TRANSNET
freight rail

TECHNOLOGY MANAGEMENT

SPECIFICATION

RADIO FREQUENCY IDENTIFICATION TAG PROGRAMMING AND INSTALLATION ON TRANSNET FREIGHT RAIL VEHICLES

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1 Introduction

Transnet Freight Rail (TFR) has a wide range of different types of rolling stock differing in sizes and shapes, each type with its own unique physical characteristics. This document outlines the differences between the wagons and or locomotives used on the Coal line, the General Freight Business (GFB) and Ore lines respectively; specifying as to how Radio Frequency Identification (RFID) tags should be mounted onto the various types of vehicles as well as how to program these RFID tags with the correct information.

Prior to June 2009 there has been inconsistency with regards to tag mounting as well as the tag programming of the TFR fleet. This document shall be the standard, to which all TFR vehicles shall adhere to and shall supersede the previous document number RSE/TE/PRO/0133 used by Transnet Rail Engineering.

2 RFID Tags

All rail vehicles shall have AT5110 (currently on Coal line), and AT5118 (GFB and Ore line) compatible RFID tags as specified in *BBC1628 Version 2*. The data stored on the tag shall include the vehicle type, asset owner, vehicle number and vehicle orientation as described in section 4 of this document (Table 1 and Table 2). All vehicles shall be fitted with two tags, one on either side as shown throughout this document.

3 TFR Vehicle Tagging Conventions

In order to determine an absolute reference for consistency, the following conventions shall be used for identifying locomotives and wagons characteristics as well as determining the orientation thereof. Refer to Section 5 for more information on the mounting of tags. In all cases where enough metal (350mm x 160mm) surrounding the tag is not available, an appropriate steel back plate shall be used to mount the tag on. See Section 5.3, Figure 12.

3.1 TFR Coal line Wagon

3.1.1 Jumbo wagons (type CCL- or CCR 5 – 11)

Each Jumbo wagon on the Coal line has its air brake control valve specifically situated at the front of the wagon as shown in Figure 1a and 1b below. This air brake control valve physically defines the front end of the wagon. Furthermore standing behind the wagon facing it will define the left hand side and right hand side of the wagon as shown in Figure 1b. The axle numbering shall always be from the front to the rear end of the wagon, which is axle 1, 2, 3 and 4 respectively.

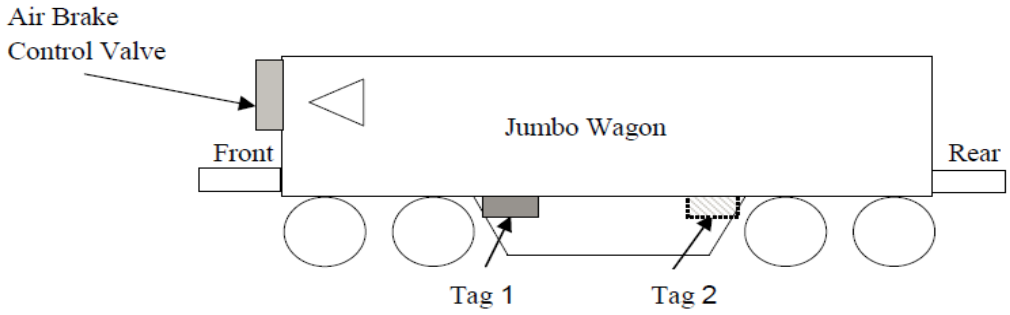

Figure 1a: Left hand side view of a Coal line Jumbo wagon

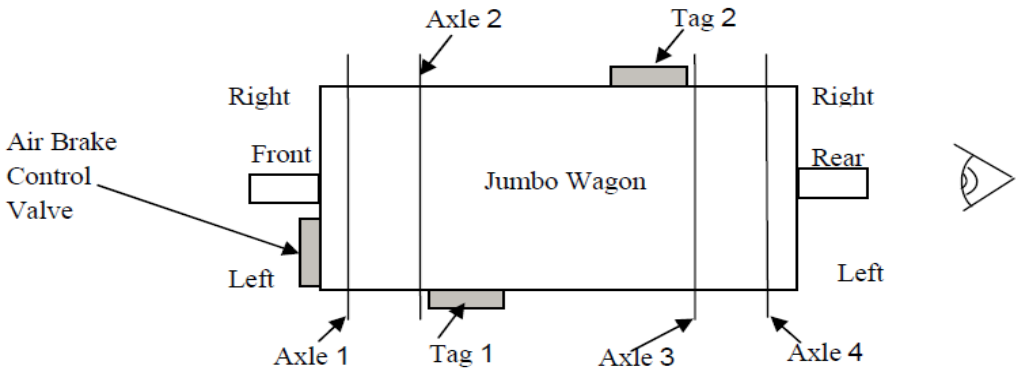

Figure 1b: Top view of a Coal line Jumbo wagon

After correctly determining the front and the rear ends of the wagon, the tag programmed with a "1" for orientation is mounted on the front end, left hand side just behind axle 2 as shown in Figure 1a & 1b. Therefore a tag programmed with a "1", defines the front end of the wagon. The tag programmed with a "2" for orientation is mounted on the rear end, right hand side of the wagon just before axle 3 as shown on Figure 1a & 1b. Therefore the tag programmed with a "2", defines the rear end of the wagon.

3.1.2 Small wagons (type CCL- or CCR 1- 4)

Each Small wagon on the Coal line has its air brake control valve specifically placed on one side of the wagon as shown in Figure 2a & 2b. When standing at the end of a wagon with the air brake control valve on the left hand side of the viewer, the viewer faces the rear end of the wagon. As in all other cases the left hand and right hand side of the wagon is defined from this position of the viewer. The axle numbering shall always be from the front to the rear end of the wagon, which is axle 1, 2, 3 and 4 respectively.

