Note: This document still contains reference to Transnet and will be amended once the IM is fully established

School of Rail

FUNCTIONAL YARD OPERATIONS

Learner Guide

SHUNTING DUTIES

(Part 3 of 3 in US 264338)

FYO_06

50019582

4 DAY MODULE

US TITLE : SHUNT RAIL VEHICLES

SAQA US ID : 264338

NQF LEVEL : 3

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MANUAL OWNERSHIP

THIS LEARNER GUIDE BELONGS TO:

NAME:	SAP/STUDENT NO.:

DEPOT:	GRADE:

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REFERENCES/ACKNOWLEDGEMENTS

REFERENCES

1. General appendix part 1
2. Train working rules
3. POSMOR
4. Occupational health and safety act 85 of 1993
5. The constitution of the republic of South Africa
6. Cir/od/0235 – shunting at night where there is no high mast lighting or inadequate lighting
7. Cir/od/0243 – jumping on and off moving wagons
8. Cir/od/1093 – riding on steps of certain vehicles prohibited
9. Cir/od/0364 – shunt wagons: position in load

NOTE OF GRATITUDE

School of Rail would like to express its gratitude to the below listed employees for sharing their expertise and knowledge on shunting duties. Their experience has been of great help in developing this learning material.

The Curriculum and Assessment department would like to express our gratitude to Mr van Rooyen who has brought to our attention the plight of Yard Officials who do not know how to work with point indicators. It is for this reason that the literature portion of point indicators was added to the learning material.

PURPOSE OF THE LEARNER GUIDE

The qualifying learner will acquire the necessary knowledge and skills to attach and detach rail vehicles in order to arrange rail vehicles into specific combinations for organizational purposes. The ability to successfully execute this shunting process is the goal of this unit standard. They will be able to apply knowledge of the rail yard, POSMOR (Principles of Safe Movement on Rail) and working orders to couple and uncouple rail vehicles and control the movement of the rail vehicles within a confined area.

CONTENTS OF THIS LEARNER GUIDE

DURATION OF TRAINING

TOTAL DURATION (Actual)	**Hours**	**Minutes**
Theory		
Group/individual activities		
Formative self-assessment(s)		
Formative self-evaluation(s) (Self-study after hours)		
Summative assessment(s)		
Simulation		
Practical training		
OJT		
TOTAL:		

FACILITATOR'S ROLES AND RESPONSIBILITIES

The Facilitator is expected (but not limited) to-

- Guide, advise, support and assist the learners towards achieving the required competency level;
- Provide the learners with all the necessary learning materials so that they can achieve the required competency level and;
- Ensure that the learning programme is completed within the allocated time.

LEARNER'S ROLES AND RESPONSIBILITIES

The learner is expected to-

- Read the contents of the training material;
- Show respect for others at all times;
- Take part in all activities;
- Give comment when required to do so;
- Ask questions if you do not understand;
- Share your knowledge/experiences with other learners and the Facilitator and;
- Adhere to the rules and regulations of the training provider.

NOTES TO THE LEARNER

- You will be assessed on the contents of this learning unit
- Should any departure from the estimated times be necessary, it will be left to the discretion of the Facilitator
- All relevant safety rules must be observed
- Make sure that you understand the contents of the unit standard applicable to this learning unit
- The activity(s) given or similar activity(s) may be repeated as often as the Facilitator may deem necessary to ensure your competence in the work covered in this training material
- There will be formative self-assessments on the contents of each element, as well as a summative assessment on completion of the learning unit. (Ask the Facilitator for the dates of the assessments.)
- The assessments are designed to test your competence of the work learned.

ASSESSMENT INFORMATION

- Formative assessments in the form of self-assessments, self-evaluations (Self-study after hours) and individual/group activities are included in the learning unit.
- A summative assessment consisting of a theoretical assessment (written) – 1 hour, which allows learners an opportunity to prove their competence.

LEARNING AND ASSESSMENT MATRIX

US TITLE : SHUNT RAIL VEHICLES

US ID : 264338

	SPECIFIC OUTCOMES	Element	Section	Where assessed
2	Couple and uncouple rail vehicles	2	2.1 - 2.12	Activity 4, Activity 5
3	Control shunt movement of rolling stock	3	3.1 – 3.5	Activity 6, Activity 7, Activity 8,

	ESSENTIAL EMBEDDED KNOWLEDGE	Element	Section	Where assessed
	Learners can understand and explain:			
1	Principles of Safe Movement on Rail (POSMOR)	1; 3	1.1; 1.4; 1.4.13; 3.2; 3.5;	Activity 1; Activity 3; Activity 6; Activity 8
2	Relevant elements of Occupational Health and Safety Act, Act 85 of 1993	4	4.1 – 4.16	Activity 9; Activity 10; Activity 11
3	Protocol of two-way communication to facilitate safe movement on rail	N/A		
4	Elementary operating knowledge of rolling stock couplings, (mechanical and electric couplings)	2	2.1 – 2.6	Activity 5
5	Principles and theory of brake systems for the purpose of shunting	2	2.7; 2.8	Activity 4; Activity 5
6	Visual and auditory communication methods used during shunting	N/A		
7	Yard layouts	N/A		
8	Shunting procedures	1	1.1 – 1.4	Activity 1; Activity 2; Activity 3
9	The hazards and risks associated with shunting and required actions to deal with these	1	1.1 – 1.4	Activity 1; Activity 2; Activity 3

	CRITICAL CROSS-FIELD OUTCOMES	Element	Section	Where assessed
1	**IDENTIFYING** **Identify** and solve problems related to the execution of shunting rail vehicles in which responses display that critical thinking is used for responsible decision making	1	1.4	FISA
2	**WORKING** **Work** effectively with others as a member of a rail operations team to prepare rail vehicles for shunting according to instructions	1	1.4	FISA

	US TITLE	**: SHUNT RAIL VEHICLES**		
	US ID	**: 264338**		
3	**ORGANISING** **Organise** and manage oneself and one's activities responsibly and effectively in the execution of shunting related activities in compliance with POSMOR	1; 3	1.4; 3.2; 3.5	FISA
4	**COLLECTING** **Collect**, analyse, organise and critically evaluate information from shunting instructions in order to prepare for and execute shunting functions	1	1.1 – 1.4	FISA
5	**COMMUNICATING** **Communicate** effectively using relevant modes associated with shunting rail vehicles	N/A		
	SUMMATIVE ASSESSMENT :ONLINE			

PURPOSE OF THE UNIT STANDARD

The qualifying learner will acquire the necessary knowledge and skills to attach and detach rail vehicles in order to arrange rail vehicles into specific combinations for organizational purposes. The ability to successfully execute this shunting process is the goal of this unit standard. They will be able to apply knowledge of the rail yard, POSMOR (Principles of Safe Movement on Rail) and working orders to couple and uncouple rail vehicles and control the movement of the rail vehicles within a confined area.

The qualifying learner is capable of:

- Describing rail yard layout.
- Coupling and uncoupling rail vehicles.
- Controlling shunt movement of rolling stock

LEARNING ASSUMED TO BE IN PLACE AND RECOGNITION OF PRIOR LEARNING

It is assumed that a learner is competent in:

- Communication at NQF Level 2.
- Mathematical Literacy at NQF Level 2

UNIT STANDARD RANGE

N/A

SPECIFIC OUTCOMES AND ASSESSMENT CRITERIA:

SPECIFIC OUTCOME 1	**Describe rail yard layout**
ASSESSMENT CRITERIA	
ASSESSMENT CRITERION 1	Train lines are identified in relation to their purpose
ASSESSMENT CRITERION 2	Signals and points are identified in terms of their meaning and purpose.
ASSESSMENT CRITERION 3	Gradients are identified and explained in relation to their impact on shunting movement
ASSESSMENT CRITERION 4	Boards are described in terms of their meaning and purpose
SPECIFIC OUTCOME 2	**Couple and uncouple rail vehicles**
ASSESSMENT CRITERIA	
ASSESSMENT CRITERION 1	The relationship between rail vehicle couplings and shunting is explained in terms of rail operations.
ASSESSMENT CRITERION 2	Rail vehicles and wagons are coupled and uncoupled according to the mechanical operation and train working rules.
ASSESSMENT CRITERION RANGE	A rail vehicle includes but is not limited to passenger coaches, wagons, locomotives and motor coaches.
ASSESSMENT CRITERION 3	Electric cabling of commuter trains is coupled and uncoupled according to the mechanical operation and train working rules.
ASSESSMENT CRITERION 4	Brake pipes are coupled and uncoupled according to the mechanical operation and train working rules.
ASSESSMENT CRITERION 5	Consequences of not coupling all the necessary connections correctly are described in terms of the impact on train movement and safety.

SPECIFIC OUTCOME 3	**Control shunt movement of rolling stock**
ASSESSMENT CRITERIA	
ASSESSMENT CRITERION 1	Shunting procedures are explained in terms of organizational procedures and train working rules.
ASSESSMENT CRITERION RANGE	Shunting procedures include but are not limited to switching of points, position of blades, operation of derailers, various track-side indicators, level crossing protection, securing of stand-alone vehicles, foreign vehicles and skidded wheels.
ASSESSMENT CRITERION 2	Communication using hand signals in shunting rail vehicles is demonstrated according to train working rules.
ASSESSMENT CRITERION 3	Communication using a two-way radio in shunting rail vehicles is demonstrated according to train working rules.
ASSESSMENT CRITERION 4	Rail vehicle movements are controlled in a specific environment according to instructions, POSMOR and train working rules.

UNIT STANDARD ACCREDITATION AND MODERATION OPTIONS

- An individual wishing to be assessed (including through RPL) may apply to an assessment agency, assessor or provider institution accredited by the relevant Education and Training Quality Assurance body (ETQA), or one with an appropriate memorandum of understanding (MOU) with the relevant ETQA.
- Anyone assessing a learner against this unit standard must be registered as an assessor with the relevant ETQA or one with an appropriate MOU with the relevant ETQA.
- Any institution offering learning that will enable achievement of this unit standard, or assessing this unit standard, must be accredited as a provider with the relevant ETQA, or one with an appropriate MOU with the relevant ETQA.
- Moderation should include both internal and external moderation where applicable.

UNIT STANDARD ESSENTIAL EMBEDDED KNOWLEDGE

- Principles of Safe Movement on Rail (POSMOR).
- Relevant elements of Occupational Health and Safety Act, Act 85 of 1993.
- Protocol of two-way communication to facilitate safe movement on rail.
- Elementary operating knowledge of rolling stock couplings, (mechanical and electric couplings).
- Principles and theory of brake systems for the purpose of shunting.
- Visual and auditory communication methods used during shunting.
- Yard layouts.
- Shunting procedures.
- The hazards and risks associated with shunting and required actions to deal with these.

UNIT STANDARD DEVELOPMENTAL OUTCOME

N/A

UNIT STANDARD LINKAGES

N/A

CRITICAL CROSS-FIELD OUTCOMES (CCFO):

UNIT STANDARD CCFO IDENTIFYING

Identify and solve problems related to the execution of shunting rail vehicles in which responses display that critical thinking is used for responsible decision making.

UNIT STANDARD CCFO WORKING

Work effectively with others as a member of a rail operations team to prepare rail vehicles for shunting according to instructions.

UNIT STANDARD CCFO ORGANISING

Organise and manage oneself and one's activities responsibly and effectively in the execution of shunting related activities in compliance with POSMOR.

UNIT STANDARD CCFO COLLECTING

Collect, analyse, organise and critically evaluate information from shunting instructions in order to prepare for and execute shunting functions.

UNIT STANDARD CCFO COMMUNICATING

Communicate effectively using relevant modes associated with shunting rail vehicles.

QUALIFICATIONS UTILISING THIS UNIT STANDARD:

	ID	QUALIFICATION TITLE	PRE-2009 NQF LEVEL	NQF LEVEL	STATUS	END DATE	QUALITY ASSURING BODY
Core	66709	National Certificate: Rail Operations (Functional Yard Operations)	Level 3	NQF Level 03	Reregistered	2015-06-30	TETA

PROVIDERS CURRENTLY ACCREDITED TO OFFER THIS UNIT STANDARD:

This information shows the current accreditations (i.e. those not past their accreditation end dates), and is the most complete record available to SAQA as of today. Some Quality Assuring Bodies have a lag in their recording systems for provider accreditation, in turn leading to a lag in notifying SAQA of all the providers that they have accredited to offer qualifications and unit standards, as well as any extensions to accreditation end dates. The relevant Quality Assuring Body should be notified if a record appears to be missing from here.

1. Aerosud Holdings (Pty) Ltd

ICONS USED IN THIS LEARNER GUIDE

Icons representing various kinds of information can be found throughout this learning unit. They serve as a "quick-look" reminder of their associated text.

ICON	MEANING OF ICON
	**EXTRACTS** from TWR This icon indicates Extracts from Train Working Rules.
	**DANGER** This icon indicates that the failure to obey a Safety warning WILL result in serious injury to yourself or other persons.
	**DEFINITION** This icon indicates a statement of the exact meaning of a word or the nature or scope of something.
	**SELF-ASSESSMENT** This icon indicates where self-assessment questions are to be answered by the learner during the learning sessions.
	**INDIVIDUAL/GROUP ACTIVITY** This icon indicates that an opportunity is provided for you to practise or explore what has been learnt by means of completing this exercise individually or in a group.
	**EXTRACTS** from OC This icon indicates Extracts from Operational Circulars that have been issued to address specific issues in the TWR and GA.

ICON	MEANING OF ICON
	**SAFETY RULES** This icon indicates the Safety Rules to observe in order to prevent injury to yourself or other persons, damage to assets, as well as to increase productivity.
	**WARNING** This icon indicates a statement or event that indicates a possible or impending danger or problem.
	**NOTE** This icon indicates important additional information.
	**EXAMPLE** This icon indicates that an example is given to further clarify the associated text.
	**GLOSSARY** This icon indicates an alphabetical list of terms/words with explanations.

ABBREVIATIONS AND ACRONYMS USED IN THIS LEARNER GUIDE

ACRONYM	TERM	EXPLANATION
GA	**G**eneral **A**ppendix No 6 Part I	TFR's instruction book for general instructions and the operation of train control systems and trains working in general
SoR	**S**chool **o**f **R**ail	A training institution of TRANSNET FREIGHT RAIL.
TFR	**T**ransnet **F**reight **R**ail	A South African giant transportation company. It is a subsidiary of TRANSNET, a state owned company
TWR	**T**rain **W**orking **R**ules	TFR Train Working Rules for the control of train and shunting movements
ICAS	**I**ntegrated **C**ampus **A**ssessment **S**ystem	A computer based assessment program that is used for formative assessments at School of Rail
SAP	**S**ystems, **A**pplications and **P**roducts in Data Processing	A data base program used for record-keeping and data processing of most Human Capital requirements in the Organisation
FISA	**F**inal **I**ntegrated **S**ummative **A**ssessment	An assessment that integrates both the theoretical and practical components to determine the candidate's competency levels
BoR	**B**ill **o**f **R**ights	A section in the Constitution of the Republic of South Africa
DoL	**D**epartment **o**f **L**abour	A governmental department that is responsible to foresee labour's needs and safety

School of Rail

FUNCTIONAL YARD OPERATIONS

Learner Guide

ELEMENT 1

SHUNTING INSTRUCTIONS

SAQA US ID: 264338 NQF Level: 3

LEARNING OBJECTIVE

In this module, you will learn about the rules of shunting wagons safely. You will be taught the rules and regulations of the organization concerning shunting. Principles of safe movement on rail applicable to your occupation will be highlighted throughout the module. Please take note of them as they might save your life as well as your colleagues'.

