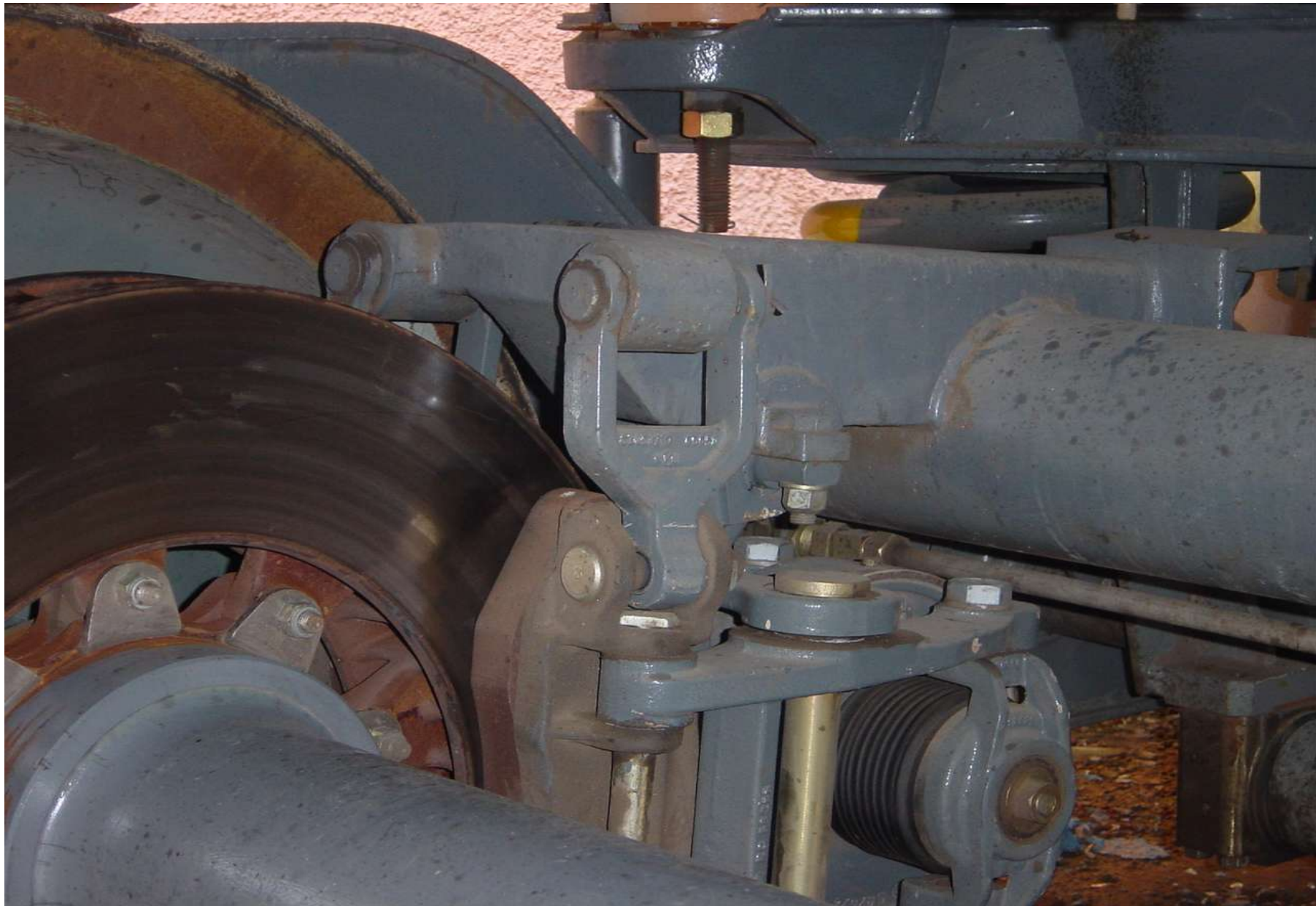


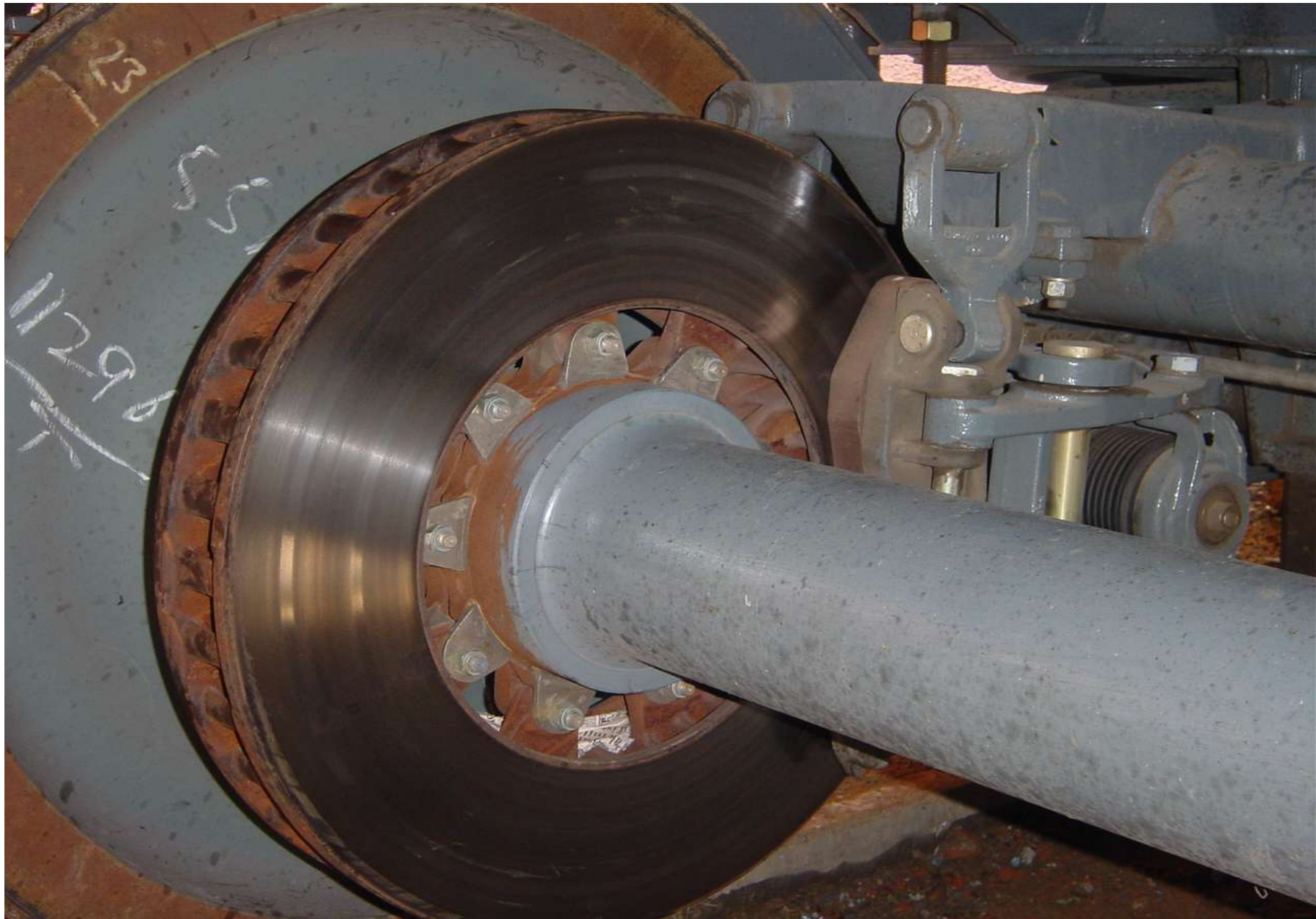
Conventional Caliper Units - Compact Caliper Units