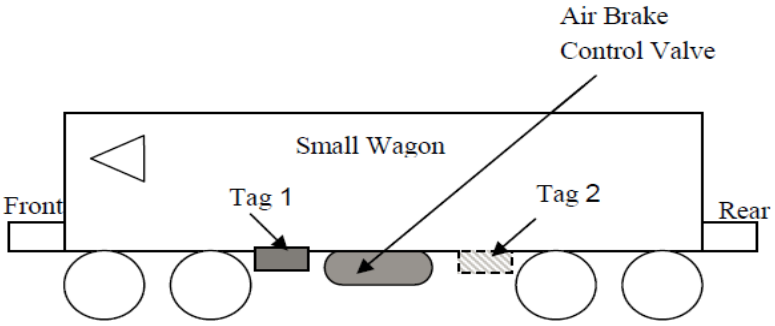

Figure 2a: Left hand side view of Coal line Small wagon.

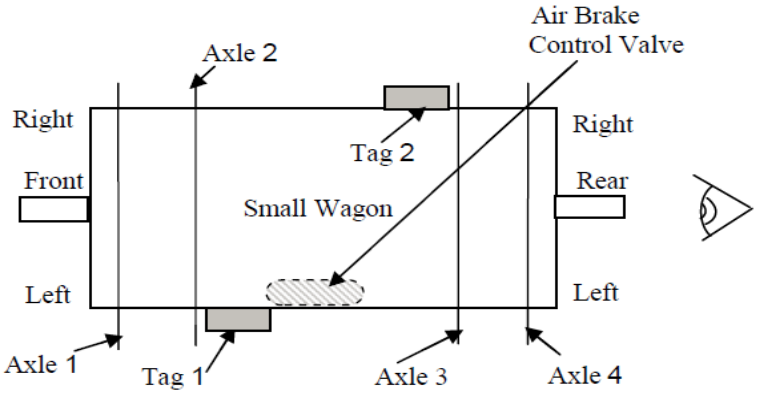

Figure 2b: Top view of the Coal line Small wagons

After correctly determining the front and the rear ends of the wagon, the tag programmed with a "1" for orientation is mounted on the front end, left hand side just behind axle 2 as shown in Figure 2a & 2b. Therefore the tag programmed with a "1", defines the front end of the wagon. A tag programmed with a "2" for orientation is mounted on the rear end, right hand side of the wagon just before axle 3 as shown in Figure 2a & 2b. Therefore the tag programmed with a "2", defines the rear end of the wagon.

3.2 TFR General Freight Business (GFB) Wagons and Passenger Coaches

3.2.1 TFR Airbrake GFB wagons

3.2.1.1 Air brake wagons where the control valve is situated on one side (left or right) of the wagon

Most air brake GFB wagons have their air brake control valve specifically placed on one side of the wagon as shown in Figure 3a & 3b below. When standing at the end of a wagon with the air brake control valve on the left hand side of the viewer, the viewer faces the rear end of the wagon. As in all other cases the left hand and right hand side of the wagon is defined from this position of the viewer as shown in Figure 3b. The axle numbering shall always be from the front to the rear end of the wagon, which is axle 1, 2, 3 and 4 respectively.

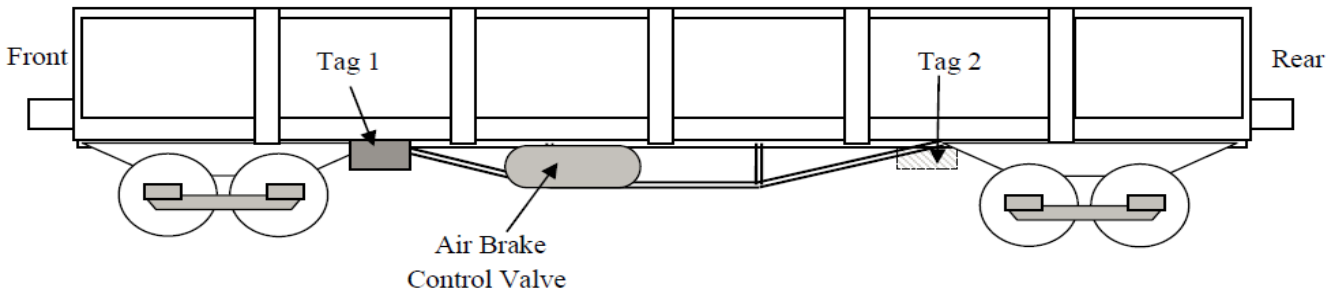

Figure 3a: Left hand side view of GFB airbrake wagon

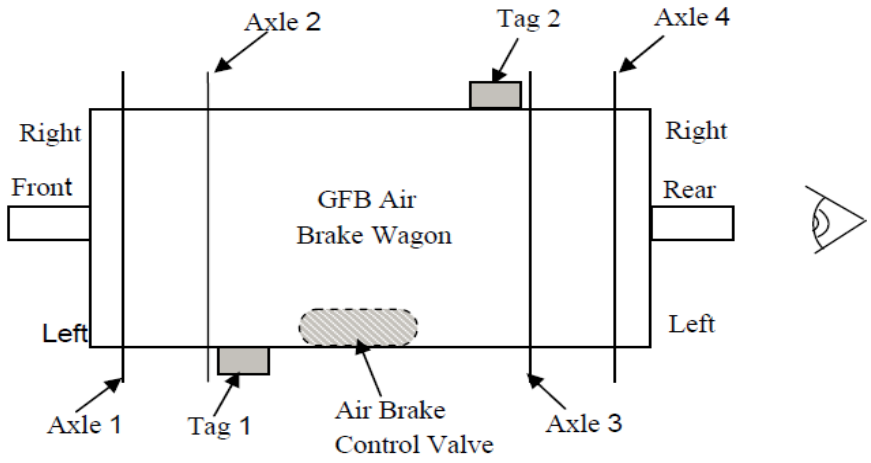

Figure 3b: Top view of GFB airbrake wagon

After correctly determining the front and the rear ends of the wagon, the tag programmed with a "1" for orientation is mounted on the front end, left hand side just behind axle 2 as shown in Figure 3a & 3b. Therefore the tag programmed with a "1", defines the front end of the wagon. A tag programmed with a "2" for orientation is mounted on the rear end, right hand side of the wagon just before axle 3 as shown in Figure 3a & 3b. Therefore the tag programmed with a "2", defines the rear end of the wagon.

