





AIR BRAKE SYSTEM

LHB COACH

AXLE MOUNTED DISC BRAKE SYSTEM

This Brake system equipment provided on the LHB design coaches to meet the requirement for high-speed train hauled by Locomotives and permits the emergency braking for such trains to be within the specific or predetermined limits when brakes are applied at a speed of 160 kmph.

COMPARISON OF LHB & ICF BRAKE SYSTEM

LHB	ICF
Axle mounted Disc brake system	Bogie mounted brake system
No brake rigging for application of brakes	Brake rigging for application of brakes
Less thick SS pipes are used	Mild Steel pipes are used, now being retrofitted with SS pipes
Bite Type fittings are used (no threaded joints)	Threaded / flange joints are used
Wheel slide protection system to take care of wheel flattening	No such device to care of wheel flattening
No wheel wears due to braking.	Wheel wear due to brake block rubbing
Provision of test points in brake control panel to know the pressures of BP/FP/CR	No such test points to know the pressures of BP/FP/CR

COMPARISON OF LHB & ICF BRAKE SYSTEM

LHB	ICF
Centralised control of a coach through brake control panel	Centralised control is not available in ICF coaches
Isolation cocks are fitted in brake control panel for easy isolation	Isolation cocks are provided at various locations of Brake system
Brake accelerator for quick reduction of BP pressure in complete train set.	No such device in conventional ICF coaches
Brake Indicators are provided to give indication of braking/release	Brake indicators are not provided
QRV rod provided for easy release of CR pressure	Wire rope only provided for release of CR pressure
Simple mechanism provided for easy operation of PEASD and provided inside the coaches to avoid mishandling	Wire rope links are used for operation of PEASD and provided outside the coach.
FIBA device provided to know the Air spring failure	No such device in conventional ICF coaches (viz; DEMU, MEMU)

Brake System Overview:

- Twin pipe graduated release brake system
- UIC (Union Internationale des Chemins) approved
- Application time: 3 – 5 seconds
Release Time: 15 – 20 seconds
Max BC pressure: $3 \pm 0.1 \text{ kg/cm}^2$

Axle Mounted Disc Brake System for LHB coaches consists of:

1. Brake Control Equipment
2. Bogie Equipment
3. Hand Brake arrangement with flex ball cables
(used only for Power Cars & SLR coaches)
4. Wheel slide protection (WSP)

Brake Control Equipments-

- **Brake Control Module or Control Panel**
- Emergency Brake Accelerator with isolation cock.
- Indicators (4 nos for EOG & 6 nos for PC).
- Passenger Emergency brake valve with isolation cock (for EOG only).
- Emergency brake cable pull box (for EOG only).
- Angle cock (4 nos.).
- Brake hose coupling (F.P. & B.P.) (2 nos each).
- Guard Emergency Brake Valve (For Power Car only).

Brake Control Module or Panel consists of:

- Distributor valve with pressure convertor (RLV-11d).
- Frame with wire mesh (protection from stone ballast).
- Reservoir 6 L – 1 nos. for control reservoir.
- Reservoir 6 L – 1 nos. for hand brake (Power Car only)
- Air reservoirs – 2 nos. (125 L for AR, 75 L for Toilet System)
- Bogie Isolation Cock – 2 nos. (For Bogie isolation)

Brake Control Module or Panel consists of:

Isolating cock – 2 nos. (For FP, Toilet)

- Isolating cock – 1 nos. (For hand brake – Power Car only)

- Filter – 2 nos. (BP & FP)

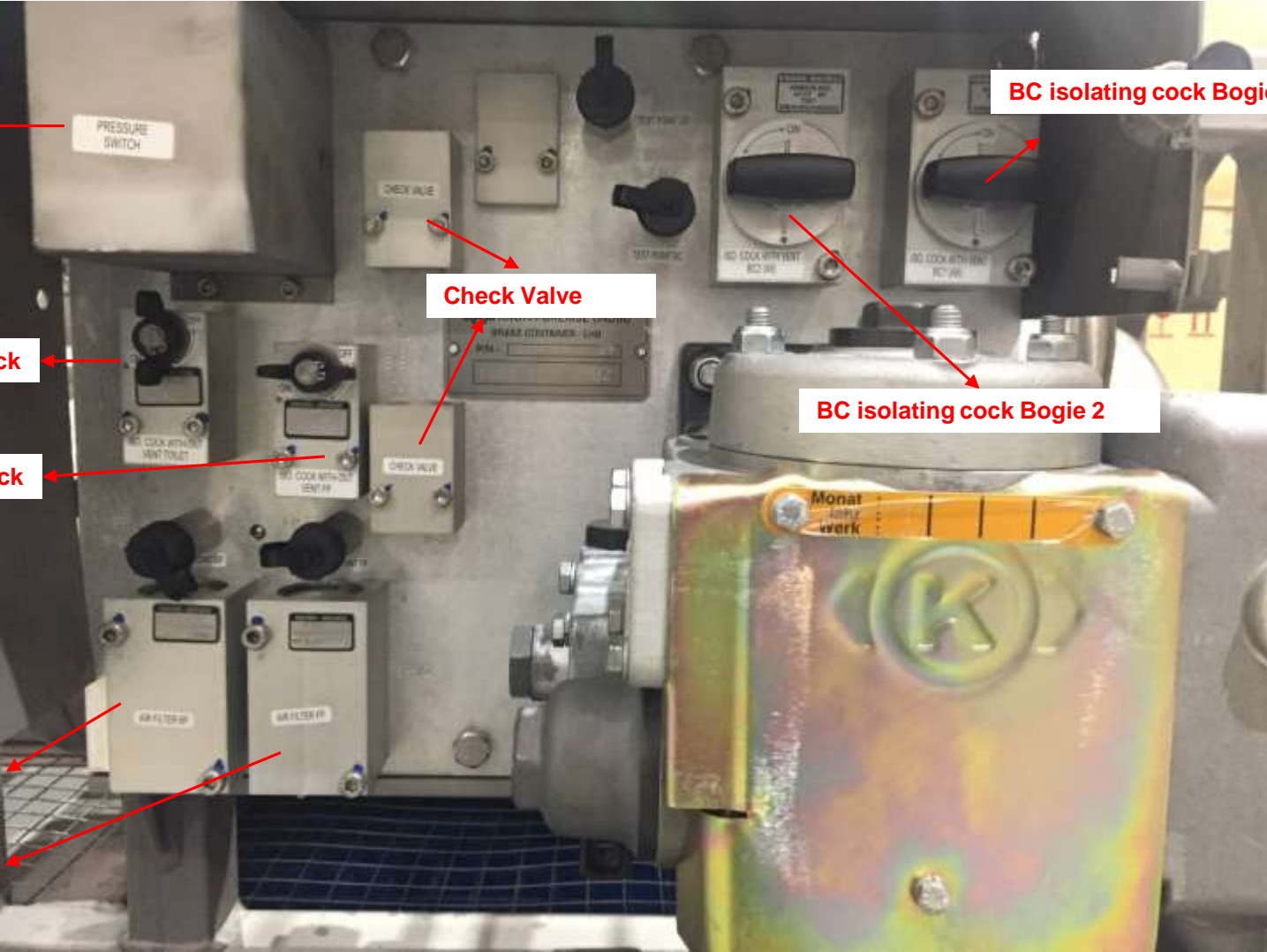
- Check valve (FP, Hand Brake & Toilet Circuit).

- Test fitting – 4 nos. (FP, BP, CR & BC)

- Pressure switch. (WSP switch ON/OFF)



Panel Mounted Brake System for EOG & PC Coaches



Pressure Switch

PRESSURE SWITCH

BC isolating cock Bogie 1

Check Valve

CDTS isolating cock

NO COOK WITH VENT TOILET

BC isolating cock Bogie 2

FP isolating cock

NO COOK WITH VENT FP

CHECK VALVE

Air Filter BP

AIR FILTER BP

Air Filter FP

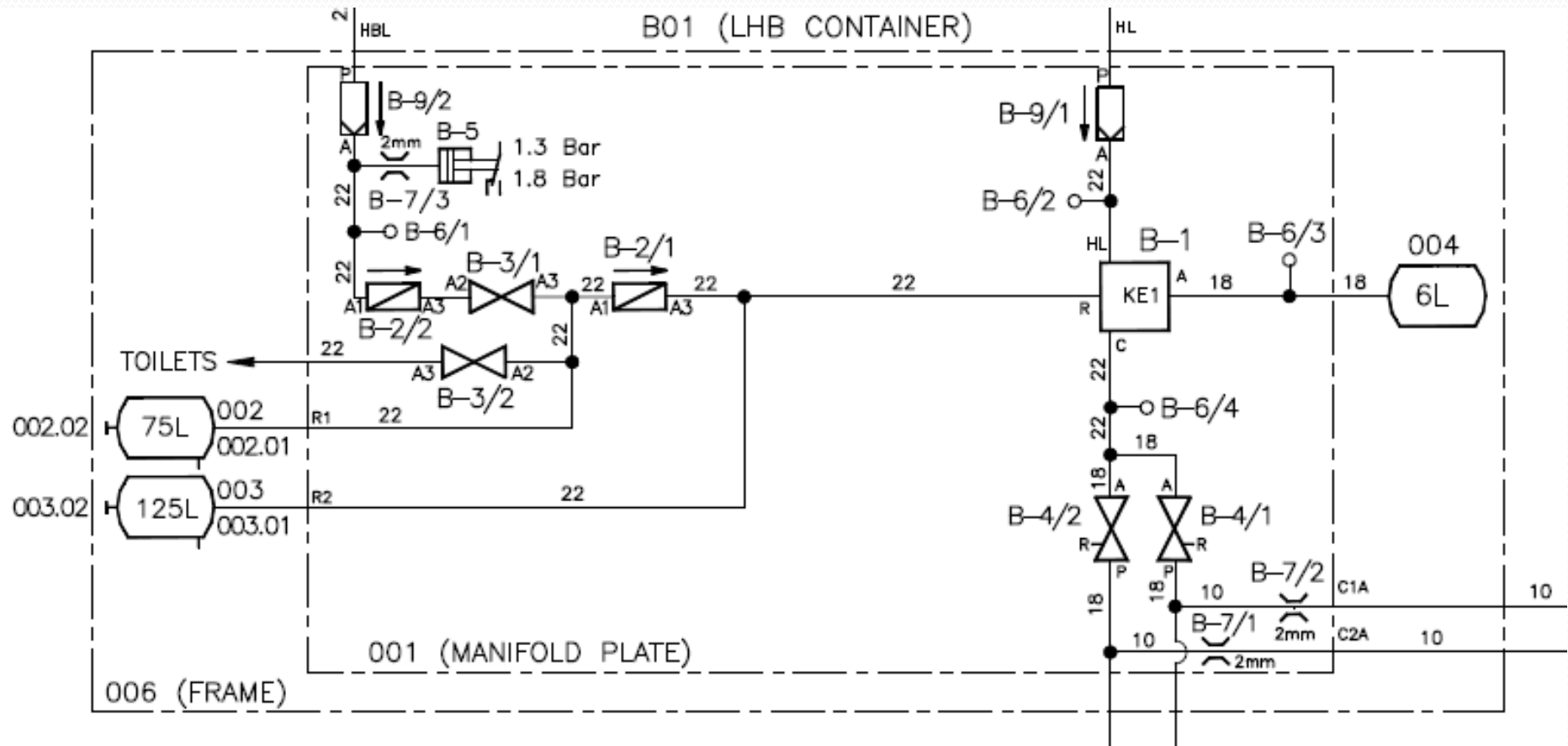
AIR FILTER FP

Monat
werk

Detailed Description

Module Plate:

- Module Plate (001) is a drill aluminium panel where main devices for brake control are mounted.
- The module plate and the air-reservoirs are installed into a Brake Container.
- This brake container is provided with mesh cover on all sides.



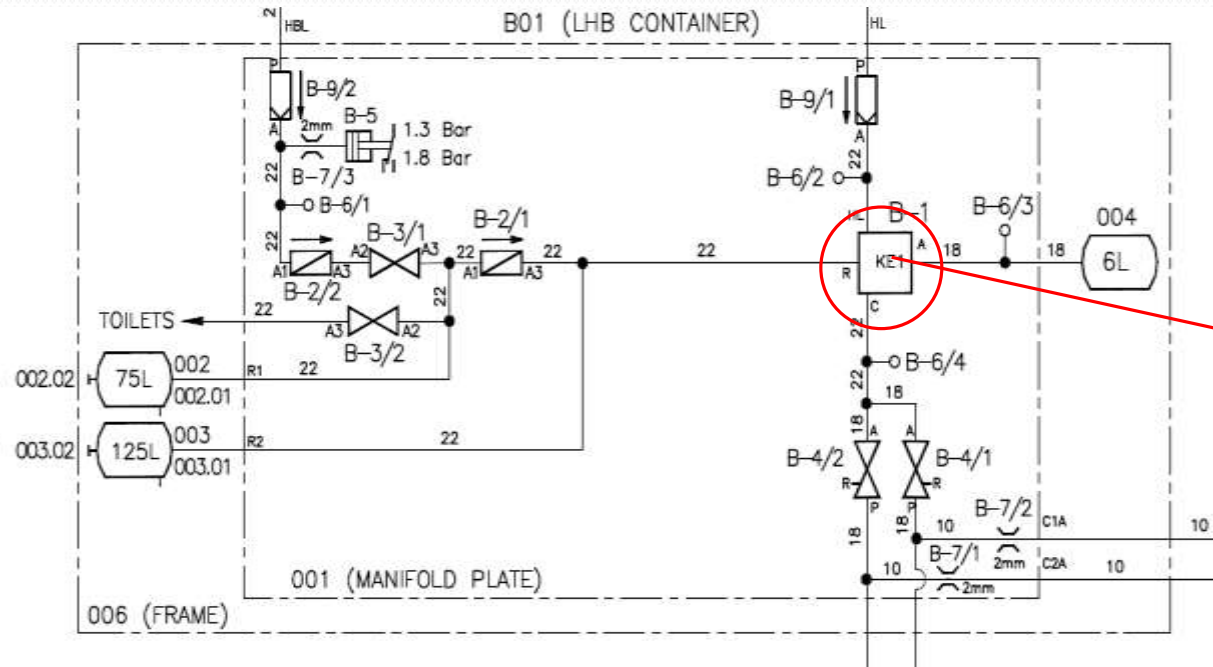
Distributor Valve:

The distributor valve KE1IPKSL is with pressure converter RLV-111d.

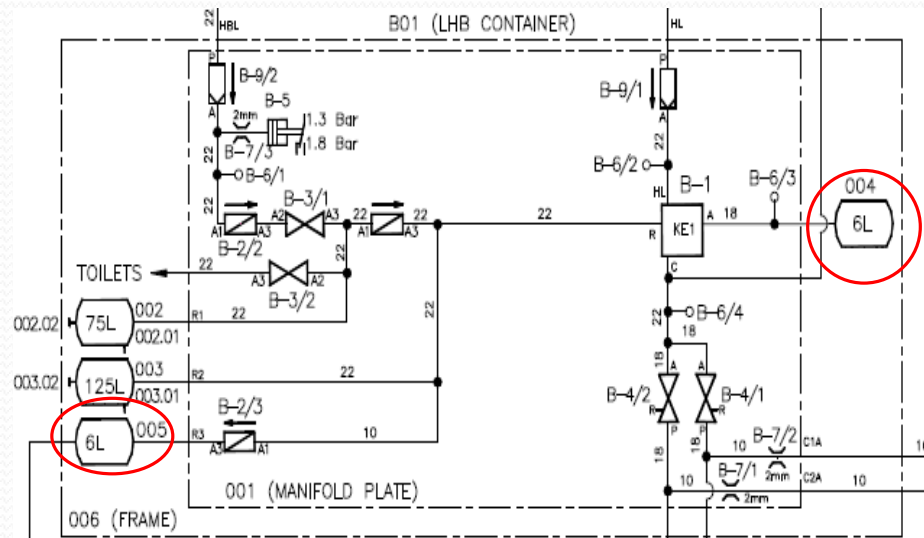
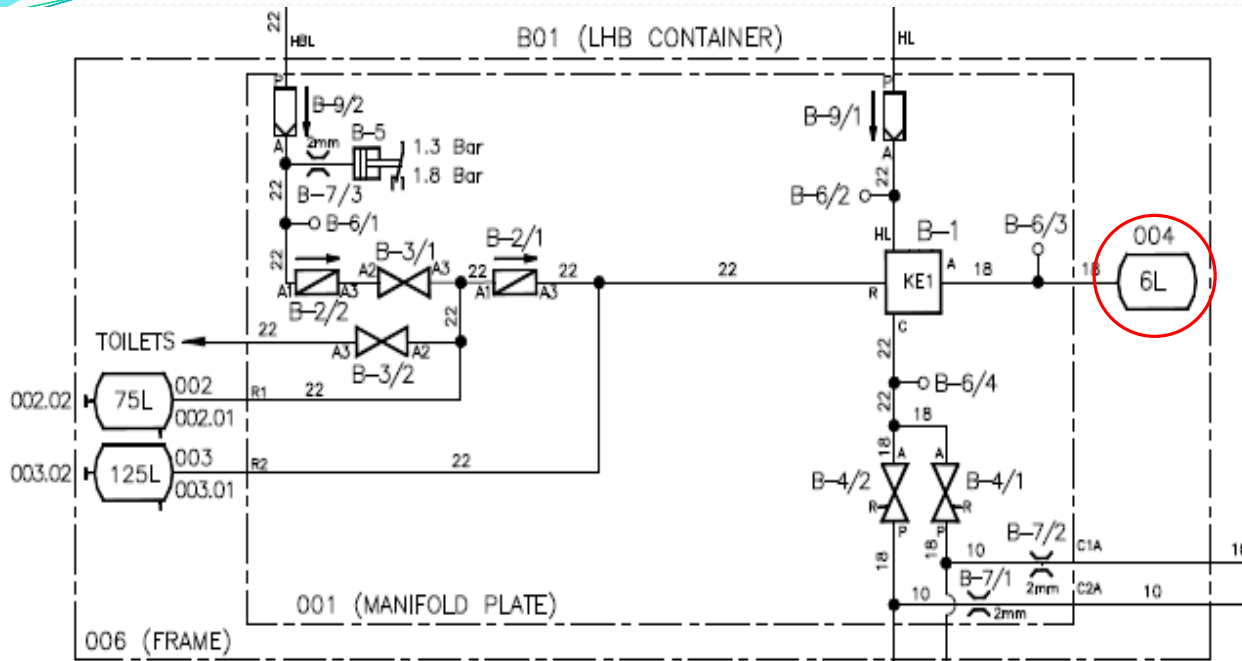
The pressure converter restricts the max brake cylinder pressure to 3.0 kg/cm².

It has a quick release device.

Also, if desired an EPZ-unit can be mounted to the valve body.
Presently used in Tejas Coaches having speed potential of 200 kmph.



