Rail Operating Code

Section 4 - Operating Instructions for Locomotive Running Staff

Publication date 09 Dec, 2024

Table of Contents

4.0 Locomotive Engineer Training and Certification

1. Specific Certification Requirements

1.1 Training Requirements

All Rail Personnel requiring training in Locomotive Engineers duties will attend formative training.

The training will deliver theory and practical elements for all tasks for training and include a comprehensive study of company rules, code, and instructions.

Trainees will sit a written examination (pass mark 80%) covering the following subject areas:

- Air Brake
- Mechanical / Electrical
- Train Handling Technique

On passing the examination, trainees will commence a period of on-the-job training at their home location. During on-the-job training, trainees must complete a logbook as a learning record.

On the job training minimum requirements:

- Locomotive Engineer Trainees with previous experience (other operators/international) 500 hours.
- Locomotive Engineer Trainees with no previous experience 1040 hours.

On the job training is the period commencing from arriving at the locomotive to undertake pre-departure checks and ending when leaving the locomotive after completing post-arrival checks, except for the on-train personal needs break time and time spent as a passenger on a train for coupling purposes.

1.1.1 Training Specifications

Training Specifications are being progressively developed as Code Supplements Training (CST).

Code Supplements - Training:

- Set the requirements for developing training
- Are indexed using the RORP LTO certification classification
- More than one CST may apply to each LTO classification

As CSTs are approved, they will be published as electronic documents on the Intranet

CSTs currently approved are:

- A – AP / 01 – Locomotive Engineer locomotive-hauled Freight and Intercity Passenger Trains
- AP2 / 01 – Locomotive Engineers – Metro Passenger
- AP2 / 02 – Re-Training for Platform Stopping Technique
- AS / 01 – Locomotive Engineer Steam Locomotives
- AF / 01 – Fireman Steam Locomotives

2. Initial Practical Certification

On completing six months of on-the-job training, the Linehaul Operations Manager or suitably qualified nominee will meet with the trainee to discuss the period of on-the-job training. If the Trainee is confident, they are ready for the certification, the Linehaul Operations Manager or suitably qualified nominee will arrange for a practical certification to be completed.

Randomly selected trains in commercial service will be used for certification purposes.

2.1 Certifications Required

The Linehaul Operations Manager or suitably qualified nominee must observe the Trainee over all routes in the geographical area of operations and complete on the job training mastery checklists for the following:

- Steep grades within the geographical area of operations.
- Express freight trains.
- Bulk express freight trains such as milk, coal, and steel have different handling characteristics.
- Light locomotive.
- Passenger trains if included in the roster at that location.

After the on-job training Mastery checklist is completed, the Linehaul Operations Manager or suitably qualified nominee will meet with the participant. If all agree that the Trainee is competent to operate in commercial service, the Linehaul Operations Manager or suitably qualified nominee will complete a certificate of competency. This is then forwarded to the National Training and Development Manager, who will issue an STF23 authorising full and final certification.

At the end of the on-job training period, the Trainee will pass the logbook to their manager to hold on file as confirmation of on-the-job training.

The on-job training logbook provides route-specific appendices to ensure the following are captured:

- Generic features (speed boards, curve warning boards etc.),
- Route specific features of each route (gradients and mandatory grades, such as Otira tunnel, Cass Bank, Waitotara Bank) and Local Network Instructions. (such as Rimutaka / Kaimai Tunnel, setting back procedures Paerata etc.).

Trainees will be observed / assessed against these features before being certified as competent to interpret and respond to them correctly.

The logbook will serve as a learning record for Locomotive Engineers who transfer between depots and may need to learn new routes before signing the road knowledge register.

3. Road Knowledge

Before operating trains over a section of track, Locomotive Engineers must undergo a period of on-the-job training and site / area familiarisation by road vehicle decided by the Linehaul Operations Manager to gain road knowledge.

The purpose of this is to ensure that Locomotive Engineers become familiar with:

- The geography of the area.
- Crew relief location access points.
- Station / junction unique features.
- Track geometry and authorised speed.
- Signal and / or track warrant locations.
- Special operating instructions.

Locomotive Engineers must not be rostered to operate a train over a section of track for which they do not have road knowledge.

3.1 Initial Road Experience

When commencing work at a depot, a Locomotive Engineer will be rostered with an experienced local Locomotive Engineer to operate trains to attain road knowledge for routes where the Locomotive Engineer has no previous or recent experience.

A safety assessment must be undertaken by authorised personnel before the Locomotive Engineer is considered to have road knowledge for each route.

The Locomotive Operations Manager / Team Leader must carry out further safety assessments over one route:

- Each month for three months, then
- Again, in months five, seven and nine following the certification date. These assessments must include a mandatory grade assessment.

NOTE
Mandatory grade assessment is not required if none exists in the operating territory.

3.1.1 Extension of Running Area

When it is proposed to extend the running area covered by a depot normal roster, Planning Personnel must first consult with the Linehaul Operations Manager. The Linehaul Operations Manager will arrange the required road knowledge and other training requirements for the extended running in line with initial road experience.

3.2 Infrequent Journeys

When Locomotive Engineers operate trains infrequently during an eight-to-12-month period over the track at the extremities of their certified territory, the speed of the trains under their control must be reduced to a level that will ensure they can be handled safely when operating over these sections.

If a Locomotive Engineer has become unsure of local conditions, they must consult Train Control. If uncertainty still exists, the train must not proceed over the section until manned by a Locomotive Engineer familiar with the area.

3.3 Prolonged Absences

If a Locomotive Engineer has not operated over routes within the past 12 months before being assigned to trains operating on those sections of the line, the Locomotive Engineer must:

- Undertake one trip over each route with an experienced local Locomotive Engineer to regain road knowledge.
- A safety observation by authorised personnel must be carried out over one of the routes. If there is a mandatory grade on one of these routes, this observation must include a mandatory grade assessment.

Prolonged absences also include Locomotive Engineers returning to work after extended leave or sickness, Locomotive Engineers relieving from other depots and personnel who operate as Locomotive Engineers part-time.

3.4 Documentation of Road Knowledge

When a Locomotive Engineer first learns the road, they must sign a road knowledge form which Authorised Personnel must validate on an attached Staff 23, and a copy is:

- Retained on the Locomotive Engineer's local file.
- Sent to the Regional Roster Coordinator, who will enter C (current) for each certified route in the road knowledge database.
- Locomotive Engineer Line Managers will be responsible for ensuring any changes to road knowledge areas or currency are advised to the Regional Roster Coordinator within 48 hours.
- There will be no need for further validation provided the Locomotive Engineer continues to operate over the routes specified as part of their depot roster.

If a Locomotive Engineer is:

- Off work for what is known will be, or becomes a prolonged absence, or
- Operates over the route on a part-time basis, or
- Relieves at the depot periodically.

The Regional Roster Coordinator must record the month /y ear of the last journey the Locomotive Engineer last travelled over each route in the database.

If a Locomotive Engineer has not operated a train for 12 months, their road knowledge will have expired. A new road knowledge form validated by authorised personnel on an attached Staff 23 will be required.

4. Practical Assessments and Certification Down Steep Grades

Competency certification for steep grades will be conducted every two years. These grades will apply on a depot-by-depot basis as follows:

- When an initial certification is being authorised.
- As part of the ongoing safety observation procedures.
- When after initial certification / bi-annual certification, a Locomotive Engineer transfers to a new depot or the running of a depot has been extended.

IMPORTANT

Bullet point 3 only applies if the route changes as identified by the Linehaul Operations Manager include a steeper grade than previously assessed.

Depot	Steep Grade
Whangarei	* Kamo to Whangarei
Auckland	* Remuera to Penrose
Te Rapa	* Owhango to Kakahi National Park to Raurimu
Mount Maunganui	* Putaruru to Tokoroa
Kawerau	* Matahina to Kawerau
Palmerston North	* Westmere to Wanganui Nukumaru to Waitotara Owhango to Kakahi National Park to Raurimu Opapa Bank (north direction)
Napier	* Waikoau to Eskdale Opapa Bank (north direction)

Depot	Steep Grade
New Plymouth / Stratford	* Westmere to Wanganui Nukumaru to Waitotara
Masterton	Nil
Wellington	* Pukerua Bay to Paekakariki
Picton	* Elevation

Depot	Steep Grade
Christchurch	* Arthur's Pass to Otira
Otira	* An annual assessment for the banker Locomotive Engineer setting back an uphill train in the Otira Tunnel
Greymouth	* Arthur's Pass to Otira
Westport	* No.1 tunnel to Tawhai
Dunedin	* Mihiwaka to Sawyers Bay
Invercargill	Nil

* In addition to the steep grades above, the following grades can also be used for safety observation / assessment.

Line	Grade
NAL	Maromaku (down direction) Kamo (up & down direction) Makarau (up & down direction) Avondale to New Lynn Remuera to Auckland
NIMT	Buckland Bank (down direction) Whangarata (down direction) Mission Bush exit (both ends) Porootarao to Waimiha Horopito to Ohakune Waiouru to Tangiwai Mataroa to Taihape Pukerua Bay to Plimmerton
PNGL	Matamau Bank (south direction) Tutira to Eskdale
MNPL	Westmere to Wanganui Westmere to Kai Iwi Waitotara Bank (north direction) Manutahi Bank (north direction)
Wairarapa	Northern portal No.2 Tunnel – Featherston (Up direction)
MNL	Dashwood – Vernon Hawkeswood – Down direction Scargill – Up and Down direction
Midland	Avoca Bank – Up direction Cass Bank – Down direction
SNL	Tawhai (up & down direction)
MSL	Deborah to Oamaru Seacliff to Merton

5. Locomotive Engineer Multiple Units - Wellington

Participants must hold electrification (DC) awareness before commencing this course. Participants required to operate EMUs in commercial service will undergo instruction and certification in rules, codes, Network Local Instructions and signalling categories before moving to specialist training to confirm competency and route knowledge to operate EMUs.