New
Design









KNORR-BREMSE
Systems for Rail Vehicles

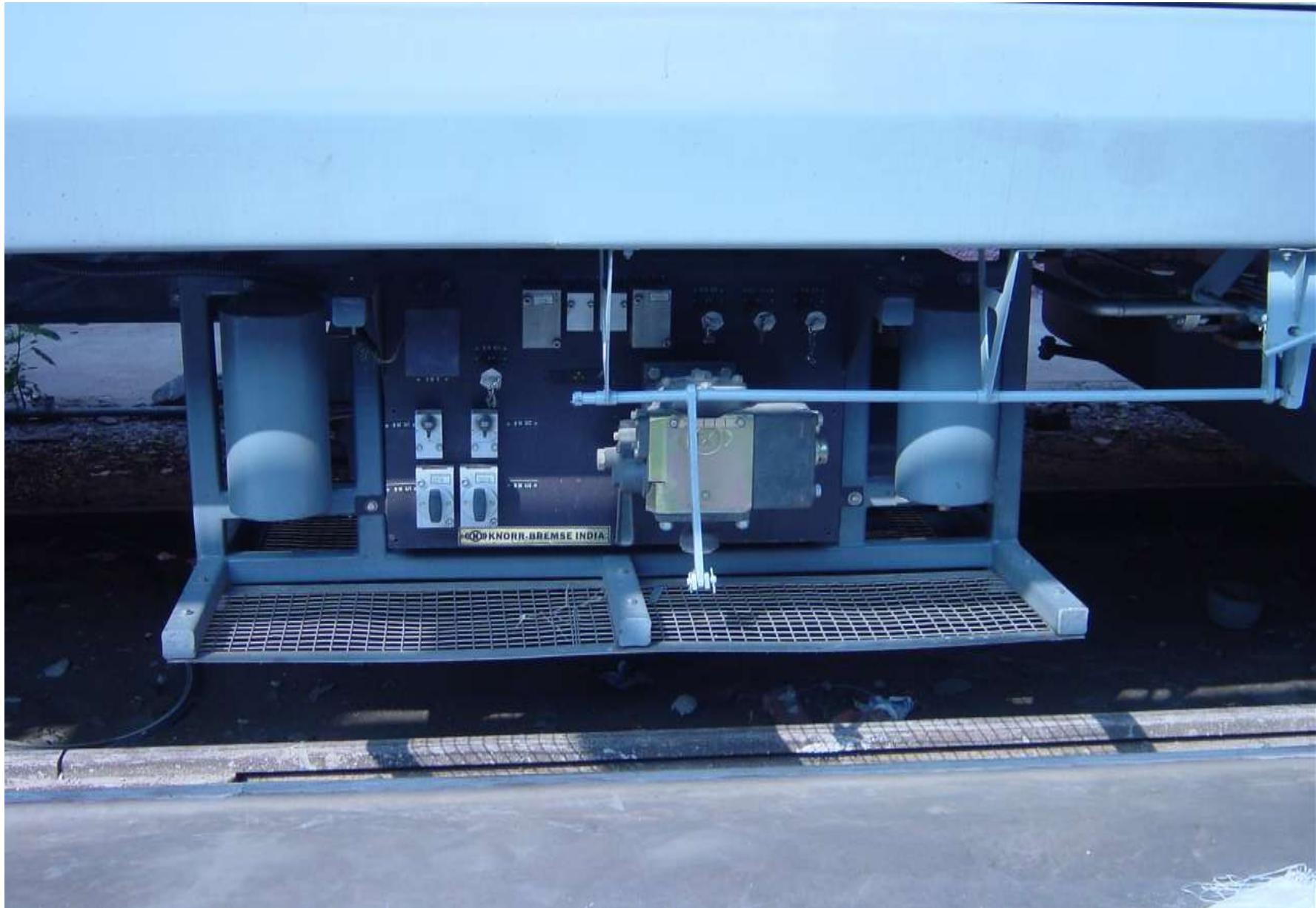








KNORR-BREMSE
Systems for Rail Vehicles





KNORR-BREMSE

Systems for Rail Vehicles

BRAKE SYSTEM

GREEN : RELEASED
RED : APPLIED

AIR BRAKE
BOGIE 2 BOGIE 1

HAND
BRAKE





KNORR-BREMSE

Systems for Rail Vehicles

BRAKE SYSTEM

GREEN : RELEASED

RED : APPLIED

HAND
BRAKE