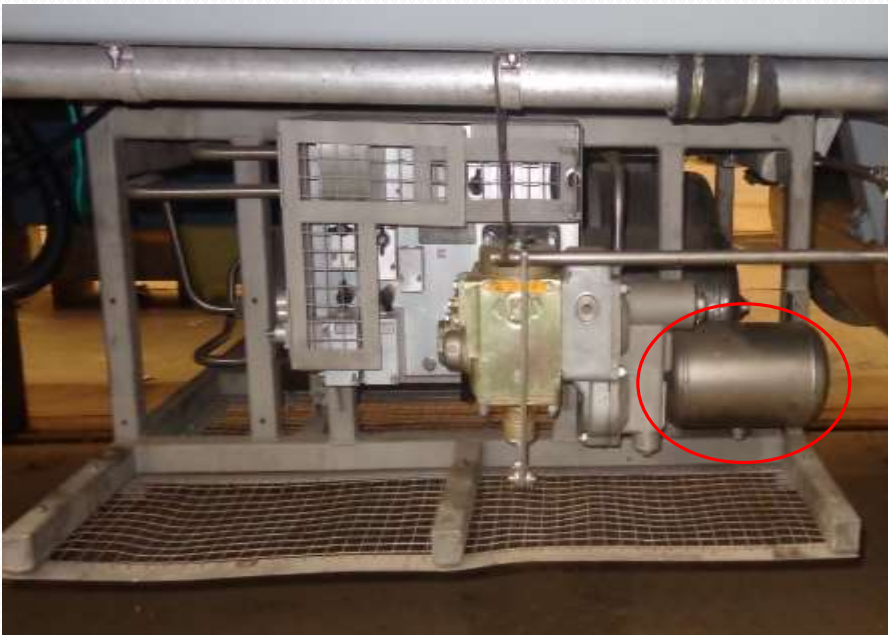
Control Reservoir:



Control Reservoir:

Reservoir 6 L – 1 nos. for hand brake (Power Car only)

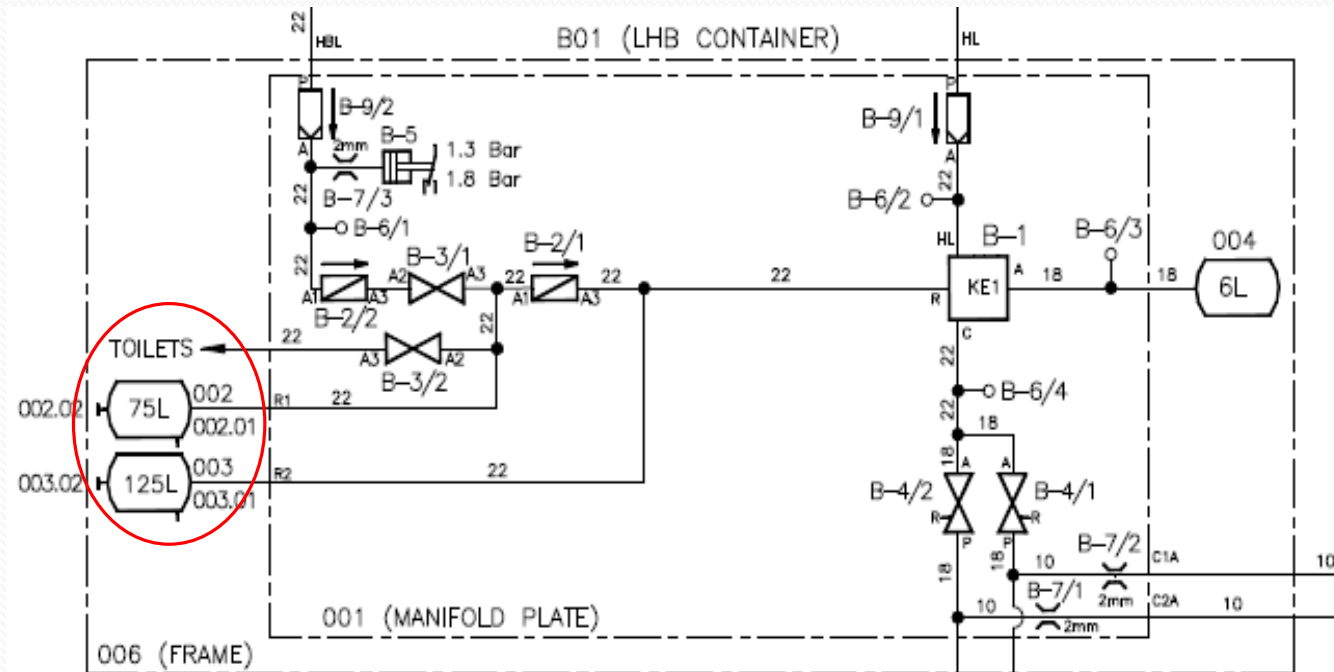
Reservoir 6 L – 1 nos. for control reservoir.



For PC

Air Reservoirs:

- Air Reservoirs – 2 nos. (125 L for AR & 75 L for Toilet System).

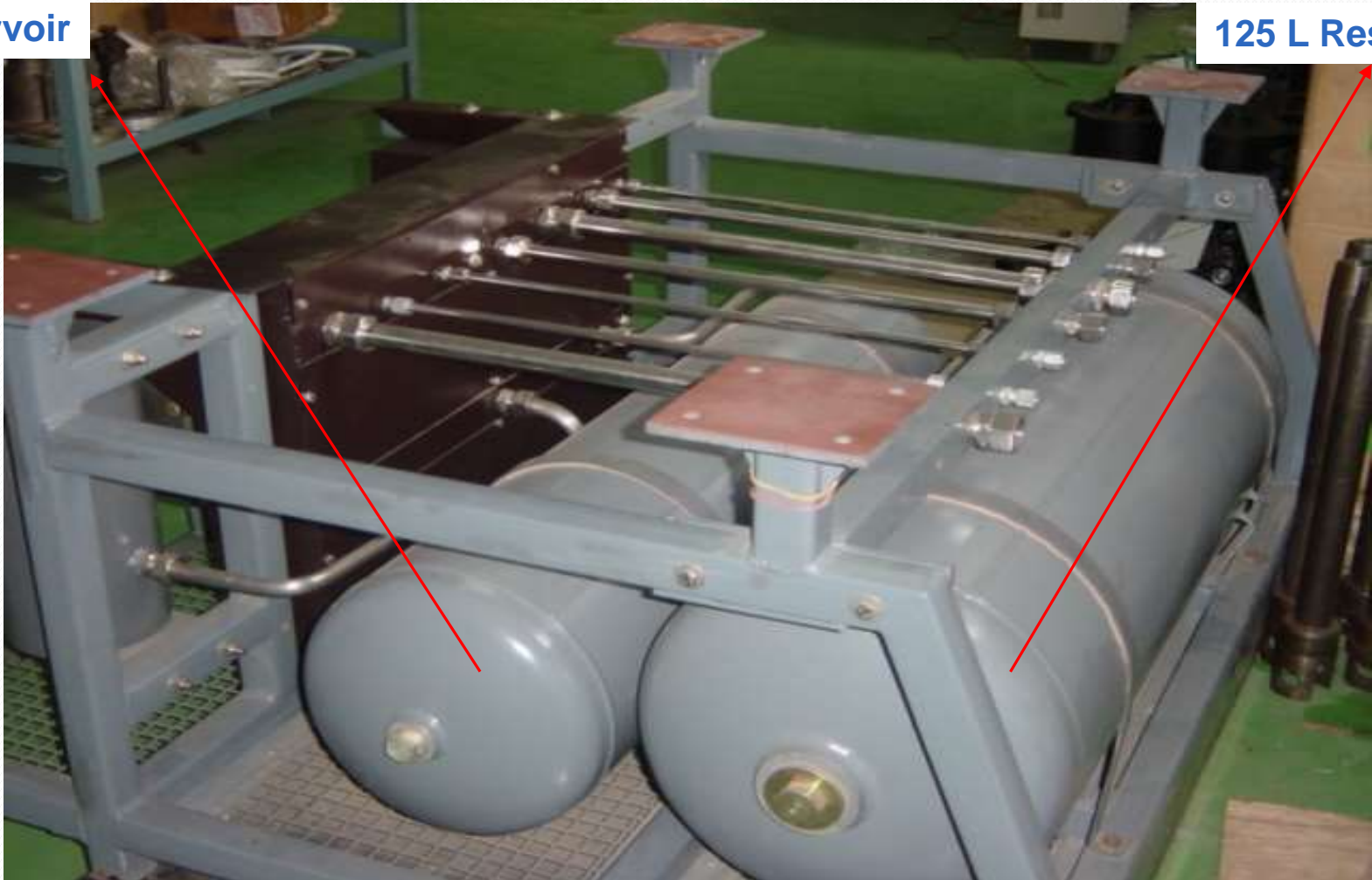


Air Reservoirs:

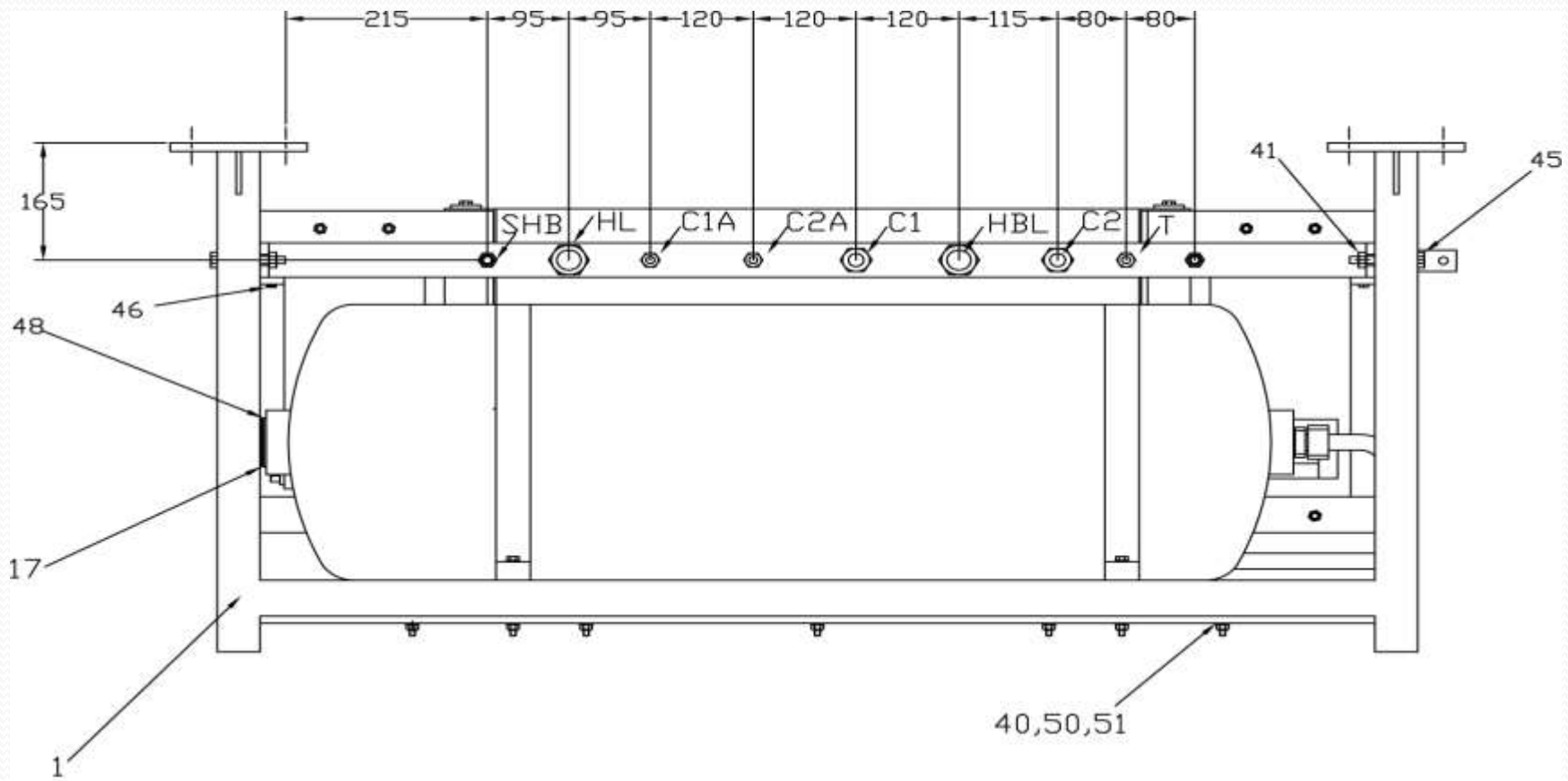
- Air Reservoirs – 2 nos. (125 L for AR & 75 L for toilet system).

75 L Reservoir

125 L Reservoir



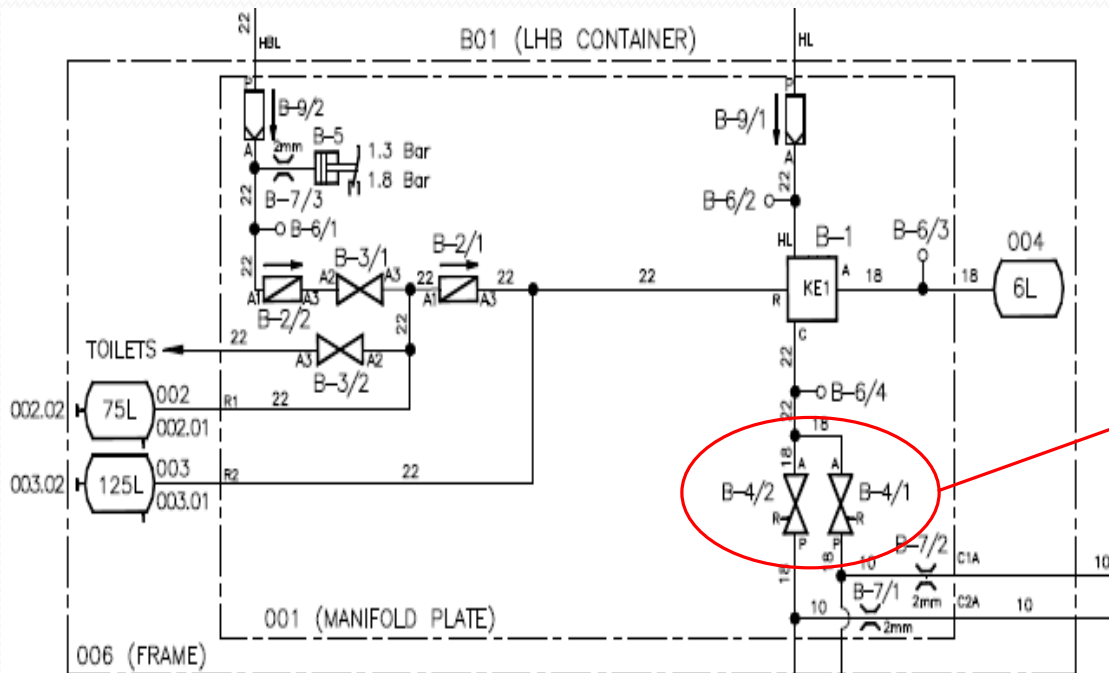
Air Reservoirs:



- DETATIL OF END CONNECTION: (GENERATOR CAR)
- HBL - FEED PIPE
 - HL - BRAKE PIPE
 - C1 - BRAKE CYLINDER-BOGIE1-C1
 - C2 - BRAKE CYLINDER-BOGIE2-C2
 - C1A - INDICATING DEVICE-BOGIE1
 - C2A - INDICATING DEVICE-BOGIE2
 - T - AUXILIARY SUPPORT PIPE(FOR TOILET)
 - MC - MANDMETER FOR C-PRESSURE.
 - SHB - SUPPORT FOR INDICATING DEVICE OF HAND BRAKE

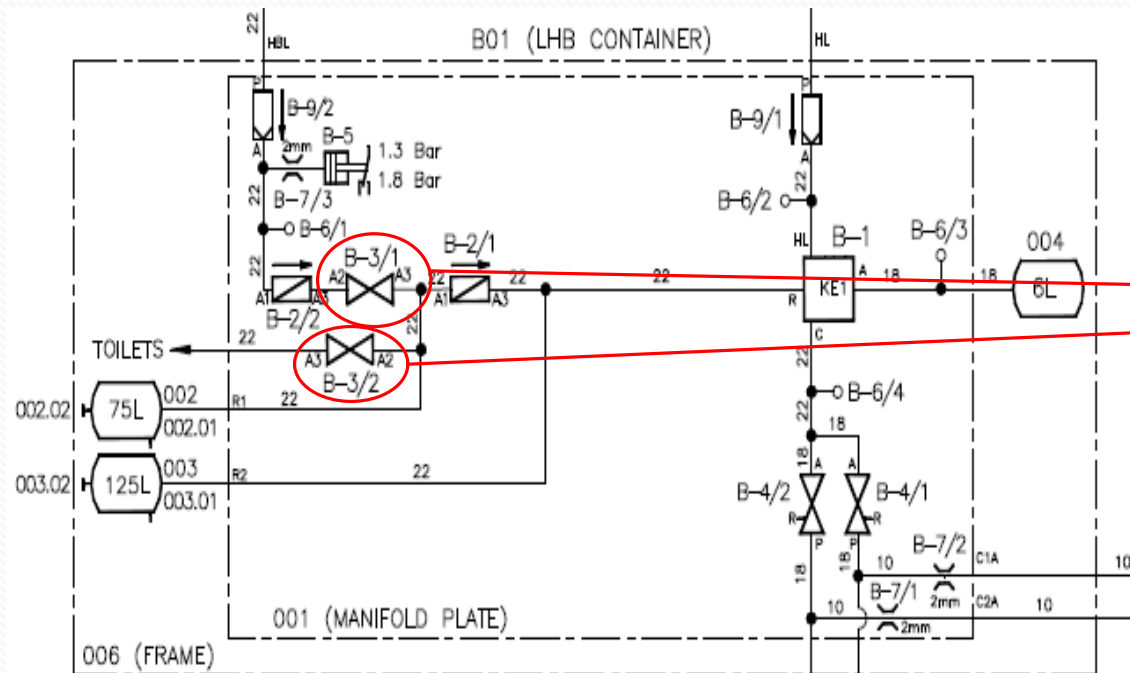
Bogie Isolation Cocks:

- Each bogie has its own isolating cock (B-4/1 or B-4/2) for brake isolation. In case of malfunction of one of the bogie brake equipment, the affected bogie can be separated from the whole brake system by turning the handle of corresponding isolating cock in off position.



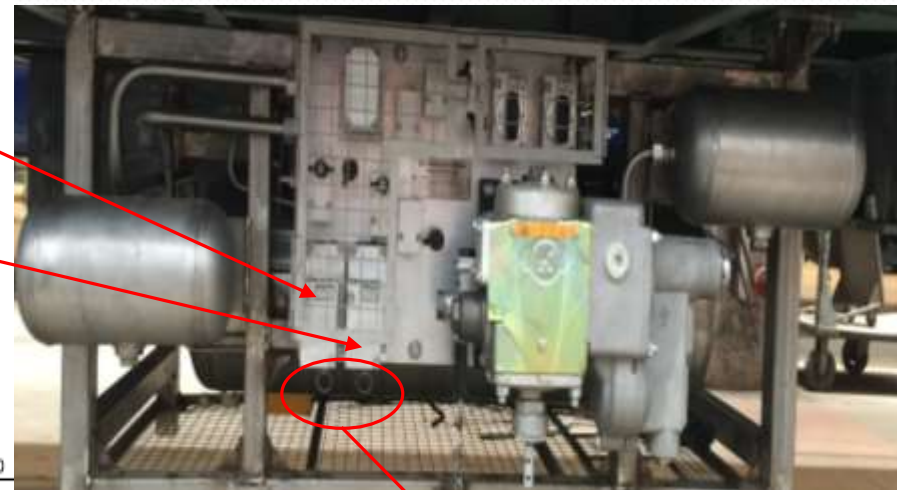
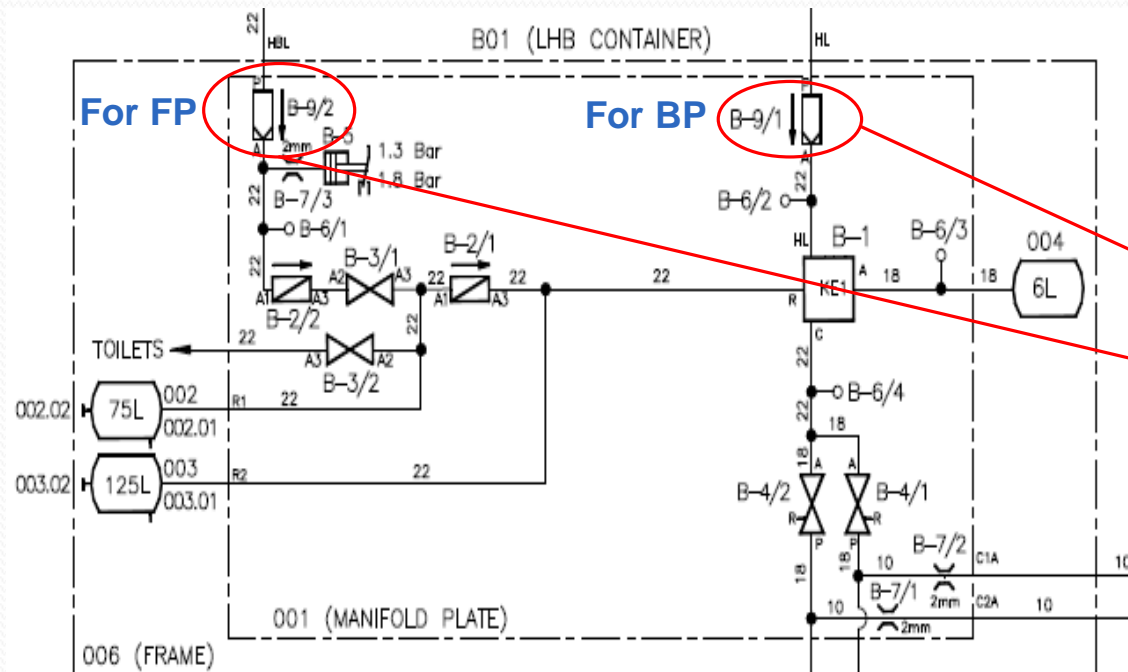
Isolating Cock:

Isolating cock (2 nos.) present for isolation of FP and Toilet



Filters:

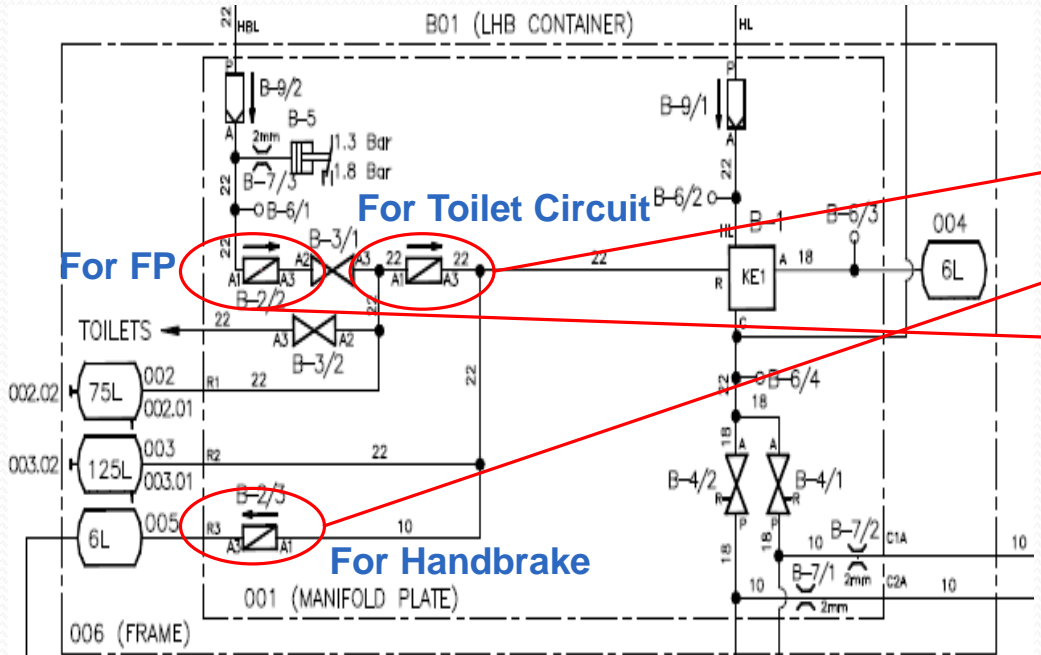
- Air Filters (2 nos.) present for BP & FP.
- The air from the feed pipe and the brake pipe passes through the filters (B-9/1, B-9/2) before it enters the module plate, to arrest the dust which could cause malfunctioning of the brake devices.