6. Second Person Duties

This course prepares personnel for Locomotive Engineer Assistants duties. There is some classroom study however, the course is mainly practical field-based exercises followed by full certification for the locations identified.

7. Area Familiarisation

Second, Persons do not require the comprehensive road knowledge necessary for a Locomotive Engineer and must be familiar with signalling layouts at terminals / stations where they are required to work.

The familiarisation will be determined on a case-by-case basis by the training provider and recorded on an STF 23.

When Second Persons are transferred into a new terminal / depot, they must be given access to all S&I diagrams relating to the new areas. They will be taken to selected station yards by the Locomotive Operations Manager or suitably qualified nominee to cover the local Rail Operating Procedures and Rail Operating Code instructions in-depth.

After receiving initial Second Person training or if the running area is extended, the Second Person will be rostered for one shift as an additional crew member over the area where they will work as a Second Person.

8. Steam Locomotive Certification

Refer Rail Operating Code Supplement Training CST/AS/01 Induction, Training, Certification and Competency: Locomotive Engineers – Steam Locomotives.

4.1 Motive Power Unit Inspection and Operating Instructions

1. Operating a Locomotive

1.1 Examination of Locomotive and Security Equipment

A Locomotive Engineer is responsible for the locomotive's safety and the safe working of the train.

If Depot Personnel do not service the locomotive, the shortage of equipment or train delays are attributable to the locomotive Train Crew.

On a serviced locomotive, it is accepted that all necessary checks have been carried out. The exception is for the requirement to check the brake set-up and countersign the brake set-up portion of the radio test card.

When a locomotive cannot complete its scheduled run and must be assisted or replaced to enable the service to run to its destination, this is classified as a locomotive failure.

1.2 Locking of Cab Doors and Windows

Cab doors on trailing locomotives running on trains must be locked when not in use.

Cab doors and windows must be kept locked at depots or other locations for security purposes when locomotives are not in use.

1.3 Servicing of Locomotives Not Prepared by Depot Personnel

A thorough examination of the locomotive and its equipment must be made when it is being serviced.

1.4 Booking Locomotive Repairs

In the event of any locomotive defect, failure, or repair, Locomotive Engineers must record all relevant information relating to the defect, failure, or repair in the Loco 54D repair book. All fields on the page must be completed when the requested information is available.

> **IMPORTANT**
>
> When a ground relay occurs, refer to ROC 4.3 Train Handling and Associated Instructions, 17.3 Ground Relay [101] for required actions, and information that must be recorded in the Loco 54D repair book.17.

Where locomotives do not run into the main depot, all repairs or adjustments must be reported to the Locomotive Operations Manager, Rolling Stock Team Leader or Loco Control, so alternative arrangements may be made as soon as possible.

1.5 Tools and Spare

Locomotive Engineers on other than serviced locomotives are responsible for ensuring the necessary maintenance and emergency equipment are on the locomotive and ready for immediate use. Any loss or damage to tools or spare equipment must be reported immediately and recorded in the Loco 54D repair book.

1.6 Sand Gear

Sanding equipment is maintained by Rolling Stock or Depot Personnel. Locomotive Engineers must ensure an adequate supply of dry sand is available on their locomotives at terminals where no Rolling Stock Personnel are on duty.

1.7 Fuel, Oil, Water and Stores

Care must be taken when fuelling locomotives, filling lubricating oil sumps, and taking water to ensure no spilling or overfilling.

A check for fuel oil, lubricating oil, and water leaks must be made. Any leaks must be rectified where possible. If they cannot be rectified, they must be recorded in the Loco 54D Repair book.

CAUTION

If spillage or over-filling occurs, immediate action must be taken to contain and recover the spill to avoid environmental damage.

The incident must be reported to the Manager in Charge of the terminal.

1.8 Locomotives Cab Storage Bins and Tool Bags

Main line locomotives are equipped with two storage bins and a tool bag.

The first aid / documentation bins contain:

- A first aid kit
- Two gas masks and four filters
- Self-Contained Self-Rescuer (SCSR) unit
- Torch
- A battery for the supplied torch
- Dangerous Goods Initial Emergency Response Guide

IMPORTANT

If Respiratory Protective Equipment (RPE) is removed and used from the bin, this must be recorded in the Loco 54D repair book. Rolling Stock Personnel must check the book at each service and must replace any opened first aid bins with a fully stocked bin.

If first aid articles, towels or wet wipes need to be replenished, this must also be recorded in the Loco 54D book repair book.

The tool bag contains:

- Two hose couplings
- Three hardwood plugs
- Coupling pin
- Four assorted cable ties
- Assorted tools
- Electrical tape

- Pink dazzle paint

Locomotive Engineers do not need to carry their equipment in the bins / bag. The bins are in the locomotive cab. The tool bag is in the locomotive as follows:

- DC in the long hood compartment
- DFT in the B side spares compartment – near the compressor
- DX Class in the B side alternator compartment
- EF in the number 1 end by the MA sets
- DL in the radiator fan compartment through the number 2 end door

Locomotive Engineers must record any shortages in the Loco 54D repair book and any items used from the first aid kit.

The Locomotive Servicing Personnel have a detailed list of the contents and will check the first aid / documentation bin and tool bag contents at regular intervals. The Linehaul Operations Managers are responsible for the book in the first aid / documentation bin.

Wheel Chocks

Main line locomotives are equipped with a bag of six wheel chocks, which will be located with the locomotive tool bag, or in a special compartment under the running board.

1.9 Storage of Detonators in Locomotives

All locomotives carry detonators. Each tin has a manufacturer's use-by date. These are located as follows:

Locomotive Class	Location of Detonators
DC	Inside the rear compartment (boot), B side underneath the number light compartment or on fan door room
DL	In the radiator fan compartment through the number 2 end door
DFT	On the inside of the B side alternator door
DH	On the inside of the end door of the long hood
DSG, DSJ	Inside the spare equipment locker, A side, number 1 end
DSC	On the inside of the spare equipment locker door in the cab
DX	On the inside of the B side alternator compartment door
EF	Stored inside a locked (square key) compartment

NOTE
Only sufficient detonators to comply with detonator protection rules are stored in locomotives.

1.10 Inspection of Privately Owned Locomotives

Annual inspection to support Rail Operating Licence includes:

- KiwiRail customer siding holders. KiwiRail Mechanical Personnel will inspect these locomotives on request.
- Other operations on the network: The Access Provider will manage the inspection requirements.

1.11 Luminous Clip Boards

A luminous clip board has been fitted next to the driver’s control console on main line diesel locomotives. This clip board provides a permanent fixture to which the completed track warrant (Mis.88) or operating instruction (Mis.51) forms can be attached. This allows the Locomotive Engineer to have sight of the written authority in operation.

At the back of the clip board, several small lights have been fitted together and, when illuminated, will highlight the information on the board.

If the lighting behind the board fails to illuminate when switched on or turned up by the control knob on the side, this fault must be recorded in the Loco 54D repair book.

1.12 Self Contained Self Rescuers (SCSR)

Servicing specifications provide a check that a locomotive has an SCSR, and for double cab locomotives, that the SCSR is positioned in the leading end for the assigned train.

In the event that a required locomotive has no SCSR, it may run as a trail locomotive only. When this occurs, the Rolling Stock Representative must advise Locomotive Allocation to identify it with a “Trail Use Only” (T) tag.

Changing Direction En route:

When an SCSR is removed from a locomotive en route, and placed into a different locomotive:

- LE Action - Tell Locomotive Allocation, and endorse the Loco 54D book “SCSR removed to DL9876 etc.”
- Loco Allocation Action - Remove the “T” tag if an SCSR is added to the locomotive, and place a “T” tag on the locomotive that the SCSR has been removed from.

Second Persons

- Except in an emergency, SCSR for second persons are not to be removed from a locomotive in service.
- Second Persons and Cab Pass Holders must uplift an SCSR (if required) from the terminal pre departure.

Missing SCSR

When a locomotive is identified without an SCSR, and the locomotive is not “T” tagged:

- LE Action - Immediately report the incident to Loco Allocation.
- Loco Allocation Action - Place a “T” tag on the locomotive, and record the incident in the Access Provider's Incident Reporting system.

Replacing SCSR

When Rail Personnel replace missing, or removed SCSR:

- Rail Personnel Action - Advise Loco Allocation and endorse the Loco 54D book.
- Loco Allocation Action - Remove the “T” tag

2. Locomotive Turntables

2.1 Turning Locomotives

Before a locomotive moves on or off a turntable, the turntable must be secured at both ends with the locking bolts or stops provided.

The locomotive must be moved slowly onto the turntable, and the brakes must be applied before turning begins.

2.2 Locking the Locomotive Turntable

Local instructions issued by the Locomotive Operations Manager / Yard Team Leader in conjunction with the Rolling Stock Team Leader will specify the requirements for locking turntables after use at each location.

3. Locomotive Brakes

3.1 Brake Test

Where provided for in **TO02 Train Brakes**, the correct brake test and a brake pipe leakage test must be carried out.

When making a brake test, the brakes must not be released until the brake pipe air has stopped exhausting at the brake valve and all pressures have equalised even though the Train Examiner may have given the release brakes signal.

If the pressures will not equalise and there is a continual blow at the brake valve exhaust, a brake valve on the locomotive or another locomotive on the train may not be correctly isolated.