LEARNING OUTCOME

- List the Principles of Safe Movement on Rail (POSMOR) and explain how to apply them in your working
- Explain the definition of the terminology used in shunting
- Adjust your behaviour to working safe with your colleagues as well as the Organization's assets
- Explain how to secure wagons that are stationary
- Differentiate between the different types of braking systems and identify the wagons using those systems

CONTENTS OF THIS ELEMENT

ELEMENT 1: SHUNTING INSTRUCTIONS

1.1 FOREWORD

Shunting is an activity of moving wagons from one track to another by means of a locomotive. These movements are performed mainly utilizing a diesel locomotive, and they take place in a confined area. Most of the time the movement will be performed while the Train Driver is pushing back with or without wagons attached to the locomotive. There are high risks involved in these kinds of movements as the Train Driver is not able to see what is going on at the back of the movement.

This is where communication is of the utmost importance. In trains working, there are very pertinent rules that must be followed by everybody for the safety of everybody. The Organisation has since developed certain safety principles that **must be complied with** at all times by all the employees of the Organisation to minimize safety risks.

As mentioned in the previous module named **Communication**, there are two kinds of communication used by the Organization, namely; verbal (radio & telecoms) as well as non-verbal (hand signals) communication. There are **eight (8) Principles** that must be in the forefront when train and shunting movements take place; namely:

1.1.1 **Common to personal behaviour**

1.1.2 **Common to movement**

1.1.3 **Authority**

1.1.4 **Before moving**

1.1.5 **Whilst moving**

1.1.6 **Stop**

1.1.7 **Whilst stationary**

1.1.8 **Common to abnormal conditions**

These principles are called **P**rinciples **o**f **S**afe **M**ovement **o**n **R**ail with an acronym **POSMOR**. Each principle has values attached to it and each one will be highlighted throughout the progress of the course.

1.2 PURPOSE

The contents of this Element deal with the instructions to be applied for the safe and correct working regarding shunting movements. Elements 2 and 3 relates more to shunting instructions and signals and system utilisation during shunting respectively. It is important that the employee concerned with shunting of wagons should know the correct and safe standard operating procedures thereof and know where to apply each instruction in relation to their action.

1.3 DEFINITIONS

NOTE: all the terms and their definitions were extracted from the Train Working Rules **[TWR]** Part I termed Definitions and General.

AUTHORITY

It is a written, oral, or other permission to a licensed person to perform a specific task, within a defined area.

DERAILER

It is any device applied to the track in a siding, which will derail wagons and/or prevent them from fouling the adjacent line in case of irregular movements;

STATION

It is a place on a running line where certain trains are scheduled to stop, with an authorised/licensed person on duty, whether trains can cross or pass there or not.

TRAIN DRIVER

Is an employee on duty in charge of and responsible for the operating of a locomotive or motor-powered wagon;

FOOTPLATE

It is the cab of a steam locomotive, or the driving compartment from which a diesel locomotive, electric locomotive, electric motor coach or electric driving trailer is being controlled;

(Note: Steam locomotives are still used by Heritage, ROVOS Rail and other private companies)

LOCOMOTIVE

It is a steam locomotive, diesel locomotive, electric locomotive, electric motor coach or electric driving trailer coupled to an electric motor coach;

SCOTCH BLOCK

It is a wooden sprag or wedge with a handle placed on the rail and under the wheel of a stationary wagon to prevent it from moving;

SHUNTER

It is an employee, irrespective of their grade, engaged in coupling and uncoupling wagons and the movement of trains or wagons within prescribed limits;

SHUNTING

Is a movement of a locomotive, motor-powered wagon wagons or of a locomotive or motor-powered vehicle with wagons attached, to, from, or on a running line or siding within certain prescribed limits;

WHISTLE

The whistle, hooter, or siren fitted on a locomotive or motor-powered vehicle, by means of which an audible (to hear) warning and/or signal may be given;

PROTECT

It is any measures designed and/or taken to prevent conflicting movements and/or unsafe conditions;

DAY

It is the period between sunrise and sunset;

NIGHT

It is the period between sunset and sunrise;

AUTHORISE

It is the permission given by a licensed person, allowing another suitably licensed person to undertake a certain task;

CLEAR

It means the track/line is free of detectable obstructions within the structure gauge. (Also within the clearance marks);

CLEARANCE MARK

It is a horizontal white line between two converging lines, which indicates the minimum distance at which rolling stock may stand from the points/crossings;

DEFINED TRACK

It is the fixed limits or boundaries of the portion of line required for movement;

TRAIN DRIVER

It is the licensed employee/person in control of a motorised rail vehicle;

HAND SHAKING

In relation to an authority, it means the process of ensuring that communication, by any means, has been understood by the one receiving it, so that the authority will be carried out as intended;

INFRASTRUCTURE

It is the signalling, high voltage electric equipment, permanent-way and communication installations and associated structures/fixtures necessary to operate a railway;

LICENSE

It is the written permission granted by the railway operator (employer) to a competent employee/person to perform certain duties;

LICENSED PERSON

It is any person that is trained and qualified to perform certain duties as specified in the rules;

LINE; TRACK

It is a railway line;

LOCOMOTIVE

It is a self-propelled rail vehicle, or set of self-propelled rail vehicles, designed to haul trains or for shunting purposes;

RUNNING LINE

It is a main line, a loop line or any other line, normally set apart for the passage of trains;

SERVICE WORTHY

It means that the rolling stock, loaded or empty, either singularly or in combination, is fit to operate safely on a railway line, with or without prescribed conditions;

SIDING

It is any line other than a running line;

STATION

It is a place on a running line where certain trains are scheduled to stop, with an authorised/licensed person on duty, whether trains can cross or pass there or not;

TOKEN; TRAIN TOKEN

It is a tangible authority, which is handed to, or is completed/ obtained by a driver to proceed over a prescribed section of a single line under specified conditions;

TRAIN-CONTROL OFFICER

It is the licensed employee who is primarily responsible for the control of trains and the operation of train control instruments signals and points;

TRAIN

It is a motorised rail vehicle, with or without vehicles attached, having a prescribed marker, specific number, defined origin and destination;

TRAIN MOVEMENT

It is the working of a train on any railway line;

TRAIN WORTHY

It means that the infrastructure is fit to accept rolling stock under specified conditions;

WAGON

It is a rail vehicle/wagon/coach for the conveyance of persons or freight on a railway line;

ACTIVITY 1 - POSMOR

COMPLETE ACTIVITY 1 ON PAGE 1 OF THE LEARNER WORKBOOK AS AN INDIVIDUAL. UTILIZE THE SHEET PROVIDED ON THE LEARNER WORKBOOK.

When you are finished with the activity, discuss the answer with the Facilitator to ensure that everyone understands the answer/s.

1.4 PRECAUTIONS TO BE TAKEN BEFORE AND DURING SHUNTING

BE ALERT, VIGILANT AND ASSESS SURROUNDINGS is one of the values found in POSMOR. This value which is found in POSMOR principle 1 **(COMMON TO PERSONAL BEHAVIOR)** applies at all times to all employees who in some or other way are involved with the running of trains or with shunting movements. Transnet has to pay millions of rand every year for claims and damage resulting from train accidents, and the need to be **observant** and **vigilant** cannot be strongly emphasised. **"Be where you are with your entire mind!"** This means that the employees must devote their full attention to their job!

1.4.1 THE APPLICATION OF PRINCIPLE 4 (BEFORE MOVING) AND ITS VALUES

Shunting in a yard must be done in an organised manner. Each shunting team and shunting locomotive must work in a defined area, and the one team may not enter the area of another team before arrangements have been made and those concerned had come to a clear understanding.

The person responsible for the shunting movement herein referred to as the Shunter, must apply principle number 4 of **POSMOR**. Before shunting is commenced, the Shunter must, when possible, advise the Train Driver of the nature and extent of the shunting movements to be performed **[TWR128(1)]**. In other words, the Train Driver must be notified of how many movements are required to complete the shunting movement.

The Shunter must always follow this principle before giving any instruction for the Train Driver to move. Listed below are the values that govern this principle. Let us have a look at those values in detail.

VALUES

1.4.1.1 THE TRACK MUST BE DEFINED

Since a movement is to take place, it must surely refer to the boundaries or limits of the track or portion of track over or on which the movement (train or shunting movement) is to take place. All will agree that the Train Driver of a train or shunting movement cannot be given a blank cheque to move, without an indication of the limits of the movement. That means that the Train Driver must know from exactly where to exactly where and via which route they may move. This must be known to all the involved personnel and understood by all involved in the same way and then it can be said that the track has been **defined**.

The defined track in the case of a shunting movement can extend over just a few metres. What is of the utmost importance, however, is that all those concerned must know the exact limits before the movement takes place.

The authorised employee who normally authorises train and/or shunting movements must, before issuing or giving the authority; themselves have absolute clarity on the "limits" of the movement. When two or more employees are concerned in defining the track, they must all be in agreement.

But it is not only people who can "define" the limits of a movement, it can also be done by "technical" means; e.g. by means of a signal which, when operated (placed at "all right", "caution" or "proceed"), authorises a movement to the next signal, especially in the case of train movements. The defined track or portion of track is thus, in this example, from signal to signal.

1.4.1.2 THE DEFINED TRACK MUST BE CLEAR

It is the responsibility of the Shunter to ensure that, before they authorise a movement, the portion of line over which the movement is to take place **(the defined track)** is clear of trains or vehicles or other detectable obstructions, and that, where points are situated in the defined track or the route over which the movement is to take place, the points are correctly set before the movement was authorised **[TWR127(1)]**. For instance:

1. For a shunting movement to take place in a station or shunting (marshalling) yard, the yard employee authorising the movement must ensure that the portion of line over which the movement is to take place, either to detach or to attach a vehicle/s, is clear for the movement to be safely carried out.
2. Where there are points within the defined track they must, where possible, be correctly set **before** the movement is authorised.

Remember – if it cannot be establish without a doubt that the defined track is free of detectable obstructions; no movement may be permitted over that defined track.

1.4.1.3 HOW TO ISSUE/OBTAIN AUTHORITY

However, although a licensed person is in charge of lines for the movement of trains or for shunting movements, a signal that has been operated for such a movement becomes the Train Driver's authority to move – and such signals tell the Train Driver how far they may proceed before receiving a new authority. Likewise, when a Train Driver receives a token (there are numerous kinds of tokens used under the different train control systems on single lines), such token too, will inform them how far they may proceed and under what conditions.

The Train Driver of a train or shunting movement may not move on any line or portion of line without such authority. Normally a separate authority must be issued/given for each movement, but one authority can, if circumstances so require, combine two or more movements.

1.4.2 TWO OR MORE LOCOMOTIVES WAITING TO BE SHUNTED

When two or more locomotives or trains are standing near to each other waiting to be shunted, the Shunter must not give a hand signal to any of the Train Drivers to move before they have made clear to all Train Drivers which locomotive or train is to be shunted first **[TWR128(2)]**. This is to avoid the confusion in case both Train Drivers mistaken the hand signal to be theirs and they start moving simultaneously.

1.4.3 SHUNTING INTO AND OUT OF SIDINGS

Before wagons in a siding are moved or before wagons are shunted into a siding, the employee in charge of the movement must ascertain the position of any wagons which may be already standing in the siding. They must also orally warn persons engaged in, about, between, or under any wagons, and request persons who may be loading or unloading to stand clear. They must also see that the line upon which shunting is to be performed is not fouled by a crane, loading apparatus, shunting implement or a road vehicle **[TWR127(2)]**.

Employees in charge, and also Train Assistants and Shunters must see that the doors of all wagons are securely closed before such wagons are attached to a train. They must also see that chains, ropes and tarpaulins are examined and made secure **[TWR121]**.

1.4.4 SHUNTING AT BOTH ENDS OF A YARD AT THE SAME TIME

When shunting operations are carried out, involving the movement of wagons from opposite ends of a line at the same time, the employee in charge must satisfy themselves that a **clear understanding** is arrived at between the Shunters at each end of the yard. In carrying out such shunting movements, precautions must be taken to guard against the wagons coming into violent contact, and Train Drivers must be vigilant and cautious and be prepared to comply with hand-signals or radio instructions **[G.A.9006]**.

It is the duty of the employee in charge of the movement to see that precautions are taken to prevent the possibility of wagons moving on to any running line or fouling the clearance marks of any adjoining line(s) or siding(s) **[G.A.9006.2 and TWR138]**.

1.4.5 SHUNTING AT NIGHT AND WHERE THERE IS NO HIGH MAST LIGHTING OR INADEQUATE LIGHTING (CIR/OD/0235)(Document 02-00)

At night, a locomotive when working exclusively on shunting operations must, in addition to a headlight, have a red light at both ends of the locomotive, meaning in front and rear **[TWR76]**.

When trains are required to be shunted at night at places where there is **no high mast lighting** or **inadequate lighting**, the following procedure must be adhered to:

Supervisory Officers must ensure that employees that are required to shunt at night are provided with hand lamps as well as headlamps that are in good working condition and spare batteries when they sign on duty.

The Area Manager must arrange with the infrastructure department and the client to ensure that walkways are level and are clear of overgrown vegetation.

Supervisory Officers must conduct regular inspections in order to ensure that walkways are clear of obstructions, clear of overgrown vegetation and are level.

There are strict rules and regulations concerning shunting at night in yards and sidings. These restrictions are there for the safety and wellbeing of employees and they must be adhered to at all times. Employees noticing his/her colleagues disregarding these set rules must report them immediately to his/her Supervisors. The rules are as follows:

Employees performing shunting duties at night are not allowed to ride on wagons or wagons steps. Climbing on and jumping off wagons in motion is prohibited. Employees must walk ahead of propelling movements and walk alongside a hauling movement.

An employee placing wagons under overhead traction equipment must ensure that the wagons are placed within the boundaries where loading and unloading is permitted.

1.4.**6 PERMISSION TO SHUNT**

Wagons must not be taken or placed on the running line outside the area protected by fixed signals unless they are attached to a locomotive, and then only when permission is given **[TWR129, 131 and 220]**.