Water Drainage facility: Water can be drained with help of drain cocks without removal of filter.

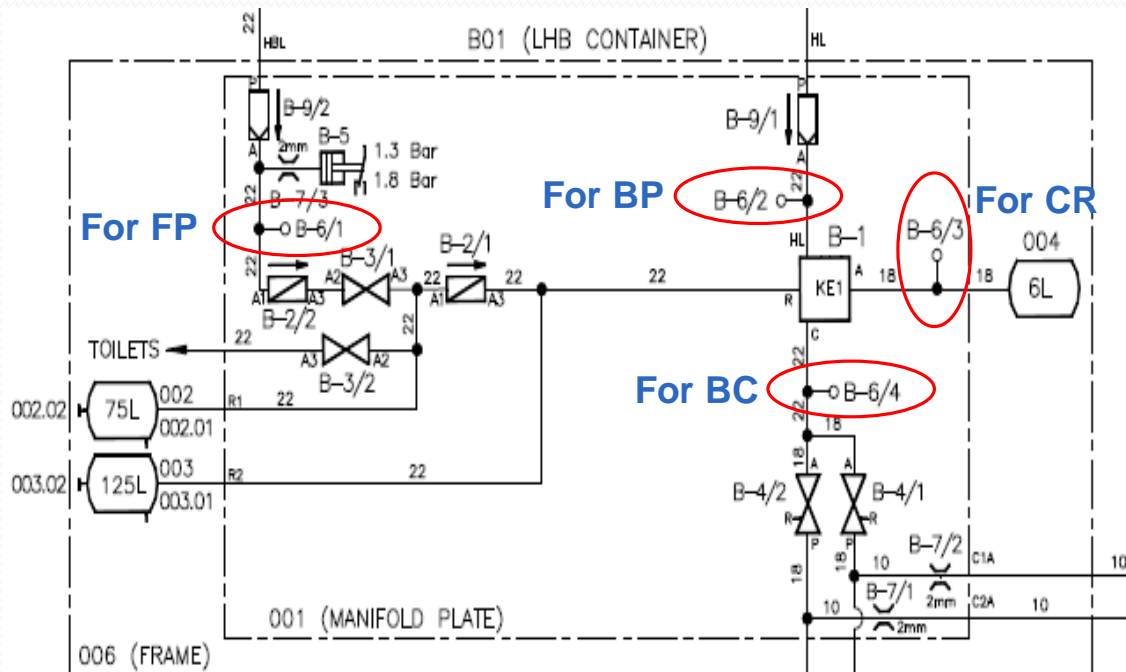
Check Valve:

- Check Valve (3 nos.) present for FP, Toilet & Hand Brake (only for Power Car).



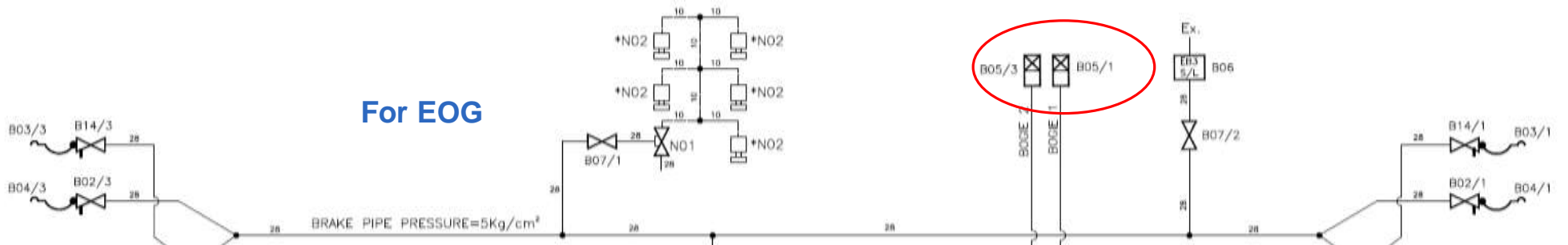
Test Fittings:

- The test point devices (B-6/1, B-6/2, B-6/3 & B-6/4) measure the pressure of FP, BP, CR & BC.

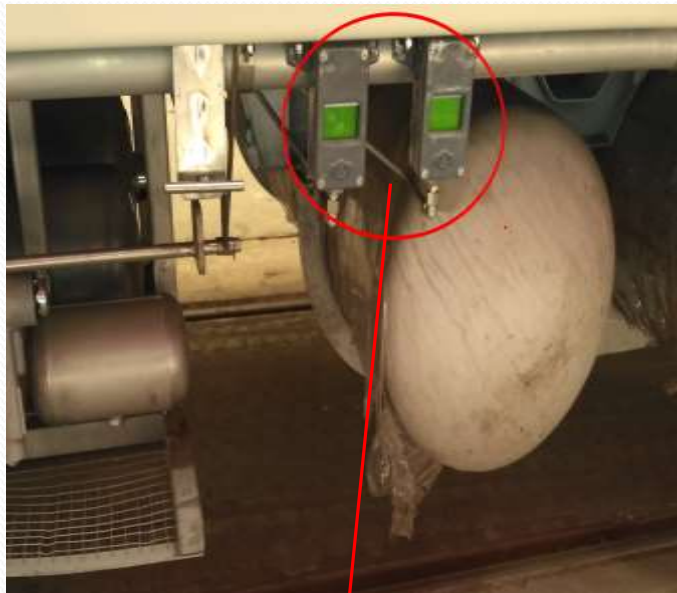


Brake Indicators:

- At both sides of the car-body there are indicators (4 for EOG & 6 for PC) which show for each bogie, if the pneumatic brake is actuated.
- 4 nos. for bogie brakes & 2 nos. for hand brake.
- Brakes Applied – **RED**;



Brake indicators



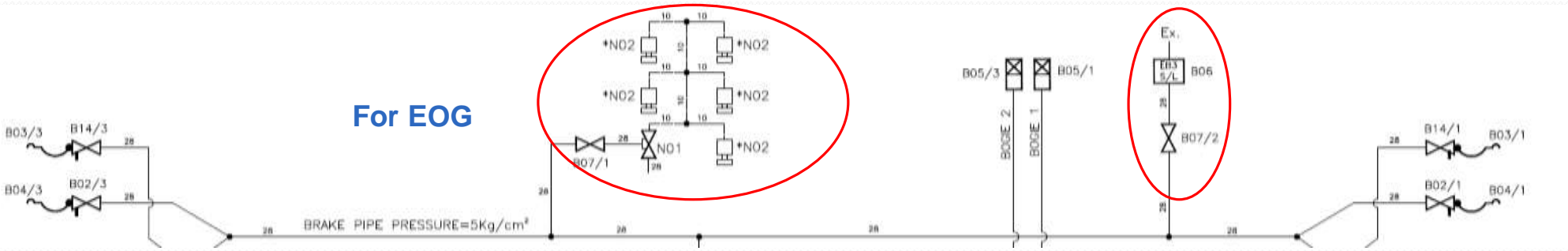
4 nos for EOG



6 nos for PC

Emergency Equipment:

- The guard emergency brake valve (N03) (only in generator cars) is directly connected to the brake pipe and vents the brake pipe, when being actuated.
- In each passenger coach emergency brake pull boxes (N02) are installed (five or more in each passenger car), which can operate the emergency brake valve NB12A (N01).
- If the handle of the emergency brake pull box is moved, the emergency brake valve NB12A (N01) starts exhausting the brake pipe via a large orifice.
- The emergency cock (B07/1) can be used to cut off the emergency brake valve (N01) in the case of malfunction.



Detailed Description



Emergency Brake Accelerator



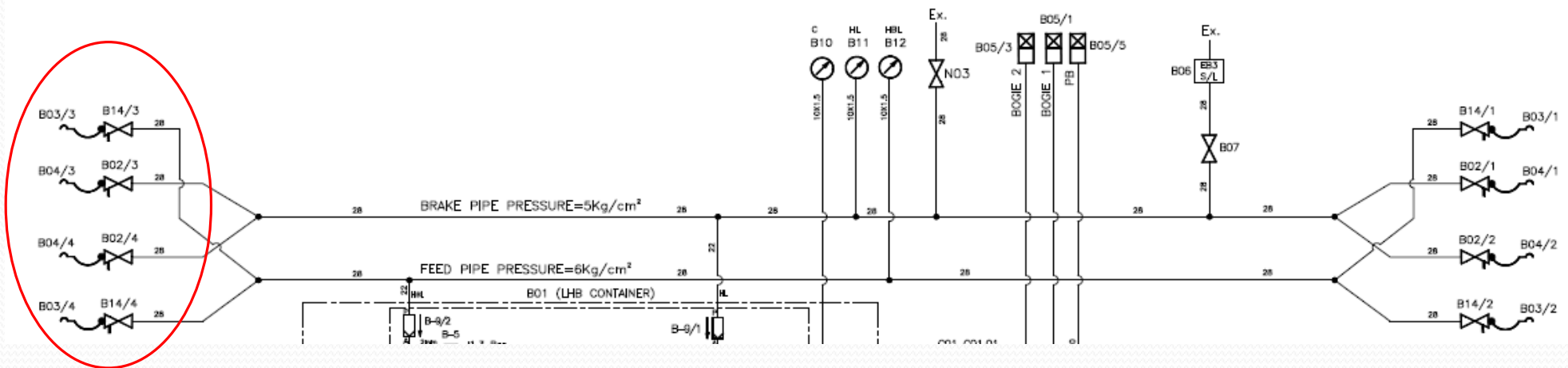
Passenger Emergency Brake valve

Passenger Emergency Pull Box:



Angle Cock & Hose Coupling:

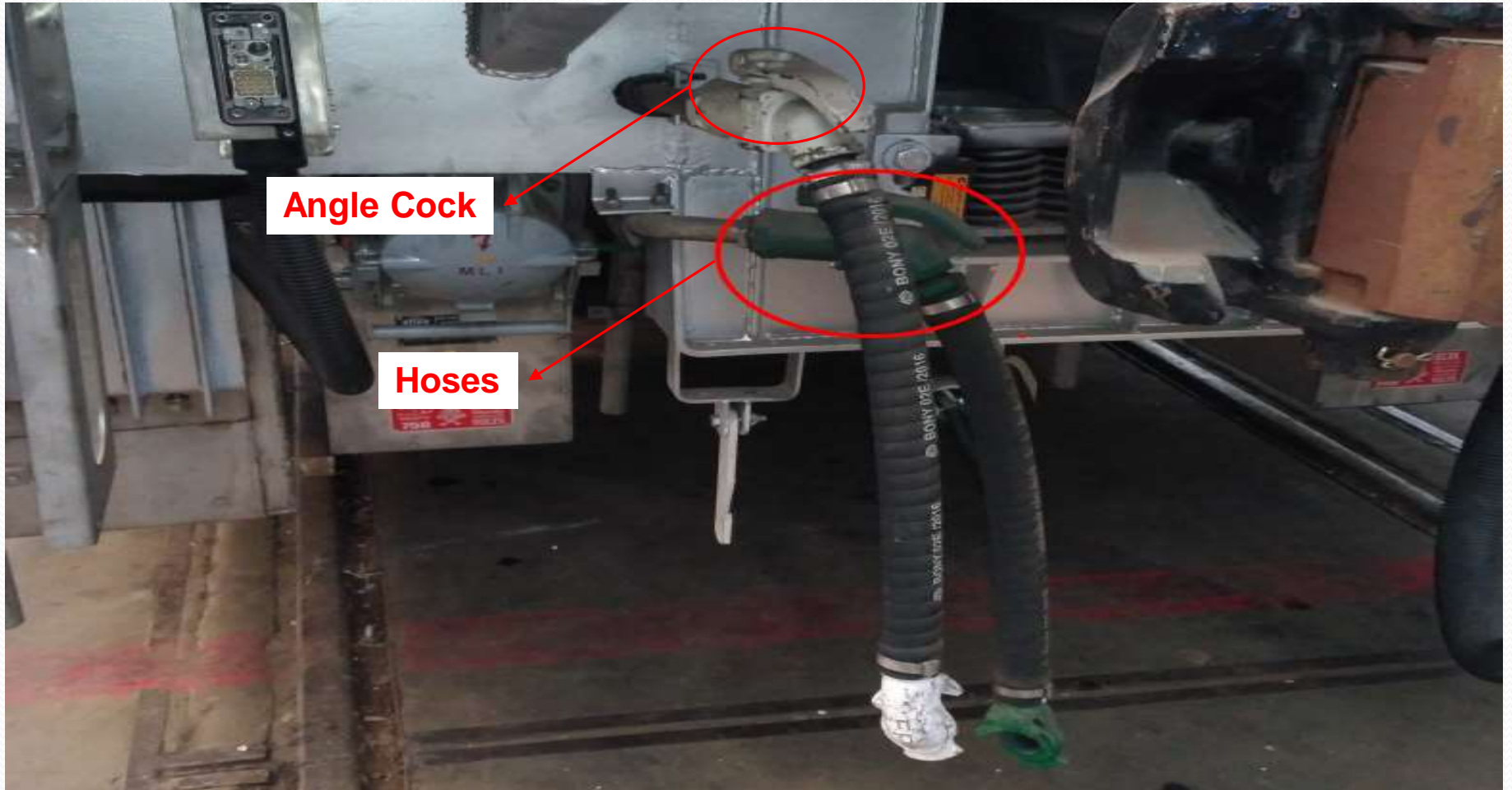
- Twin pipe graduated release air brake system with 25 mm bore dia of BP/FP at 5 & 6 kg/cm² operating pressure respectively.
- At each end of the pipe, an angle cock (B02, B14) and a brake pipe coupling / feed pipe coupling (B03, B04) is fitted to connect the pipes to the adjacent car.



Angle Cock & Hose Coupling:

Angle Cock (4 nos.)

- Brake Hose Coupling (2 nos. for BP & FP)



Equipment's on Bogies

1. Hose connections:

- 4 Nos (To Connect BC line to each axle)
- 8 Nos (Bifurcates BC to each brake cylinder)

2. Brake calipers (Type UP10):

- Qty required: 8 Nos (4 nos per bogie-2 LH and 2 RH)
- Suitable for Fitting UIC type 200x2 square pads of thickness 35 mm
Calipers shall give effective brake radius of 247mm

3. Brake cylinder (Type UP-10X):

- Compact construction
- Auto slack adjuster
 - Brake shoe clearance due to wear corrected Automatically by single acting slack adjuster
No manual adjustment required after brake pad replacement.
- Piston stroke: 21 mm (max)
- Slack capacity: 160mm (min)
- Cylinder size: 10 inches
- Max BC pressure: 3.0 kg/cm² and in High Speed 3.8 kg/cm²

- **Brake pads**

- Quantity per coach:
- Wear limit

35mm thick and 200 Cm²
(Composite type)
32 Nos. (16 LH & 16 RH)
(16 on each bogie-2 on each caliper)
28mm max.(7 mm remaining)

- **Brake Disc:**

- Quantity per coach
- Disc dimensions
- Condemning Limit-
- Material: -

- 8 Nos (two per axle)
- 640X110 mm
640 X 96 mm
Grey cast iron

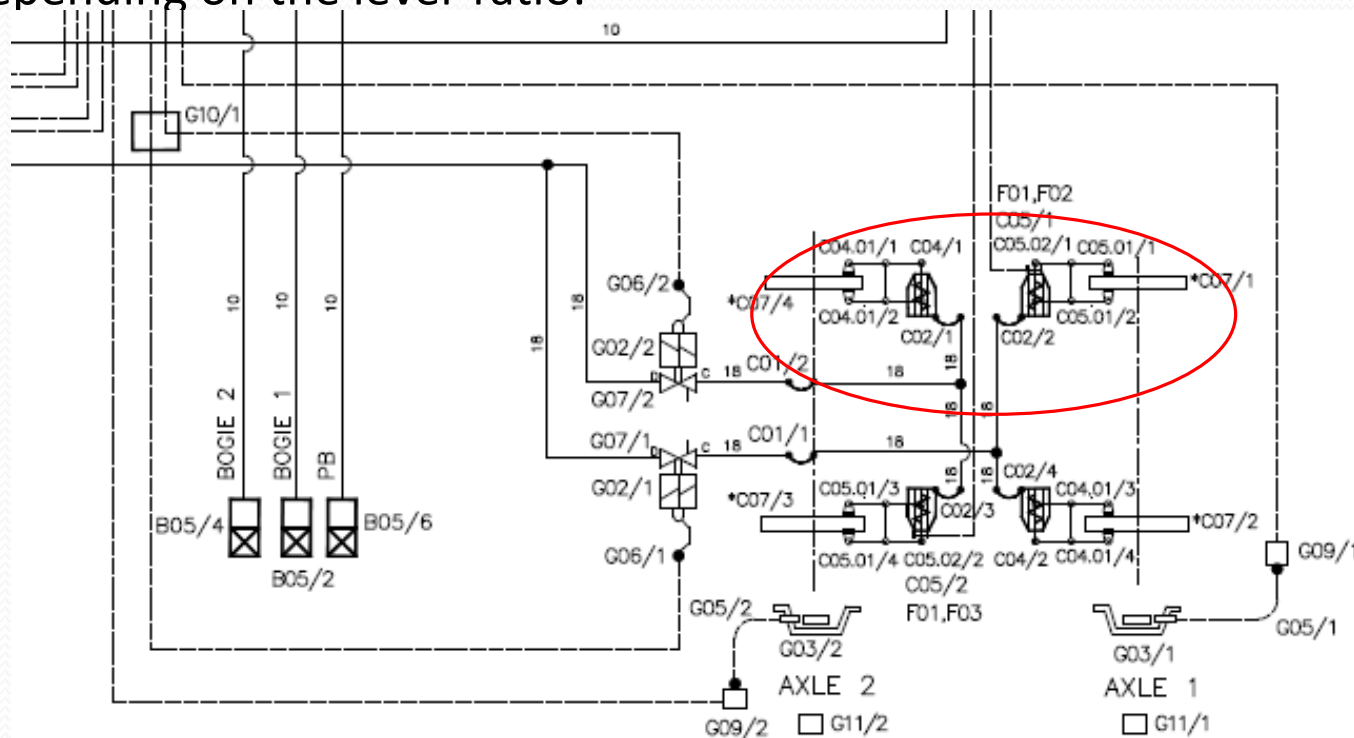
- **Speed Sensor cable with pole wheel (80 teeth):**