3.2 Running Train Brake Test

A running train brake test is a procedure that must be completed by all Operators as soon as practicable at the start of the journey.

The running train brake test must also be completed:

- After completing shunting activities en route. This also includes if the locomotive consist changes, or
- When an Operator hands over a train to another Operator.

Its purpose is to test the air brake system's integrity and braking effectiveness throughout the train consist at the earliest opportunity when running on the controlled network.

This will require the Operator to move the automatic brake valve handle into the service zone and beyond the minimum reduction position.

The Operator is to use the TEM head-end unit or in-cab air gauges to confirm brake pipe pressure falls relevant to the application made.

The Operator should feel the train slow; after equalisation occurs, the train brakes can be released. This confirms brake functionality throughout the train, and the train can continue its journey.

NOTE

When completing the running train brake test, consideration must be given to:

- The train consist and make up
- Gradient
  - Ascending
  - Descending
  - Mandatory grades at the start of the journey

3.3 Running Train Brake Test Failure

After initiating the running train brake test, the train fails to slow. The Operator is to make an emergency train brake application and bring the train to a stop.

Once the train is stationary, the Operator will contact Train Control and report suspected train brake failure and await further instructions.

3.4 Maximum Speed

> **WARNING**
> Operators must not exceed the maximum speeds shown in TO10 Network Line Speeds.

Lost time should be made up where possible, provided the maximum authorised speed is not exceeded.

A notice must be placed in the locomotive cab by a Rolling Stock Representative if the locomotive's speed has been reduced from the maximum running speed. They must also tell Loco Control of the restriction and its reason. The locomotive must be identified on the daily tagged locomotive list in accordance with Mechanical Codes. Alternatively, a bulletin must be issued.

3.5 Examination of Locomotive Brakes

Where servicing personnel or Locomotive Engineers service locomotives, they must ensure the air brake and handbrakes are operating and adjusted correctly.

Any irregularities noted in the operation of the train or locomotive brakes should be reported as soon as possible to the Train Controller or the Locomotive Operations Manager / Yard Team Leader, who must tell the nearest Rolling Stock Representative. All air brake irregularities must be recorded in the Loco 54D repair book.

3.6 Main Reservoir Leakage Test

The main reservoir leakage test must be applied as follows:

1. Handbrake applied and engine running.
2. Independent or straight air brake valve in the release position.
3. Brake valve cut off valve at cut out position.
4. When the compressor loads, watch the main reservoir gauge needle; when the compressor unloads (needle stationary), time the loss over one minute. Pressure loss must not exceed 20 kPa for one minute.
5. Record any faults in the Loco 54D repair book.

3.7 Brake Pipe Leakage Test

The brake pipe leakage test must be applied as follows:

1. Engine running.
2. Make a 75 kPa brake pipe pressure reduction.
3. Leave the brake valve handle in this position.
4. Place the brake valve cut out valve to cut out position.
5. Watch the brake pipe gauge needle. Pressure loss must not exceed 20 kPa over one minute.
6. Place the brake valve cut off valve to cut in and release the brakes normally.
7. Record any faults in the Loco 54D repair book.

3.8 Brake Blocks and Brake Piston Travel

With the brakes fully applied, the piston travel should be as follows:

- On short-stroke cylinders without slack adjusters, as fitted to current main line locomotives, the travels are between 35mm and 125mm.
- On long-stroke cylinders without slack adjusters, the travels are between 125mm and 200mm.
- With automatic slack adjusters fitted, the travel is 90mm.
- When brake blocks are renewed, the travel should be adjusted to the minimum figure as practicable. In normal service, the adjustment need not be altered unless it is obvious the travel will exceed the maximum before completing the run.
- Brake blocks must be examined to ensure sufficient thickness to enable the locomotive to complete its rostered run. Brake blocks have a raised wear limit pad cast on the side about the middle of the block.
- While any of this pad is still visible, the block is still serviceable to run the rostered run.
- Cracked blocks are serviceable. Broken blocks (pieces missing) are not serviceable and must be replaced as soon as possible.

4. Locomotives in Multiple

4.1 Different Classes

When operating different classes of locomotives in multiple, the load for the combination may be less than the individual load schedule. This is covered in the Master Locomotive Load Schedule.

This is because different classes of locomotives develop their maximum tractive effort at different speeds. As the train starts to ascend a grade and speed decreases, one locomotive may reach its maximum tractive effort before another.

If the load is the equivalent of the load schedules for each locomotive, then because the other locomotive is not putting out its maximum tractive effort, the combined tractive effort is not enough to ascend the grade, and speed falls further.

When this happens, the locomotive that reaches its maximum tractive effort first will start slipping, and this may lead to the train stalling. If wheel slip does not occur, the traction motors will be operating at their short-term ratings.

4.2 Operating DFT Locomotives in Multiple with DC locomotives

DFT locomotives may run trail behind any other locomotive class. Still, if road speed drops below 22 km/h when working in notch 7 or 8, the locomotive may only be operated for 15 minutes in this condition. After 15 minutes of notch 7 or 8 operations at 22 km/h or lower, the locomotive must be stopped, and the engine idled for 15 minutes to cool the traction motors. Then the locomotive may again be run in notch 7 or 8 at 22 km/h or lower for a further 15 minutes. A normal load schedule will apply regardless of whether the DFT is leading or trailing.

4.3 Remote Isolation Switch – DXB5074

A Remote Isolation switch has been fitted to DXB5074, which allows Operators to connect / disconnect the throttle signals between the lead and trailing locomotives.

The switch has two positions:

- **Run / Online** (position 1) – any operating trailing locomotive will operate normally.
- **Isolate / Offline** (position 2) – Any operating trailing locomotive will not produce power, they will remain in idle regardless of the notch position of the lead locomotive.

> **IMPORTANT**
> Dynamic brake remains unaffected by this modification and will operate on all locomotives regardless of the position of the switch.

- The switch is located on the control stand as shown below
- The normal position of the switch is in the “I” position (Online) - Operators should check the position of this switch.
- When the switch has been moved to the “II” position (Isolate / Offline), ALL trailing locomotives will go offline.
- The switch should only be moved between positions when the throttle is in idle.
- The switch is only to be operated from the lead cab, the switch is to remain in the Run / Online position in any trailing cab.

Remote Offline Switch Location

Switch Use

This switch should be operated when there are portions of the journey where trailing locomotives are not required due to topography.

When a train weight (including dead locomotives) is less than 90% of the single-locomotive load, then trailing locomotives are to be shut down.

Should trailing locomotives no longer be required during a journey, and there is still a significant portion of the trip ahead – any trailing locomotive should be shut-down to avoid excessive idling of the diesel engine.

5. Starting and Moving Locomotives

Before starting a locomotive, the reverser handle must be centralised and either the airbrake or handbrake applied. Never start the locomotive engine when a person is working on that locomotive in a position where their safety is compromised.

Before moving a locomotive:

1. Walk round the locomotive
2. Ensure all persons are clear
3. Ensure brakes are applied on all bogies
4. Ensure handbrakes are released
5. Check brakes are cut in correctly
6. Check headlights are illuminated

Check brake gauges:

7. Full main reservoir pressure
8. Full brake cylinder pressure
9. Equalising reservoir and brake pipe reservoir are equal at 550 kPa

Position reverser for the direction of travel:

10. Apply minimum power
11. Release the independent brake to see if the locomotive moves

If a Not to Move or Do Not Start Engine board is displayed on either end of a locomotive or is placed on the controls, the locomotive must not be moved until authority is given by a Rolling Stock Representative and the board is removed.

5.1 Stationary Locomotives

Stationary locomotives must not stand with power applied.

When moving a train, all brakes must be released, or if starting on a grade, sufficiently released to enable the train to move. The engine should be shut down if it is anticipated the locomotive will stand for more than the following times:

- Main line locomotives - 20 minutes
- Shunting locomotives - 15 minutes

In populated areas where complaints concerning noise are likely to be received, the engine may be shut down sooner at the discretion of the Locomotive Engineer.

> **IMPORTANT**
> Refer to the Loco 54D repair book for any recent battery defect problems before shutting the locomotive down.

5.2 Reverser Handle

The reverser handle must only be moved when the locomotive is stopped. Always bring the locomotive to a stop before moving the reverser handle, even into the neutral position. The reverser handle must be centralised before starting and shutting down the locomotive.

5.3 Half Wheel Test

When moving motive power units that have been stabled or shut down in terminals, depots, sidings, or changing driving cabs.

After normal checks (running gear) have been completed:

1. Move the MPU forward approximately 1m
2. Apply the MPU brake to confirm that the brake is operational. It is unnecessary to bring the train to a complete stop when applying this test

> **NOTE**
> This test does not apply to remote controlled locomotives as the Remote Controller Operator performs set pre-operational checks.

5.4 Movements within the Depots

The requirements and conditions for moving locomotives and shunting are outlined in Local Yard Operating Instructions for terminals.

5.5 Coupling of Locomotives

Locomotives not fitted with automatic couplers must be coupled together with coupling links.

5.6 Level Crossings

When passing over railway crossings and crossovers, reduce the throttle to notch 4 before reaching the crossing and leave the throttle at notch 4 until all power bogies are over the crossing. This permits coasting over the crossing with little or no load on the motors and protects the commutator surfaces from damage from brush arcing.

5.7 Assisting with the Work of Trains

When trains cross or shunt at a station where there is a Roving Shunter, Locomotive Engineers must act under the direction of and assist the Roving Shunter, who will be responsible for the locking of facing, derailers, and safety points. The Locomotive Engineer must not start the train until the Roving Shunter has authorised them.