3.2.1.2 Air brake wagons where the control valve is positioned at the front end of the wagon

A GFB air brake wagon that has the air brake control valve specifically positioned at the front end of the wagon shall follow the convention as in Section 3.1.1.1 of this document (that is the same as Jumbo wagons type CCL - or CCR 5 – 11).

3.2.2 TFR Vacuum brake GFB wagons and passenger coaches

3.2.2.1 Non symmetrical vacuum brake wagons and passenger coaches

Most vacuum braked GFB wagons/ passenger coaches have a main train vacuum brake pipe specifically fitted to the one side of the wagon/ coach as shown in Figure 4a & 4b below. When standing at the end of a wagon/ coach with the main train vacuum pipe on the left hand side of the viewer, the viewer faces the rear end of the wagon/ coach. As in all other cases the left hand and right hand side of the wagon is defined from this position of the viewer as shown in Figure 4b. The axle numbering shall always be from the front to the rear end of the wagon/ coach, which is axle 1, 2, 3 and 4 respectively.

After correctly determining the front and rear ends of the wagon/ coach, the tag programmed with a "1" for orientation is mounted on the front end, left hand side just behind axle 2 as shown in Figure 4a & 4b. Therefore the tag programmed with a "1", defines the front end of the wagon/ coach. A tag programmed with a "2" for orientation is mounted on the rear end, right hand side of the wagon/ coach just before axle 3 as shown in Figure 4a & 4b. Therefore the tag programmed with a "2", defines the rear end of the

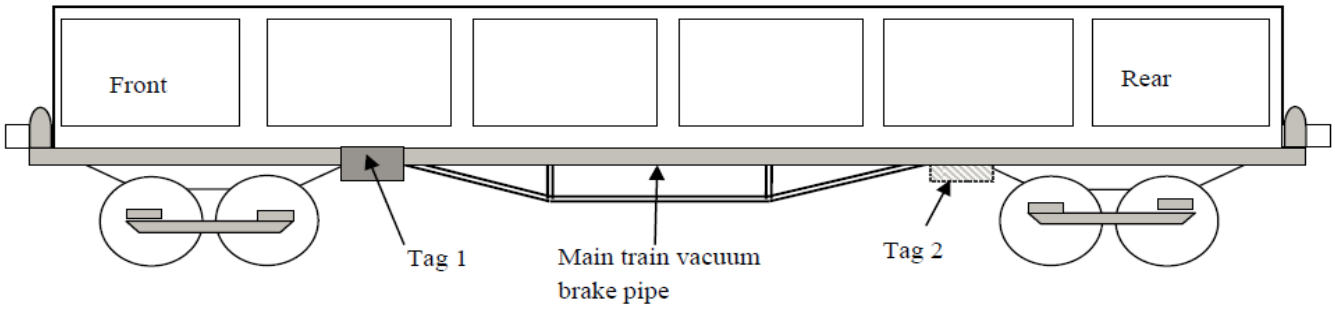

Figure 4a: Left hand side view of a vacuum GFB wagon/ passenger coach

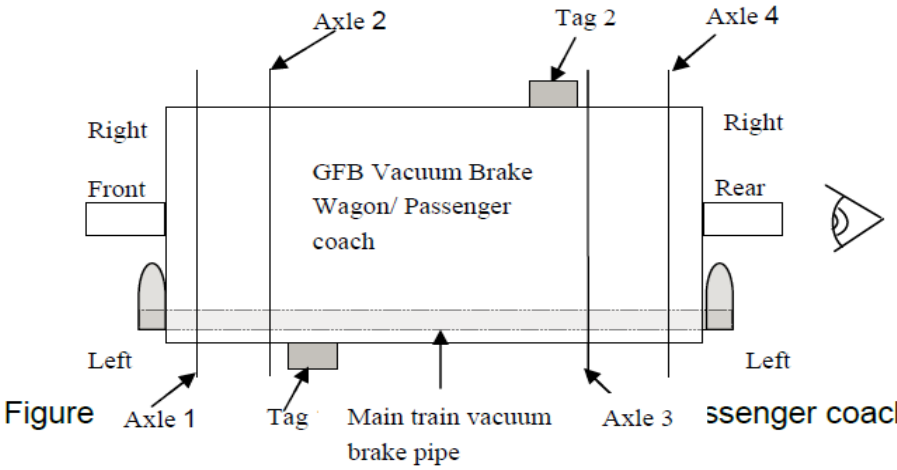

Figure ssenger coach

3.2.2.2 TFR Combined vacuum and air brake GFB wagons

TFR wagons that have both air brake and vacuum braking systems installed on them shall follow the convention in Section 3.2.1 of this document (TFR air brake GFB wagons). After determining the correct front and rear ends of the wagon, the correct tag mounting procedures can be carried out as shown in Section 5, Figures 10 – 14.

3.2.2.3 TFR Symmetrical vacuum braked wagons

Only if there is no feature to distinguish (As described in Sections 3.2.2.1 and 3.2.2.2) a side for the wagon, an arbitrary front and rear end shall be chosen. This chosen front end shall have a bevelled back plate regardless of the amount of metal surrounding the area to where the tag is to be fitted. Figure 5 shows the bevel on the left bottom corner of the back plate that is closest to the front end of the wagon. After determining the correct front and rear ends of the wagon, the correct tag mounting procedures can be carried out as shown in Section 5, Figures 10 – 14.