A train standing on a running line at a telegraph station must not be moved forward or set back, nor may a train be allowed to foul an adjoining running line, until the permission of the Train-Control Officer has been obtained. Permission to shunt on running lines may be obtained in the following manner from the Train-Control Officer: **[TWR173(3)(a)]**

1.4.6.1 Where fixed signals are provided to control the movement, these fixed signal(s) must be operated. In addition, the prescribed hand signal or oral instructions must be given to the Train Driver, either by the Train-Control Officer or employee in charge of the movement **[TWR173(3)(1)]**.

1.4.6.2 Where no fixed signals are provided to control the movement oral instructions and the prescribed hand signal must be given to the Train Driver. These instructions and hand signal must be given by the Train-Control Officer or by the employee in charge of the movement. The latter employee must however first obtain the oral permission of the Train-Control Officer **[TWR173(3)(2)]**.

1.4.6.3 At a place other than a telegraph station (a token station or inter-loop) the permission must be given by the employee in charge of the shunting movement **[TWR173(3)(b)]**.

ACTIVITY 2 – NIGHT SHUNTING AND AUTHORITIES

COMPLETE ACTIVITY 2 ON PAGE 2 OF THE LEARNER WORKBOOK AS A GROUP OF NOT MORE THAN THREE (3) LEARNERS PER GROUP. UTILIZE THE SHEET PROVIDED ON THE LEARNER WORKBOOK.

When you are finished with the activity, discuss the answer with the Facilitator to ensure that everyone understands the answer/s.

1.4.7 SPEED TO BE REGULATED AND DAMAGE TO BE PREVENTED

The Shunter must give the correct hand signals or oral instructions to the Train Driver, and **not** allow wagons to touch stop blocks (which are intended to indicate the ends of lines only) or come into contact with other wagons and the movement must be maintained at a speed not exceeding average walking pace **[TWR134]**.

During shunting, a Train Driver must be vigilant, maintain a good lookout, and promptly obey hand signals and/or oral instructions. They must regulate the speed and prevent their locomotive or wagons attached thereto, from striking stop blocks or coming into contact with other wagons with undue force. Brakes must be applied by the Train Driver in a manner that will not cause skidding of wheels. The Train Assistant must also keep a good lookout when not engaged in locomotive duties.

Yard supervisors must realise that safety promotes efficiency and, if employees do not work safely in marshalling yards, the productivity of the yard will be severely hampered. Reckless shunting of wagons at high speeds causes damage, not only to wagons, but also to the contents thereof. When goods in wagons are damaged, claims can be logged against TRANSNET and large amounts are paid out annually as a result of this. The conveyance of this type of traffic may also be lost to private enterprise. Rough shunting may also damage wagons to such an extent that it may become defective in the section, thereby causing the train to derail.

1.4.8 MASS AND SPEED OF WAGONS SHUNTED

Discretion must be used in deciding the number of wagons to be shunted at a time, and the speed of the movements, taking into account to the class of locomotive employed, the state of the permanent way, and the traffic and physical conditions at the place where the work has to be undertaken **[TWR134(2)]**.

1.4.9 DECIDING ON BRAKING POWER

Before shunting is commenced the employee in charge of the shunting movement must advise the Train Driver of the number of wagons with vacuum coupled through as well as his/her total mass and general composition **[G.A.9001]**.

If, at this stage or later during the shunting movement the Train Driver is not satisfied that he/she has adequate brake power available, they must advise the employee in charge of the shunting movement of the additional number of wagons they require the vacuum to be coupled through. **[G.A.9001.1.1]**.

1.4.10 MOVING IN-BETWEEN WAGONS

When an employee has to move in between two locomotives, a locomotive and a wagon or two wagons to adjust the knuckles or centre or adjust the couplers or test the gravity locks to ensure that they are fully down, in position, or for any other reason whatsoever, the movement must be brought to a standstill before he/she moves in between the locomotives/wagons concerned **[G.A.9017.2]**.

Many of the company's employees have been gravely and seriously injured, and others even fatally as a result of being pinched between the couplers because of moving between the locomotives/wagons during a movement.

Nobody may be between two locomotives, a locomotive and a wagon or two wagons when they are brought together to be coupled [G.A.9017.3].

The instruction for coupling of locomotives/wagons may not be given whilst a person is still between the locomotives/wagons concerned [G.A.9017.4].

OPENING A BUFFER WITH A FOOT

Opening a buffer with a foot or other object when it is stuck is strictly prohibited.

Should the employee performing the shunting movement see the need to adjust the buffers, they should bring the movement to standstill first before moving in to adjust the buffers.

After the instruction for coupling the locomotives/wagons has been given, nobody, for whatever reason, may move in between the wagons concerned until the movement has been brought to a standstill **[G.A.9017.5]**.

1.4.11 SHUNTING AND DETACHING WAGONS WHERE A LINE IS NOT LEVEL

When a train is standing on a gradient and it is necessary to detach the locomotive f, the Train Assistant or Shunter must first apply the hand-brake of the last wagon , and then as many wagons brakes and scotches blocks at the lower end wagons so as to prevent them from moving **[TWR137(1)]**.

When shunting wagons to a siding situated on an incline, the number of wagons must not be more than the locomotive can move up the incline without having to approach the siding at excessive speed. Moving at excessive speeds may cause the Train Driver to be unable to stop the movement in time, thereby causing a collision or derailment. **[TWR137 (2)]**.

1.4.12 PROPELLING MOVEMENTS

During a propelling movement; a member of the shunting team must, with due allowance for his/her own safety, **ride upon a suitable wagon** at the leading end in such a manner that they will have the **best view to both sides of the line**.

PROPELLING MOVEMENT

They must keep a good lookout and give the correct hand signals or oral instructions to the Train Driver to prevent accidents or damage taking place **[TWR134(4)(a)]**.

Should there be no suitable wagon to ride upon with safety, or the circumstances are such that the Shunter will not have a clear view to the front, they must walk ahead of the movement **[TWR134(4)(b)]**.

1.4.13 THE APPLICATION OF PRINCIPLE 5 (WHILST MOVING) AND ITS VALUES

It is of utmost importance to at this stage observe principle 5 of POSMOR as well as its values. Principle 5 (WHILST MOVING) reflects on what the personnel that is involved in the shunting movements must adhere to during the movement, especially propelling movements.

The shunting team must always follow this principle whilst there is a propelling movement. Listed below are the values that govern this principle. Let us have a look at those values in detail.

VALUES

1.4.13.1 **Adhere to speed instructions**

It must also be remembered that certain types of vehicles and circumstances call for speed restrictions, which must be obeyed by Train Drivers.

1.4.13.2 **Stopping distance of trains**

As a general rule, any train must have sufficient train-braking ability to enable it to stop within a distance of 1,500m under all circumstances. This norm is used for determining signal placing, and for the protection of maintenance crews. Signals, however, can be placed at shorter distances where gradients aid train retardation.

In order to conform to the stopping distance norms, and depending on train and route profile, various restrictions have to be enforced. These restrictions include limitations on average train-axle loading, general and downgrade, speed restrictions, special prescribed train-handling methods, and minimum train-braking power requirements.

Although 1,500m are the absolute norm, variations in the mechanical condition of equipment, co-efficient of friction of brake blocks, wheel temperature, adhesion, and train handling, in general, necessitate a more conservative design norm.

1.4.13.3 Permissible train speed

The maximum permissible train speed is dependent on various factors, such as:

1. **Vehicle speed**. The maximum safe speed of a rail vehicle depends on various parameters. From a stability point of view, the type of bogie, wheel profile and maintenance standard play a role. It is important to note that in some vehicle types the stability limit lies just above the maximum speed of the vehicle and exceeding of the speed will lead to instability and possible derailment. Although individual vehicles have an inherent safe vehicle speed, additional factors have to be taken into account when vehicles are marshalled to form a train.
2. **Speed restrictions** are also to be applied and observed during shunting operations. In this respect there are a number of aspects the Train Driver must take into consideration, e.g., the length and weight of the load; the class locomotive and the nature of the brake power; the number of vehicles on the load with the brake coupled through; whether the line is on a falling gradient, on level ground or on an incline; whether there are curves in the line that could obstruct the view on the leading vehicle and/or shunting personnel; the distance – defined track – over which the movement is to take place, etc. While the foregoing refers to technical/physical aspects, Train Drivers must at all times obey the hand signals of the shunting personnel and regulate the speed of the movement accordingly.

1.4.13.4 Adhere to trackside and other indicators

Trackside and other indicators are provided for the information of the train personnel, but especially for the information of drivers, too, call for special attention to ensure correct train handling and safety.

Whistle boards are also provided for the purpose of ensuring safety. Not necessarily the safety of the train itself – although we cannot exclude trains – but the safety of road users requiring to cross the line at level crossings, i.e. drivers of road vehicles and pedestrians.

Other trackside indicators are apparatus indicators, "B" and "X" boards, etc., as well as hand signals displayed by technical personnel working on or in the proximity of the track, etc. Apart from trackside indicators there are also overhead indicators such as electric traction indicators, while it is quite likely that indicators could, in future be provided in locomotive cabs for the information of Train Drivers.

It is not necessary to list all indicators here – it will be done in another publication (e.g. notices, instruction books) – but what is important to remember is that they are all provided to ensure safety and efficiency in train and shunting operations and must, therefore, be strictly obeyed.

1.4.15 **IRREGULAR HABITS**

The shunting personnel are in the habit of moving in between wagons, mostly moving, to centralise couplers, to couple/uncouple vacuum pipes and even leaning and stretching across and under buffers to reach something on the other side. **This is dangerous and is strictly prohibited**. The instructions clearly stipulate that wagons must be stationary before employees may move in between wagons.

Personnel are ***injured or even killed because they walk on the railway line with one or both feet, concentrating on the coupler(s), vacuum pipes, etc. and forgetting about the wagon's wheels***. Some of the new wagons are designed in such a manner that the wheels are fitted very close to the ends of the wagons and are therefore very dangerous.

The practice of ***crawling under wagons or climbing over buffers is not permitted***. Personnel must ***never slacken their concentration during shunting operations*** and must look out ***carefully before crossing a railway line***, especially lines on which traffic and detached wagons are standing. If personnel ***do have to move in between wagons, they must first make sure that both wagons are stationary and that no other movement is going to be carried out on that particular line, which may probably endanger their safety.***

If no precautionary measures were taken beforehand, no person must loiter unnecessarily between two lines and waste any time in the danger zone.

No person must walk or stand on the sleepers between the lines or on the sleeper heads alongside the line for convenience sake. Only those, whose duties require them to do so, may do so and even then the greatest care must be taken.

Employees are not always well informed of the contents of their duty sheets, which clearly state what duties must be performed, and on what conditions. One must not always rely on the controlling officer to take the lead in complying with or promoting the precautionary measures that are laid down. These measures are for everybody's safety and every employee, however insignificant their job may seem to be, must be part thereof.

When signing on duty, employees must read the instructions on the notice boards and in the paste books as there may be instructions that may apply to them **[G.A.1005.0, G.A.1055.0]**.

If one does not fully understand an instruction, they must ask their Supervisor to explain it to them. It will not be an excuse if they say afterwards that they did not understand or have not received an instruction **[G.A.1005.0, G.A.1055.0]**.

NOTES

ACTIVITY 3 – PRE-ASSESSMENT

COMPLETE ACTIVITY 3 ON PAGE 3 OF THE LEARNER WORKBOOK AS AN INDIVIDUAL. UTILIZE THE ANSWER SHEET PROVIDED ON THE WORKBOOK.

When you are finished with the activity, discuss the answer with the Facilitator to ensure that everyone understands the answer/s.

School of Rail

FUNCTIONAL YARD OPERATIONS

Learner Guide

ELEMENT 2

COUPLING INSTRUCTIONS

SAQA US ID: 264338 NQF Level: 3

LEARNING OBJECTIVE

In this element, you will learn instructions pertaining to coupling of different types of wagons. You will learn how to secure detached wagons and prepare wagons before they are moved

LEARNING OUTCOME

- Explain the difference between an air brake wagon and a vacuum wagon
- Explain how to apply hand brakes on all types of wagons
- Explain how to release the brakes before moving wagons
- Understand the use and marshalling of a shunt wagon
- Identify foreign wagons

CONTENTS OF THIS ELEMENT

ELEMENT 2: COUPLING INSTRUCTIONS

2.1 GENERAL

There are two (2) types of braking power that are used on TRANSNET trains, namely- **Vacuum Brake System** and **Air Brake System**. The Vacuum Brake System utilizes the suction power of the exhauster found in the locomotive. For the train brakes to apply, the exhauster must suck the air out of the pipes of the train. There must be no or minimum leakage of air in the pipes or leakage must be minimal for the brakes to be effective.

The Air Brake System utilizes the compressor that is in the locomotive to pump air in the train pipes in order for the brakes to function. In both brake systems there are gauges in the locomotive cabs that notifies the Train Driver if they have obtained the required amount of pressure for the train brakes to be work effectively.

Needless to say then, there are wagons that only utilize vacuum braking, others utilize only air braking and others have a combination of both vacuum and air braking systems.

The coupling and uncoupling of air brake hoses of air braked wagons and the closing and opening of their associated angle cocks must be so performed as to avoid injury to personnel, damage to equipment and unnecessary delay.

When air brakes are coupled through and in use and the locomotive is detached from a train or a wagon or a group of wagons, or the locomotive together with one or more wagons is detached from one or more wagons, it must be so done that an emergency brake application is caused on the wagon/s remaining behind. The angle cock of the first wagon remaining behind where the parting occurs must be left fully open, and the angle cock on the wagon that is now last and still attached to the locomotive or the angle cock on the locomotive must be closed.

Any air braked wagon, or a group of air braked wagons with their brake pipe hoses coupled, which is/are left standing without a locomotive attached, must have at least one angle cock at an uncoupled brake pipe hose left in the fully open position. Leaving the angle cock open will allow the air pressure to escape, thereby applying the brakes on the remaining wagons.

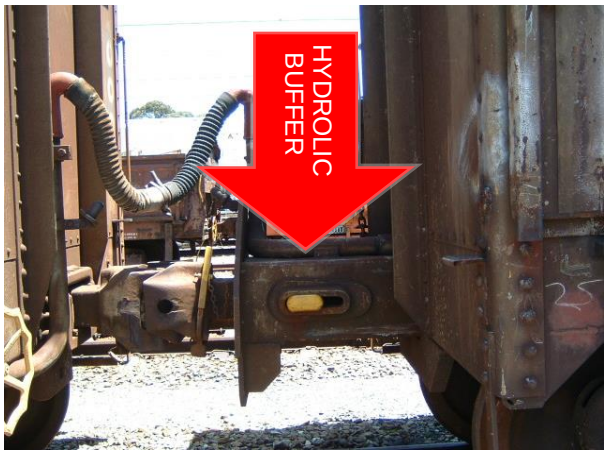
When shunting with air brake wagons, the Train Driver must ensure that sufficient brake power is coupled through and available for the particular movements and circumstances.