5.8 Train Crew Change Over

Locomotives must be brought to a stop when crews are changing over, and the Locomotive Engineers must inform the relieving Locomotive Engineer of any defects in the locomotive. They must also record these defects in the Loco 54D repair book.

For Metro operations in the Auckland area, face to face handover is not required. All faults / defects must be recorded in the 54M repair book, and the Metro Service Operator’s Control Room must be notified if the fault / defect may cause a service failure.

Rail Personnel booked to work shunting locomotives who are to change over in the yard must report to the terminal office before commencing duty.

If a locomotive is handed over in an unsatisfactory condition due to carelessness or negligence, the Locomotive Engineer taking over must report the matter to the Locomotive Operations Manager / Yard Team Leader.

Crew changes must be carried out promptly. Train Crew must co-operate with Train Control to take advantage of the most suitable place for personal needs breaks and provide any help they can get at stations to speed up departure.

5.9 Second Persons

When travelling, Operators will be aware of where signals are located, and strict attention to the indications of the signals displayed is important for safe operations.

When a Second Person assists in watching for signals, the signal indications must be called and repeated between both people. The Operator must ensure the second person is not attending to other work as the train is approaching signals.

5.10 Length of Trains

Locomotive Engineers must know the length of the train in metres to tell when the last vehicle of the train has cleared a restriction.

As the locomotive passes the T board on a restriction, press and release the button on the distance counter of the head-end monitor. The odometer will start calculating the number of metres travelled.

When the figure on the odometer reading matches the length of the train, the last vehicle is passing the T board.

6. Train Unable to Run at Timetable Speeds

If an Operator is unable to maintain timetable speed for any reason, they must inform the Train Controller of the problem as soon as possible. The Operator must clearly state the reasons and the procedure to be adopted under the circumstances.

7. Illness En route

If the Operator feels ill (i.e., stress or sickness), the Train Controller must be contacted to make alternative arrangements.

If the Operator is fatigued, they should not continue but should tell the Train Controller so alternative arrangements can be made if necessary.

8. Using the Air Horn

The locomotive air horn must not be used excessively. However, when it is used, the air horn's sound should be distinct and of duration proportionate to the distance at which the warning is required to be heard and the circumstances under which it is required to be used. Record any defects to the air horn in the Loco 54D repair book.

All Locomotive Running Personnel should be conversant with the rules concerning locomotive horn signals.

All cases where drivers of motor vehicles ignore the air horn signals at level crossings must be reported immediately. The reports in each case include as much detail as possible regarding the vehicle concerned.

A motive power unit or MTMV must not enter service with a defective air horn.

9. Farm Livestock on Track

Operators must avoid killing or injuring farm livestock straying on the line, even to the extent of stopping the train if this will ensure that the stock can be removed without injury.

If significant numbers of farm livestock are killed or injured by a locomotive, the Operator must report to their manager, noting the condition of fences and gates in the location.

Operators must tell the Train Controller when farm livestock are found on or near the line.

10. Fires

10.1 Trackside Fires

If an Operator encounters a fire at the side of the line or on adjacent property, the Train Controller must be informed. If a track gang is encountered, the train must be stopped, and the Ganger advised of the fire if the Operator has been unable to contact the Train Controller.

When fires endanger bridges, buildings, or other property and arrangements cannot be made for other members to reach the location within a reasonable time, the Train Crew must take the necessary steps to suppress the fire.

DANGER
Beware of high voltage overhead wires.

10.2 Rail Vehicles on Fire

When a rail vehicle on a train is on fire, the Operator must use judgement as to the best course to adopt in the circumstances, taking into consideration the proximity of firefighting appliances, the load in the vehicle, and the possibility of damage to bridges, adjacent rail vehicles, or property.

10.3 Extinguishing a Dynamic Brake Fire

The following procedure is to be used in the event of a dynamic grid fire on a DC, DFT and DX Class locomotive:

1. Suspend the use of dynamic brake immediately after a brake grid fire is discovered and use serial braking for the remainder of the grade

IMPORTANT
The serial braking rules for the locality must still be observed.

2. Coast or drive the locomotive to an accessible location that has pressurized water available and is clear of tunnels, bridges and preferably overhead catenary wires
3. Stop the locomotive and apply the locomotive and train brakes
4. Shut down the diesel engine
5. Open the battery knife switch
6. Apply sufficient handbrakes on the train for the locality
7. Spray water into the dynamic brake grids until the grid insulation has cooled to the point where it will not spontaneously reignite

DANGER
Overhead Traction Wires: If stopped under or near overhead traction wires, before water is used, overhead power must be isolated, earthed, and a permit to work issued.

8. The locomotive can now be restarted and operated normally for powering operation, but no attempt should be made to use the dynamic brake. The fault must be written up in the 54D repair book for attention

> **CAUTION**
> **DX class locomotives**: number 5 traction motor will have failed, so locomotives must not be restarted and must be towed to the destination.

10.4 Fire Precautions

The best protection against fire is cleanliness. This applies particularly to the engine and engine room, the underframe mounted equipment, and bogies.

Diesel fuel alone is not readily flammable. A lit match will not ignite fuel oil in a clean container, but it will readily ignite diesel fuel spilt on paper or any other substance which can act as a wick.

To minimise the risk of fire, never leave waste rags or paper in the engine room or use naked lights for inspection around the power unit. Report any arcing in electrical equipment and pay prompt attention to any overheating.

Cotton waste is prohibited on any MPU as it is a fire hazard. Cotton waste may also damage diesel engines, gearboxes, air compressors and electrical equipment.

10.5 Automatic Engine Shutdown

The fire safety systems in KiwiRail main line diesel locomotives are being modified to provide the Locomotive Engineer with manual control of engine shutdown returning to the control scenario before fire detection, shutdown and in most cases suppression systems were fitted.

Manual control allows the driver to keep a train moving until it reaches a place safe to evacuate passengers (known as “Running Capability”) as required by Duty Cards for a train fire in a tunnel.

In the event of an engine bay fire, the fire alarm will sound, then the following will occur:

- The diesel engine will remain running on the burning locomotive.
- The burning locomotive will remain on line.
- The alarm bell will ring on all locomotives on the consist.
- The remote fire warning lamp will illuminate on the non-burning locomotives in the consist.
- 30 seconds after the fire alarm begins to sound, the fire suppressant will be discharged into the engine bay.

> **IMPORTANT**
> To shut down the diesel engine, use the Engine Stop button.

Fire Alarm Actions

1. Press the emergency selcall button.
2. If possible, keep the train moving until you have reached a place where it is safe to evacuate passengers.

3. Once in a safe stopping location, stop the train.
4. In the burning unit, switch the isolation switch to the Stop/Start position.
5. Press the Engine Stop Button. This will stop the diesel engine and stop the fuel transfer pump.
   - DXR - Do not use the Stop position on the throttle to stop the diesel engine as the fuel transfer pump will remain running.
   - DFB - Once the diesel engine has stopped, open the circuit breaker panel and switch off the Soak Back Pump circuit breaker (shrouded breaker in the centre of the top row).

11. Dead Locomotives

Where practicable dead locomotives should be coupled behind the train locomotive(s).

If locomotives are three pipe locomotives, the three pipes must be coupled, and the brakes of the dead locomotive set up as for trailing. This will prevent flats after air brake applications. However, where instructions prohibit locomotives from being coupled together, they must be coupled as close together as the instructions permit.

11.1 Extra Locomotives on Passenger Services

When extra locomotives of any class are conveyed on passenger services, the trailing unit is to be conveyed as a dead engine unless the tractive effort is required to meet the operating timetable.

If a trailing unit is to be conveyed dead on a passenger service, only one locomotive may be conveyed as a dead engine.

11.2 Locomotive Set Up for Dead Haulage

When the brake pipe only is connected, the dead locomotive is to be coupled to the live locomotive as follows:

1. Ensure locomotive is fit to travel, including checking brake block condition.
2. Set the dead engine device to dead, automatic brake to cut out, and Independent brake to release.
3. Drain the main reservoir until it is less than 350 kPa.
4. Couple with brake pipe only.
5. Open cocks and ensure main reservoir pressure climbs to 450 kPa.
6. Release the park brake.
7. Operate the independent release valve to ensure there is no residual application.

11.2.1 Setting Up Locomotives Fitted With CCBII-P Brakes For Towing Dead 3 Pipes Coupled

If a locomotive fitted with CCBII-P brakes is to be towed dead, then the minimum brake pipe reduction of 50 kPa must be increased to 70 kPa and equalisation occurs before the brakes are released.

Locomotives fitted with CCBII-P brakes must only be set up for towing dead single piped by a Rolling Stock Representative.

Locomotives Fitted With CCBII-P Brakes

- DL9521 – DL9792
- All EF Locomotives

On prepared, or in-service locomotives

1. Pull out jumper cable between locomotives
2. Push engine stop button
3. Set one of the Park Brake switches to release and **wait for 10 seconds**
4. Check the Park Brake indicator on the running board has changed to green
5. Open the Battery Knife switch

6. Set the Park Brake switch back to Apply
7. Centre the reversers and Brake Transfer switches in Cab 1

Preparing locomotives for service

1. Couple locomotive to other units in consist
2. Ensure jumper cable is removed, if fitted
3. Shut down the engine if running
4. In Cab 2, ensure the knife switch is closed and release the Park Brake switch, **wait 10 seconds** and open the knife switch
5. Set the Park Brake switch back to apply
6. Check the Park Brake indicator on the running board has changed to green
7. Set up the brakes as per **ROC Section 4.1, Instruction 13.5 Setting Up Brake Equipment**
8. Centre the reversers and Brake Transfer switches in Cab 1
9. Couple up BP, ER and MR pipes and open the taps
10. Perform an automatic and independent brake test on the lead locomotive. Release the IBV and visually check the park brakes on the trailing DL locomotives have released
11. Book in Loco 54D book “Three Pipe, electric PB release”

ROC Section 4.1, Instruction 16.3 Trailing Locomotives, is modified accordingly.