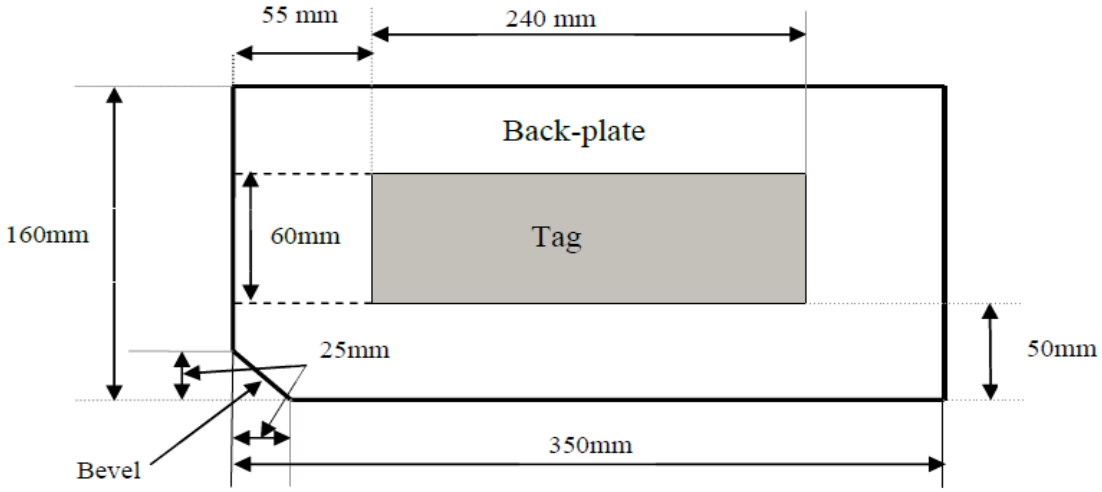

Figure 5; Bevelled back plate for symmetrical wagons

3.3 TFR Ore line wagons (CR-13 and CR-14)

Each Ore line wagon has its air brake control valve specifically placed on one side of the wagon as shown in Figure 6a & 6b. When standing at the end of a wagon with the air brake control valve on the left hand side of the viewer, the viewer faces the rear end of the wagon. As in all other cases the left hand and right hand side of the wagon is defined from this position of the viewer. The axle numbering shall always be from the front to the rear end of the wagon, which is axle 1, 2, 3 and 4 respectively.

After correctly determining the front and rear ends of the wagon, the tag programmed with a "1" for orientation is mounted on the front end, left hand side just behind axle 2 as shown in Figure 6a & 6b. Therefore the tag programmed with a "1", defines the front end of the wagon. A tag programmed with a "2" for orientation is mounted on the rear end, right hand side of the wagon just before axle 3 as shown in Figure 6a & 6b. Therefore the tag programmed with a "2", defines the rear end of the wagon.

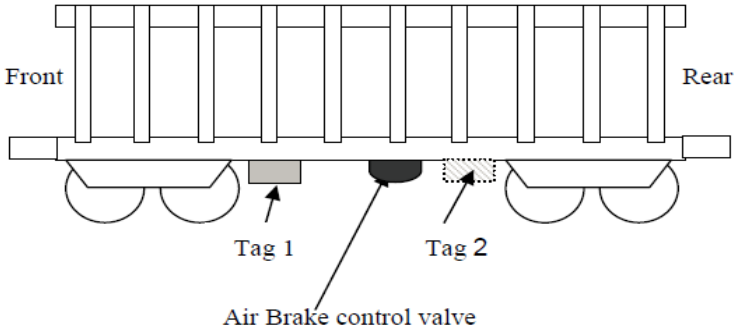

Figure 6a: Left hand side view of an Ore line wagon

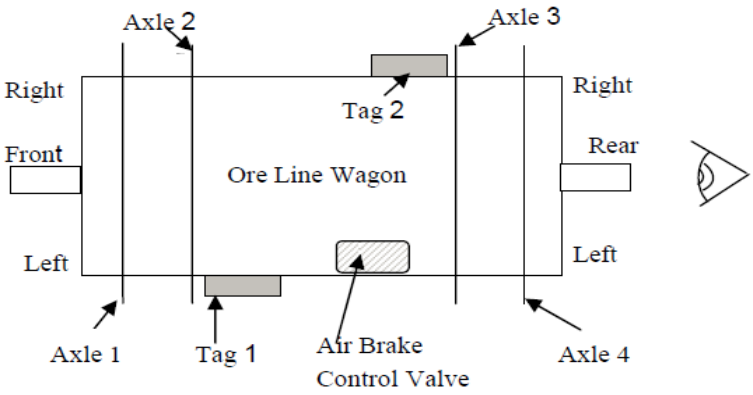

Figure 6b: Top view of an Ore line wagon

3.4 TFR Locomotives

3.4.1 TFR Diesel locomotives

Diesel locomotives only have one driving cab. This cab is defined as the cab end and in turn defines the front end of the locomotive with the opposite end being the rear end. As in all other cases the left hand and right hand side of the locomotive is defined from this position of the viewer as shown in Figure 7b. The axle numbering shall always be from the front end to the rear end of the locomotive, which is axle 1, 2, 3 and 4 respectively (for 4 axle locomotives) and 1,2,3,4,5 and 6 respectively (for 6 axle locomotives).