- 4 Nos.
- Gap between speed-Sensor and pole wheel

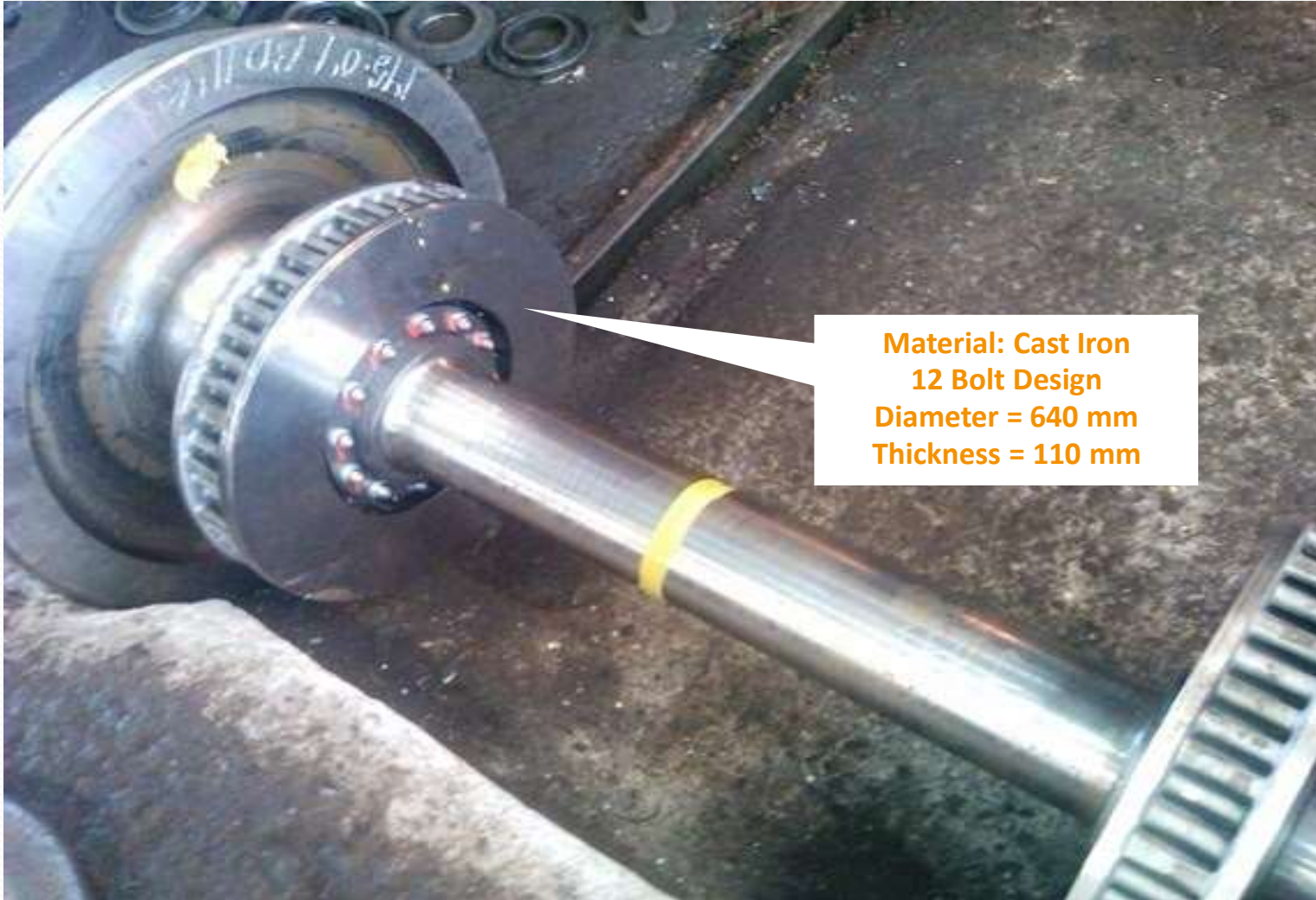
- One per axle)
- 0.9 to 1.5 mm

Bogie Mounted Brake Equipment

- Each bogie has two axles, each is equipped with two grey cast iron brake discs instead of the conventional system of brakes at wheel treads.
- The brake energy is dissipated only at the axle mounted brake discs (C07), so that the wheel set is only stressed by the weight of the coach.
- The braking force is generated for each disc by a brake caliper unit (C03, C04, C05), which consists of a brake cylinder (type UP10) and the brake caliper amplifying braking cylinder force depending on the lever ratio.



Brake Disc:

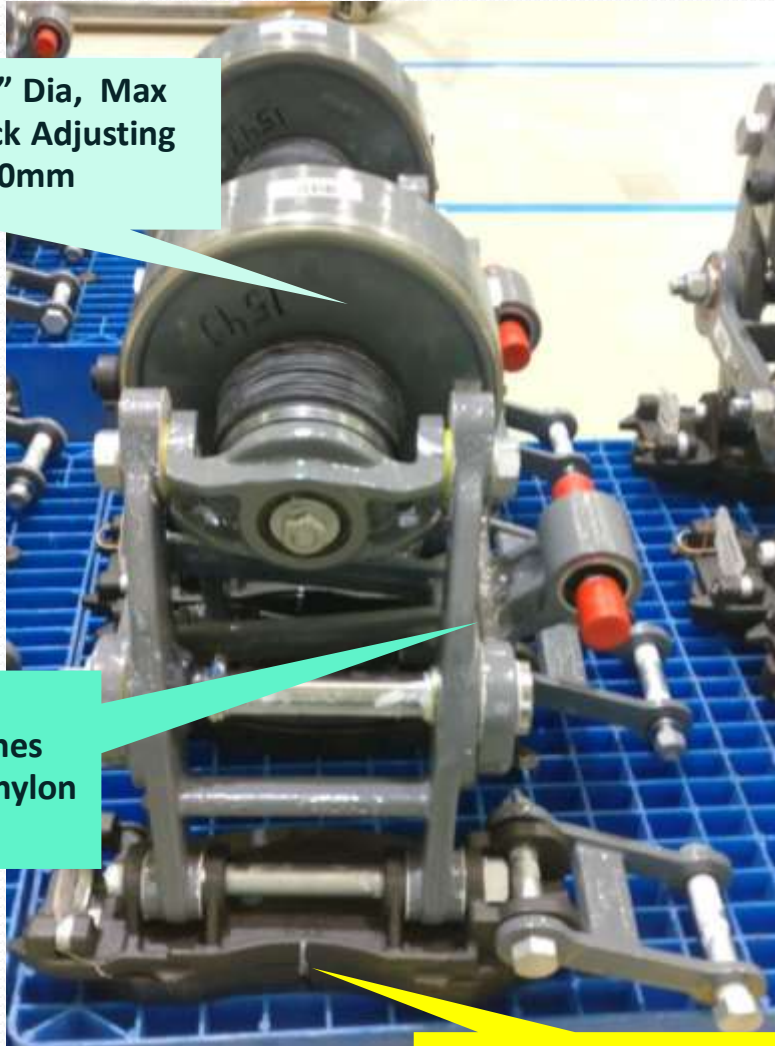


Detailed Description

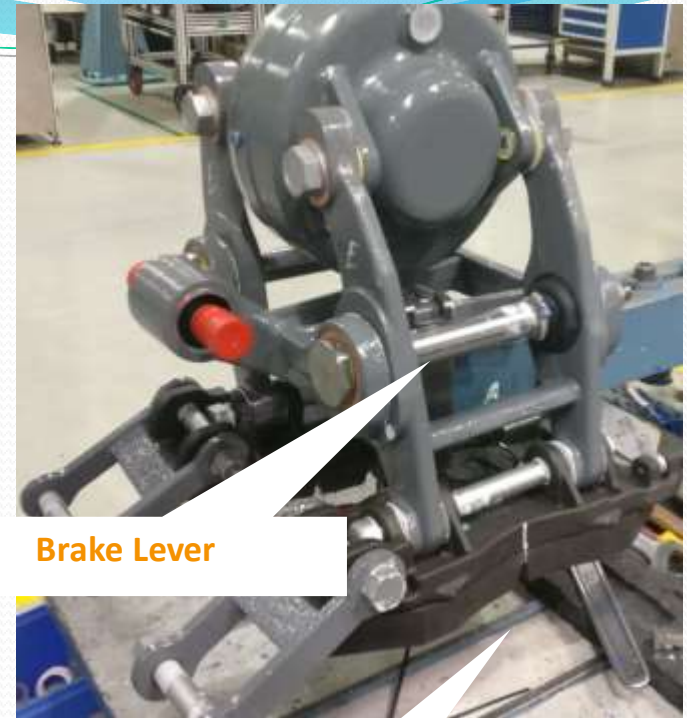
Brake Caliper Unit:

Brake Cylinder 10" Dia, Max Stroke 21mm, Slack Adjusting Capacity 120mm

Self Lubricating
Non- Metallic Bushes
Devlon – polyamide- nylon
6



Brake Pad Holder



Brake Lever

Brake Pad

Rigging Ratio:

For EOG = 2.17 = $(2 \times 177 / 163)$

For PC = 2.48 = $(2 \times 188 / 152)$

BOGIE EQUIPMENT CONSISTS OF

Brake Calipers with Pads



Brake Caliper Pads:

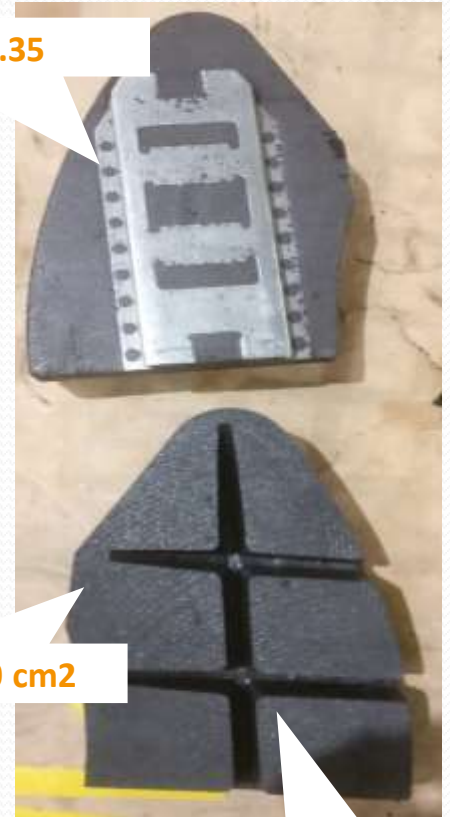


Lock Spring

Snap Lock Gate

Type: Organic

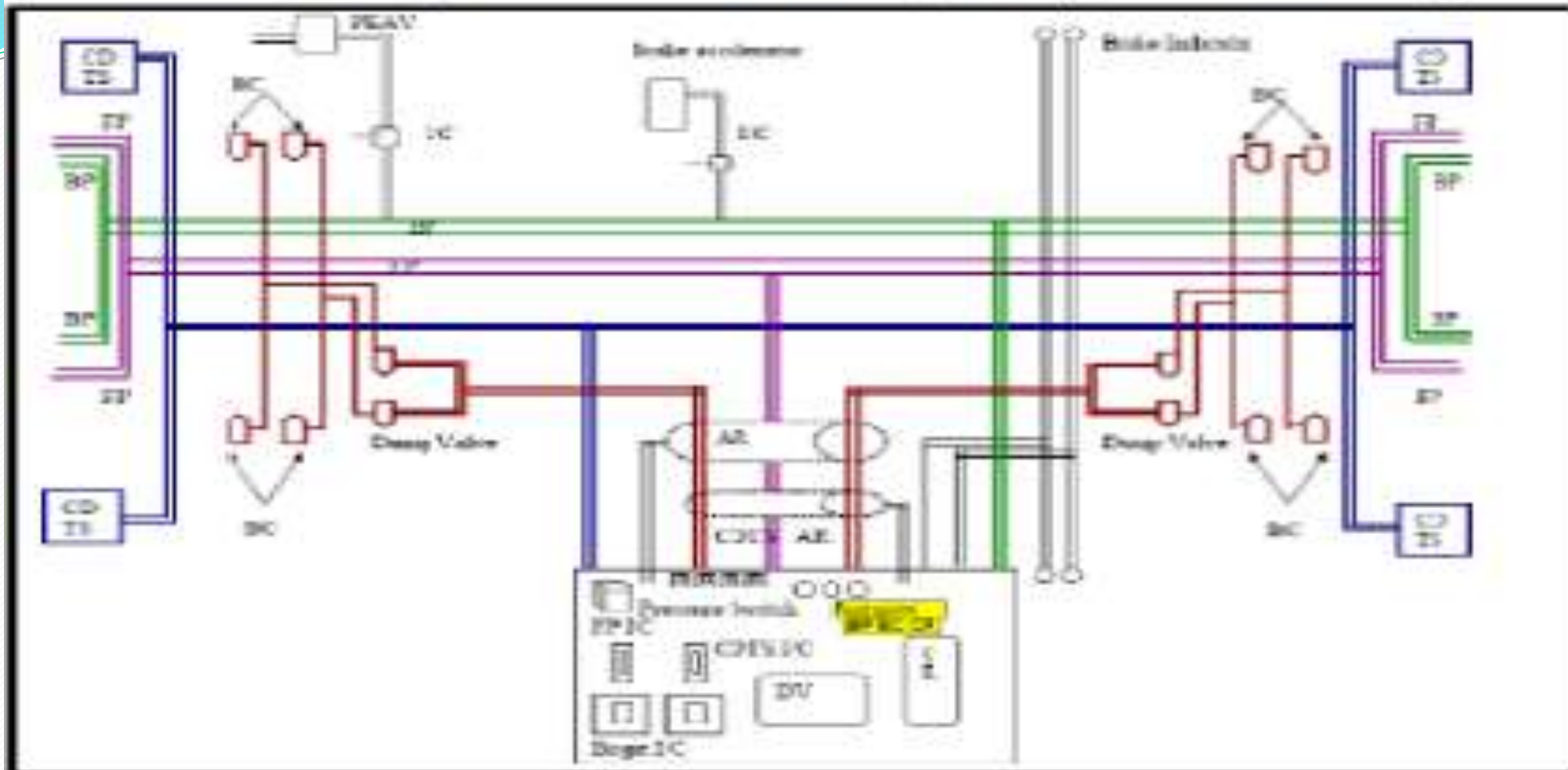
Friction Coefficient = 0.35



Contact Area = 400 cm²

Brake Pad Thickness = 35 mm

Schematic diagram of LHB Air brake system (KNORR BREMSE)

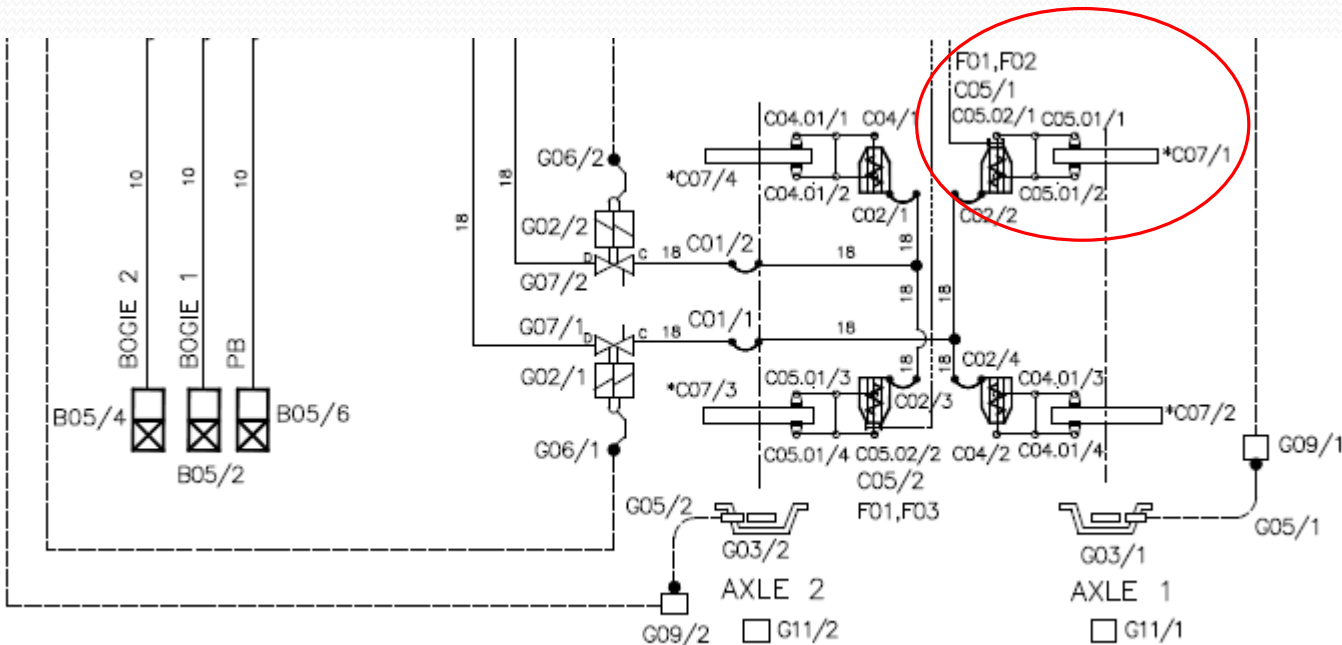


Hand Brake Arrangement with Flex Ball Cable consists of

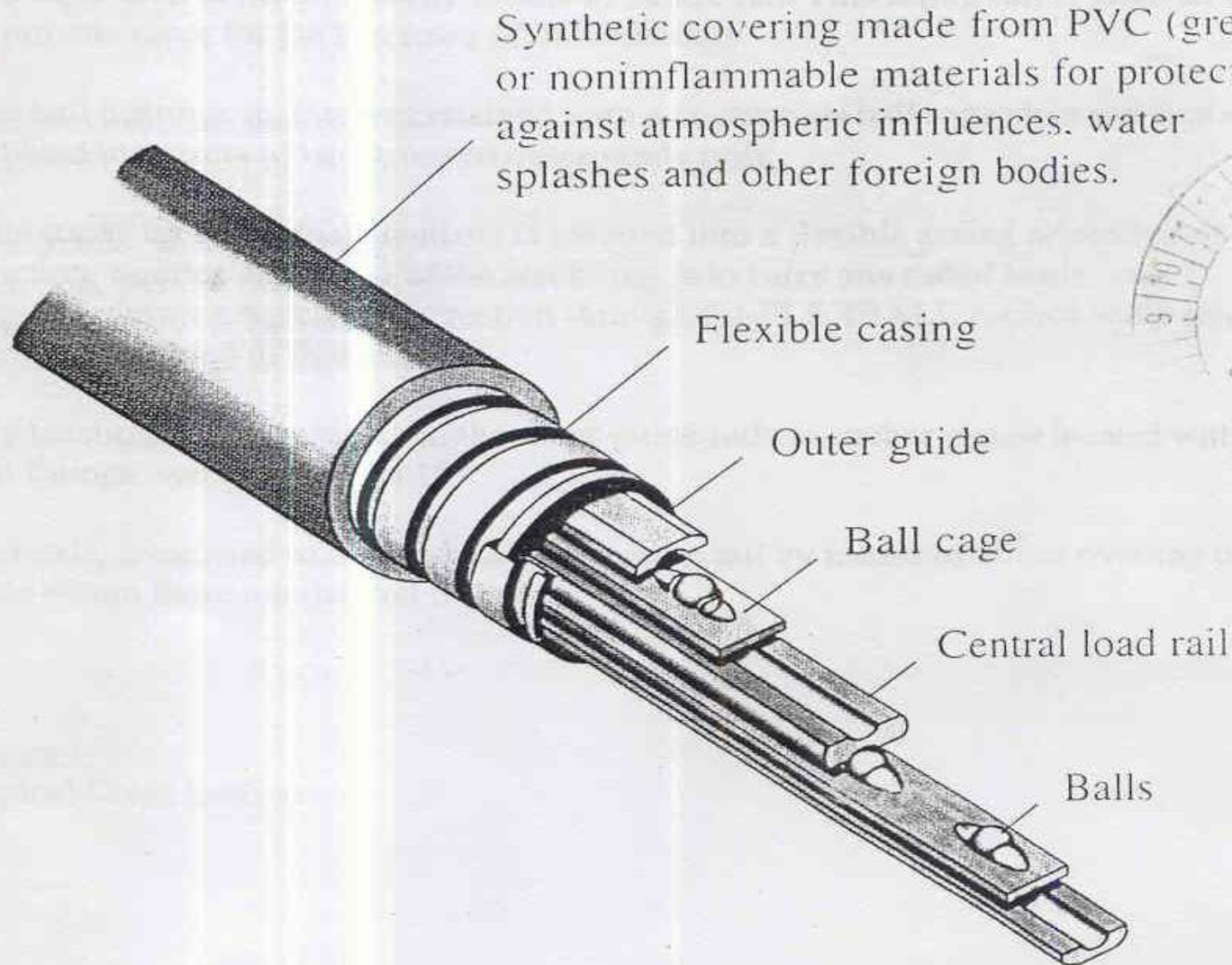
- Flex ball cables of suitable lengths (3 types) :
 - Length = 2197mm - 2 nos. per coach
 - Length = 4024 mm – 1 nos. per coach
 - Length = 2333 mm – 1 nos. per coach
- Brake calipers with hand brake arrangements (2 nos. on 1 bogie mounted diagonally opposite to each other)
- Check Valve (on brake control panel)
- Pressure tank (6L on brake control panel for actuation of indicator)
- Roller lever valve
- Indicators (on side of coach on power car only)