11.3 Passenger Trains Hauled by EF Locomotives

Passenger trains hauled by EF class locomotives operating with a traction group cut out are not to haul dead locomotives.

11.4 Air Brake / Handbrake and Running of Dead Locomotive

The Locomotive Engineer of the train is responsible for ensuring the correct set-up of the air brake and handbrake and the safe running of the dead locomotive.

> **WARNING**
> Locomotives may have been set up by servicing personnel.

11.5 When Changing Over En Route

The Locomotive Engineer must tell the relieving Locomotive Engineer there is a dead locomotive on the train and advise the condition, class, number, and location in the train.

12. Safety Precautions

12.1 Electrical Equipment

Before any electrical equipment is worked on, the Operator must ensure the following precautions are taken:

- Apart from fuses and light bulbs, only repair personnel or Operators under instruction from servicing or repair personnel may work on locomotive electrical equipment.
- A Locomotive Engineer is responsible for maintaining the locomotive. This may involve checking or replacing fuses or light bulbs.
- The pantograph must be completely lowered and clear of the overhead on electric locomotives.
- The engine must be shut down, and the Battery Knife Switch (BKS) opened before touching high voltage equipment. High voltage equipment is enclosed or covered with suitable covers and marked

with the words 600V Danger. These covers must not be removed with the engine running, and they must be replaced before the engine is started.
- When it is necessary to observe the operation of high voltage equipment while it is live, two Competent Workers must be present.
- Do not touch live low voltage equipment. The equipment must be switched off, or the fuse must be removed. If this is not possible, shut the engine down and open the BKS.
- The Operator must ensure that no article holds or touches contacts with live equipment. This includes watches, rings, and metal objects. The Operator must also ensure the safety of all other persons under his control.
- The locomotive must be shut down when centering the reverser, and the BKS opened.

12.2 Locomotive Batteries

Acid and Alkaline

Any work on locomotive batteries must only be authorised by a Rolling Stock Representative.

12.3 Crankcase Covers

These covers are placed on the sides of the diesel engine crankcase to allow a Rolling Stock Representative access to the crankshaft bearings and the engine sump area.

When the engine is running, a vapour is constantly given off from the lubricating oil in the sump. A small amount of gas also escapes past the piston rings into the crankcase. Normally, these crankcase gases are too rich to support combustion, but they become highly flammable and possibly explosive if diluted with air.

If the engine shows signs of a crankcase explosion, such as black oily burn marks or other signs of distress around the crankcase covers, the crankcase covers must not be removed, or the engine restarted. The locomotive should then be prepared for towing.

Mechanical Personnel should only remove the crankcase covers.

12.4 Headlight and Headlight Alert Function

An operating constraint has been identified with the Locomotive Headlight Alert wiring.

Caution

If the Headlight Control is set to “CONTROLLED FROM ANOTHER UNIT COUPLED AT EITHER END”, The headlight and headlight alert will not work on the controlling locomotive.

Cause

The “headlight alert” electrical pick-up is wired to the live side of the isolation switch.

Headlight control setting

Safety Action Required

Locomotive Engineers must:

- Not rely on the “Headlight Alert” to warn against the headlight not operating.
- When boarding locomotives or changing cabs, complete a secondary safety check to ensure that the “Headlight Control” is correctly set for the controlling locomotive.

13.Operating Efficiency Test

13.1 Vigilance Device

This device is fitted to locomotives for the protection of the crews. Any unauthorised interference of any sort whatsoever will be treated as serious misconduct.

> **WARNING**
> Placing the reverser handle into the neutral position will cut out the vigilance device protection.

Only locomotives tagged to run as a trail unit (a note will be placed in the cab advising of inoperative vigilance) is to be taken into service with inoperative vigilance equipment. When taking over a locomotive, Locomotive Engineers must check that the isolating cock glass is intact. If they do not do so, they may be held responsible for breaking this seal.

13.1.1 Random Non-Predictive Vigilance Device

Locomotives are programmed to operate on a non-predictive vigilance cycle:

- Vigilance will cycle randomly between 30 and 50 seconds.
- A penalty brake will apply if the vigilance goes to whistle five times within seven cycles.

13.1.2 Train Crew Responsibilities

Locomotive Train Crew are responsible for reporting any in-service failures and logging any faults in the Loco 54D repair book. The correct functionality is described in the following sections.

13.1.3 Vigilance Cycle

At the start of a journey and periodically en route, Locomotive Engineers must allow the vigilance cycle to run through to whistle.

The time cycle is as follows:

1. Start timing from any of the locomotive cancelling switches.
2. between 30 and 50 seconds to the illumination of the warning lights.
3. A further 10 seconds plus or minus two seconds to the sounding of the warning whistle.
4. From the sounding of the warning whistle until the penalty brake operates, a further 10 seconds plus or minus two seconds is allowed.
5. Reject only if the total time exceeds 77 seconds, or any of the stages are defective.

IMPORTANT

The penalty brake must be allowed to operate during this procedure, allowing 47 seconds before resetting.

With a serviced locomotive and at change-over on the road, only the warning whistle is tested by allowing it to sound and then cancelling by the operation of any cancelling switch.

All staff that carry out radio and vigilance tests are to be aware that when the vigilance system runs to penalty brake:

- The brake pipe pressure must fall rapidly to zero.
- Throttle power must be cut so that notch 1 cannot be obtained.
- The radio must send out a vigilance selcall to Train Control.

If any part of the vigilance penalty brake fails to operate, the locomotive must be restricted to trail only operation until repairs have been carried out and verified with a successful vigilance cycle test.

13.1.4 Vigilance Failure

If the equipment fails in such a manner that requires isolation, the Train Controller must be advised as soon as possible. Arrangements will then be made to replace the locomotive at the first opportunity.

When ATC is in operation, and the locomotive cannot be replaced at the next crossing station the Train Controller will arrange for a second crew member until the locomotive reaches a place where it can be replaced.

While any one of the cancellation methods remains operative, the locomotive may complete its scheduled run.

13.1.5 Defects

Details of any defect must be recorded in the Loco 54D repair book.

In the case of equipment failure, which requires isolation, a report must be sent to the Linehaul Operations Manager / Yard Team Leader after completion of the shift.

The report must state the defect and whether a penalty brake application resulted, whether lights and whistle indications were given, or merely whistle without lights.

Actions before the failure must be reported, whether in power or dynamic brake and if the controls or sander were being operated frequently.

13.1.6 Reset of Penalty Brake Application

Place the brake valve handle in the handle off position when the train stops to prevent loss of locomotive air via the train pipe penalty dump valve.

The Locomotive Engineer must tell the Train Controller the reason for the penalty brake application and request permission to proceed.

After 50 seconds, firmly depress the penalty brake reset push button for one second.

Place the brake valve handle in release position to allow the brake pipe to recharge. If the penalty brake fails to reset, the brake pipe will not recharge, and the reset sequence must be repeated.

When the brake pipe pressure is correct, make a 100 kPa brake pipe reduction. When equalisation has taken place, release the brake.

13.2 Tranzlog Event Recorder / Vigilance System

Locomotives fitted with the Tranzlog event recorder vigilance system hold approximately one month’s compressed data and can be downloaded by a laptop with appropriate software installed. Rail vehicles with Tranzlog have a blue headlight warning light and a red signal alert push button on the control stand.

The Tranzlog vigilance system is programmed to operate the same way as the electronic vigilance systems. The only difference is that the cycles and style of operation are fully programmable.

The vigilance lights flash when the vigilance is suppressed or set up for trail, but on locomotives, the trail set up is also triggered by having the 26C brake valve in the handle off position.

On locomotives, the event recorder function can be checked by holding the vigilance reset push button depressed when standing stationary in neutral. If the event recorder is correctly working, the headlight alert will remain off, and the audible alarm will sound after six seconds. If there is a fault, the headlight warning light will illuminate immediately, and the audible alarm will sound after six seconds.

The Tranzlog system has two additional illuminated push buttons (red and blue) fitted in the cab. On locomotives, they are fitted in the Tranzcom console on top of the brake stand (The Tranzcom console contains the Argo radio control head, head-end monitor, and entertainment radio).

13.2.1 Signal Alert Function

The Tranzlog system has two additional illuminated push buttons (red and blue) fitted in the cab. On locomotives, they are fitted in the Tranzcom console on top of the brake stand (the Tranzcom console contains the Argo radio control head, head-end monitor and entertainment radio).

The signal alert is activated by pushing the red Signal Alert button when you approach or are at a caution signal in an Automatic Signalling area.

The system will flash a light and continually beep as an audible reminder to you that you are approaching a signal at stop.

Operation of the Signal Alert function:

- Push the red Signal Alert button when you approach or are at a signal at Caution
- The Signal Alert light will illuminate and flash every two seconds

- An audible alarm sounds, which pulses twice for every 50 metres the locomotive moves
- If movement stops, the audible alarm will stop pulsing but the Signal Alert light will continue flashing
- When movement restarts the audible alarm will resume pulsing for every 50 metres of movement
- The Signal Alert is cancelled when the Locomotive Engineer presses the red Signal Alert button again
- The Signal Alert light will cease flashing when the Signal Alert function has been cancelled

The alert should only be cancelled:

- after the movement has been brought to a stop, or
- if the signal has cleared to proceed, or
- if Stabilised Approach has been initiated and it is safe to do so

13.2.2 Headlight Alert Function

The blue combination light / push button is part of a headlight monitoring system called Headlight Alert.