It must not be assumed that any air brake application which may exist on a detached wagon or group of wagons will remain effective, and should there be any possibility that detached wagons may move as a result of a gradient or other reason, an adequate number (enough) of hand brakes must be applied.

Before a stationary air braked wagon or a group of wagons coupled together are moved for shunting or for any other reason, it must be ensured that the air brakes and hand brakes of each wagon are fully released.

2.2 BUFFERS

Wagons are equipped with buffers at each end to enable them to be joined together.

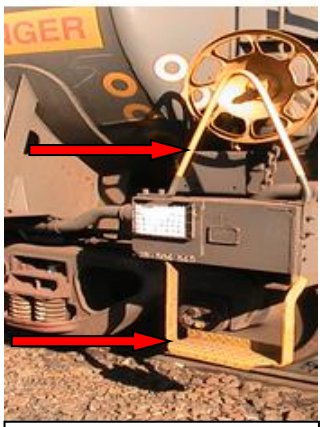


Certain wagons are equipped with hydraulic buffers to cushion bumps and knocks. Bumps and knocks have a detrimental effect on the contents/load of these wagons and must under all circumstances be carefully shunted.

Supervising personnel must give special attention to the shunting of these wagons as the wagon as well as contents may be damaged by rough shunting.

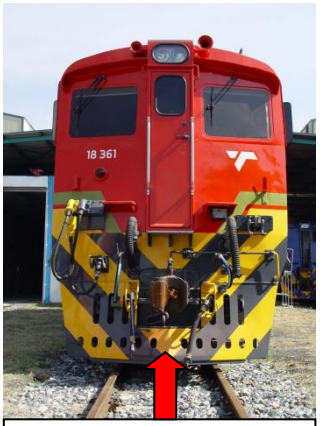
2.3 JUMPING ON AND OFF AND RIDING ON wagons

2.3.1 HANDGRIPS AND STEPS TO BE USED FOR RIDING ON WAGONS



HAND GRIP AND STEP IRON

Shunters must make use of the step irons and handgrips on wagons to ride upon and to facilitate the application of the brakes **[TWR134(3)(a)** and **G.A.9014.1]**. Shunters must not ride upon locomotive cowcatchers or on the footplates in front of the smoke box of steam locomotives or on the couplers of locomotives or wagons **[TWR134(3)(b)]**.



COWCATCHER

(NOTE**:** steam locomotives are still used by Heritage, ROVOS Rail and other private companies)

2.3.2 JUMPING ON AND OFF A MOVING VEHICLE PROHIBITED

Climbing on and jumping off wagons in motion is prohibited. Should it be necessary for an employee to climb onto or get off a moving wagon, the employee must instruct the Train Driver to stop the movement before they may do so **[CIR/OD/0243]**.

2.3.3 RIDING ON STEPS OF CERTAIN TYPES OF VEHICLES PROHIBITED [CIR/OD/1093]

Due to the design and positioning of handles on certain wagons, flat bed and container wagons to be precise, result in employees having to take a poor posture and lack of proper balance. By adopting a poor and uncomfortable posture, employees risk slipping and falling from moving wagons. It is for this reason that it is strictly prohibited for employees to ride on the following types of wagons for shunting purposes:

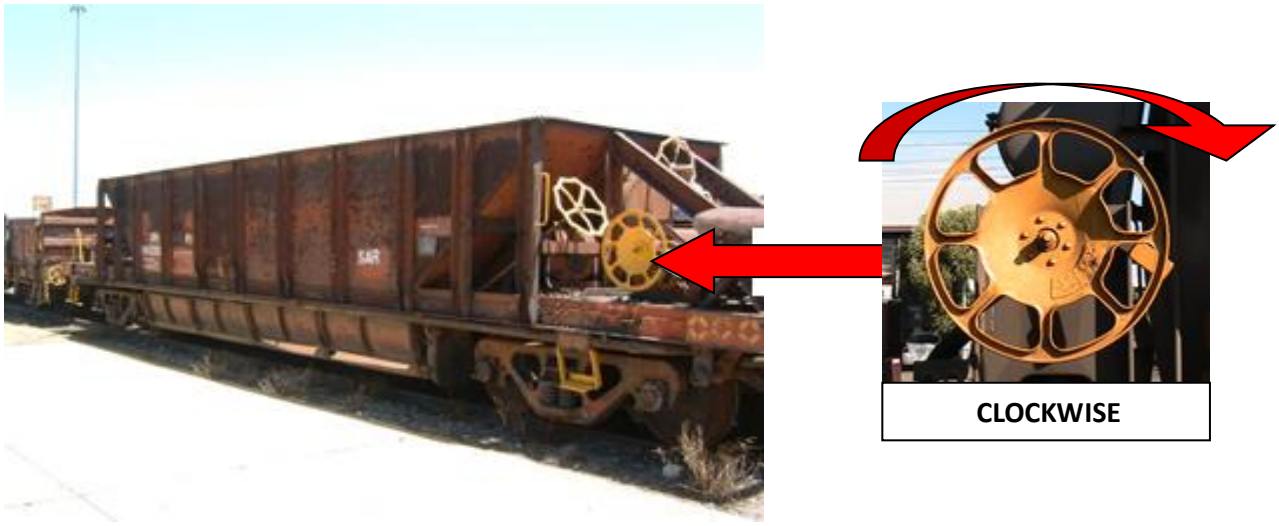
1. S and SLJ – ABNORMAL LOADS;
2. SH, SHD, SHJ, SHLJ and SHR – CX CONTAINERS;
3. SMJ, SML, SMLJ and SMR – PX CONTAINERS;
4. SMLJ-9 – PX CONTAINERS, FLATBED AND OTHER SIMILAR TYPES OF WAGONS;
5. STL-8 and 14 – PX CONTAINERS AND FLATBEDS; AND
6. Other similar types of wagons but not limited to the wagons mentioned hereunder;
   - 6.1. NGO;
   - 6.2. NGST;
   - 6.3. AKJ;
   - 6.4. DGLJ;
   - 6.5. DZM;
   - 6.6. CR;
   - 6.7. FSLJ;
   - 6.8. OLJ;
   - 6.9. QZL;
   - 6.10. FKJ;
   - 6.11. SSJ;
   - 6.12. SFJ;
   - 6.13. STJ;
   - 6.14SKJ1.It is therefore strictly prohibited for any employee to ride on the above listed wagons.

2.4 HAND BRAKES

The hand brakes (wheel operated handles) on main line coaches are fitted to the sole bars on each side, and approximately in the centre of the coaches **[G.A.9122.0]**.

The hand brakes of motor coaches are situated inside the coaches in the Train Driver's compartment, on the end framing.

For the application of the brakes, the hand-brake wheel must be operated in a clockwise direction.



2.5 COUPLING AND UNCOUPLING OF LOCOMOTIVES

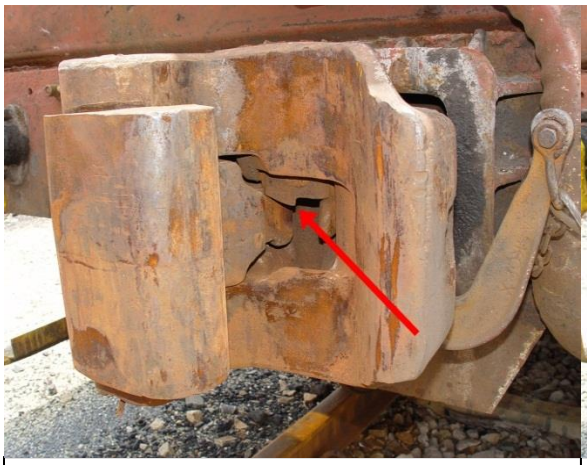
The Train Assistant on a locomotive is under the direct control of the Train Driver and the Train Assistant must obey the Train Driver's instructions. Locomotives i.e. locomotive to locomotive, must as far as possible, not be coupled on curves **[G.A.9017.7]**. Except where another qualified employee is available for the duty, the Train Assistant must couple or uncouple all connections between the locomotive and the train at the starting point and at the terminal, and also at intermediate stations where the locomotive is detached for shunting purposes **[TWR167(1)]**.

Before commencing a trip, and also before starting from an intermediate point where the locomotive has been uncoupled for shunting purposes, the Train Driver must see that the locomotive is securely coupled to the train **[TWR167(2)]**.

2.6 COUPLING OF WAGONS

Locomotives and wagons are equipped with various types of couplers. Employees who perform shunting or must couple locomotives or wagons, must familiarise themselves with the methods of establishing that the gravity locks are fully down in position **[G.A.9017.1]**.

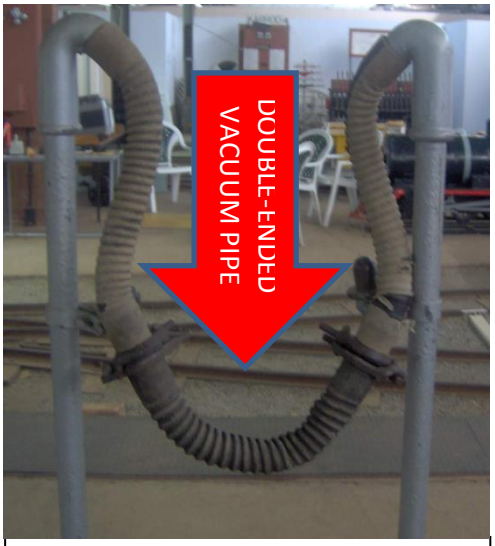
A gravity lock is an iron block that is on the inside of the buffer. Gravity locks are there to lock the buffer when it is in the closed position and they use the force of gravity to just drop down after the buffers have been coupled together.



GRAVITY LOCK UP

GRAVITY LOCK DOWN

After the locomotives/wagons have been coupled the employee concerned must examine the coupling and ensure that it is secure. If the locomotives/wagons are coupled in the presence of a member of the wagon maintenance personnel the latter must also ensure that the coupling is secure **[G.A.9017.6]**.



DOUBLE ENDED VACUUM PIPE

When locomotives/wagons must be coupled on a curve, the couplers, where possible, must be pulled over to the best position, with both knuckles half open, and the wagons/locomotives must be moved slowly together **[G.A.9017.7.2]**.

It is not necessary to use force to couple locomotives/wagons and hard bumps must be avoided **[G.A.9017.8.1]**. Brake pipes, jumper-cables, etc. must be coupled after the coupling of wagon/locomotives has been successfully completed and whilst the movement is stationary **[G.A.9017.9.1]**.

If it is necessary to use a **double-ended** vacuum hose pipe as an extension between the ordinary vacuum hose pipe couplings, both ends must be fastened with wire **[G.A.9017.9.2]**.

2.7 VACUUM WAGONS

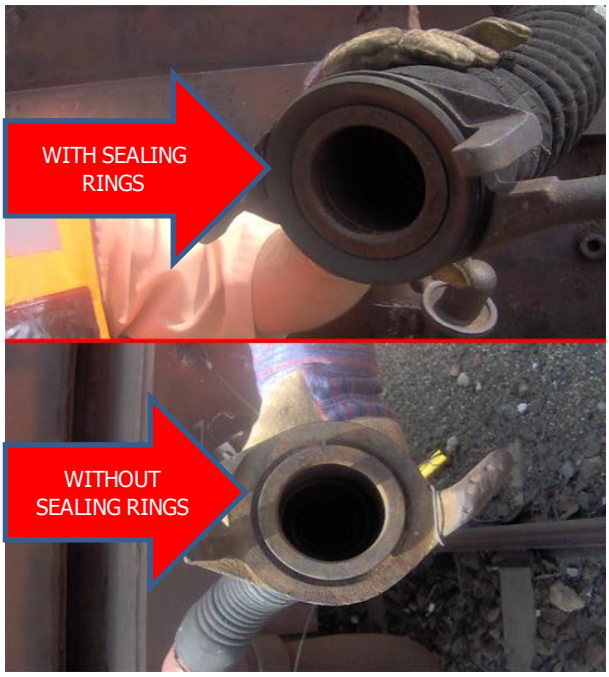
Vacuum wagons are noticeable by having axle hot boxes on them. These axle hot boxes must always be lubricated with oil to prevent the axle from burning out or breaking off due to heat friction. Vacuum wagons are also noticeable by their thick vacuum hose pipes.

2.7.1 USE OF VACUUM RELEASE VALVE

The vacuum brake of a detached wagon can be released by pulling the vacuum release valve wire and, if necessary, holding it in the pulled position until the brake is completely released. If necessary, this procedure must be followed before moving a wagon of which the vacuum hosepipes have not been coupled **[G.A.1019.13.1]**.

If the vacuum brake of one or more wagons of which the vacuum hosepipes are coupled and under vacuum is not released when vacuum is fully created, the vacuum release valve wires of such wagons must be pulled until the brakes are released **[G.A.1019.13.2]**. If this procedure is not done, there may be a possibility of wagons running away because of vacuum brakes that are not applied.

2.7.2 COUPLING AND UNCOUPLING OF VACUUM HOSE PIPES



When vacuum hosepipes are coupled and/or uncoupled, it must be done in such a way as to avoid damage to the pipes and loss of sealing rings **[G.A.1019.11.1]**.

When vacuum hosepipes are coupled and/or uncoupled, special care must be taken to prevent dust or foreign objects (e.g. cotton waste) to be sucked into the vacuum pipes **[G.A.1019.11.2]**.

During shunting operations the hose couplings of vacuum pipes, when not in use, must be placed on the dummies provided for that purpose **[TWR126 (1)]**.

When diesel or electric locomotives equipped with vacuum stand pipes on both sides of the coupler are coupled to passenger wagons, only the vacuum hose pipe on the right-hand side of the coupler, in the direction of travel, must be connected **[G.A.1019.11.3]**.

ACTIVITY 4 - SAFETY

COMPLETE ACTIVITY 4 ON PAGE 11 OF THE LEARNER WORKBOOK AS AN INDIVIDUAL. UTILIZE THE SHEET PROVIDED ON THE LEARNER WORKBOOK.

When you are finished with the activity, discuss the answer with the Facilitator to ensure that everyone understands the answer/s.