AIR BRAKE
BOGIE 1 BOGIE 2



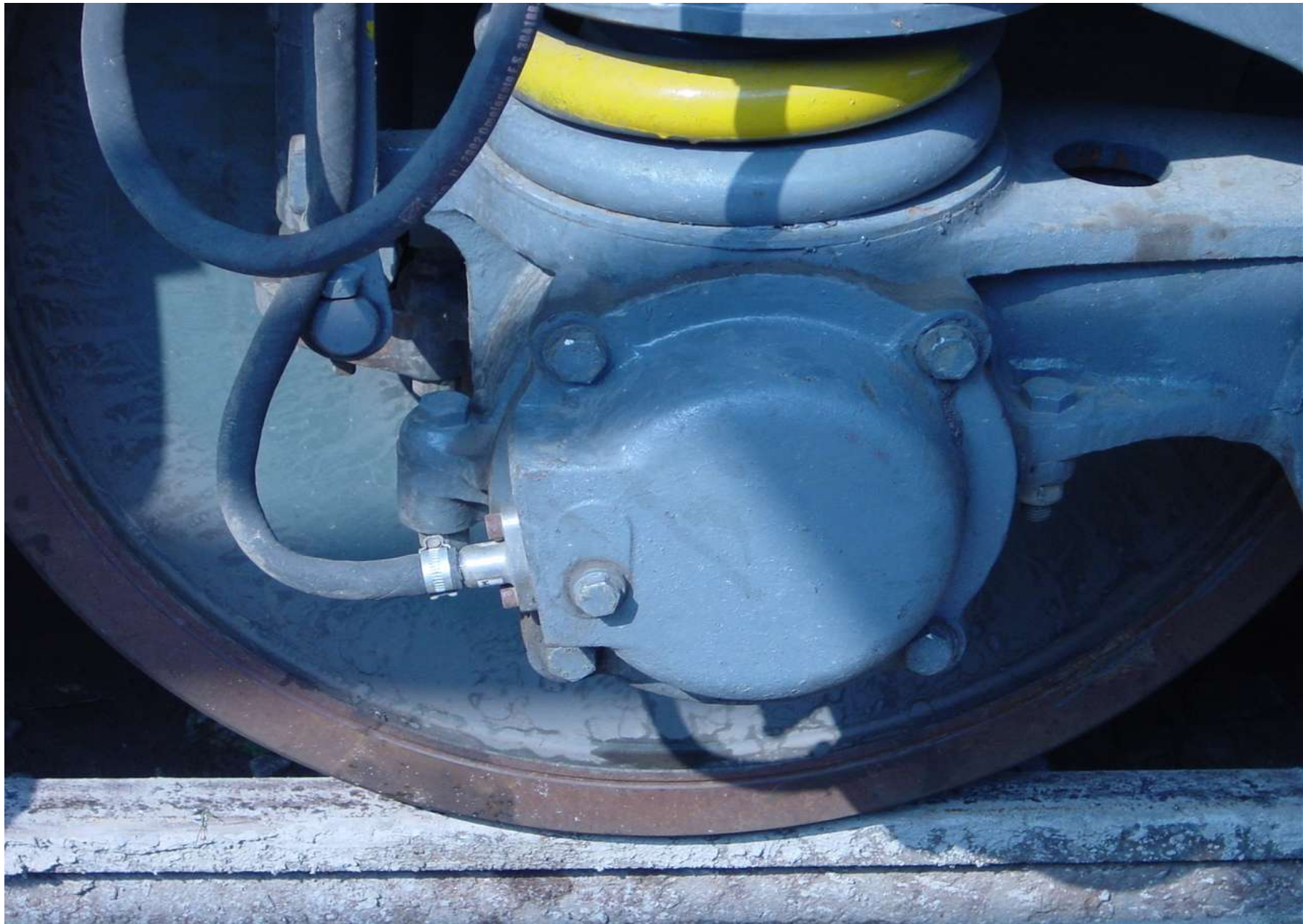


KNORR-BREMSE
Systems for Rail Vehicles



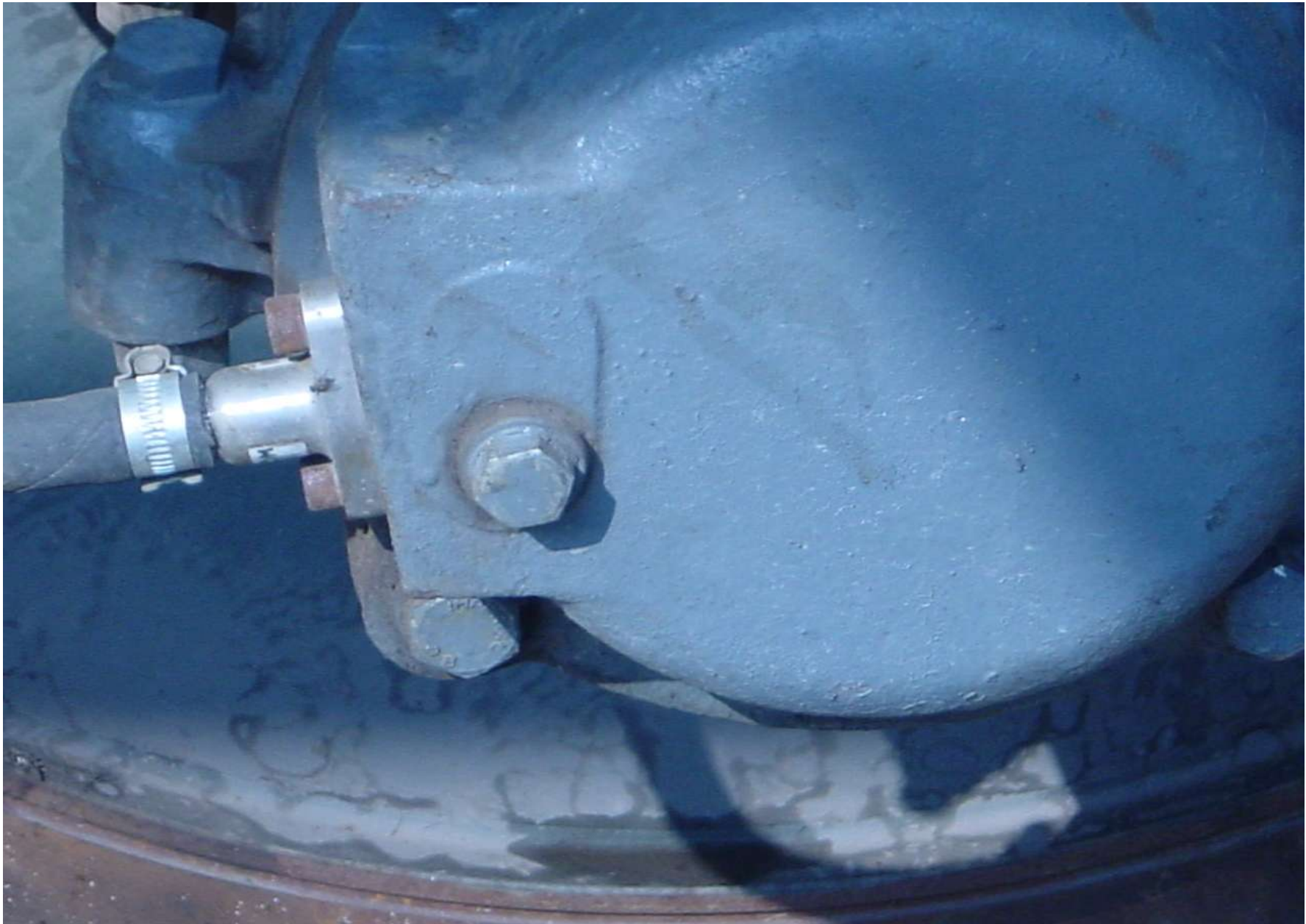


KNORR-BREMSE
Systems for Rail Vehicles





KNORR-BREMSE
Systems for Rail Vehicles





KNORR-BREMSE
Systems for Rail Vehicles







KNORR-BREMSE
Systems for Rail Vehicles





KNORR-BREMSE
Systems for Rail Vehicles





KNORR-BREMSE
Systems for Rail Vehicles





KNORR-BREMSE
Systems for Rail Vehicles







KNORR-BREMSE
Systems for Rail Vehicles

















Computer Controlled Brakes

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



CCB major parts

- ▶ **Microprocessor**
 - ▶ **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.**
-



KNORR-BREMSE
Systems for Rail Vehicles

THANK YOU