If the loco reverser is in forward or reverse, the controller is placed in notch 1, and the headlights are off, the audible warning will slow pulse for five seconds, and the blue light will also pulse with the audible warning.

Switching on the headlights in the direction of travel or pushing the blue push button will cancel the Headlight Alert warning.

If the headlights remain off, the warning will be repeated after five minutes.

13.3 Tranzlog Lite

The depot refit Tranzlogs are known as Tranzlog Lite. The GPS and Cellular antenna can identify them on the short hood. They do not have the Headlight Alert and Signal Alert push buttons / lights as fitted to the full Tranzlog installs.

Features

The original vigilance whistle is used for the vigilance, road overspeed, and headlight alert warnings:

- The whistle has a normal solid tone for vigilance and overspeed warning.
- The whistle pulses for the headlight alert warning.

All Tranzlog Lite units monitor headlight function in the same way as for full Tranzlog installs:

- If the headlight is not switched on for the selected direction of travel and the speed is over 40 km/h, the vigilance whistle will sound with a pulsing tone.
- The audible headlight alarm can be cancelled by switching on the headlight / ditchlight in the direction of travel.
  - The audible alarm can be suppressed for five minutes by pressing the driver vigilance cancel push button.
  - If a vigilance audible alarm is activated simultaneously with a headlight alarm, the vigilance alarm takes precedence. It must be cancelled before the driver vigilance cancel push button can be used to suppress the headlight alarm.

The old recorder fault light will no longer operate on Tranzlog Lite upgrades installed in locomotives previously fitted with Locolog event recorders.

- These units have software installed that flashes the vigilance light once for one second when the direction is selected to indicate that the vigilance is active and the Tranzlog is logging.
- The vigilance light will flash three times when the reverse handle is set to neutral to indicate that the vigilance is suppressed.

Tranzlog Lite units hold approximately 30 days of data logged at one-second intervals, so they do not need to be disconnected following an incident to retain vital data.

13.4 Loco Log Event Recorders

Locomotives which run on the main line must have an installed event recorder of an approved type. An event recorder is not currently required in several classes of private steam locomotives (because of their limited operating speed) or KiwiRail locomotives working local shunting services.

Normal Operation

- Stationary: one flash per 20 seconds.
- Above 5 km/h: one flash per six seconds.

Faulty Operation

- One flash per two seconds, or continuously on or off.

13.4.1 Testing

The event recorder must be tested before the locomotive enters service.

If the event recorder fails the test, the locomotive must not enter service unless the Rolling Stock Service Manager approves putting a notice in the cab stating the locomotive can run without an event recorder.

If the event recorder fails while the locomotive is in service, the conditions of the failure must be recorded in the Loco 54 repair book, and the Train Controller must be advised of the failure as soon as possible.

Following a successful test before entering service, the test light may be extinguished using the provided switch.

13.4.2 Private Operators Locomotives

Tranzlog Data Loggers for Event Recorders

The Licence Operator's Engineering Representative is responsible for ensuring the data logger is functioning correctly.

13.4.3 Disconnecting Loco Log Event Recorder

In the event of a main line derailment, main line collision or similar incident, the information within the short-term log must be retained by disconnecting the event recorder (Loco log) before the locomotive is moved.

The event recorder is to be disconnected by a member authorised by the Linehaul Operations or Regional Manager.

Once the event recorder has been disconnected, the locomotive may be driven to complete its journey and to a locomotive depot equipped with an event recorder extractor. These are available at Westfield, Te Rapa, Palmerston North, Wellington, Christchurch and Dunedin.

The Competent Worker who disconnects the event recorder must:

- Place a sign in the locomotive cab indicating that the event recorder has been disconnected.
- Tell Train Control and the Loco Control of the circumstances.

13.5 Setting Up Brake Equipment

No.4 Brake	Light, Lead or Single Loco	Assisting Loco	Dead Loco
Auto Brake Handle	Running	Release	Release
Isolating Cock	Open	Closed	Closed
Straight Air Brake	Release	Release	Release

26L Brake & WABTEC 26LA	Light, Lead or Single Loco	Second Loco 3 Pipe Coupled	Additional Locos Running or Dead 3 pipe coupled	Assisting Loco BP only coupled	Dead Loco BP only Coupled	Dead DFT on rear of Passenger Train
Automatic Brake Valve	Release	Handle Off	Handle Off	Handle Off	Handle Off	Handle Off
Brake Valve **Cut Off Valve**	Cut in	Cut Out	Cut Out	Cut Out	Cut Out	Cut Out
Independent Brake Valve	Applied	Release	Release	Release	Release	Release
MU2A Valve	Lead or Dead	Trail 6/26	Trail 24 or 4/24	Lead or Dead	Lead or Dead	Lead or Dead
Dead Engine **Device**	Closed	Closed	Closed	Closed	Open	Closed
No.2 MR	N/A	N/A	N/A	N/A	Reduce to 350 kPa or less	N/A

CCBII and CCBII-P	Loco Cab	Lead Single Loco	Trail Loco Three Pipe Coupled	Assisting Loco BP only Coupled	Dead Loco Three pipe coupled	Dead Loco BP only coupled
Automatic Brake Handle	Lead Cab	Release	Handle OFF	Release	Handle OFF	Handle OFF
	Trail Cab	Handle OFF	Handle OFF	Handle OFF	Handle OFF	Handle OFF
Independent Brake Handle	Lead Cab	Applied	Release	Full Service	Release	Release
	Trail Cab	Release	Release	Release	Release	Release
Brake Mode Selector Switch	Lead Cab	FRT / PASS	TRL	OUT	N/A	N/A
	Trail Cab	TRL	TRL	TRL	N/A	N/A
Dead Engine Device	N/A	Closed	Closed	Closed	Closed	Open
No.2 MR	N/A	N/A	N/A	N/A	N/A	Reduce to 200kPa
13 Pressure Test Point	N/A	N/A	N/A	N/A	N/A	Reduce to 0kPA
BC Headstock Cock	N/A	N/A	N/A	N/A	N/A	Open

NOTE
Locos set up in Trail 24 will not bleed off the brakes when the lead loco brakes are bled off.

For Setting Up Brake Equipment for all Arthur's Pass – Otira services, refer **Local Network Instruction L6.1 Otira Tunnel.**

13.5.1 Setting Up DL or EF fitted with CCBIIP brakes when required to assist disabled train in the rear

Following an incident when setting up a locomotive fitted with CCBIIP brakes to assist a stalled train on the Paerata bank from the rear, whenever the assist locomotive was set up for direction the penalty brake tripped.

This problem occurred because Tranzlog saw the brake set up as an incorrect electronic brake valve initialisation. The EBV was set up to Out and Handle Off.

For a CCBIIP brake DL or EF locomotives to assist a stalled train from the rear, the following procedure should be used:

1. Couple the assist locomotive onto the rear of the stalled train.
2. Apply the independent brake to full service.
3. Leave the automatic brake in release and set the selector switch to Out.
4. The brake pipe can now be coupled through.
5. Once movement begins release the independent brake.
6. The independent brake bail off will need to be used to release the assist locomotive brakes whenever a BP reduction is made from the lead train locomotive.

13.5.2 Incorrect Brake Set Up Protection

As part of the next Tranzlog software upgrade, Incorrect Brake Set Up Protection is being added to the older main line loco classes. This protection is already set up on DL class locos and on selected older locos that are being used to test the new software.

The test locomotives have a note on the cab rear wall describing the software changes.

Description of the changes

There are 2 parts to the incorrect brake set up protection for the older main line locomotives:

1. Incorrect Trail loco brake set up: This is where the automatic brake valve has been left in the release position when the loco is trail, so there is a chance that the ABV will try to pump off any brake application made from the lead loco. This has happened a number of times in recent years and means that the train brake won't apply beyond minimum reduction unless the LE uses the emergency brake position.

The indications that Tranzlog takes as incorrect trail loco brake set up are:

- ER pressure is greater than 350 kPa (The ABV is not in handle off).
- There is no vigilance lead signal from the loco reverse handle (Reverse handle out).
- There is a forward or reverse trainline signal coming through from another loco

When these conditions exist for 2 seconds a penalty brake application is made without a selcall being sent.

This protection is active now on the test locomotives.

2. Incorrect MU2A valve set up: This is where the loco is operated with the MU2A valve in one of the Trail positions. The loco brake won't work and only emergency brake is available on the ABV. This usually results in a collision as not all people use emergency brake to stop.

When the software is rolled out 2 pressure switches will be fitted to detect MU2A valve position.

If the input from either pressure switch to the Tranzlog is high and the reverse handle is moved to direction to set up vigilance lead, the penalty brake will apply after 2 seconds to prevent movement. No selcall is sent for this protection.

This protection won't be active until the pressure switches are fitted as part of the software rollout.

How to avoid a penalty brake application during change from lead to trail

When changing from locos from Lead to Trail:

1. Cut in the brakes on the new lead loco
2. Cut out the brakes on the new trail loco
3. Do not select direction on the new lead loco until the ER pressure in the new trail loco is less than 350 kPa.

Otira Banker Process

1. Bankers couple to the train locos, then ease out to check the drawbar connection
2. Banker throttle to idle, then couple the hoses and open the taps. Do not insert the jumper cable. Bankers can be put into notch 1 if required to hold the train
3. Cut out the brakes on the lead train loco
4. Carry out the intermediate brake check on the consist
5. On completion of the brake check, Insert the jumper cable between the downhill banker and lead train loco
6. Carry out the power check on the locos

13.5.3 Incorrect Brake Setup Protection Suppression for Trail Locomotives

The Tranzlog vigilance system in all main line locomotive classes is now programmed to detect incorrect trail loco brake set up. This change has been made so that it is not possible to move a train while the trail locomotive automatic brake valve is still set up for lead operation.