Hand Brake (Power Car only),

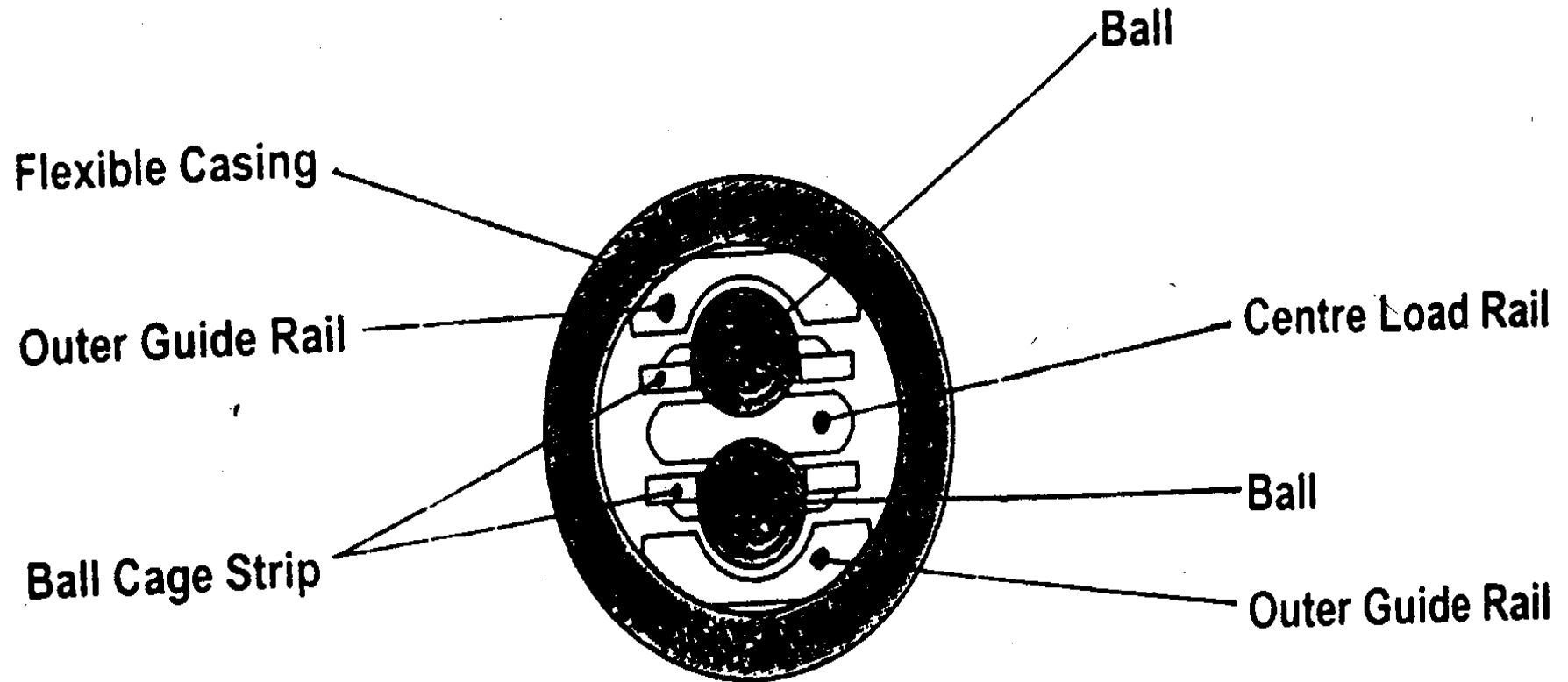
- To actuate the hand brake, two calipers on the Power car are equipped with hand brake actuating devices named as flex-ball (F01-F02, F01-F03).
- When the hand wheel of power car is turned, flex-ball cables directly move two brake calipers
- These flex-ball cables are directly connected to hand wheel to apply on bogie.
- The rotation of hand brake wheel, actuates the roller lever valve, thereby turning the hand brake indicator to red.



Flex-ball Cable (Remote Control)



Cross-Section View of Flex-ball cable



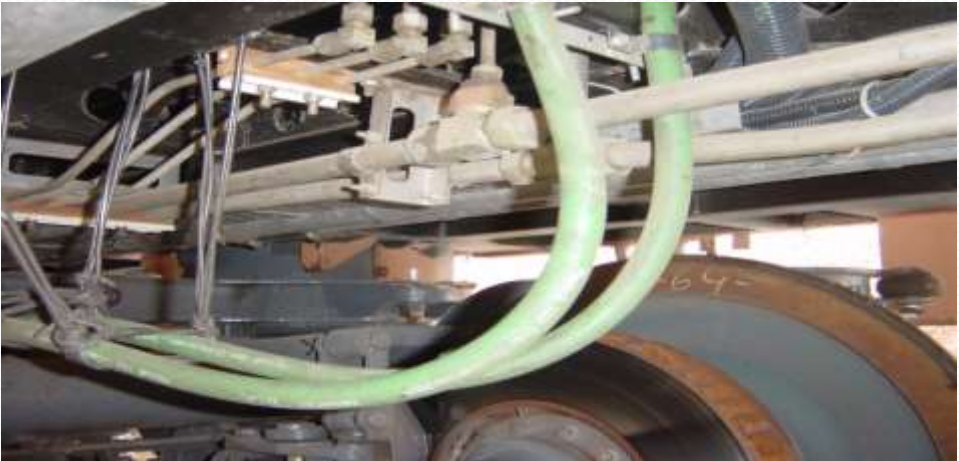
Detailed Description

Brake Cylinder for Hand Brake Arrangement



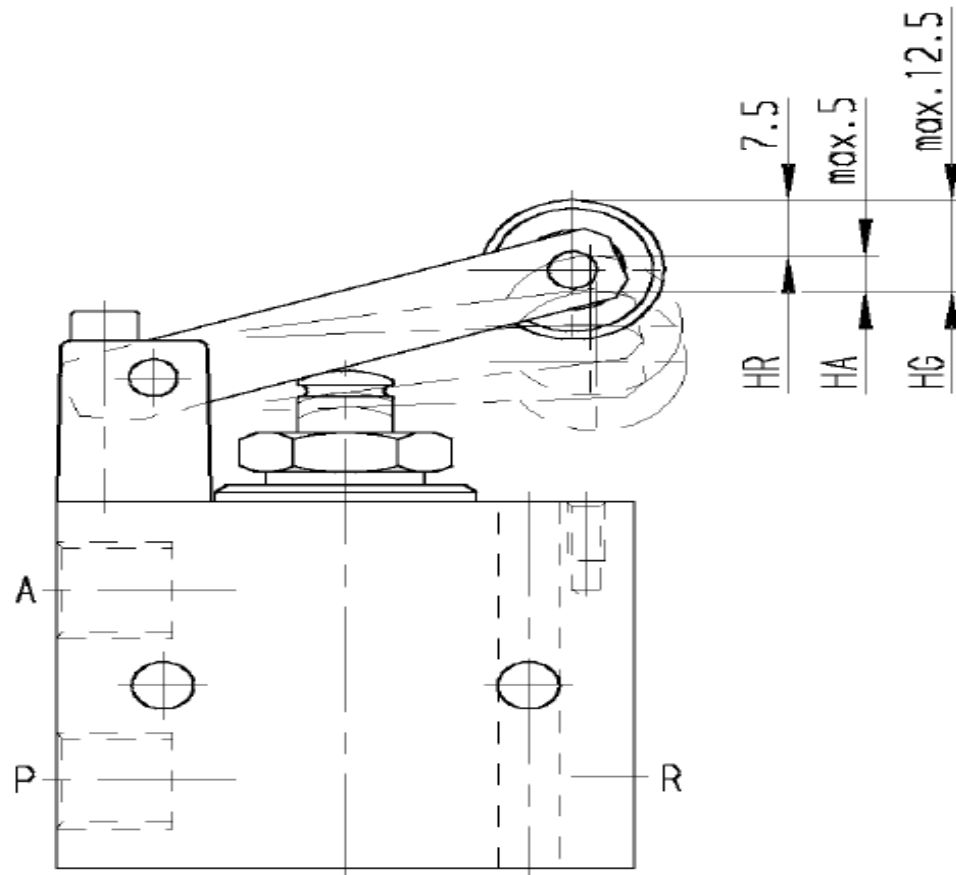
Detailed Description

Flex ball cables (Power Car only)



Roller Lever Valve

- When the hand brake wheel is operated, the roller lever valve (B08) indicates this action and air stored in reservoir flows through the roller lever valve to the indicators.



Hand Brake Operating Wheel (Power Car only)



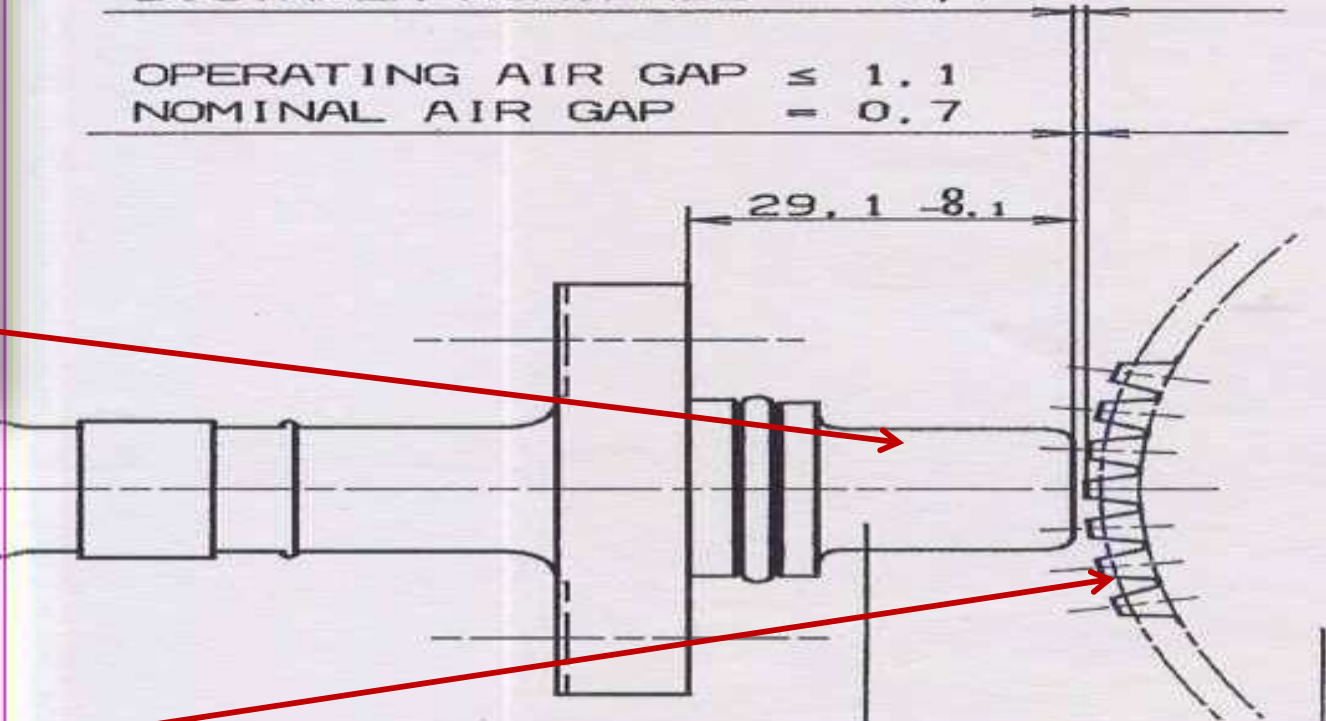
Mounted in Guard's Cabin

SPEED SENSOR WITH POLE WHEEL



DISTANZA DI LAVORO $\leq 1,1$
DISTANZA NOMINALE = 0,7

OPERATING AIR GAP $\leq 1,1$
NOMINAL AIR GAP = 0,7



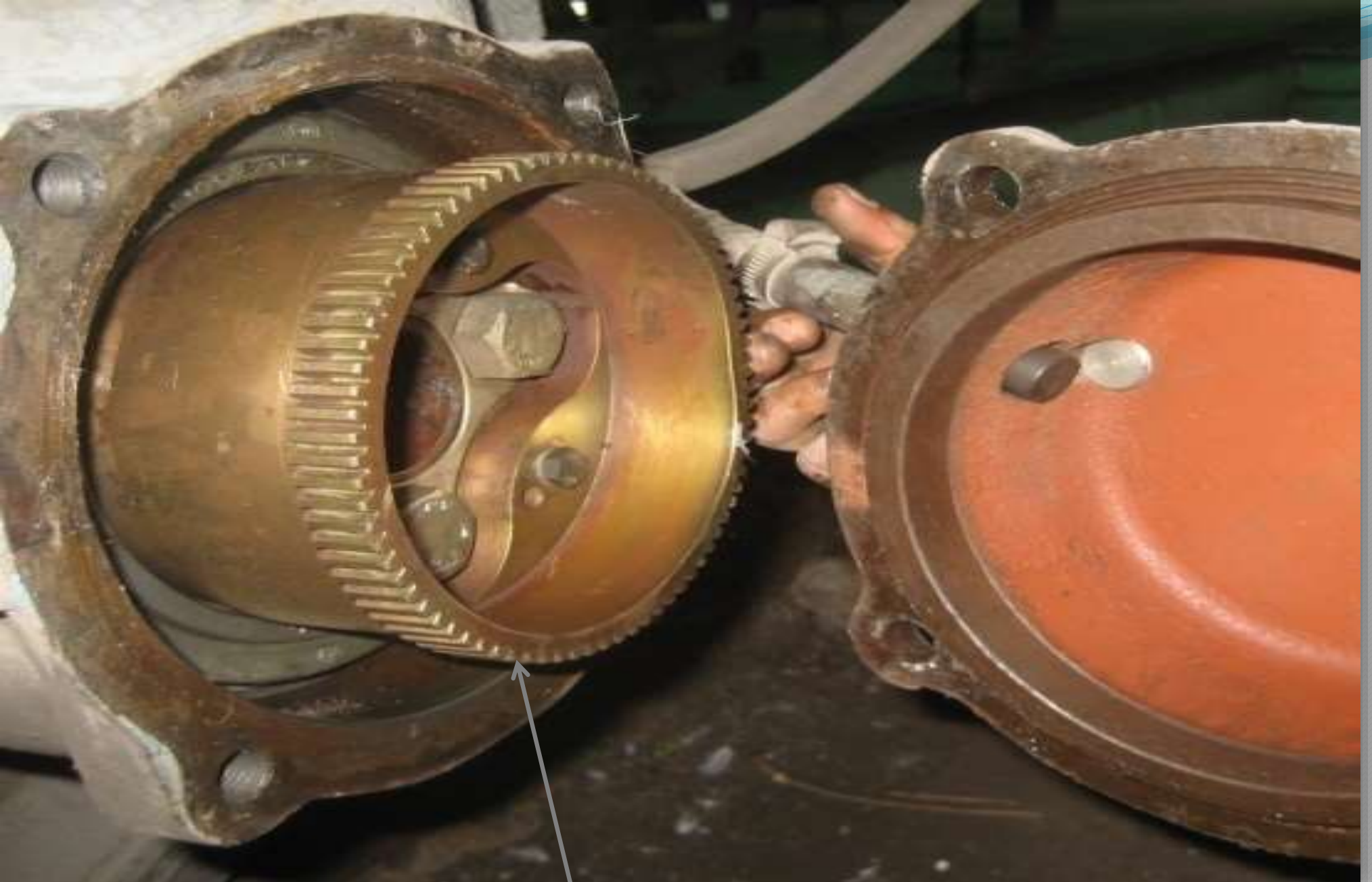
CAPTATORE DI VELOCITA'

SPEED SENSOR

RUOTA DENTATA

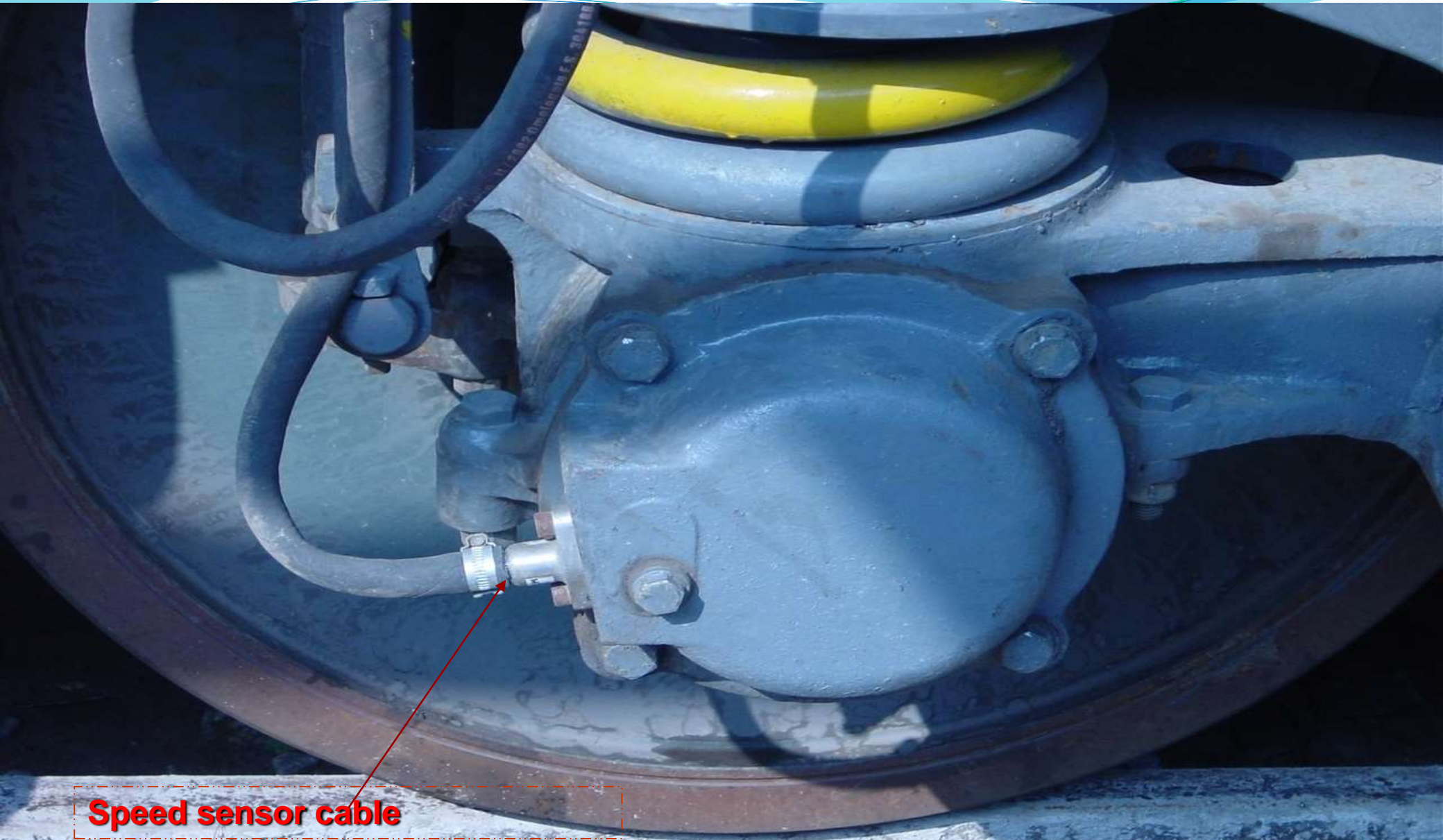
TOOTHED WHEEL





PHONIC/POLE WHEEL 80 TEETH

SPEED SENSOR CABLE WITH POLE WHEEL



Speed sensor cable

Equipments Inside the coach:

- **WSP micro processor (Electronic unit)**
- **Emergency Brake Pull Boxes**
(one in each cabin & Two in Chair Car) No Pull Box in Power Car
- **Emergency brake valve (in guard cabin) is directly connected to BP and vent it when being actuated (vent the pipe quickly).**
- **If handle of pull box moved then the brake valve exhausts the BP via PEAV through a large orifice up to 3 bar and retains 2 bar in brake pipe.**
- **Emergency brake light outside the coach will be activated by using the pull box, which is equipped with an electrical switch.**

Equipment on car body:

- ☞ **Angle cocks** : 4 Nos.
(At coach ends on BP and FP Pipes)
- ☞ **Brake and feed pipe coupling** : 4 Nos. (2BP and 2 FP)
- ☞ **Brake application and release indicators** : 4 Nos (2per Bogie-2 on each side of the coach)
- ☞ **Antiskid valve (Electro-valve)** : 4 No (2 per Bogie or one per Axle)
- ☞ **Terminal Box for speed sensor cable** : 4 Nos
- ☞ **Terminal Box for Antiskid valve** : 4 Nos

⇒ **Emergency brake valve**

:1 Nos.