2.8 AIR BRAKE WAGONS

2.8.1 COMPONENTS THAT MAKE UP AN AIR BRAKE WAGON AND THEIR FUNCTIONS

2.8.1.1 Brake pipe

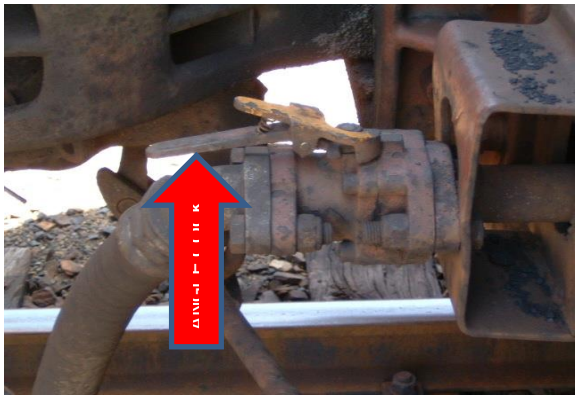
A brake pipe is continuous steel pipe which runs through the full length of an air brake wagon. It is found underneath the wagon. Air brake pipes are inter-coupled together throughout the train by brake pipe hoses and are used for charging the brake equipment on the wagons with compressed air, as well as for controlling the application and release of the brakes by means of pressure variations in the pipe.

2.8.1.2 Brake pipe hose

BRAKE PIPE HOSES WITH COUPLING HEADS

It is a flexible hose with a coupling head and it is attached to the angle cock. It is used for inter-coupling the brake pipes between wagons. Sometimes there is a dummy to close off a brake pipe hose which is not in use.

2.8.1.3 **Angle cock**



An angle cock is a shut-off cock in the brake pipe at each end of an air brake wagon and with which the brake pipe can be closed. The cock is open when the handle is in line with the brake pipe and it is closed when the handle is at right angles to the brake pipe. The handle must be lifted or unlatched to operate the cock. The handle latches when the cock is fully open or fully closed.

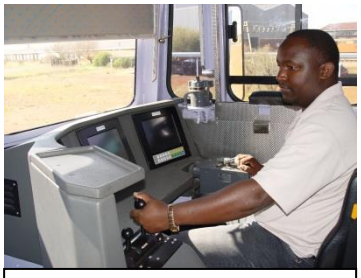
2.8.1.4 **Brake cylinder**

A brake cylinder is a cylinder which is operated with compressed air and which is used to apply the brake blocks to the wheels by means of a system of rods and levers. To apply the brakes, compressed air is admitted to the cylinder in which case the piston rod emerges (comes out) from the cylinder. To release the brakes the compressed air is released from the cylinder in which case an internal spring retracts (pulls back) the piston rod into the cylinder.

BRAKE CYLINDER

2.8.1.5 Brake pipe pressure

Brake pipe pressure is the pressure in the brake pipe, at any particular point in the train. The pressure in the brake pipe can be read in the Train Driver's cab on the locomotive gauges. The pressure reading from the rear of the train to the locomotive may not, however, be less than 420 Kilo Pascals (KPa).



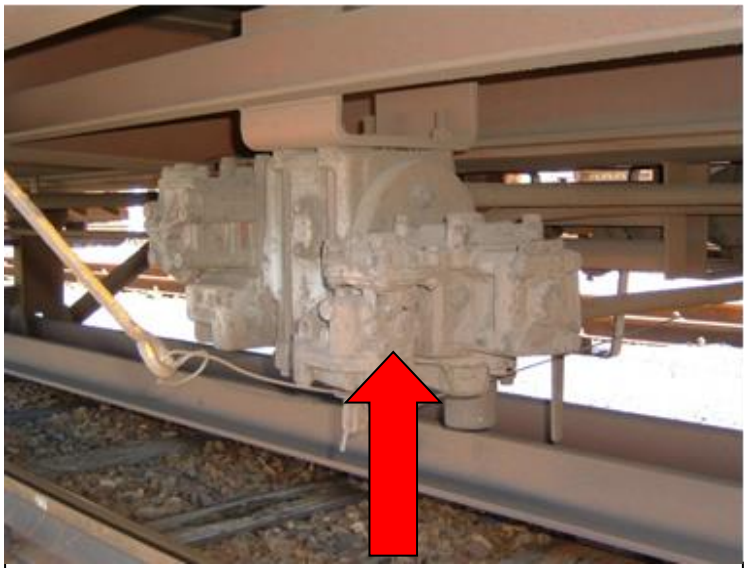
TRAIN DRIVER'S CAB

2.8.1.6 Brake pipe pressure gradient due to leakage

Brake pipe pressure gradient due to leakage is the difference between the brake pipe pressure at the locomotive and that at the rear of the train, with the train brake equipment fully charged. For instance, if the pressure on the locomotive is 10 KPa, and the rear registers 8 KPa, then the gradient in pressure will be 10 – 8 = 2KPa.

2.8.1.7 Control valve

It is a valve situated underneath an air brake wagon which is connected to the brake pipe and other components of the brake equipment and which controls the charging of

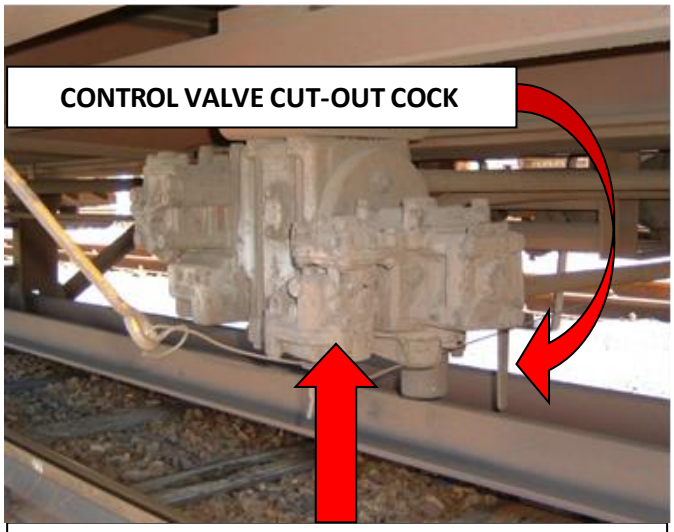


THE CONTROL VALVE

the brake equipment as well as the application and release of the brakes on the wagons in accordance with the pressure variations in the brake pipe. The valve includes a device with which a brake application on the wagon can be manually released.

2.8.1.8 Control valve cut-out cock

It is a lever in the connection between the brake pipe and the control valve of an air brake wagon, which is used for isolating the control valve from the brake pipe. The cock is open when the handle is at right angles to the connecting pipe, and it is closed when the handle is in line with the pipe.



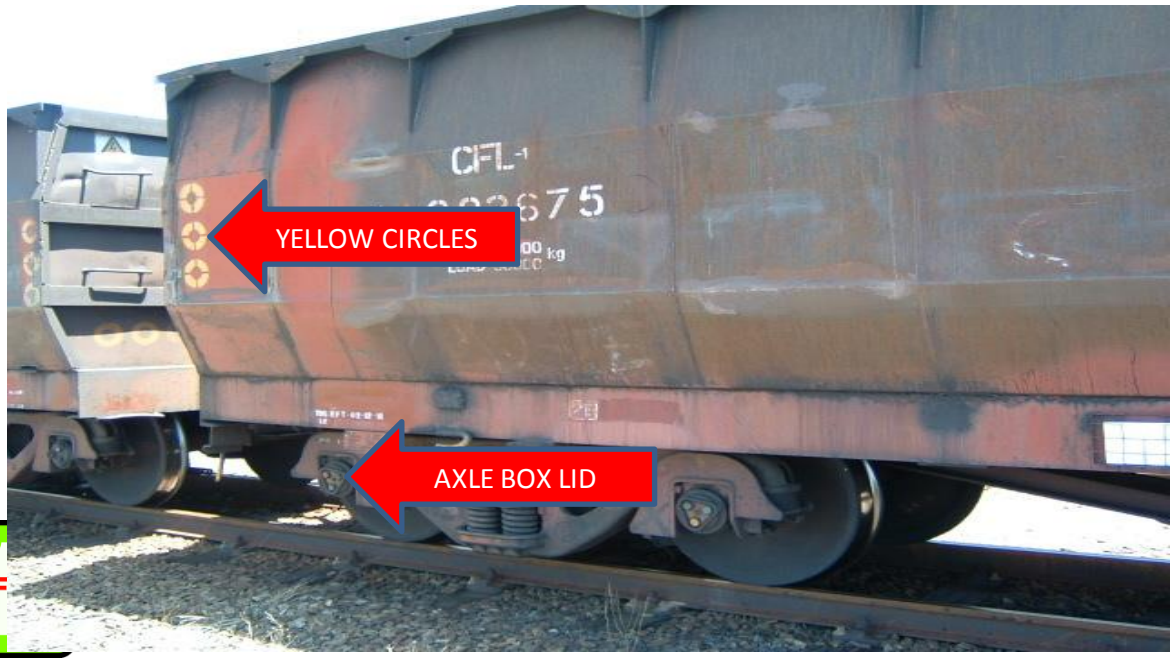
THE CONTROL VALVE

2.8.2 IDENTIFICATION OF AIR BRAKE WAGONS

Three (3) yellow circles are painted on the four corners of all air brake wagons. They may be vertically or horizontally painted. On light coloured wagons, the yellow circles are painted on a black background, whilst on dark coloured wagons only the three yellow circles are painted

[. The roller bearing axle boxes are easily distinguished as the trade name "Timken", "SKF", etc. that is casted on the end caps of package type roller bearings and on the lids of roller bearings axle boxes . **[G.A.9122]**.

The hand brakes of wagons fitted with roller bearings must be applied when a wagon is standing loose from another wagon, because if the vacuum or air brake is not in operation, roller bearing wagons may easily be set in motion on a gradient by wind or other external influences. Wagons with roller bearings must not be detached from the locomotive or other wagons and left alone unless the hand brakes of the roller bearing wagons have been applied **[G.A.9122.12]**. A slight push of a wagon with roller bearings can set it in motion.



When two or more wagons fitted with roller bearings are left standing coupled together, **the hand brakes must be applied on at least half the number of wagons**, irrespective of whether the vacuum or air brake is in operation or not. Before moving one or more of such wagons, the personnel concerned must satisfy themselves that sufficient hand brakes, as laid down above, are applied on the remaining wagon or wagons **[G.A.9122.10]**.

Great care must be taken to ensure that hand brakes are released before the wagons are set in motion, otherwise the wheels will be skidded. The brakes on all coaches on a train must be checked before departure of the train **[G.A.9122.11]**.

When a train, consisting either in part or wholly of wagons fitted with roller bearings is required to have the vacuum or air brake released at any depot en route for the purpose of examination or adjusting the brakes, or for any other reason, it is the responsibility of the **carriage and wagon personnel** to ensure that the hand brake or a sufficient number of hand brakes is applied, if necessary, to keep the wagon(s) stationary **[G.A.9122.10.1]**.

2.8.3 FOREIGN WAGONS FITTED WITH ROLLER BEARINGS

All foreign wagons fitted with roller bearings, which are permitted to work over TRANSNET lines will have distinctive markings. Goods wagons will have the distinctive marking of three yellow circles on a black background on the four lower corners of such wagons **[G.A.9122.8]**.

These foreign roller bearing wagons are fitted with hand brakes similar to the TRANSNET type, and such wagons must have the hand brakes applied when they are standing uncoupled from any other wagon because if the vacuum or air brake is not in operation, the roller bearing wagons may easily be set in motion, even on level ground, by wind or other external influences **[G.A.9122.9]**.

2.9 POSITION OF SHUNT WAGONS IN THE LOAD (CIR/OD/0364)

To provide shunting personnel with a facility in which to travel safely and store their equipment and personal belongings, VLJ-13 air-brake guard's vans have been converted for use as **shunt wagons. Shunt wagons** are not designed to carry heavy loads, but rather to travel on the rearmost of a train, they are not constructed to withstand forces to which goods wagons are normally subjected to.

In the light hereof, and until further tests in this regard have been concluded by technical personnel, **shunt wagons may not be marshalled between other wagons on a shunt train or during shunting movements**.

SHUNT WAGON

The shunt wagon must, if possible, be detached before shunting movements are carried out. During propelling movements, the shunt wagon must be marshalled at the leading end of movement, in the direction of travel. During a hauling movement, the shunt wagon must be marshalled at the rear end of the movement, in the direction of travel.

2.10 CRANES

When a crane is detached during train or shunting movements, and the crane is accompanied by a Crane Driver, **the Crane Driver** must ensure that it is properly secured and the employee detaching the crane must satisfy himself/herself that this has been done **[TWR124(5)]**.

If a Crane Driver does not accompany the crane, the employee detaching it must ensure that the crane is properly secured. If the crane is standing on a gradient, exceptional care must be taken in such cases. Hand brakes must be applied and scotches must be used.

Before attaching a crane to a train, or coupling it to other wagons during shunting operations, the employee concerned must satisfy himself/herself that it has been properly secured, particularly when it is standing on a gradient. When the crane has been securely coupled, care must be taken before it is moved to ensure that the brakes have been released and that there is no obstruction on the line **[TWR124 (6)]**.

2.11 PASSENGER COACHES

When passenger coaches are being attached to a portion of a train, or detached from a train, the shunting movement must, as far as possible, be made without moving the remainder of the train. The vacuum brakes of the coaches being shunted must be used in connection with such movements **[TWR142]**.

When attaching passenger coaches to a portion of a train, the Shunter must see that the automatic couplings, links and pins, vacuum and steam heating pipes, electrical and other appliances, are properly connected. (Note: - Links and pins are still used on narrow gauge trains)

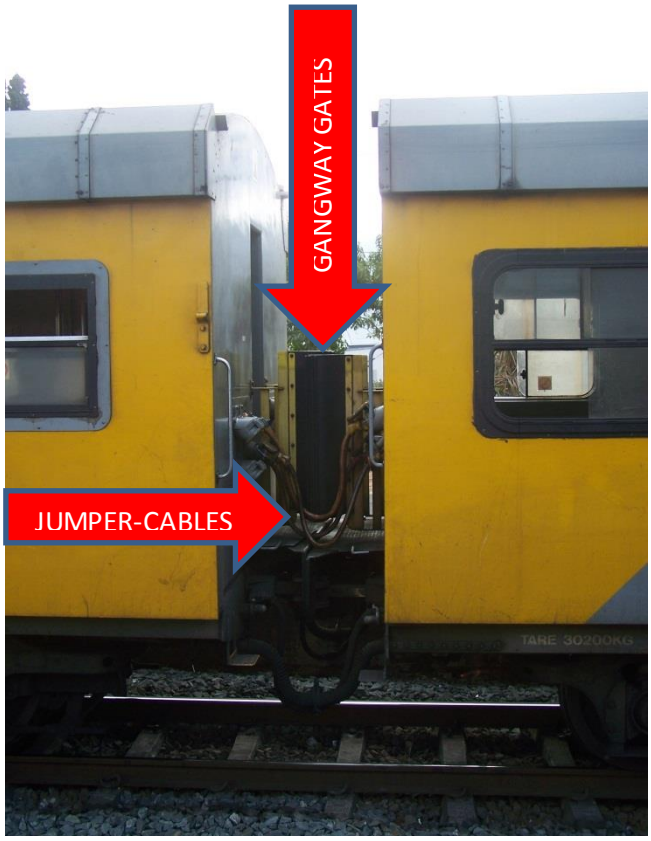
Before detaching passenger coaches from a train, the Shunter must see that the automatic couplings, links and pins, vacuum and steam heating pipes, electrical and other appliances are properly disconnected and secured.