The Incorrect Brake Setup Protection will activate on a trail locomotive if:

- equalising reservoir pressure is greater than 350 kPa, and
- the vigilance is set up for trail operation (reverse handle removed), and
- a forward or reverse signal comes through the trainline jumper from the lead locomotive.

When these three conditions are met, the penalty brake will apply after a 2 second delay, to prevent movement.

To Suppress the Incorrect Brake Setup Protection:

1. Move the ABV / EBV to Handle Off.
2. Allow the equalising reservoir pressure to blow down to zero.
3. Set the ABV / EBV selector to Cut Out.

The remainder of the trail brake setup procedure can now be done as normal.

Penalty Brake Reset Procedure For Incorrect Brake Setup Protection:

On Locomotives fitted with CCBII-P Electronic brakes ensure the brake system is switched on before carrying out this procedure.

1. Set the ABV / EBV handle to Handle Off position.
2. On CCBII-P brake systems, switch the EBV to FRT.
3. Allow the equalising reservoir pressure to blow down to zero.
4. Set the ABV / EBV selector to Cut Out.
5. Press the penalty brake reset push button to reset the penalty brake application.

13.5.4 Traction Override Relay Setup on Capital Connection and Te Huia

Currently on the Te Huia and Capital Connection trainsets the Traction Override Relay will not lock out if either:

- **Capital Connection:** The doors have been released for opening before the train locomotive is coupled up.
- **Te Huia:** The doors have been released from the driving cab about to be vacated, but before the new driving cab is activated.

To Set Up The Traction Override Relay For Passenger Operation:

- **Capital Connection:** Once the locomotive is coupled to the train consist and the 24 volt jumper has been connected between them, switch the Selector switch from FRT to PASS and then press the door release push button.
- **Te Huia:** When entering the new driving cab, switch the selector switch from FRT to PASS and then press the door release button.

This will ensure the Traction Override relay stays locked out until the right of way gong is activated.

13.5.5 Changing Brake Setup

Locomotive Engineers must be careful when changing the brake setup of a consist. If all brake valves on a consist are cut out, the brakes may release if there is excessive leakage from the brake cylinder equalizing pipe over time. The park brake or hand brake must be applied before changing the locomotive brake setup.

It is also recommended that Locomotive Engineers do not delay cutting in a brake valve when changing ends.

The appropriate table above should be used to determine the brake setup on each locomotive in the consist.

13.5.6 When Two or More Locomotives are Coupled in Multiple, either Running or Dead

Before taking locomotives into service (which must be completed by servicing staff at locations where provided), it is important to check the operation and functionality of the automatic (ABV) and independent (IBV) brake valves.

The testing of the brakes requires two people:

- A Competent Worker to operate the locomotive controls, and
- A Competent Worker to visually ensure the brakes apply / release on all locomotives in the consist.

The brake may only be tested with brake equipment correctly set up:

- The main reservoir (MR) pressure shows between 875 to 975 kPa.
- Brake pipe (BP) charged to 550 kPa.
- Equalising reservoir (ER) charged to 550 kPa.
- Locomotive secured against accidental movement. Any applied park or hand brakes pistons should be ignored when observing correct brake movement.

Testing Process		
	Person on Ground	**Locomotive Operator**
1	• Request for the brakes to be released • Check that the brake cylinder pistons release on all locomotives	• Release the Independent brake • Check that brake cylinder pressure drops to zero
2	• Request for the brakes to be applied. • Check brakes apply on all locomotives	• Apply ABV, making a 75 kPa brake pipe reduction • Check that ER and BP gauges drop to 475 kPa • Cut out the ABV and perform a BP leakage test (not to exceed 20 kPa per minute)

Testing Process		
3	• Request for the brakes to be released • Check that the brake cylinder pistons release on all locomotives	• Cut the ABV back in and move to the release position
4	• Request for the brakes to be applied • Check brakes reapply on all locomotives	• Apply IBV • Check that brake cylinder pressure has increased to 400 kPa

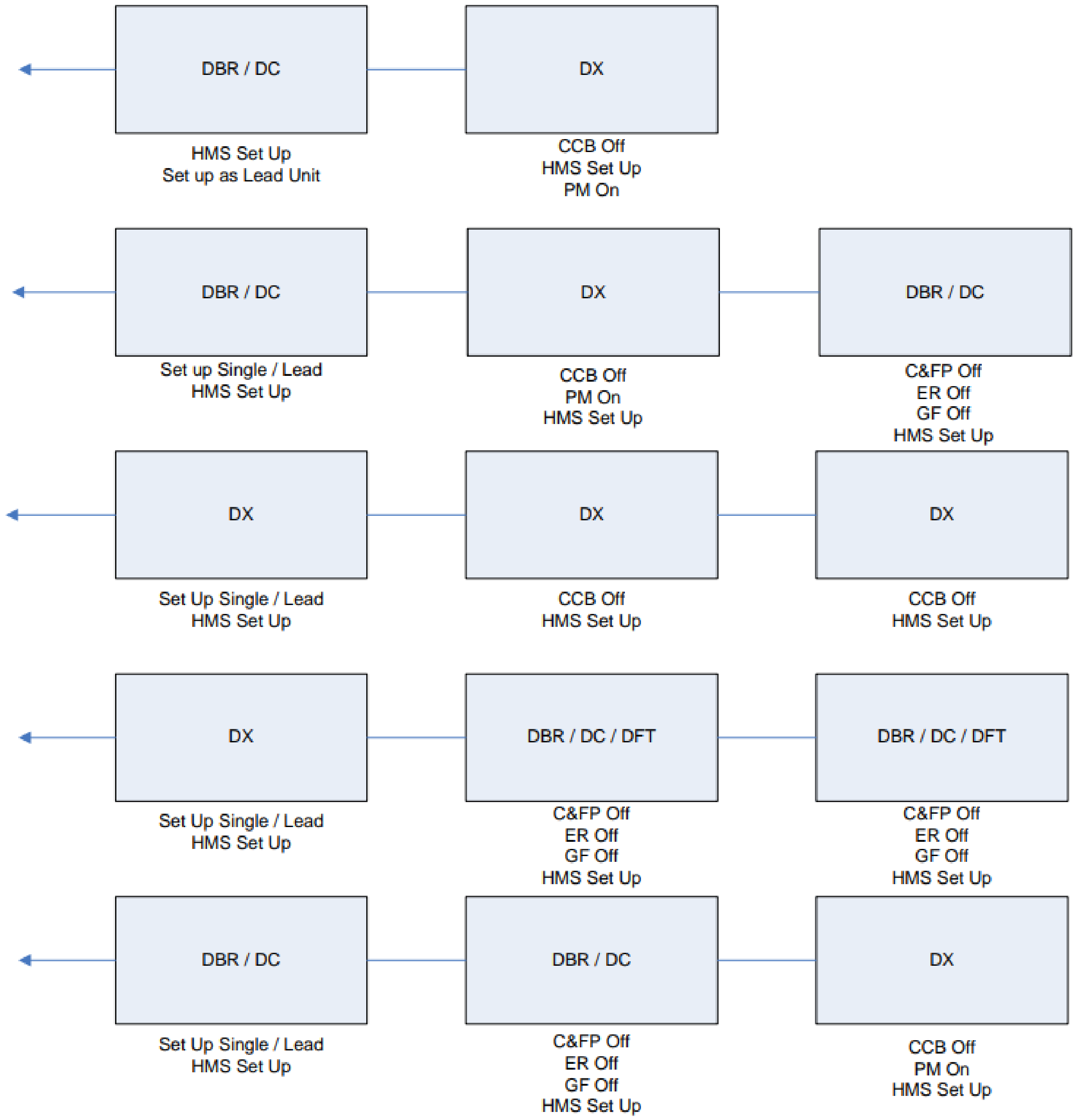
13.5.6 Radio Test Card / Brake Set Up

The brake set-up portion of the Loco387 Radio Test card must be signed in all locomotive cabs assigned to a service, whether by Servicing, Depot Driver, or Locomotive Engineer. These tests / checks must be completed before entering service or when the locomotive consist changes, including en route.

With the introduction of this new process, when locomotive(s) are presented from servicing, the Depot Driver and/or Locomotive Engineer are now required to check the brake set-up and countersign the card; the following instructions are modified accordingly:

- **ROC Section 4.1, 1.1 Examination of Locomotives and Security of Equipment**
- **ROC Section 4.1, 14.3 Prepared Locomotives**

13.6 Setting Up for Multiple



Starting in Multiple:

1. Start each locomotive separately - switches off as per diagram
2. Leave isolation switch in Start / Idle (DC) EC in Idle (DX)
3. Insert jumper
4. Trail locomotive's isolating switch in Run (DC) EC in Run (DX)
5. Jumper Lead test

CCB - Control Circuit Breaker

C&FP - Control and Fuel Pump switch

ER - Engine Run switch

GF - Generator Field switch

PM - Power Match switch

HMS - Headlight Remote switch

13.6.1 Multiple Unit Jumper Test on the Lead Locomotive

1. Turn the isolation switch to Start.
2. Advance the throttle lever to notch 4 or 5 and check that the trailing unit responds to the throttle advance.
3. Place the throttle lever to Idle.
4. Release all the brakes and place the reverser level in the direction of travel.
5. Advance the throttle lever until the trail unit pushes the lead unit.
6. Place the throttle lever to Idle and turn the isolation switch to Run.
7. Advance the throttle lever and check that the lead unit operates by the ammeter.