⇒ **Emergency Brake accelerator**

:1 Nos.

⇒ **Mounted in brake pipe. If any fast pressure reduction in BP, equal to emergency brake application it support this pressure reduction and vents the BP via a large orifice. This causes an equal BP reduction speed over the whole train in BP, so the actuation speed of the Brake cylinders at the end of a train will be as fast as in coaches near the actuation point.**

⇒ **Brake Pipe and Feed Pipe size OD 28mm running through the coach and 22 mm 18 mm and 10 mm pipes are used for Air Spring, Brake Cylinder and toilet respectively.**

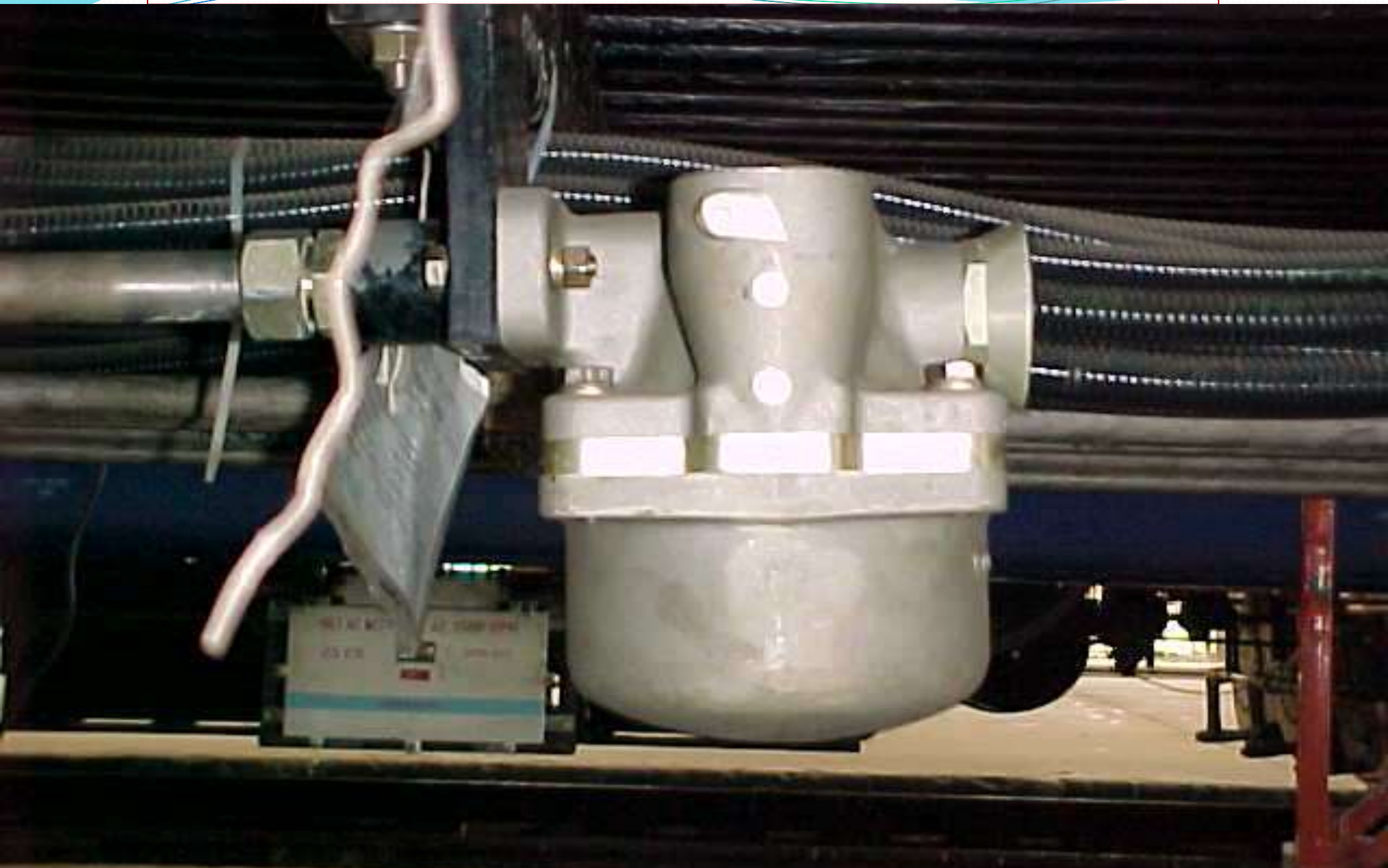
ANTI SKID (DUMP) VALVE



ONE PER AXLE



BRAKE ACCELERATOR



BRAKE ACCELERATOR



PIPES AND PIPE FITTINGS

- **No flange/threaded joints i.e. no threads required on pipe.**
- **Metric Pipes (Seamless Precision Pipes):**
(Metric pipes described by O.D.)
 - **Pipes used:**
 - **28mm for BP and FP: Wall Thickness = 2.0 mm**
 - **18mm for brake cylinder pipes (BC line)**
wall Thickness = 2.0 mm
 - **10mm for CDTs and pressure gauges**
and its wall thickness = 1.5mm

PIPE FITTINGS-BITE TYPE

- ✎ **Cutting ring Ferrule ensures sealed joint.**
- ✎ **Designed for metric tubes. (OD of pipe is important)**
- ✎ **Proper assembly results achieved by 1 and 1/2 turns of the nut only.**

Precautions:

- 🧑 ***Fittings are to be handled with care. Bite edge to be protected***
- 🧑 ***Do not use hand cutters. Edge of should be straight.***
- 🧑 ***Fix pipes line with clamps.***
- 🧑 ***Non standard materials or tolerances lead to incorrect fittings.***
- 🧑 ***The tools & lubricants recommended ensures safe assembly.***

- **Advantages:**

- ☺ **Sealing capability very high.**

- ☺ **High pressure resistance.**

- ☺ **Highly Durability**

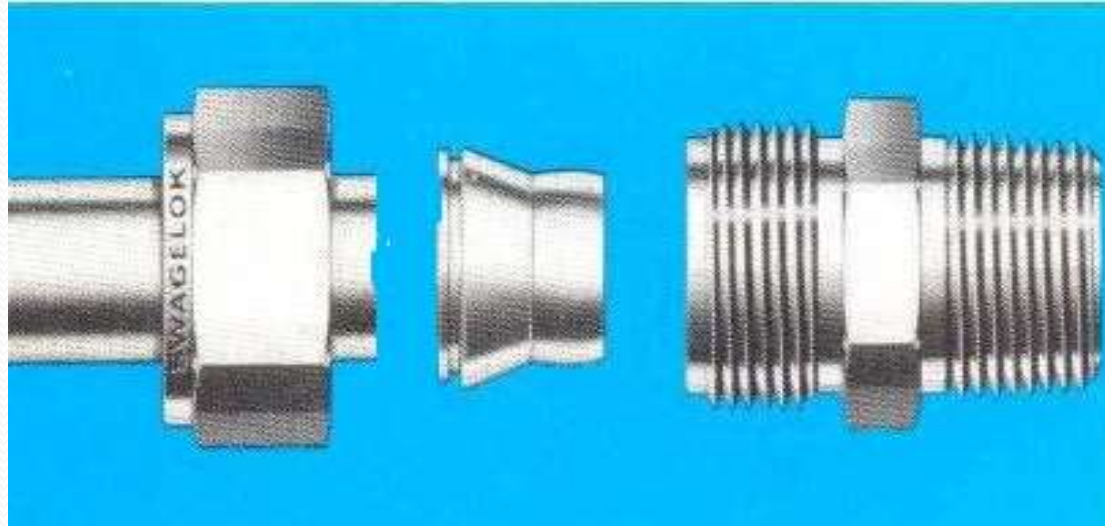
- ☺ **Bite control -Wedge between the tube wall and inner cone**

- ☺ **Assembly cost-less time for piping after presetting**

- ☺ **Very Reliable- No leakage.**

PIPES AND PIPE FITTINGS

Step 1 :



Step 2 :

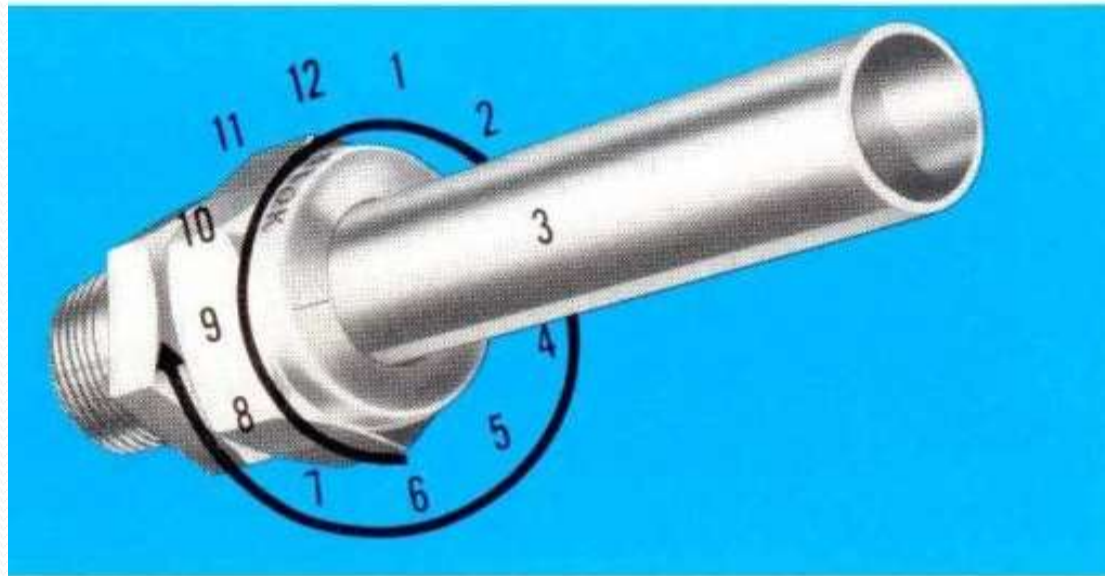


PIPES AND PIPE FITTINGS

Step 3 :



Step 4 :



PIPES AND PIPE FITTINGS

Precautions required on ferrule fitted pipelines:

- Pipelines are to be clamped properly to avoid vibrations.
- Vibrations will loosen the ferrule joints and lead for to leakage
- Ferrule fittings should not be over tightened.
- Cut the tubes at right angles (90°) and de-burr cut-edges

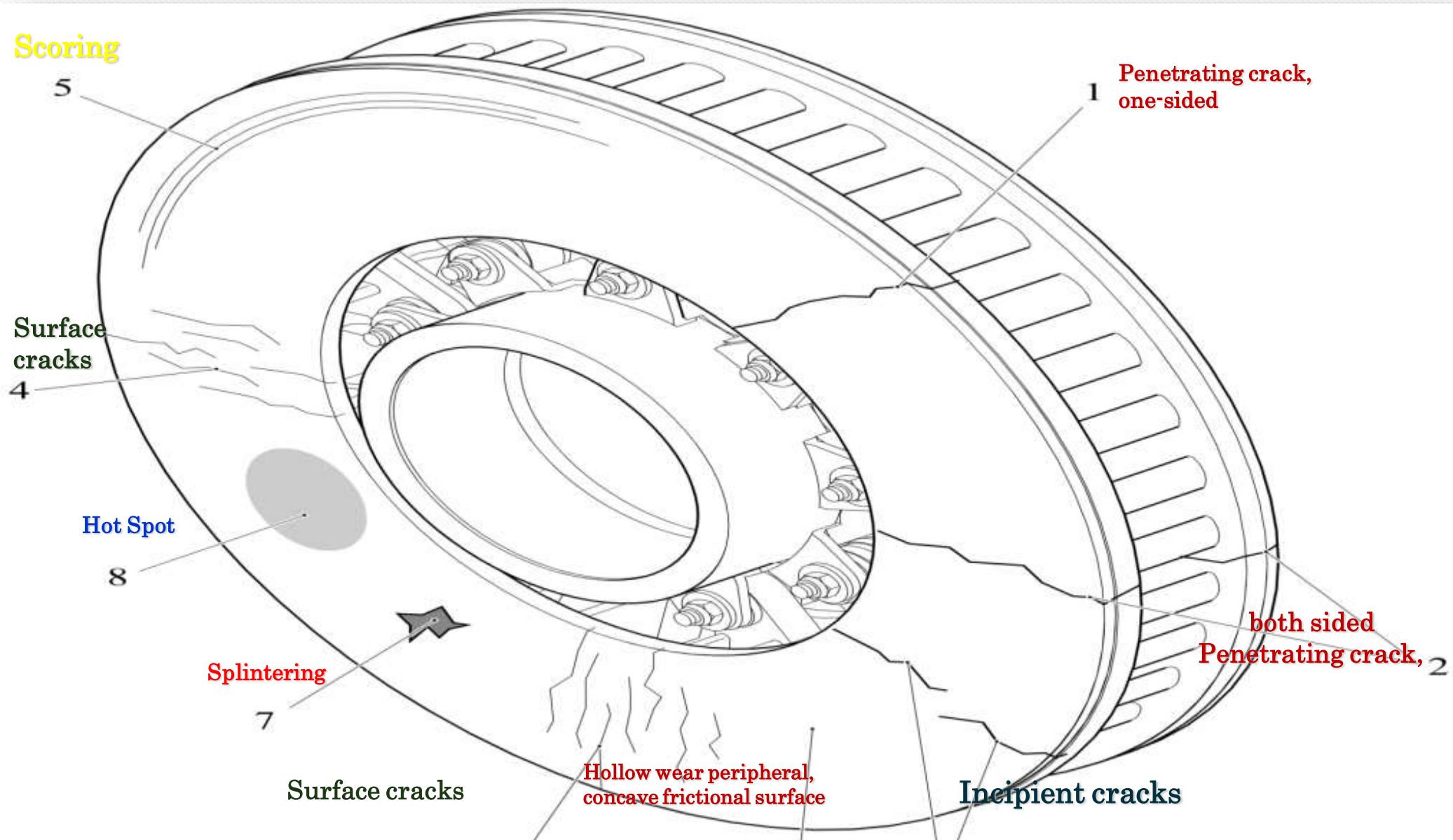


FERRULE FITTINGS USED IN PNEUMATIC PIPE LINE OF LHB COACHES.

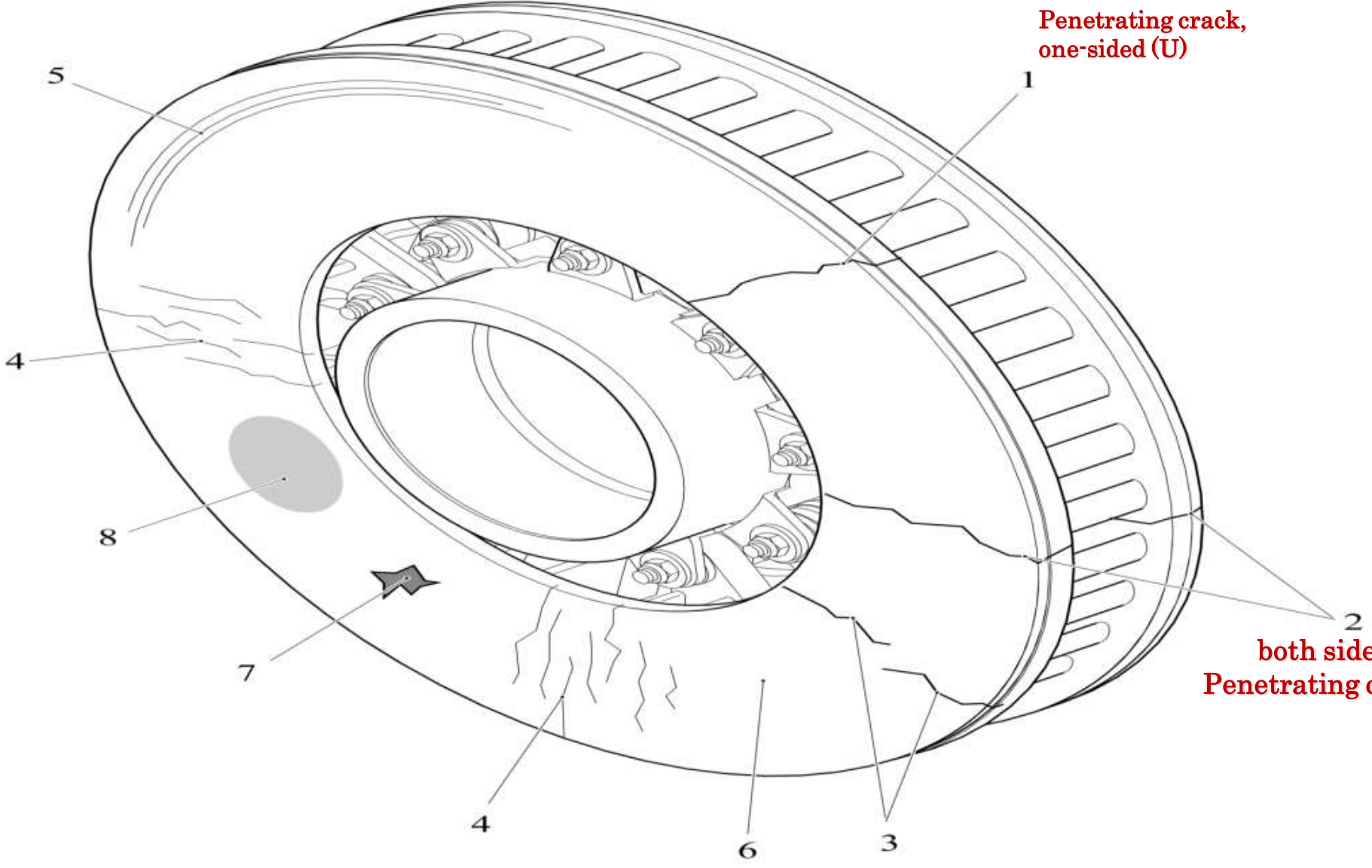
SINGLE FERRULE TYPE



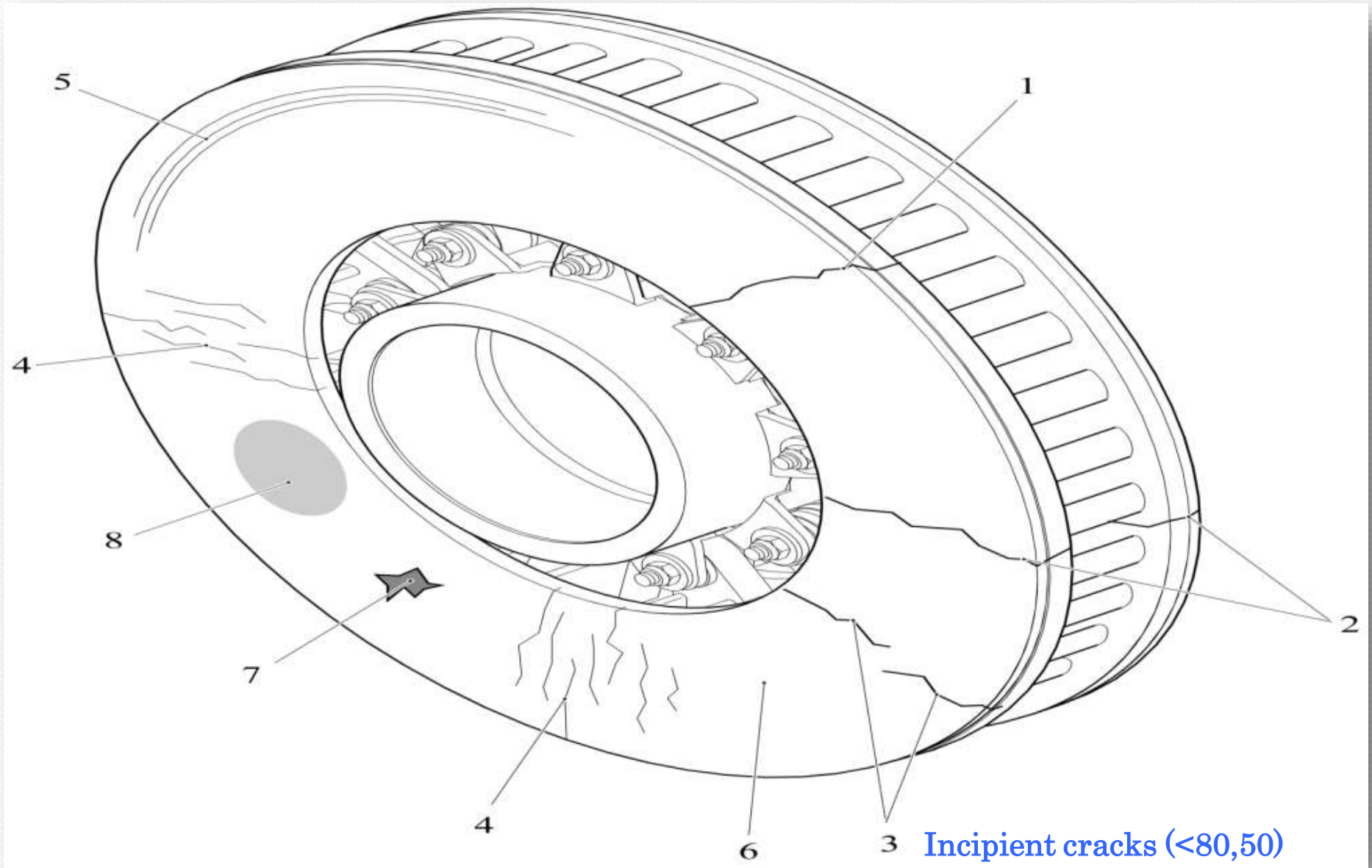
BRAKE DISC DEFECTS CHECKING PROCEDURE AT SHED / YARD