2.11.1 **STEAM HEATING OF PASSENGER TRAINS**

The personnel will be notified, every year, through the Management Notice or circular on what date the steam-heating of passenger trains will be commenced or terminated. Those who are responsible for the coupling of coaches are also responsible for the proper coupling of the steam-heating pipes and to see that the locking devices are in position.

A train is properly marshalled for steam-heating when all steam pipes are coupled and all stopcocks are fully opened. After steam is blown through, the stopcock at the back of the last coach must be closed and thereafter slightly opened to allow a small quantity of steam to escape from the pipe. Hereby a constant and even flow of steam and, thus, heating for the entire length of the train is ensured. When coaches are to be uncoupled, the nearest stopcocks, at both ends, must first be closed and the locking devices opened before the coaches are separated. To prevent injury, the personnel responsible for the coupling/uncoupling of the equipment must wear the special type of gloves provided for this purpose.

When passenger trains are heated by means of steam, a passenger coach to which the heating system is not coupled, or of which the device is out of order thus preventing the passage of steam, except where otherwise provided in the local appendix, must be marshalled immediately in front of the brake van **[G.A.1021.2]**.



2.12 COMMUTER COACHES [G.A.9018]

Except in the case of two adjoining coaches both equipped with Gummi Wulst tubular rubber diaphragm, gangway gates must be provided should it be necessary to provide thoroughfare for passengers and/or train personnel.

Where thoroughfare is not possible or necessary, the end door of the coach must be locked and a gangway gate placed across the doorway on the brackets provided.

Before and during shunting movements with coaches conveying passengers, the employee in charge of the movements must ensure that gangway gates between coaches that are to be separated are removed or disconnected, as the case may be, and that the requirements are met in respect of the coaches being moved and those remaining stationary.

When coupling together electric coaches to PRASA trains, employees must ensure that all train couplings, vacuum and compressed air pipes, and jumper-cables are made correctly. Vacuum and compressed air pipes and jumper-cables not in use must be secured on the dummies **[METRO General Appendix 12006.2]**.

In the event of a plain trailer having to be coupled to the driving end of an intermediate motor coach or driving trailer, the employee coupling the coach must, in addition to carrying out the normal duties set out, place a gangway gate in the closed position at that end of the plain trailer adjacent to the driving end of the intermediate motor coach or driving trailer to prevent exit at that end. Brake pipes, jumper-cables, etc. must be coupled after the coupling of wagon/locomotives has been successfully completed and whilst the movement is stationary **[G.A.9017.9.1]**.

NOTES

ACTIVITY 5 - PRE-ASSESSMENT

COMPLETE ACTIVITY 5 ON PAGE 12 OF THE LEARNER WORKBOOK AS AN INDIVIDUAL. UTILIZE THE ANSWER SHEET PROVIDED ON THE WORKBOOK.

When you are finished with the activity, discuss the answer with the Facilitator to ensure that everyone understands the answer/s.

School of Rail

FUNCTIONAL YARD OPERATIONS

Learner Guide

ELEMENT 3

UTILIZATION OF FIXED SIGNALS, POINTS AND INDICATORS FOR SHUNTING

SAQA US ID: 264338 NQF Level: 3

LEARNING OBJECTIVE

In this element, you will learn the different types of signals that are relevant to shunting. You will learn their names, their meaning as well as where they are positioned in the yard and sections.

LEARNING OUTCOME

- Identify the different types of signals
- Explain what their meaning is when they are operated
- Explain how to react to signals that do not have aspects or are not clearly displayed

CONTENTS OF THIS ELEMENT

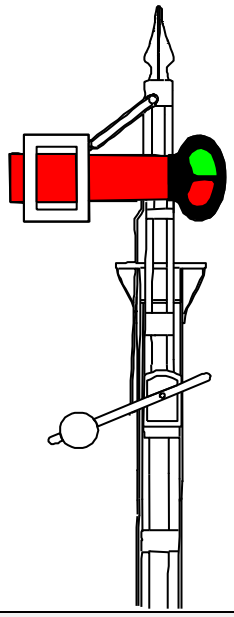
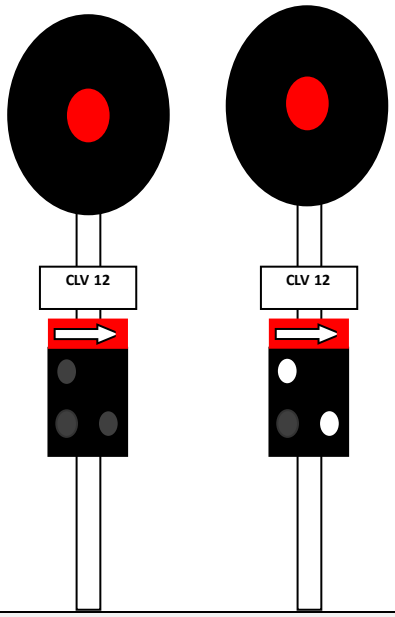
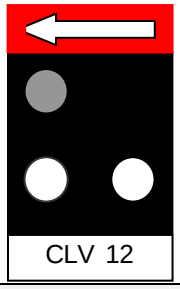
ELEMENT 3: UTILIZATION OF FIXED SIGNALS, POINTS AND INDICATORS FOR SHUNTING

3.1 OVERVIEW

There are three (3) types of signals in yards and stations which employees responsible for shunting in yards and sidings will deal with; namely: Semaphore signals, Boards and Colour-light signals. These signals are **fixed** signals, meaning that they are securely placed, fastened and immovable **[TWR14]**. Position-light shunt signals, used in areas where colour-light signalling is installed, are also fixed signals **[TWR14 2(b)]**.

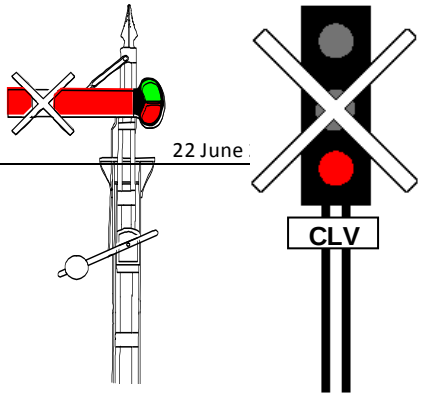
Semaphore signals are signals of which the position is indicated by means of rectangular arms during the day and coloured lights during the night. The arms of Semaphore signals are moveable from horizontal position up to an acute angle. Colour-light signals are signals of which the position is indicated by means of different colour lights also known as **aspects** by day as well as by night.

Below are the examples of both Semaphore and Colour-light signals for shunting:

		
SEMAPHORE SHUNT	**COLOUR-LIGHT SIGNAL WITH ONE POSITION LIGHT SHUNT SIGNAL**	**TWO POSITION LIGHT SHUNT SIGNAL**

Signals, whether Semaphore or Colour-light can display red, yellow, green, white, blue or purple colours or aspects, depending on the type of signal. When signals display a danger position, whether a red aspect for Colour-light signals or a horizontal position for Semaphore signals, they are said to be absolute stop signals. An absolute stop signal is a signal that may not under any circumstance be passed while it is at danger **without the permission** of a Train-Control Officer or Control Shunter in the yard.

A description and meaning of aspects and colours is explained more in detail in other modules. In this module we will discuss only those signals that affect shunting in yards and sidings.



A signal in course of installation, or one that is not in use owing to alterations, must have a white cross, affixed to the front thereof **[TWR21(1)]**. A signal to which a white cross is attached must not be acted upon **[TWR21(3)]**.

Where signals are operated for a shunt movement, the Train Driver must receive either a hand signal or oral instruction from the employee responsible for the shunting movements. The Shunter and the Train-Control Officer must at all times have a clear understanding as to the nature, extent and duration of the shunting work to be performed **[TWR132(5]**.

Employees responsible for shunting must always be vigilant and work cautiously. It must always be borne in mind that the wagon are loaded with expensive articles of the public, on whom, we as a Transportation organisation is dependent. Further more expensive rolling stock is being used.

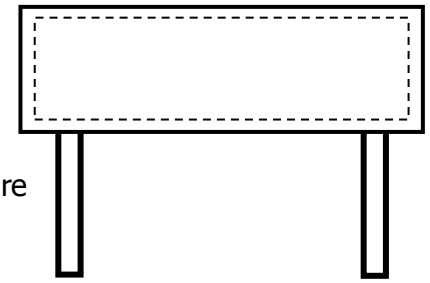
3.2 FIXED SIGNALS USED FOR SHUNTING

Fixed signals are signals that have an unchanging and unmoving position. They are set at a place and will remain there until such time they are officially removed or moved. For shunting purposes, we have two kinds of signals that directly affect shunting movements. And those are; colour-light signals as well as semaphore signals. We will now have an in-depth look at each of those signals that affect shunting movements.

3.2.1

3.2.2 WARNING BOARD

A warning board is a rectangular white board, the back of which is black, with a border of white reflective paint on the front. The warning board is fixed on two upright poles or beams. Warning boards and watering boards are fixed



signals and must be observed as such **[TWR52(1)(a)]**. Warning boards are applicable to single lines only.

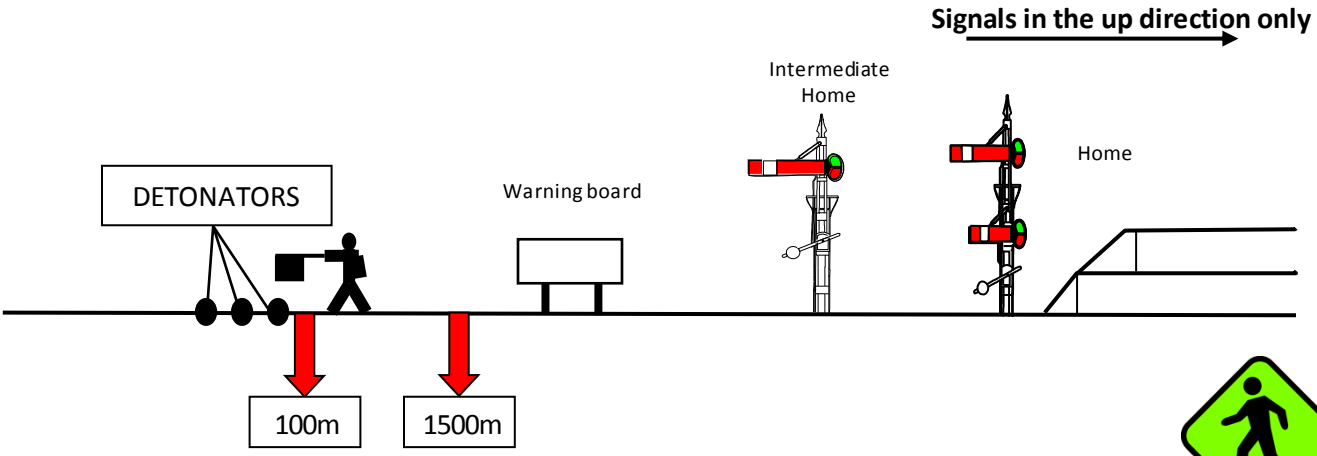
A warning board can be placed at one of the following places:

1. A distance of not less than 800 metres from the **outermost set of facing points** of a station or junction, and
2. **Where there are no facing points**, not less than 800 metres from the centre of a halt or token station/order station **[TWR52(1)(b)]**.
3. Where specially provided in local appendices, warning boards are erected at a distance of not less than **800 metres** from the **outermost controlled signal**, which is usually an intermediate home signal **[TWR52(1)(c)]**.

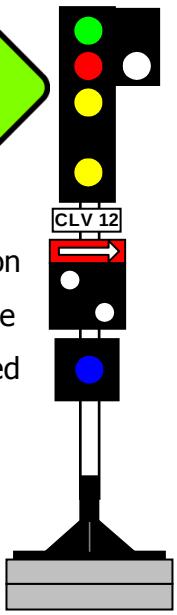
3.2.2.1 SHUNTING BEYOND THE WARNING BOARD

At stations where the outermost fixed signal or the very first signal towards the station is a warning board, or distant signal (no outer-home-signal) the running line between the clearance mark and the outermost fixed signal must not be occupied for shunting purposes unless the operation can be completed **at least ten minutes before the expected arrival of a train at the outermost fixed signal**.

When, however, it is absolutely necessary to make a shunting movement outside the clearance mark, but within the limits of the area protected by the outermost fixed signal, and that movement cannot be completed in the prescribed time, the operation must be protected by an authorised employee equipped with flags to display hand signals and detonators. Such employee must display a danger hand-signal at **a distance of 1.5 km or further** if the view is restricted, in advance of the portion of the line occupied. He/she must also place three detonators **20 metres** apart on one rail. The first detonator must be placed 100 metres from the employee who displays the hand signal **[TWR220(3)]**.



3.2.3 COLOUR-LIGHT SIGNALS



Fixed colour-light signals are provided to indicate on which line and in which direction train or shunting movements may, or may not, be made according to these rules. The signals must not be used for any other purpose except when they are being tested **[TWR18]**.

Aspects are the appearance of a colour-light signal, as seen from the direction of an

approaching train, to which a particular meaning must be attached in accordance with these rules or other applicable instructions.

A stop signal displaying a proceed aspect will automatically display a danger aspect when the front end of the train passes the signal, and it will not again be able to display a proceed aspect before the rear part of the train has cleared the section overlap beyond the next stop signal **[G.A.7002.4]**.

A controlled signal is a signal operated by a Train-Control Officer from a train control office and every signal has a **distinctive number**, which is preceded by code letters **[TWR22(1)]**.

3.2.3.1 INTERPRETATION OF DIFFERENT ASPECTS

The meanings of the different aspects displayed by colour-light-signals are as follows-

ASPECT	MEANING
Red light	Danger – stop
Yellow light	Proceed, but stop at the next signal unless it is seen to be at "proceed". Except in areas where two colour lights are used to indicate (shows) a turn-out or turn-in over points, this aspect also indicates that the driver must expect to turn out or in over one or more sets of lower-speed points (where there are points).
Green light	Proceed - next signal displays a "proceed" aspect

ASPECT	MEANING
Red above yellow (Goods or siding aspect)	Proceed - the train is being admitted onto a goods siding
No light (in stop signal)	Danger – stop
Blue light	Emergency – proceed on sight

Colour-light signals can be found in the following places:

1. Fixed to overhead structures or

2. Fixed to posts or brackets or

3. Fixed close to ground level, **alongside** the track.

3.2.3.2 NO SHUNT SIGNAL OPERATED

If shunting has to be performed where there is no position-light shunt signal or the position-light shunt signal cannot be operated, a colour-light signal **may be operated** for a shunting movement provided a clear understanding has been arrived at beforehand between all concerned. The next controlled signal, where there is one in the particular interlocking area, must be kept at danger **[G.A.7005.11.1]**.