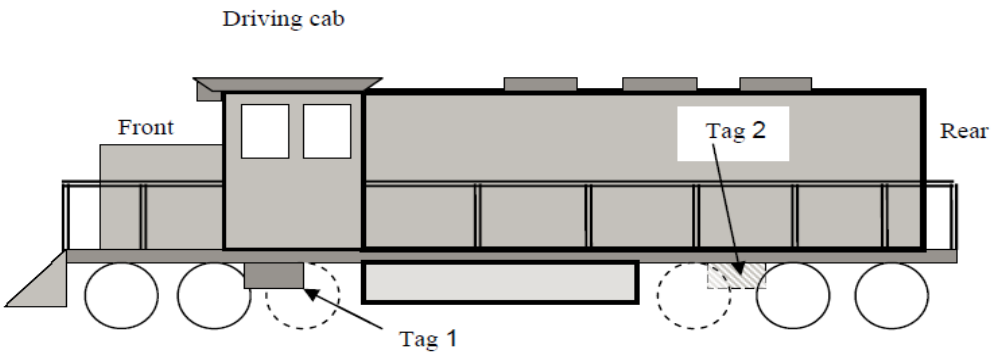

Figure 7a: Left side view of a diesel locomotive

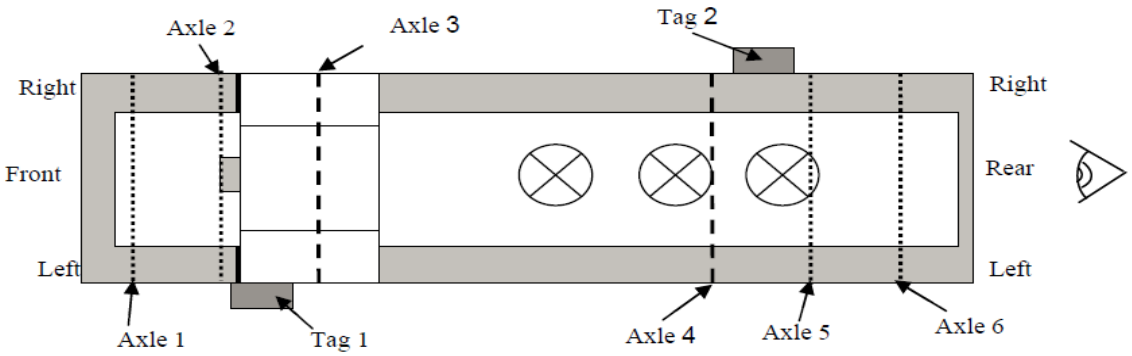

Figure 7b: Top view of a diesel locomotive.

After correctly determining the front and rear ends of the locomotive, the tag programmed with a “1” for orientation is mounted on the front end, left hand side just behind axle 2 as shown in Figure 7a & 7b. Therefore the tag programmed with a “1”, defines the front end of the locomotive. A tag programmed with a “2” for orientation is mounted on the rear end, right hand side of the locomotive just before axle 5, for 6 axle locomotives or just before axle 3, for 4 axle locomotives as shown in Figure 7a & 7b. Therefore the tag programmed with a “2”, defines the rear end of the locomotive.

3.4.2 TFR Double driving cab electric locomotives

Locomotives that have two driving cabs are defined as having a number one cab and a number two cab. The number one cab defines the front end of the locomotive with the opposite end being the rear end (number two cab). Furthermore, if standing at the rear end facing the locomotive, the left side and right side follows as shown in Figure 8b. The axle numbering shall always be from the front end to the rear end of the locomotive, which is axle 1, 2, 3 and 4 respectively (for 4 axle locomotives) and 1,2,3,4,5 and 6 respectively (for 6 axle locomotives).

After correctly determining the front and rear ends of the locomotive, the tag programmed with a "1" for orientation is mounted on the front end, left hand side just behind axle 2 as shown in Figure 8a & 8b. Therefore the tag programmed with a "1", defines the front end of the locomotive. A tag programmed with a "2" for orientation is mounted on the rear end, right hand side of the locomotive just before axle 5, for 6 axle locomotives or just before axle 3, for 4 axle locomotives as shown in Figure 8a & 8b. Therefore the tag programmed with a "2", defines the rear end of the locomotive.

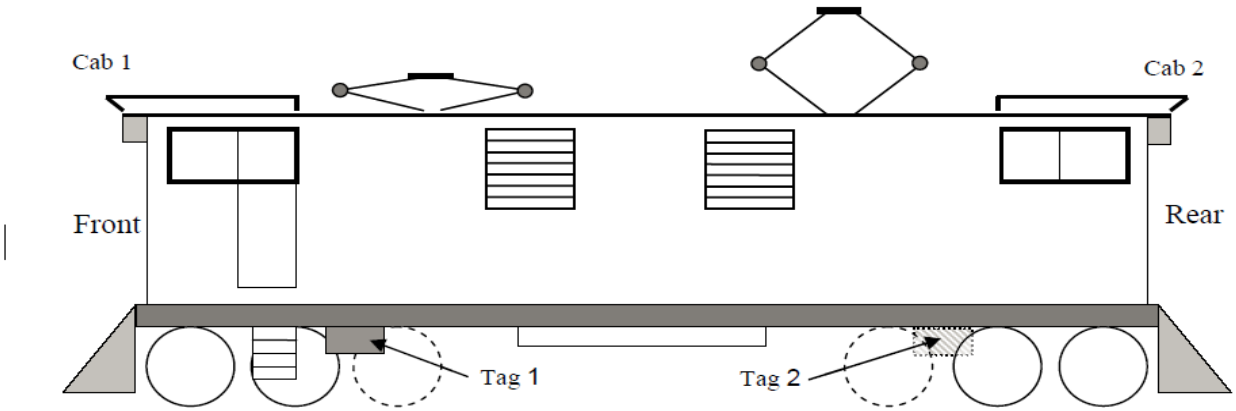

Figure 8a: Left hand side view of a double cab electric locomotive

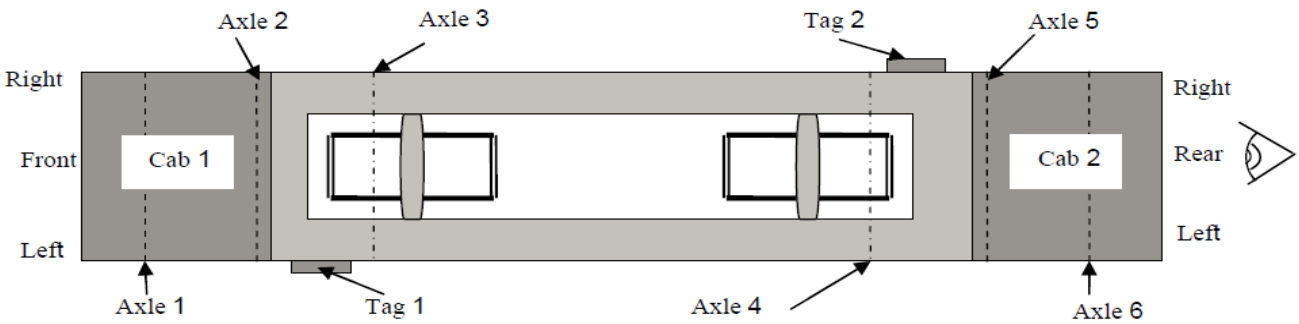

Figure 8b: Top view of a double driving cab electric locomotive

3.4.3 TFR Single driving cab electric locomotives

The driving cab end of a single cab electric locomotive is defined as the front end with the opposite end being the rear end. Furthermore, if standing at the rear end facing the locomotive, the left side and right side follows as shown in Figure 9b. The axle numbering shall always be from the front end to the rear end of the locomotive, which is axle 1, 2, 3 and 4 respectively (for 4 axle locomotives) and 1,2,3,4,5 and 6 respectively (for 6 axle locomotives).