BRAKE DISC DEFECTS CHECKING PROCEDURE AT SHED / YARD

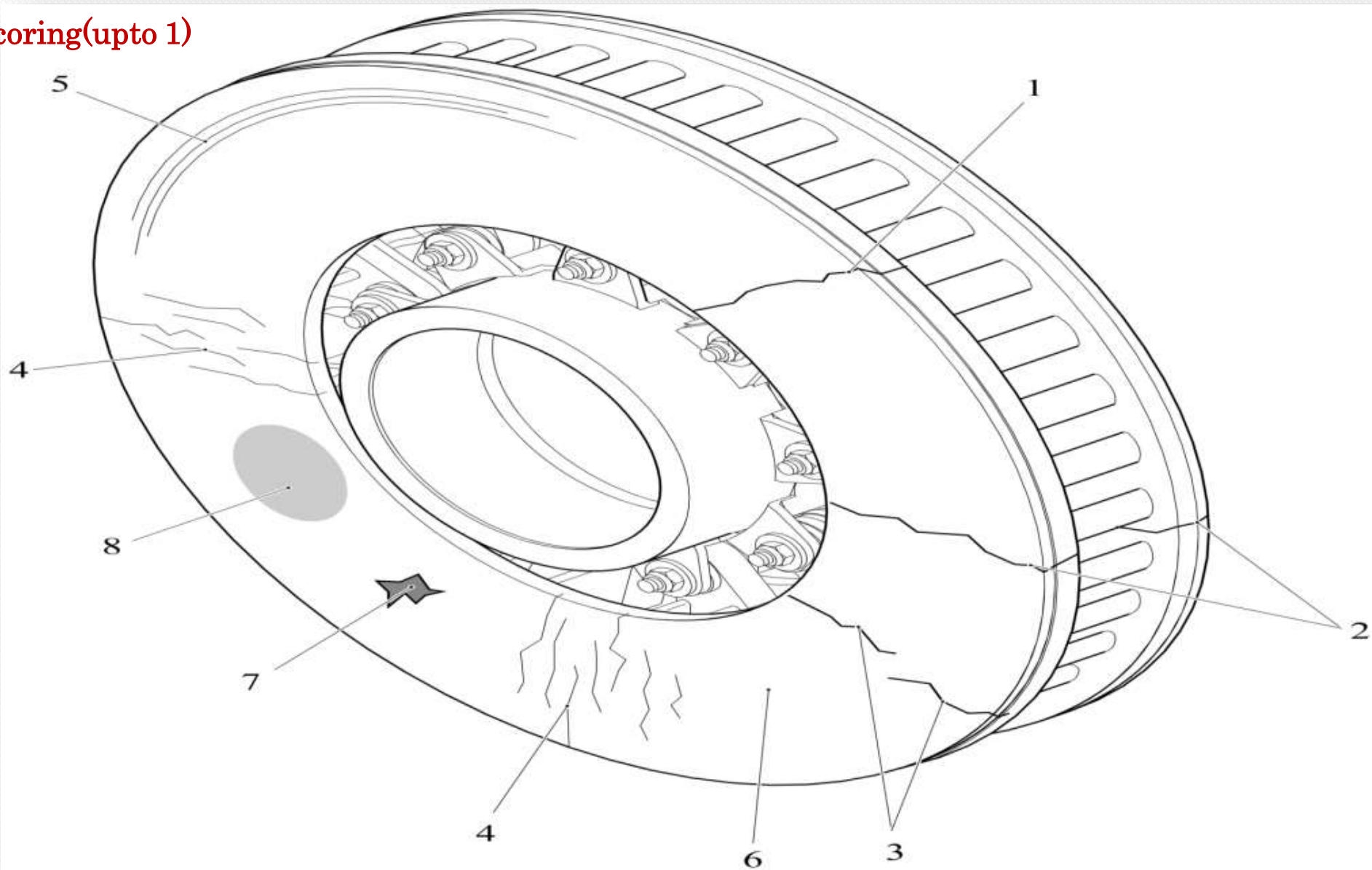


BRAKE DISC DEFECTS CHECKING PROCEDURE AT SHED / YARD

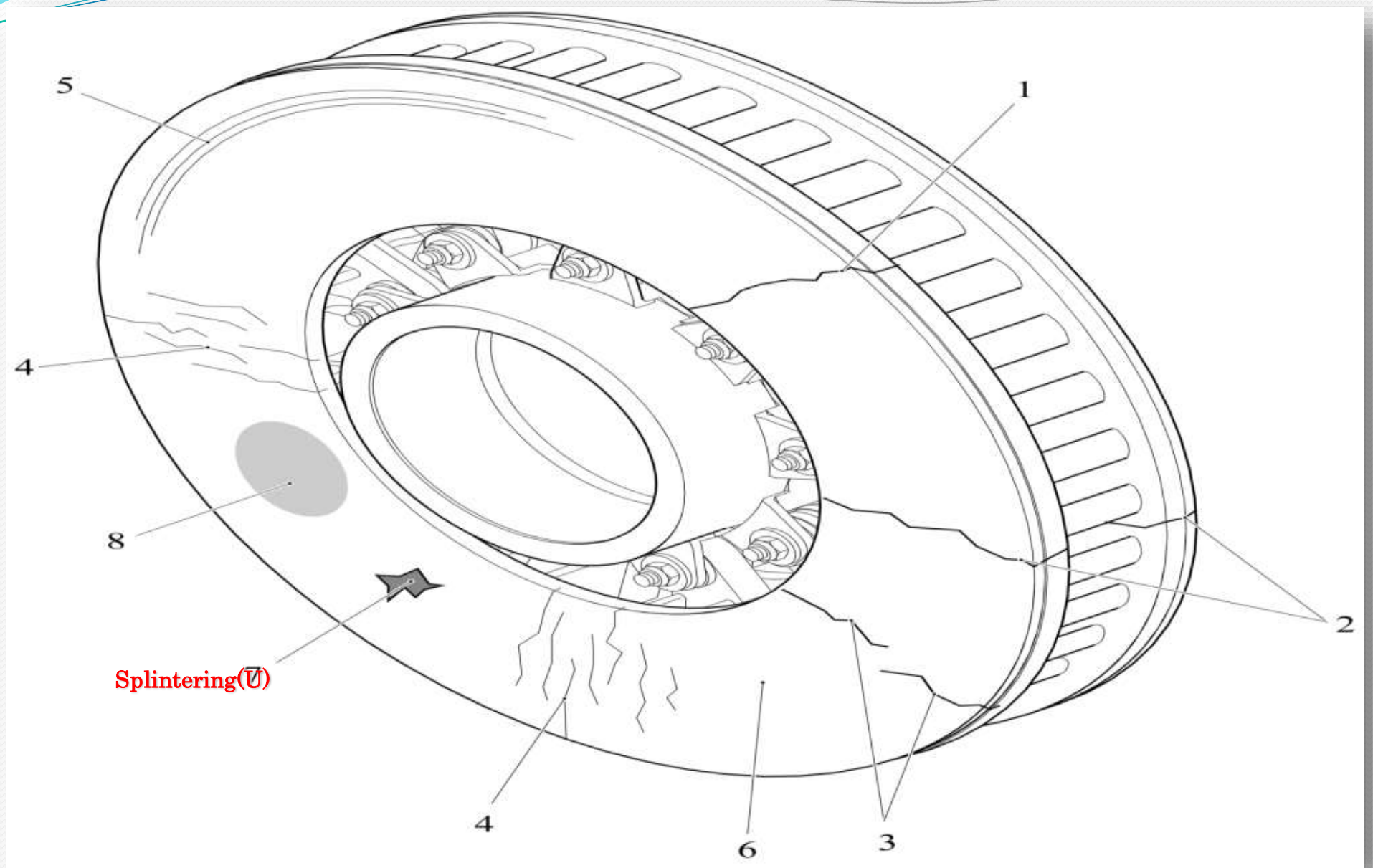


BRAKE DISC DEFECTS CHECKING PROCEDURE AT SHED / YARD

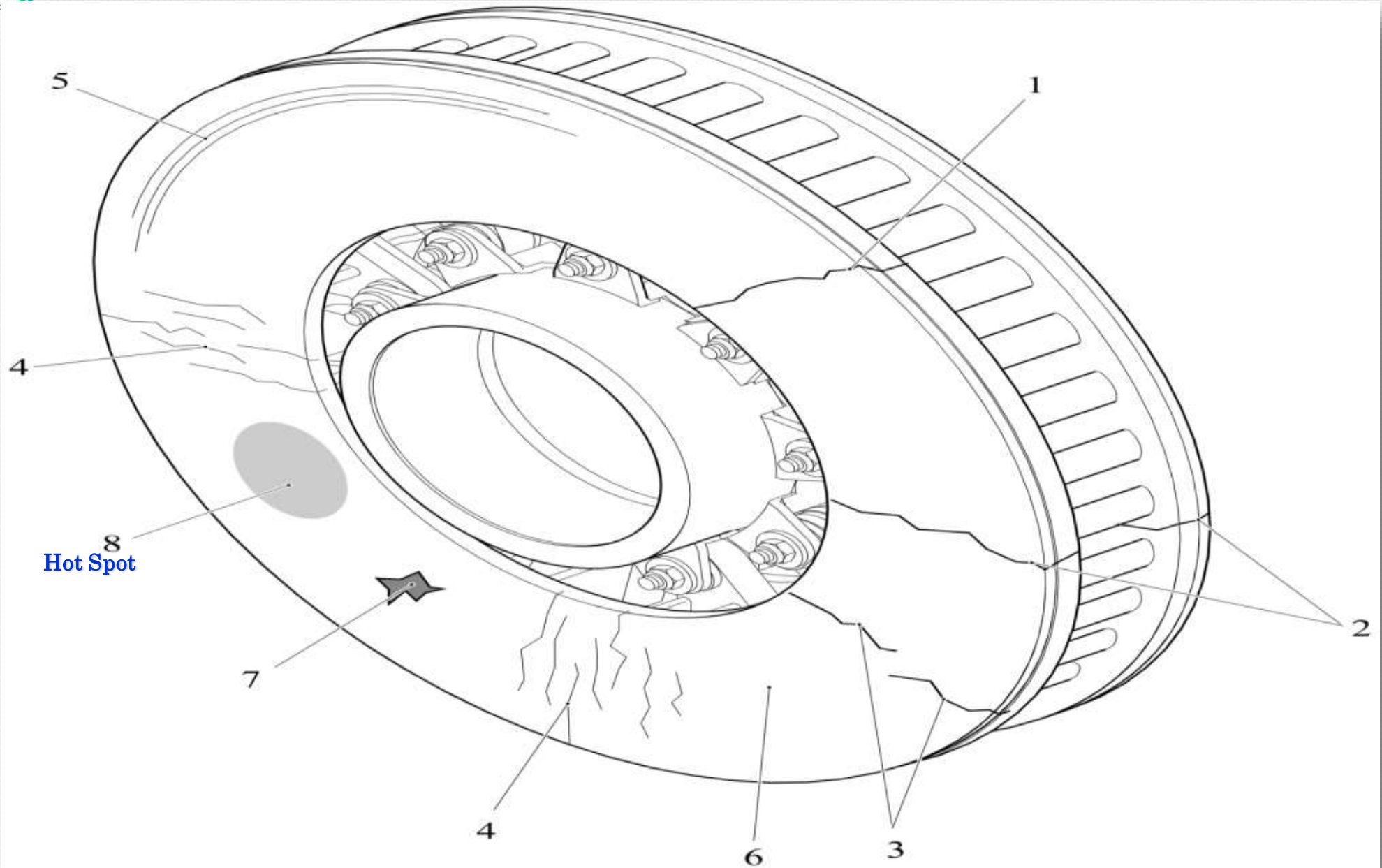
Scoring (upto 1)



BRAKE DISC DEFECTS



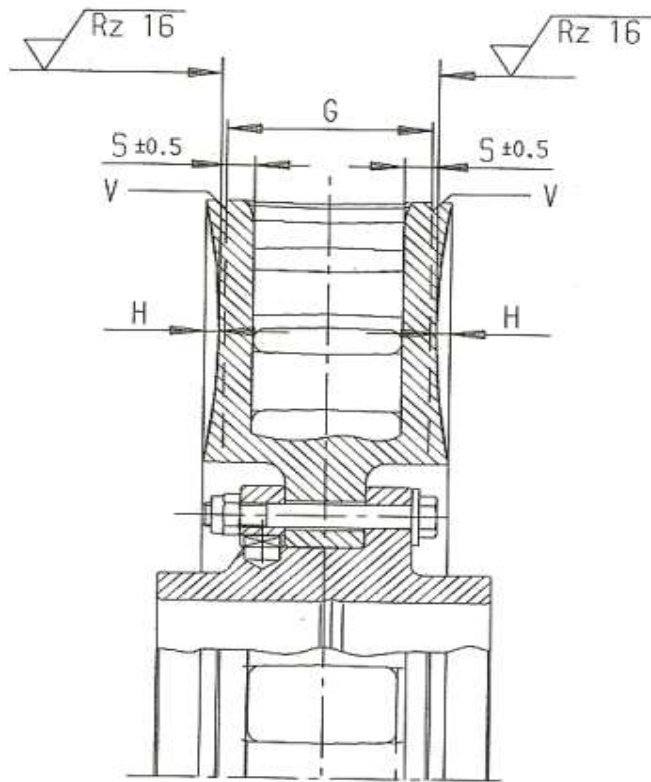
BRAKE DISC DEFECTS



Brake Disc

9 Rev.U2

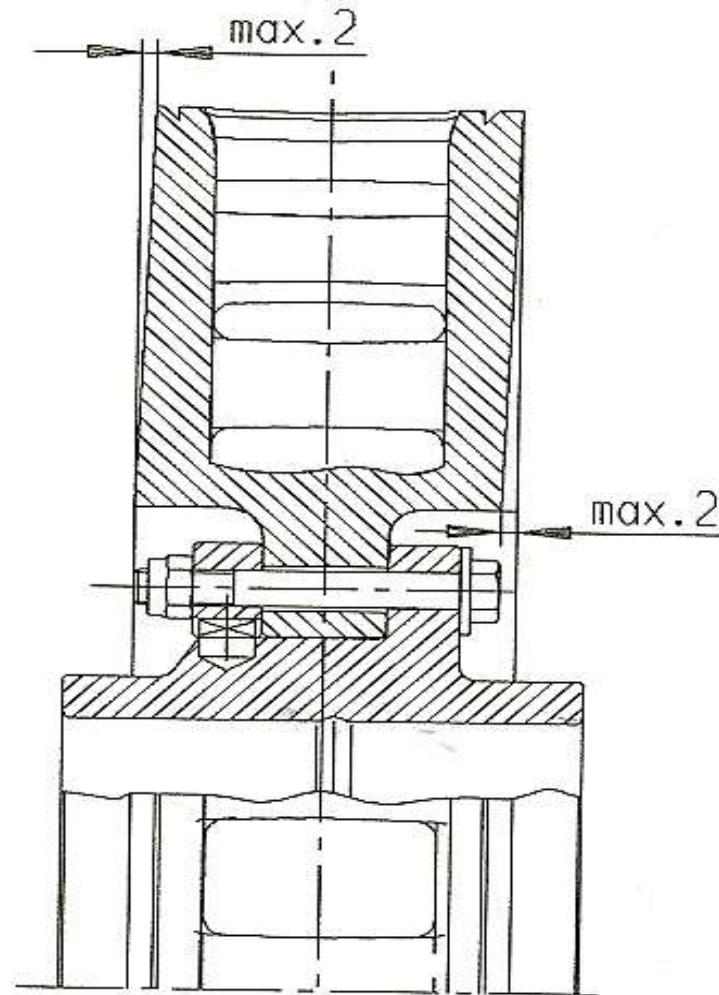
Fig. 9 Facing off the friction ring



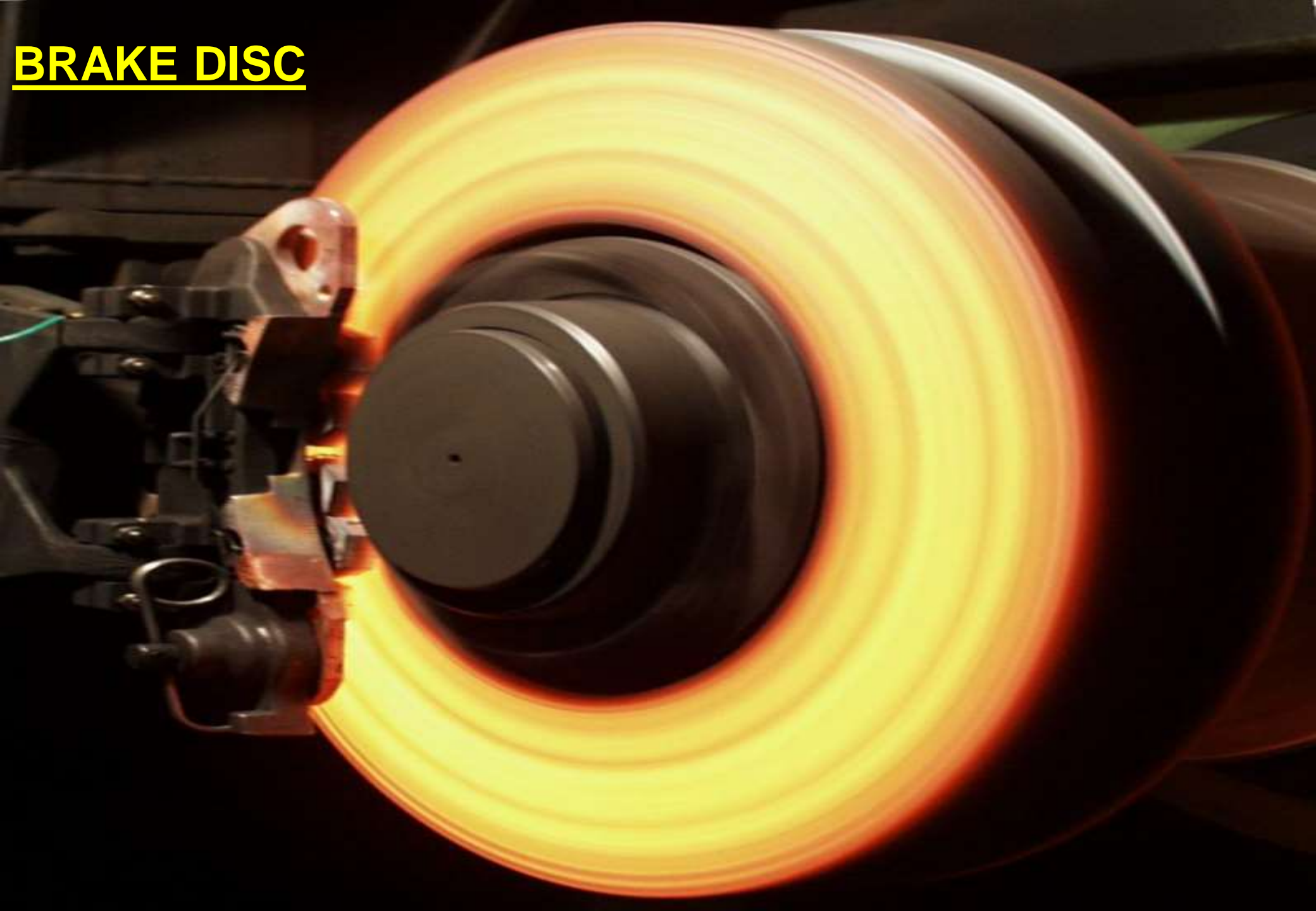
- | | | | |
|---|------------------|---|---|
| G | Condemning limit | S | Residual thickness of friction surface after facing off |
| H | Concave wear | V | Wear identific. groove |

C 13083/6

Slanting wear



BRAKE DISC



CHECKING PARAMETERS

S No	Determining the actual condition	Evaluation/measures
1	Wear marks on friction ring.	The wear marks must be visible .Pay attention to hollow wear & scoring
2	Hollow wear and scoring in the frictional surfaces.	The permissible values for the hollow wear are 1.0 mm and for the depth of scoring 1.0 mm.
3	Splintering in the frictional surfaces.	Unacceptable; replace friction ring.
4.1	Cracks in the hub	Unacceptable; replace axle-mounted brake disc.
4.2	Cracks in the connection & screw connection areas of hub & friction ring.	Unacceptable; replace axle-mounted brake disc.
4.3	Cracks in the frictional surfaces.	See Crack definitions
4.4	Penetrating cracks.	Unacceptable; replace friction ring.
4.5	Incipient cracks.	Unacceptable; replace friction ring.
4.6	Surface cracks.	See Crack Definitions
4.7	Cracks in the cooling fins.	Permissible on max. 2 cooling fins. there must be at least 3 undamaged cooling fins in-between.
5	Foreign bodies in cooling ducts.	Remove foreign bodies and clean cooling ducts
6	Hot spots	Permissible.
7	Missing or loose fastening, screws and segments.	Unacceptable.