Great care should be taken when a signal controlling entry to a route over which shunting has to be done, is defective or, for some other reason, cannot be operated. The Train-Control Officer must correctly set all the interlocked points in the route by means of the independent operation thereof and satisfy himself/herself that the correct indications appear to ensure that the route is locked. After the Train-Control Officer has obtained an assurance from the Shunter that the points are correctly set, may authorise the Train Driver to pass the signal at danger for shunting purposes only or he/she may instruct the Shunter to authorise the Train Driver verbally to pass the signal at danger **[G.A.7005.11.2]**.

3.2.3.3 SHUNTING PAST THE SECTION ENTRY SIGNAL

If on a unidirectional running line shunting has to take place past a section entry signal that cannot be operated for the shunting movement, the Train-Control Officer must authorise the Train Driver to pass the signal at danger by displaying a **caution hand signal** or having it displayed, or by authorising the Train Driver **verbally** or instructing the Shunter to authorise them **verbally**. **The authority number is not required [G.A.7005.11.3.1]**.

3.2.3.4 INCONSISTENT DISPLAY OF THE ASPECT

When a signal is imperfectly shown or is displaying a combination of lights that should not thus be displayed, or when two or more signals are at all right or proceed where only one signal should thus be shown, or should no signal be seen where one is always shown, it must be regarded that the signal is displaying its most restrictive position or aspect and the circumstances must be immediately reported **[TWR20(1)]**.

3.2.3.5 INDICATORS ON COLOUR-LIGHT SIGNALS

Route and direction indicators are used in conjunction with colour-light signals controlling access to more than one line over interlocked points and show the route set up, or the platform road onto which the train is being admitted **[TWR25]**. Route or direction indicators are also used in conjunction with certain position-light shunt signals.

The route or direction indication is displayed only when the applicable colour-light signal is displaying a proceed aspect or when the relevant shunt signal is in the caution position.

3.2.3.6 ROUTE INDICATORS

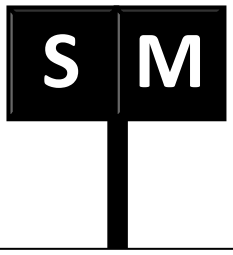
Route indication is given in the following ways - **[TWR25]**

1. By an illuminated direction arm,

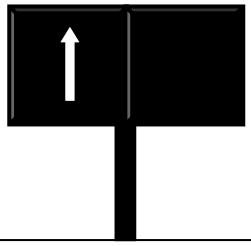
ILLUMINATED DIRECTION ARM FOR STRAIGHT LINE AND THREE DIVERGING ROUTES TO THE LEFT

or

ILLUMINATED DIRECTION ARM FOR STRAIGHT LINE AND THREE DIVERGING ROUTES TO THE RIGHT



ILLUMINATED NUMBER(S) / LETTER(S)



VERTICAL ARROW INDICATION

2. By illuminated figures or letters, or a combination of both, or a vertical arrow indication.

3.2.3.7 POSITION OF ROUTE INDICATORS

The route indicator may be fixed above or below or alongside the signal to which it relates.

3.2.3.8 IF THE ROUTE INDICATION IS NOT DISPLAYED

When a signal, equipped with a route or direction indicator, displays a "proceed" aspect or, if it is a shunt signal, the "caution" position, without a route/direction indication, the Train Driver must proceed over the points at the appropriate restricted speed. Except when the signal displays a green light only, the Train Driver must be ready to turn out over points.

DIRECTION INDICATORS

2.10.1 **PURPOSE**

Direction indicators only indicate whether or not the route will include a turn-out over facing points. Where signals capable of displaying the aspects green above yellow and yellow above yellow are in use, direction indicators as a rule, are used which, instead of indicating the route, only indicates whether or not the route will include a turnout over facing points. If the route includes more than one turn- out, only the first turnout will be indicated.

2.10.2 **DESCRIPTION**

Direction indicators consist of one, two or three arms, each with three or more white lights, erected above the signal, thus –

2.10.3 **POSITION**

The vertical arm indicates the main or straight route. An arm 45° to the left or right indicates that the train will turn out to the left or right, respectively, at facing points (not necessarily the first set of facing points) en route to the next signal.

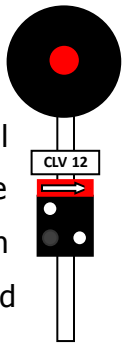
The route or direction indication is displayed only when the applicable colour-light signal is displaying a "proceed" aspect or when the relevant shunt signal is in the "caution" position.

3.2.3.9 **POSITION-LIGHT SHUNT SIGNALS**

Position-light shunt signals are used, where necessary, in conjunction with colour-light signals and each position-light shunt signal has a distinctive number and code letter. The shunt signals may be of the one-position or two-position light type **[TWR45]**. **A position-light shunt signal may be placed at caution to allow a train or wagons to pass it for shunting purposes only**, provided the Train-Control Officer is satisfied the line is clear as far as is required for the shunting movement to be performed **[TWR46]**.

3.2.3.10 ONE-POSITION-LIGHT SHUNT SIGNAL

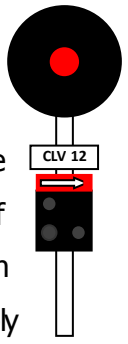
It is fixed below or adjacent to a main colour-light signal and displays only the caution position. The caution position is indicated by two white lights at an angle of 45 degrees. A one-position-light shunt signal may be placed at caution as authority for a train to pass the colour-light signal on the same post as the one-position-light shunt signal. This can be done if the colour-light signal is defective or the line onto which the train has to be admitted is occupied or is obstructed at the forward end **[TWR46(d)(i)]**.



3.2.3.11 TWO WHITE LIGHTS DISPLAYED ON A ONE-POSITION LIGHT SHUNT SIGNAL

Where two white lights at an angle of 45 degrees are displayed below a running line signal, this indicates **proceed with caution** for shunting purposes as far as the line is clear, but not further than the next stop signal or shunting limit.

Before acting on a one-position light shunt signal, a Train Driver must, except where instructions to the contrary have been issued by the Chief Executive [TRANSNET], bring his/her train to a standstill at such signal and thereafter pass the main colour-light signal on the same post as the one-position light shunt signal at danger; but only if the one-position light shunt signal has been placed at caution. A Train Driver must be ready to stop short of any obstruction and to comply promptly with a danger hand signal should such signal be displayed **[TWR46(d)(ii)]**.



3.2.3.12 NO LIGHTS DISPLAYED ON A ONE-POSITION LIGHT SHUNT SIGNAL

The danger position is not displayed in the one-position light shunt signal as the red aspect of the main signal is exhibited and indicates Danger - stop.

3.2.3.13 TWO-POSITION LIGHT SHUNT SIGNAL

A two-position light shunt signal may be fixed near ground level or on a post by itself.

3.2.3.14 TWO WHITE LIGHTS DISPLAYED HORIZONTALLY ON A TWO-POSITION LIGHT SHUNT SIGNAL

Where two white lights are displayed in the horizontal position or no light is displayed in a two-position light shunt signal, this indicates danger, and the movement must stop.

3.2.3.15 TWO LIGHTS DISPLAYED AT 45 DEGREES ON A TWO-POSITION LIGHT SHUNT SIGNAL

Where two white lights are displayed at an angle of 45 degrees in a two-position light shunt signal, this indicates that the movement may proceed with caution for shunting purposes as far as the line is clear, but not further than the next stop signal or shunting limit.

3.2.3.16 TWO LIGHTS DISPLAYED VERTICALLY ON A TWO-POSITION LIGHT SHUNT SIGNAL

Where a main colour-light signal is at proceed and the Train Driver has to pass an intermediate two-position light shunt signal, two vertical white lights are displayed in the two-position light shunt signal as an indication that the Train Driver may pass the two-position light shunt signal without receiving a caution hand signal or oral instruction **[TWR46(d)(iv)]**.

The Train-Control Officer or authorised employee, as the case may be, must ensure that the points are correctly set and that everything is in order before he/she gives an oral instruction, permitting a movement over the points in question.

A two-position light shunt signal may be passed at danger only when –

1. An oral instruction has been given to the Train Driver by the Train-Control Officer; or
2. On his/her authority by the employee in charge of the movement

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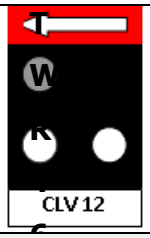
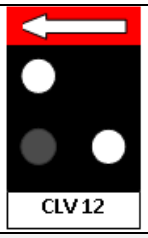
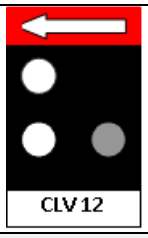
		
two white lights displayed in the horizontal position – **danger – stop**	two white lights displayed at an angle of 45 degrees - **Proceed with caution after receiving an oral instruction**	two white lights displayed in the vertical position – **proceed past the two-position light shunt signal without receiving a caution hand signal or oral instruction**

]

ACTIVITY 6 – SIGNAL ASPECTS

COMPLETE ACTIVITY 6 ON PAGE 21 OF THE LEARNER WORKBOOK AS AN INDIVIDUAL. UTILIZE THE SHEET PROVIDED ON THE LEARNER WORKBOOK.

When you are finished with the activity, discuss the answer with the Facilitator to ensure that everyone understands the answer/s.

3.2.4 BARRIERS PROTECTING LEVEL CROSSINGS

A barrier is a gate, a pole gate, a chain, or other appliance, used for the protection of a level-crossing. Where barriers are provided, they must be closed before moving over the level crossing **[G.A.9007.5]**.

An employee on duty in charge of a level crossing hereby referred to as a crossing attendant must be supplied with a red flag, a hand lamp with a red shade only, and ten detonators **[TWR146]**.

3.2.4.1 OPERATION OF BARRIERS

Level crossings must be kept open for road traffic, except when it is necessary to close the barriers for the passage of trains **[TWR147 (1-2]**. Unauthorised persons must not be allowed to interfere with or operate barriers.

3.2.4.2 SHUNTING OVER LEVEL CROSSINGS NOT PROTECTED BY BARRIERS

Shunting over level crossings must be performed with great care, and every endeavour must be made to minimise delay of road traffic **[G.A.9007.1]**.

LEVEL CROSSING WITHOUT A BARRIER

Except where otherwise provided in local appendices, before locomotives or wagons are shunted over a level crossing, the employee in charge of the shunting movement must ensure that the crossing is clear, that road traffic has been brought to a stop and that two employees each prominently displaying a danger hand signal, one on each side of the crossing, is standing in a position so that it can be seen clearly by motor vehicles drivers of road traffic and pedestrians. The danger hand signal exhibited to road traffic must be given by day by means of a red flag and by night by means of a red light **[G.A.9007.3]**.

Except where otherwise provided in the Local Appendices, the Train Driver must not permit his/her locomotive or any wagon attached to his/her locomotive to foul a level crossing until he/she has received the prescribed hand signal from the employee in charge of the movement, and then only after he/she has sounded the locomotive whistle. In the absence of such hand signal, he/she must stop short of the level crossing **[G.A.9007.4]**.

Except where otherwise provided in local appendices; loose shunting over level crossings is prohibited **[G.A.9007.8]**.

Attention is directed to the special instructions in Local Appendices regarding the shunting over and/or the protection to be provided at certain level-crossings including level crossings in workshop areas, in marshalling yards, stores yards and locomotive depots and private sidings/service lines **[G.A.9007.9]**.

Except where otherwise provided in local appendices the Train Driver must not permit his/her locomotive or any wagon attached to his/her locomotive to **foul a level crossing**:

1. until he/she has received the prescribed hand-signal from the employee in charge of the movement and
2. then only after he/she has sounded the locomotive whistle in terms of this clause.
3. In the absence of a hand-signal he/she must stop short of the level crossing.

4. Where barriers are provided, they must be closed before moving over the level crossing.

The employee in charge of the movement must ride on the locomotive or on the leading wagon in the case of a propelling movement in the direction of the movement and after he/she have ensured that road traffic has stopped, he/she may authorise the Train Driver to proceed **[G.A.9007.6]**.

When a train has to shunt over a level crossing on a station, inter-loop, token or order station, inter-siding or other unattended place and no other personnel than the Train Driver and the Train Assistant are available, then the Train Assistant must afford protection **[G.A.9007.7]**.

ACTIVITY 7 - LEVEL CROSSING SHUNTING

COMPLETE ACTIVITY 7 ON PAGE 22 OF THE LEARNER WORKBOOK AS A GROUP OF NOT MORE THAN THREE (3) LEARNERS PER GROUP. UTILIZE THE SHEET PROVIDED ON THE LEARNER WORKBOOK.

When you are finished with the activity, discuss the answer with the Facilitator to ensure that everyone understands the answer/s.

3.2.5 **MASS MEASURING BRIDGES AND TURNTABLES**

Mass measuring bridge roads must not be used for regular shunting operations. When wagons are pushed over mass measuring bridges for mass measuring purposes, the speed of such wagons must not exceed 5 km/h **[TWR145]**.

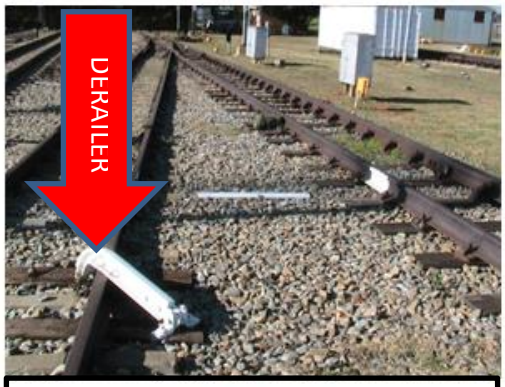
Shunting over turntables is not permitted under any circumstances. The speed of a locomotive passing over a turntable must not exceed 5 km/h. The lever of a turntable must not be dropped into the slot until the turntable has been completely stopped **[G.A.9011.1]**.

3.2.6 **POINTS**

There are different kinds of points that are utilised in the rail environment. Points are mainly used to have an impact on a movement, whether train or shunting. That impact can either be a change in direction of a movement or preventative. A change in the direction of movement will allow a movement to go from one line to the other line, while a preventative measure would cause a movement to either stop or derail. Points and derailers can either be hand operated or machine operated. We will now have a breakdown of the different types of points we utilise on the rail environment.