After correctly determining the front and rear ends of the locomotive, the tag programmed with a "1" for orientation is mounted on the front end, left hand side just behind axle 2 as shown in Figure 9a & 9b. Therefore the tag programmed with a "1", defines the front end of the locomotive. A tag programmed with a "2" for orientation is mounted on the rear end, right hand side of the locomotive just before axle 5, for 6 axle locomotives or just before axle 3, for 4 axle locomotives as shown in Figure 9a & 9b. Therefore the tag programmed with a "2", defines the rear end of the locomotive.

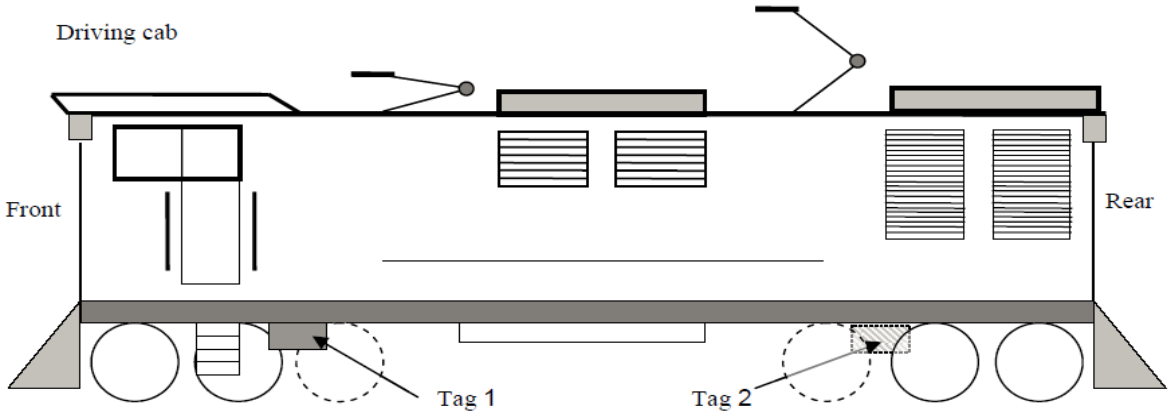

Figure 9a: Left hand side view of a single cab electric locomotive

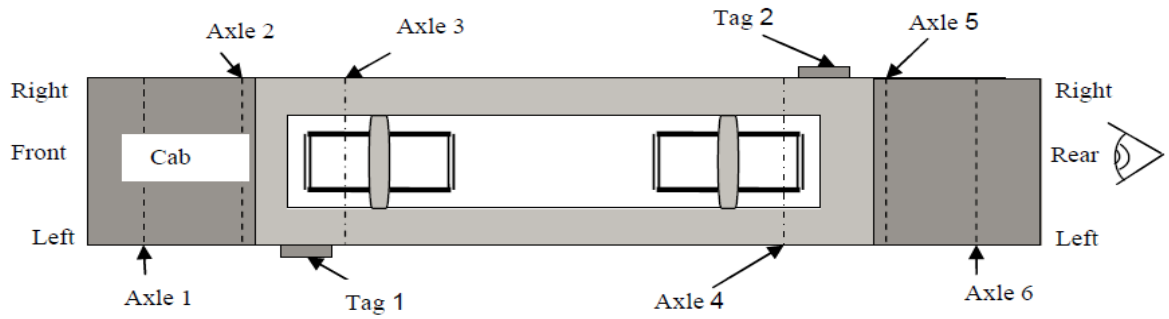

Figure 9b: Top view of a single cab electric locomotive

4 Programming of RFID tags

Table 1 shows an example of the definition of the content of tags found in TFR. The program structure of tags is configured into 15 lines, each consisting of 10 bytes (characters). TFR only utilizes the first two lines. All tags shall be programmed according to the definition in Table 1. That is, the first line consisting of an asset type field (6 characters long). If the asset type field code is shorter than 6 characters then padding spaces shall be used to complete the field of 6 characters. The asset field is followed by a banked space separating the asset type field to the next field, which is the owner code consisting of 2 characters. Finally to complete the first line a banked space is inserted into the tenth space of Line No.1. In the case of a wagon, the second line consists of a wagon number field consisting of 8 characters. This is followed by a banked space separating the wagon number field from the following field, which is the 10th character defining the orientation field (1 for front or 2 for rear). If the wagon number is shorter than 8 characters, padding spaces shall be used to complete the wagon number field.

In the case of a locomotive, the second line consists of a locomotive number field consisting of 8 characters. If the locomotive number is shorter than 8 characters, padding spaces shall be used to complete the field of 8 characters. This is followed by a banked space separating it from the next field, which is 1 character for the orientation of the locomotive (1 for front or 2 for rear).