- **Brake Disc Wear checks/limits:**

- No hair, incipient crack or through cracks permitted on Hub / connected flange:
- Incipient cracks on Disc:
 - <80mm, apart by 50mm min. permitted propagating between two edges
 - <50mm, apart by 50mm min permitted propagating from the edges
- Scoring up to 1mm allowed
- Concave wear up to 2mm allowed
- Residual thickness up to 14mm of disc friction surface
- Slanting wear up to 2mm allowed.

Maintenance–Brake disc

<u>Weekly</u>	Functional check with brake caliper. Visual check for external damage.
<u>Monthly</u>	Repeat above checks. Check disc for cracks. Check cooling ducts for foreign bodies.
<u>Bi-annually</u>	Repeat above checks. Check friction ring wear (Scoring/Splintering).
<u>Annually</u>	Repeat above checks. Check for loose friction ring and loose bolts.
<u>5 - 6 years</u>	Repeat above checks. Clean and check friction ring for damage and impermissible wear. Replace if necessary.



BRAKE BINDING

Procedure to Release and isolate, Brake Binding of LHB Coach at enroute

In case of brake binding, the brake indicator of the affected bogie will show red colour.





Pull the release lever of DV.

Rotate the isolation cock of the affected bogie provided on the brake panel in anti-clockwise direction by 90 degree to release and isolate the brake cylinders of the affected bogie.



If brakes are released, brake indicator of the affected bogie will change colour from red to green as shown. Check that the brakes are released by shaking the brake calipers. If brakes are released, allow to work the train.



Open flexible pipes of B.C. lines of one / both the axles of one / both trolleys having brake binding using suitable open end Spanner. If suitable Spanner is not available, try to puncture/cut the flexible pipe to exhaust the BC pressure and brakes will be released.

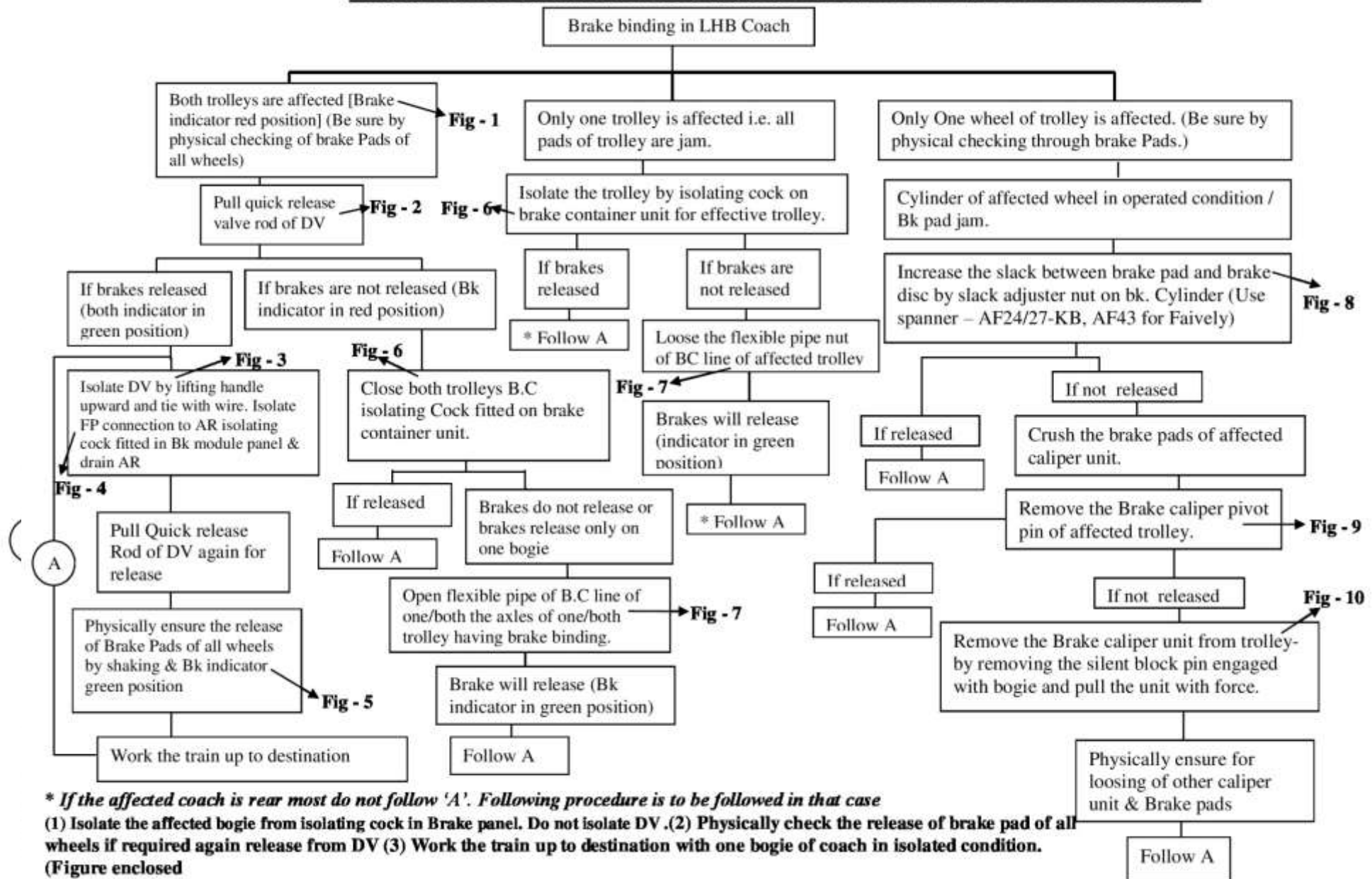


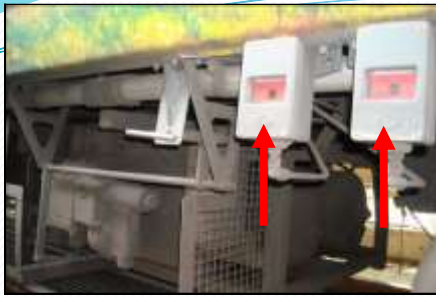
If not released

Loosen the hexagonal nut of the brake cylinder by spanner. Check that the brakes are released by shaking the calipers and allow to work the train.



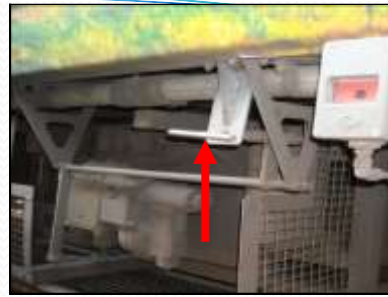
PROCEDURE FOR HANDLING CASES OF BRAKE BINDING IN LHB COACHES.





Brake indicator Red

Figure - 1



DV Quick Release Rod

Figure - 2



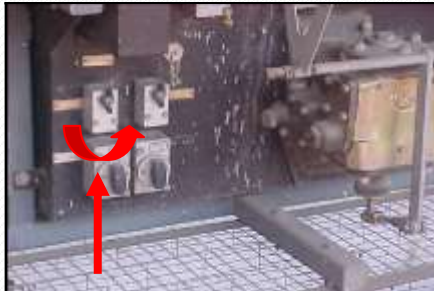
DV Isolating Handle in isolating position

Figure - 3



*FP connection Isolating Cock (FTIL)
(To move anti-clockwise by 90°)*

Figure - 4



*FP connection Isolating Cock (KBI)
(To move anti-clockwise by 90°)*

Figure - 4



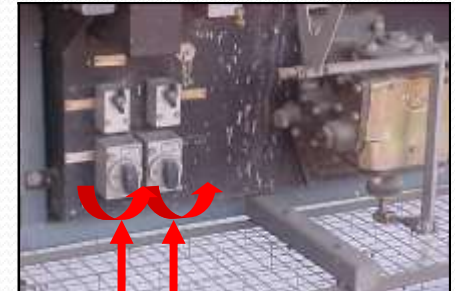
Brake indicator Green

Figure - 5



*BC Isolating Cock (FTIL)
(To move anti-clockwise by 90°)*

Figure - 6

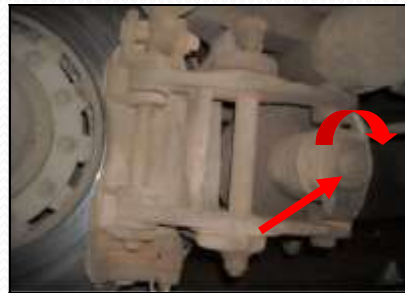


*BC Isolating Cock (KBI)
(To move anti-clockwise by 90°)*

Figure - 6



*BC line Flexible hose
Figure - 7*



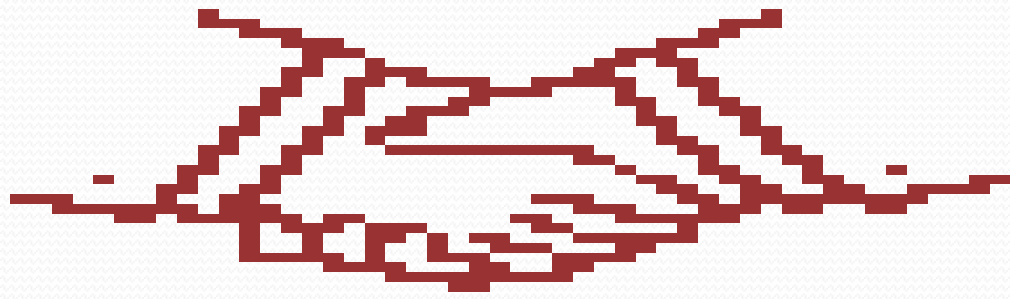
*Brake cylinder slack adjuster nut
Figure - 8*



*Brake caliper pivot pin
Figure - 9*



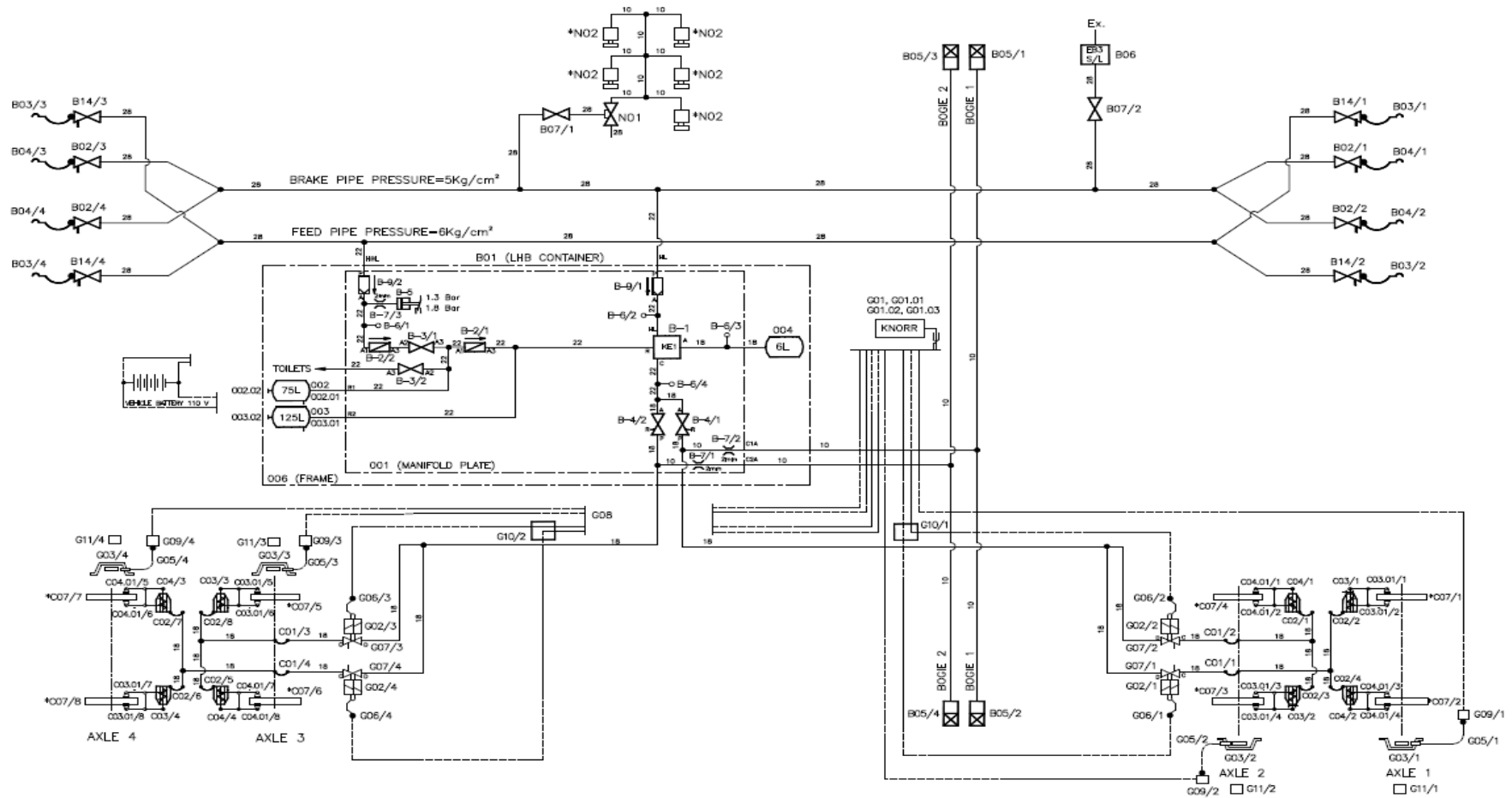
*Brake caliper unit silent block pin
Figure - 10*



Thank You



Schematic Layout of LHB - EOG



LEGEND:

1. PNEUMATIC PIPE
 28=28mm OD PIPE
 22=22mm OD PIPE
 18=18mm OD PIPE
 10=10mm OD PIPE
2. ELECTRIC CONNECTION
3. EQUIPMENT BOUNDARY

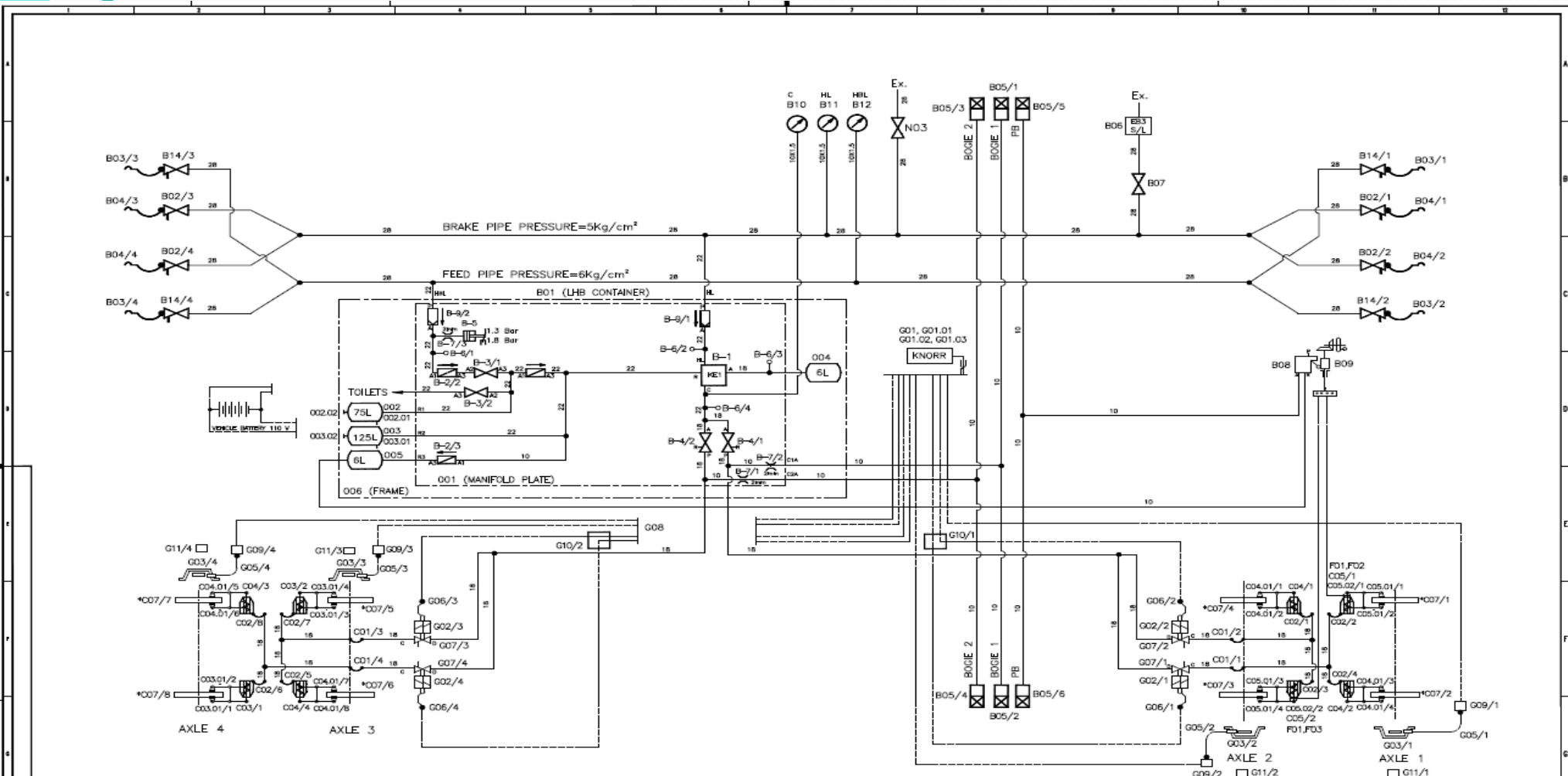
Notes:

1. * Marked items are not in Knorr-Bremse India scope of supply.
2. For details of position no. items refer our scope of supply- TA39170/1A.

This is a schematic diagram of the LHB - EOG system. It is not a physical drawing and should not be used for manufacturing purposes.

Vehicle type AC/ACN-AC (EOG) PASSENGER COACHES	Calculator RCF	Sheet No. 1/1	Rev. 01
Working para no. TA39170/1A	Transportation authority INDIAN RAILWAYS	Job No. 66401LOB	
Date 13.08.2012	Name Srinivasulu Reddy	EXEMPT: DIAGRAM OF KNORR (ISC)	
Check 13.08.2012	Signature Srinivasulu Reddy	BRAKE EQUIPMENT KE-P-(O)-EP-SX10	
By Srinivasulu Reddy	Signature Srinivasulu Reddy	WITHOUT HANDSHAKE FOR LHB COACHES	
For Srinivasulu Reddy	Signature Srinivasulu Reddy	TA39170/11	
By Srinivasulu Reddy	Signature Srinivasulu Reddy	TA39170/11	
By Srinivasulu Reddy	Signature Srinivasulu Reddy	TA39170/11	

Schematic Layout of LHB Power Car



- LEGEND:**
- 1. PNEUMATIC PIPE
 - 25=25mm OD PIPE
 - 22=22mm OD PIPE
 - 18=18mm OD PIPE
 - 10=10mm OD PIPE
 - 2. ELECTRIC CONNECTION
 - 3. EQUIPMENT BOUNDARY

Notes:

1. * Marked items are not in Knorr-Bremse India scope of supply.
2. For details of position no. items refer our scope of supply- TA39170/2A.

Table No.	Table Title	Author	Checker	Date
TA39170/2A	GENERATOR CUM BRAKE UNIT (POWER CAR)	INDIAN RAILWAYS	INDIAN RAILWAYS	66401LOB
SCHEMATIC DIAGRAM OF KNORR DISC BRAKE EQUIPMENT HE-A-03-BT-SK10 WITH HANDBRAKE FOR LHB COACHES				
TA39170/12				



Emergency Braking Distance

- with EP assist system

Initial speed	pneumatic	With EP
160 km/h	1173 m	1017 m
180 km/h	1451 m	1275 m
190 km/h	1600 m	1415 m
200 km/h	1757 m	1562 m