3.2.6.1 DERAILER

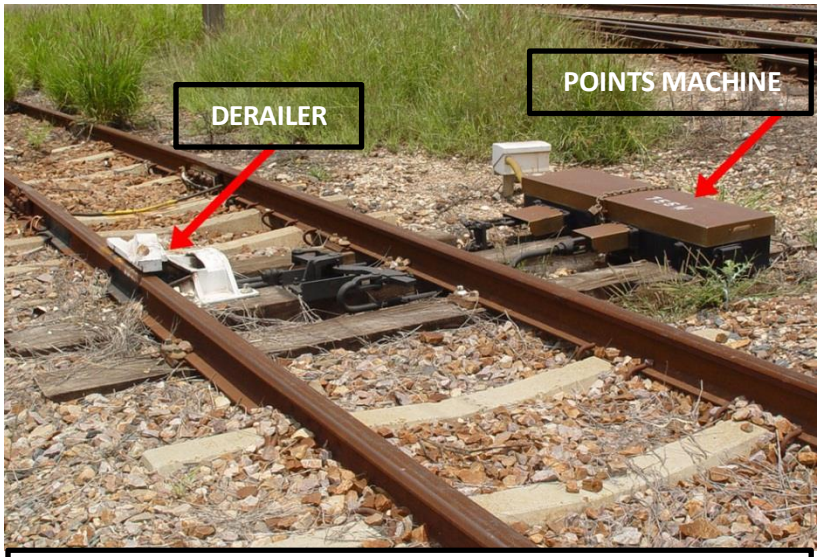
It is any device applied to the track in a siding, which will derail wagons and/or prevent them from fouling the adjacent line in case of irregular movement;



HAND OPERATED DERAILER

3.2.6.2 WHERE A DERAILER IS INSTALLED

Where a derailer is installed, the employee required operating it for a train or shunting movement must see that it is correctly set before authorising the movement. As soon as the movement has been completed, the derailer must be restored to its normal position **[TWR85]**.



MACHINE OPERATED DERAILER

After a wagon or wagons have been detached on a running line or in a siding, the Shunter concerned must ensure that the wagons in the siding are a safe distance from the derailer and that such a derailer is properly set and secured **[TWR120(1)]**.

NOTE: A derailer is situated inside the clearance mark.

If a shunting locomotive is brought to a standstill at or near a derailer, the Train Driver must satisfy himself/herself that such derailer is in the correct position before moving the shunting locomotive over it **[TWR173(4)]**.

3.2.6.3 WHEN A DERAILER IS NOT INSTALLED

After a wagon or wagons have been detached on a running line or in a siding, the employee in charge of the movement must ensure that, the wagon or wagons on a running line or in the siding are inside the clearance marks **[TWR120(2)]**.

3.2.6.4 SECURITY AND PROTECTION OF DETACHED WAGONS

Detached wagons must be placed within the clearance marks and within the derailer, where provided. The wagons must be secured by means of hand brakes and if any doubt exits as to the safety of the wagons, e.g. on account of gradients, they must be secured by means of hand brakes and scotch blocks **[TWR136]**.

Should there be any wagons standing in a dead end at a station, a red flag during the day or a red light during the night or foggy weather must be shown from the end of the wagon furthest away from the stop block and facing towards the entrance to such dead-end **[TWR119]**.

3.2.6.5 HAND POINTS

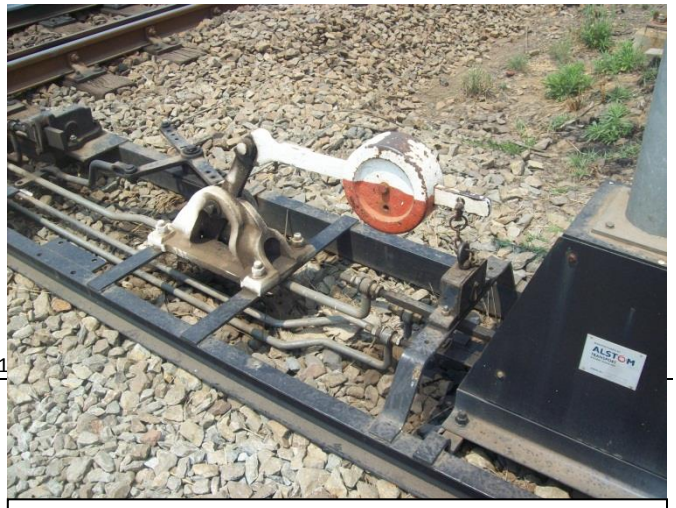
Hand points are points that are operated by hand using a lever with a tumbler connected to it to act as a counter-weight. Except where otherwise laid down in local appendices, the normal position of all points leading off the running line is for them to be set and locked for the running line **[TWR218(1)]**.

Hand operated points may come in a form of running ling points, which are points found on the running line or mainline; whereas non-running line points are found inside yards and sidings.

At a station the Train-Control Officer is responsible for seeing that all hand points connected with running lines are kept in the normal position **[TWR218(2)]**. Hand points leading to a running line or from one running line to another may only be operated by the Train-Control Officer on duty or on his/her authority, by another competent employee on duty **[TWR118]**.

3.2.6.6 RUNNING LINE POINTS

Running line points which, except when they must be reversed for a movement,



RUNNING LINE POINTS

are to be kept locked in a specific position. They are distinguishable by the counter-weight or the counter-weight indicator plate where the switch box is parallel to the line, the one half of which is painted white and the other half red. The white and red halves are divided horizontally with the white half uppermost when the points are set for the main line with the counter weight on that side of the switch box to which the lock and chain are provided **[G.A.8002.2].**

3.2.6.7 NON-RUNNING LINE POINTS

Non-running line points which, except when they must be reversed for a movement, must be kept locked in a specific position. These points are distinguishable by the counter weight of which the centre recess on both sides is painted black **[G.A.8002.2.1]**.

NON-RUNNING LINE POINTS

Where the points lock is locked by means of a special key instead of a right-hand Chubb key, the key must be kept by the official-in-charge of train control, or his/her deputy who must exercise proper control over it **[G.A.8002.2.2]**.

All points locks and keys must be carefully examined and if any defect is found, they must be repaired or replaced immediately **[G.A.8002.2.3]**. The keyhole plates on all hand-points locks must be replaced over the keyhole after use, so as to keep the locks free from dirt **[G.A.8004.7.1]**.

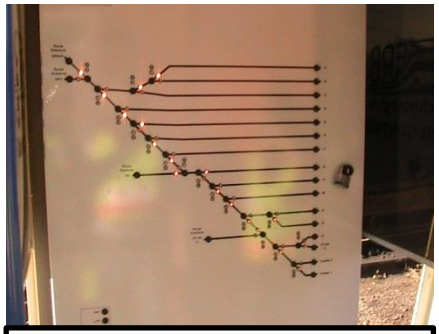
The Shunter or other authorised employee who is responsible for the operation of points must see that all wagons are clear of the points before such points are operated. He/she must also see that the points over which wagons have to pass are set for the intended route and that the points blade(s) is/are close against the stock rail(s) **[TWR133]**.

Where the points are not worked from a lever frame or from a panel, the employee who is responsible for the operation of the points must carefully examine the switchblade to see that it is close against the stock rail before authorising a movement. He/she must also, **after the movements have been completed**, ensure that –

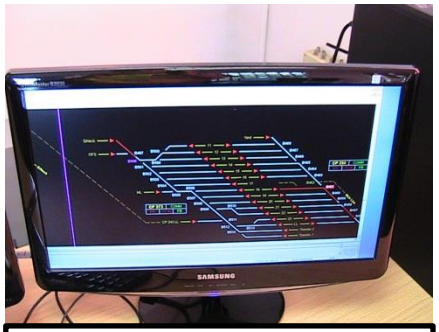
1. Derailers are set and locked in the normal position, i.e. in the position which will derail wagons and/or prevent them from obstructing an adjacent line; and
2. Points to be kept locked in a specific position, are set and locked in that position **[G.A.8002.1]**.

3.2.6.8 MACHINE OPERATED POINTS

The POINTS MACHINE is an electrical hydraulically operated configurable yard points machine that offers the capability of interfacing with an existing operational yard environment. The points machine allows for different methods of points control and includes a **local electrical panel with push buttons** at the control point, push buttons in a box at the points and a **computerised control system in a tower** for controlling shunting.



PANEL AT THE POINTS



COMPUTERISED IN TOWER

The points machine is designed to operate a single set of points. However, the points machine can be configured to operate in a crossover configuration where one points machine can communicate to another points machine and they both can then operate in conjunction with each other to support crossover functionality.

The advantages of a points machine in the yard are as follows:

1. The points machine interfaces with a computerized yard management system to allow autonomous points control of yard shunting and increased yard throughput with less human physical contribution.
2. The points machine is designed such that if proper points position cannot be achieved whereby the point-blade is not against the stock rail, the points indicator shall display a red indication as a warning.
3. The points machine is designed to operate with a **protective device** in a form of a sensor that detects the presence of rolling stock near or over the points and will inhibit points movement until the points are not occupied. This feature prevents derailments in the event that an employee is trying to operate the points while they are still occupied.
4. The points machine is designed to provide an indication to the operator if a gap or any other fault in the operation occurs.
5. The points machine is linked to an external 2 or 3 light signal display with an indication of the position of the points – both facing and trailing indications will show.

6. The point's machine is designed with fault accommodating logic that will inhibit or disable the point's machine in the event of an unsafe operating condition.

Should the normal way of operating the points fail-whether by means of a panel or computer-there is a manual way of operating the points. Further details and proper procedures are discussed in the annexure named "MACHINE OPERATED POINTS". Either way, whether points are operated normally by point's machines or, by manual operation, it is still the responsibility of the Operator to make sure that the points are set correctly before instructing the Train Driver to proceed over the points.

3.3 POSMOR PRINCIPLE 6 (STOP)

It is important that at this juncture that we stop and talk about principle 6 of POSMOR, which is STOP as the signals will signify a stop to some movements. Signals will signify a beginning and an end of an authority. Let us look at the values of this principle.

VALUES

3.3.1 AT LIMIT OF MOVEMENT

As we have seen under the value, "track must be defined" – it must have a beginning and an end or definite boundaries or limits. And it is at the end that the Train Driver must stop; i.e. at the limit of the "defined track", as prescribed by his/her authority. However,

when we say that the train or shunting movement must stop at the limit, it does not mean that the Train Driver may ignore limitations such as a danger signal, i.e. hand signal, red banner, etc. displayed en route, or that they may ignore dangerous conditions, such as wash-aways, trees blown across the track, etc. It merely means that they may not proceed beyond the point to which they were authorised to proceed. And they must stop there unless; they receive a new authority to proceed over the next "defined track".

3.3.2 WHEN AND WHERE SCHEDULED

Running times are predetermined for each type of train. Such running times make provision for scheduled stops, e.g. for passengers, freight or other reason(s), or, if circumstances arise or demand, special arrangements can be made to accommodate a special stop en route. What is important is that whether a train is scheduled or pre-arranged to stop en route, it must stop there.

3.4 HAND SIGNALS TO BE USED TOGETHER WITH FIXED SIGNALS DURING SHUNTING

When a train or shunting locomotive is required to make any of the following movements:

1. moving in the **wrong direction on any running line,**

2. or **from one running line to another,**

3. or **to shunt into or out of sidings connected with running lines;**

and fixed signals are provided for this purpose, such signals must be operated. A prescribed hand signal or oral instructions must be given to the Train Driver over and above the operated signal. Where fixed signals are not provided for this purpose, then the Train Driver must be orally instructed, and thereafter the necessary hand signals must be exhibited **[TWR130]**.

During shunting operations where there are fixed signals for shunting, the Train Driver must ensure that the signal has been operated. In the case of a propelling movement where the Train Driver cannot observe the signals from the locomotive, they must act upon the fixed signal at all right, proceed or caution, only after the Shunter or other authorised employee has given them the prescribed hand signal or oral instruction **[TWR135(1)]**.

Where, before an initial shunting movement, a locomotive stands beyond a signal and the Train Driver is unable to see the signal, they must obtain an assurance from the Shunter that the signal is at all right, proceed or caution or, where the signal cannot be operated, that the Train-Control Officer has given permission for the shunting work to commence. If the shunting movement is a propelling movement, the Shunter must ensure that the signal has been operated before they give a hand signal or oral instruction to the Train Driver to move and in this case the Train Driver, if they cannot observe the signal, may act according to the hand signal or oral instruction **[TWR135(2)]**.

If shunting operations with a light locomotive are not under the control of a Shunter, the Train Driver may act upon a fixed signal at all right, proceed or caution without the hand signal or oral instruction **[TWR135(3)]**.

3.5 WHILST STATIONARY (POSMOR 7)

Principle 7 of POSMOR illustrates the values that must be followed in securing the wagons when they are stationary. Let us now have a look at how we can incorporate these values to the context of the above content.

VALUES

3.5.1 STANDING CLEAR OF POINTS (NOT FOUL)

The front of the leading locomotive of a train, or leading vehicle of a shunting movement must, when brought to a standstill in a station or siding, not be allowed to stop beyond the clearance mark of the adjoining line. Failure to obey this value will inevitably lead to an accident – sometimes with tragic consequences.

The same procedure must be followed when a vehicle or vehicles are detached on a running line or in a siding. In other words, trains or vehicles standing on one line must not form an obstruction for trains or vehicles which have to pass on the adjoining line and must, therefore, not be left standing beyond the clearance mark, i.e. on that side of the clearance mark nearest to the points. Where catch points or a derailer is provided, trains or vehicles must stand on that side of the catch points or derailer which is furthest away from the points giving access to that line.

3.5.2 **BE SECURED (AGAINST MOVEMENT)**

Whenever a train/shunting movement/vehicle/locomotive is at a standstill, it must be secured against irregular movement! This purely means that it must not be able to move. It may also not be moved without authority.

When a train, comes to a standstill, the train brakes, must be applied for as long as the train is required to remain stationary. In addition, should the train be left standing, sufficient handbrakes must be applied and, where necessary, a scotch blocks placed under the wheels.

All detached vehicles must be secured by enough hand-brakes and if necessary with scotch blocks.

3.5.3 **BE PROTECTED**

A train standing on a running line in the section is protected by means of detonators placed on the line and hand signals. Trains, shunting movements, or vehicles standing in yards or signalled areas can be protected in different ways. For instance, when the wagons are at a standstill, by setting the points for another line, a collision can be prevented from other movements. They can also be protected by placing and keeping the relevant signals on either side at danger and by the use of reminders in train control centres/stations to remind the Train-Control Officer not to operate certain signals and points.

Whatever measures are taken to safeguard trains, shunting movements or vehicles against collisions, can be regarded as protection.

NOTES

ACTIVITY 8 - PRE-ASSESSMENT

COMPLETE ACTIVITY 8 ON PAGE 23 OF THE LEARNER WORKBOOK AS AN INDIVIDUAL. UTILIZE THE ANSWER SHEET PROVIDED ON THE WORKBOOK.

When you are finished with the activity, discuss the answer with the Facilitator to ensure that everyone understands the answer/s.