Line No.	Field Description	Definition of field	Field Size (max 10 characters) - show example.									
1	Asset Type & Owner code (for both Wagons and locos) Line 1	Type of asset consisting of 6 characters and 2 characters for owner code	S	M	L	J	1	3	Banked space	0	0	Banked space
2	Wagon Number & orientation char. Line 2	The unique number of the asset (8 char) plus 1 char for orientation (1 or 2)	5	2	1	2	3	4	5	6	Banked space	1
2	Locomotive Number & orientation char. Line 2	The unique number of the locomotive (7 char) plus 1 char for orientation. The number must include a prefix for locomotive type (E = Electric, D = Diesel or S = Steam)	E	0	0	7	0	1	1	Space	Banked space	2

Table-1: Examples of information to be programmed onto TFR vehicle tags

Vehicle Type	Tag Type Field (Max 6)	Owner code field (Always 2)	Number Field (Max 8)	Orientation Field (only 1)
Locomotive	34D400	00	34D123	1 or 2
GFB wagon	FZJ7	00	87654321	1 or 2
Coal line wagon	CCR11	00	63512345	1 or 2
Ore wagon	CR14	00	12345678	1 or 2

Table-2: Typical tag content information examples

5 Tag mounting

Two RFID tags shall be fitted on all TFR vehicles. One tag shall be fitted behind the second axle on the left hand side (front end of vehicle) and another tag shall be fitted in front of the third axle (or 5th axle on 6 axle locomotives) on the right hand side (rear end of the vehicle). The following conditions/ rules shall be adhered to when installing tags.

5.1 Tag height on TFR vehicles

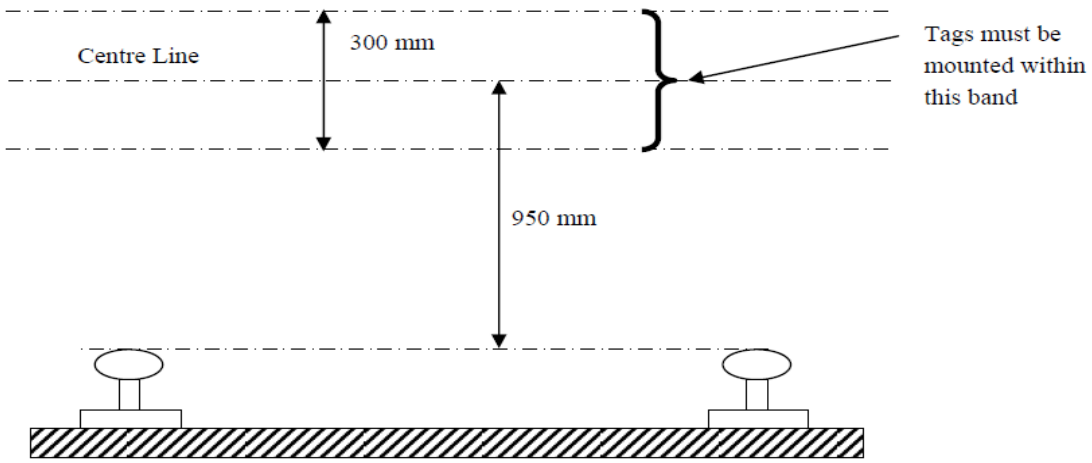

Figure 10; Tag height

Tag mounting height ideally shall be 950mm above the crown of the rail. This is the height at which the wayside reader antenna is positioned. If this height can't be met, tags can be installed up to 1100 mm or down to 800mm above crown of rail. See Figure 10.

5.2 Position of tag relative to wheels on locomotives or wagons

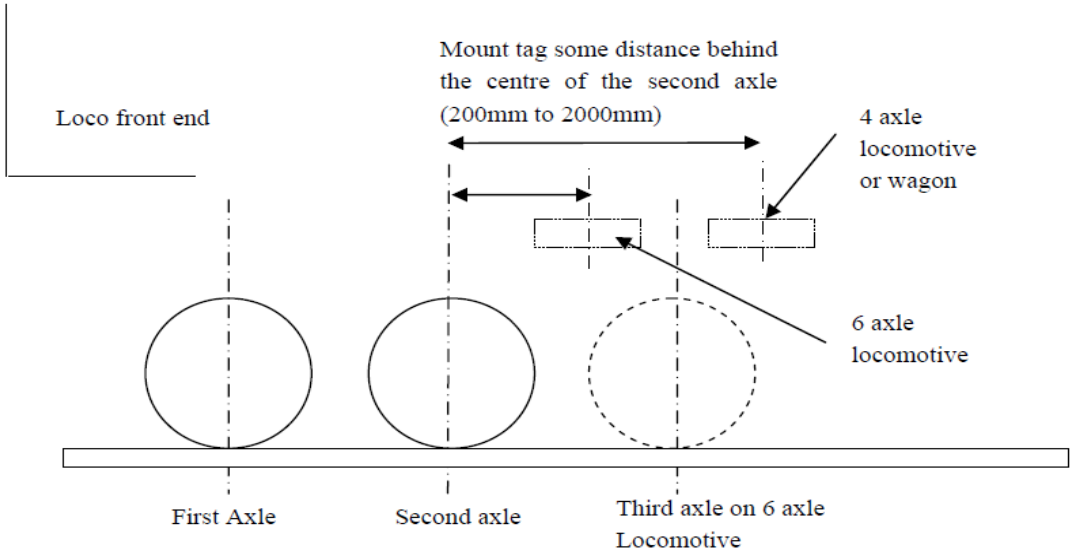

Figure 11; Tag positioning

Tags shall be installed behind the second axle, ideally in the range 200mm from centre of axle up to 2000mm. If these conditions can't be met, tags can be installed up to a distance of 500mm before centre of wagon. See Figure 11.

5.3 Minimum back plate dimensions (front view)

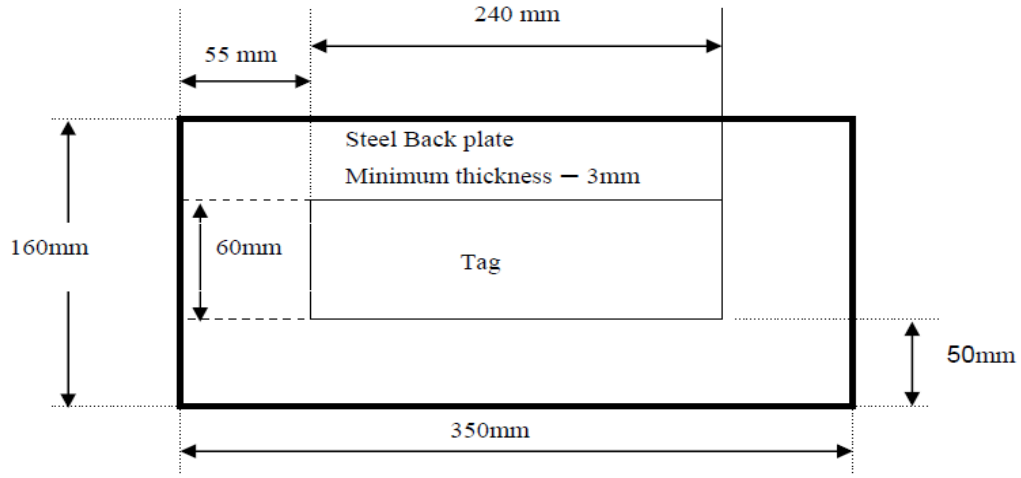

Figure 12; Back plate dimensions

If enough metal surrounding the tag is not adequate (350mm x 160mm), a back plate shall be used to mount the tag on before it is mounted onto the vehicle. See Figure 12.

5.4 Minimum clearance of metal surrounding the tag

When a tag is fitted it must be ensured that no metal intrusions are near the tag in a 25mm band around the tag. See Figures 13 & 14.

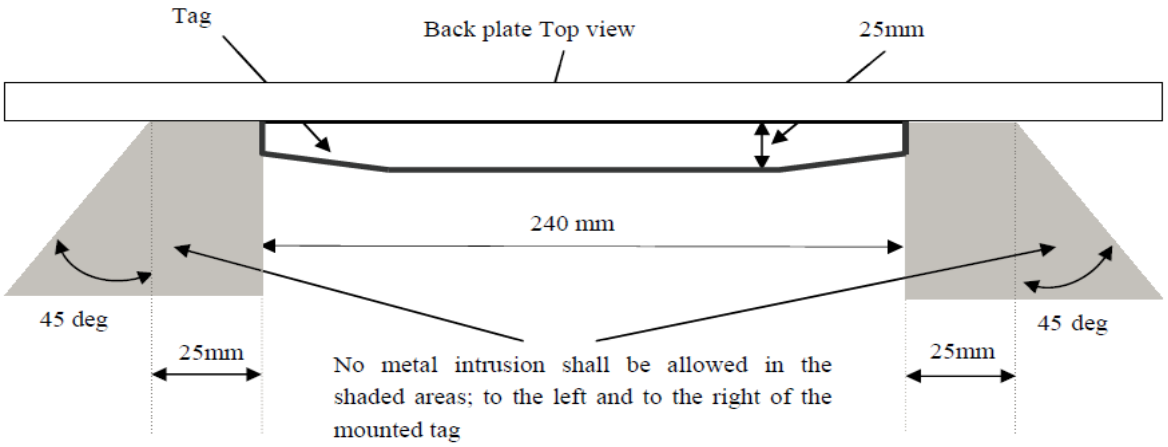

Figure 13; Minimum clearance – Top view

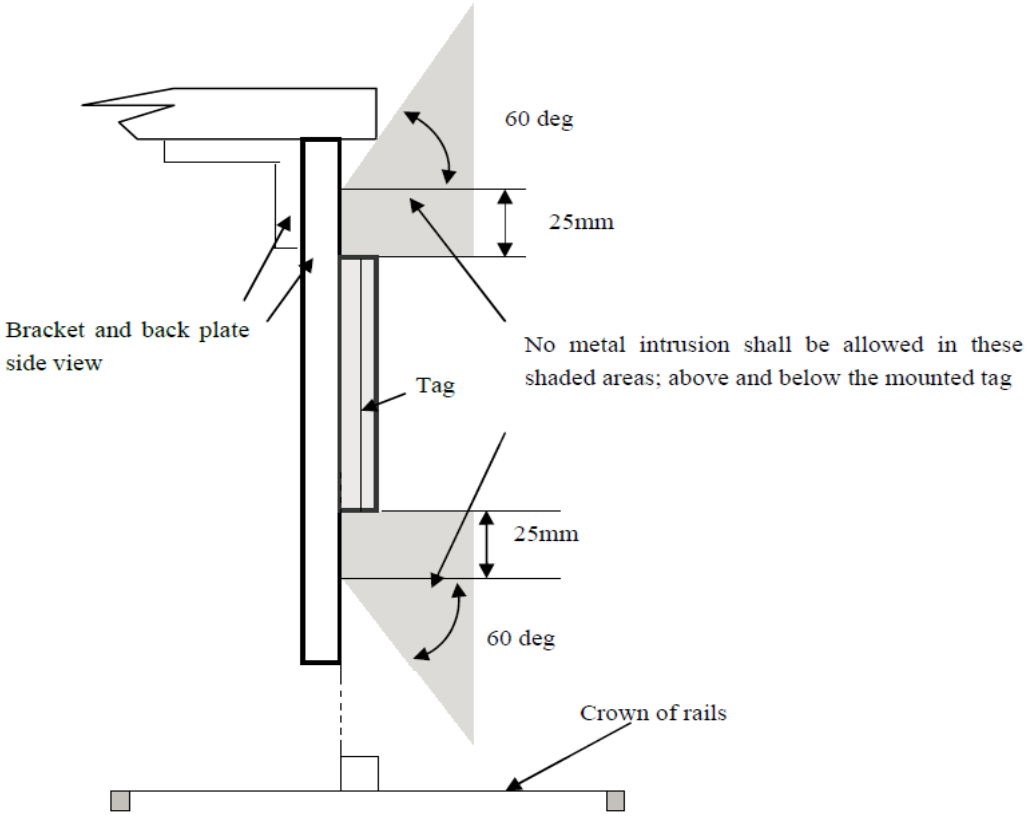

Figure 14; Minimum clearance – Side view