This test can also be carried out on the road if it is suspected that the trailing unit is not operating correctly.

13.6.2 Jumper Cables

Jumper cables between locomotives must be stowed in the approved position when not in use for multiple locomotive control. Refer to the individual locomotive code supplements for jumper cable stowing locations.

The jumper cable must not be left in the socket and looped over / through the handrail on the end of a locomotive.

13.7 Defective Speedometer on an MPU

13.7.1 Locomotive

When a fault occurs to the speedometer in any locomotive (including private locomotives) which runs on the main line, the following instructions will apply:

- If the speedometer is defective, a locomotive must not leave a depot as the lead locomotive on a train.

When the locomotive speedometer develops a fault en route, the train should proceed at a reduced speed (speed table provided in **Emergency Procedures Manual 8.6.2 Speedometer Failure**) until the locomotive can be replaced. Train Control must be advised as soon as possible.

The tolerance for the speedometer gauge readings before the defective is plus or minus 5 km/h.

13.7.2 Multiple Unit

If the speedometer on a multiple unit becomes defective, the following instructions will apply:

- When the speedometer is known to be faulty before moving from the terminal, that set must be replaced / reduced or placed in the train consist where it will not be used as the leading cab until the speedometer is repaired. Once the set has moved off, the instruction for a fault applies.
- If the speedometer develops a fault en route, then the multiple unit must proceed at a reduced speed (speed table provided in **Emergency Procedures Manual 8.6.2 Speedometer Failure**) to its destination. Reference must also be made to the timetable times of trains between stations. The Train Controller, Metro Service Operator's Service Manager and the Train Manager must be advised. The return run is made as if in a cab with an operative speedometer. However, arrangements must be made before arrival to enable repairs or the service to be replaced or re-marshalled.

14. Alternative Train Crewing

14.1 Duties of Locomotive Engineers

14.1.1 Documentation

The Yard Operating Personnel gives the Locomotive Engineer:

- A train work order
- Other documentation relating to the train includes the relevant dangerous goods documents when dangerous goods are being conveyed
- Correspondence to be conveyed

Where required, the documentation relating to train load details is completed and/or altered by the Locomotive Engineer.

14.2 Security of Locomotive and Equipment

The Operator is responsible for the security of all the motive power units and portable control equipment attached to their train.

Door and window locking is provided on all motive power units. The security of door keys is extremely important. Operators are responsible for all keys issued to them.

14.3 Prepared Locomotives

The Locomotive Engineer who books onto a prepared locomotive must accept that all necessary checks have been carried out, except for the requirement to check the brake set-up and countersign the brake set-up portion of the radio test card.

14.4 Assistance to Locomotive Engineers

The Locomotive Engineer will be given assistance in the following circumstances on ATC trains.

14.4.1 Shunting at Stations

ATC trains will not shunt at stations where personnel are not in attendance.

When a wagon must be reduced from a train (i.e., to remove a defective vehicle or adjust a load) at an unattended station, the Locomotive Engineer must ask the Train Controller for assistance.

14.4.2 Train Stalled

The Locomotive Engineer must give the details and location of the stalled train to Train Control and agree on one of the available options:

- An assisting locomotive
- Return to the station in the rear
- Double bank to station in advance

14.4.3 Assisting Locomotive

The Locomotive Engineer takes the locomotive only to the station in advance, attaches it to the assisting locomotive and returns to the train.

If detaching the locomotive is not practical, and assistance is required to reach the assisting locomotive, treat the train as disabled.

14.4.4 Return to Station in Rear / Double Bank to Station in Advance

The Train Controller will send a certified person to help the Locomotive Engineer move the train.

14.4.5 Train Disabled

The Locomotive Engineer must give the Train Controller the details and location and follow the agreed procedures. The Train Controller will provide a relief locomotive from the station in the front or rear.

When entering the section where the train is located, the Locomotive Engineer of the relief locomotive will follow the relevant Rules.

14.4.6 Train Parted / Divided

If the train has parted completely and cannot be reconnected by the Locomotive Engineer, the Train Controller will send a certified person to help remove the rear portion from the section.

The Locomotive Engineer must:

1. Check the reason for the parting
2. Ensure that sufficient brakes are applied on the rear portion of the train
3. Ensure the whole train is inspected for load shift, damage or derailment

The Locomotive Engineer must give the Train Controller the details of the problem and the train's location and discuss the available options:

1. Wait at that location for assistance to reconnect the train (the Locomotive Engineer will need assistance if automatic couplers are to be connected disconnected), or
2. Take the front portion forward and wait for assistance.

If the Locomotive Engineer is to move the train, the Train Controller must send a certified person to assist.

If the Locomotive Engineer considers the train can be recoupled without assistance, there are no level crossings between the train portions. The Locomotive Engineer must:

1. Obtain authority from the Train Controller and the Signaller (when there is no Train Controller).
2. Set back the front portion cautiously onto the rear portion.
3. Recouple.

TO09 Setting Back and Propelling 9. Propelling, RP02 Using Track Warrant Control 11. Train Divided or Stalled, and **SO02 Automatic Signalling Rules 5. Setting Back in a Block Section Authority** are modified accordingly.

14.4.7 Locomotive Parting Procedure for Trains with Three or More Locomotives coupled in Multiple

The following procedure applies when there is a parting between locomotives, when there are three or more locos coupled in multiple.

1. Once movement stops, proceed to the last locomotive on the leading portion. Close the EP, MR and BP pipe cocks. This will restore full braking on these locomotives.
2. Proceed to the leading locomotive on the trailing portion. Close the EP and MR cocks on this locomotive. Do not close the BP cock.
3. If this locomotive is a gen 2.3 DL fitted with CCBII-P brakes (DL series 9523 – 9688):
    a. Move the Independent brake handle to full service.
    b. Leave the Automatic brake handle in handle off
    c. Set the EBV selector switch to Lead.
4. Proceed down the train and apply handbrakes in accordance with the park / hand Brake table in **ROC Section 5.1, Instruction 3.2.6.**

> **NOTE**
> All handbrakes must be applied in the Otira – Arthur's Pass section.

5. Bring the parted locomotives onto the locomotives that are attached to the train.
6. In the lead locomotive place the Automatic brake valve in handle off.
7. Once the BP pressure has settled at approx. 50 kPa, open a brake pipe cock on the front of the lead locomotive.
8. Couple the MR, EP and BP pipes between the parted locomotives and open all the cocks.
9. If the lead locomotive on the trailing portion is a Gen 2.3DL fitted with CCBIIP brakes, release the Independent Brake set the EBV selector switch to Trail. This restores control of the brakes on these locomotives to the lead locomotive.
10. Return to the lead locomotive and close the brake pipe cock on the headstock.
11. On the lead locomotive, move the ABV into Release to recharge the train.
12. Once the train is recharged make a full-service Automatic brake application.
13. Release all handbrakes.

14.4.8 Train Parted En Route Instructions

Should a train break into two or more portions:

- Sufficient hand brakes must be applied to secure the disconnected portions
- Ensure the whole train is inspected for loads shift damage or derailment
- When the Locomotive Engineer is fully aware of the circumstances, the coupling cock at the rear end of the first portion will be closed, and the Locomotive Engineer requests to release brakes
- The first and second portions of the train must then be coupled, and the Locomotive Engineer should release the air brakes on the second portion. Care must be taken to ensure that the coupling cock at the rear end of the second portion has been closed before opening the cock at the rear end of the first portion
- When the Locomotive Engineer has released the air brakes on the second portion, the same process must be carried out with any remaining portions

When recoupling the train, an intermediate brake test must be completed, and all hand brakes released after each portion is coupled.

14.4.9 Penalty / Emergency Brake Application

Following a Penalty or Emergency Brake application on a freight train, the Locomotive Engineer must:

1. Ensure that sufficient brakes are applied to hold the train
2. Ensure the whole train is inspected for load shift, damage and derailment
3. Give the Train Controller the location of the train, the reason for the Penalty / Emergency Brake application and follow the agreed procedures

14.4.10 Burst Brake Hose

If the Locomotive Engineer cannot replace a burst hose, the Locomotive Engineer must give the Train Controller the details and the location and follow the agreed procedures.

The Train Controller will send a certified person either to replace the hose or assist with moving the train to a place where the hose can be replaced.

If a hose bursts while the train is on a gradient, ensure sufficient handbrakes have been applied to prevent the train from rolling downhill while the brake hose is being replaced.

After a burst hose has been replaced:

1. Ensure the whole train is inspected for load shift, damage or derailment
2. Return to the locomotive and place the burst hose in the cab
3. Ensure that the train brake system is fully recharged
4. Carry out an intermediate brake test using the TEM
5. Re-apply the train brakes
6. Release the train handbrakes
7. Return to the locomotive
8. Release the air brakes and continue the journey

When it is not possible to replace a burst hose:

1. The coupling cock on the brake pipe must be closed immediately in front of the burst hose
2. Request the Locomotive Engineer to release the brakes
3. Release all the air brakes in the rear of the burst hose by pulling the wires attached to the release valve handles (this will completely discharge the air from the wagon brake system)
4. Tell the Locomotive Engineer the number of air brakes taken out of operation and how many are in working order

The train must proceed cautiously to the nearest place where the burst hose can be replaced.

14.4.11 Replacing a Burst Main Reservoir Hose

If a main reservoir hose bursts between locomotives or multiple units, the Locomotive Engineer must immediately close the coupling cock on each side of the burst hose to prevent further air loss.

When duplicate hoses are provided:

- Couple before the train proceeds.

When a duplicate hose is not provided:

- Replace before the train proceeds.

14.4.12 Unusual Circumstances

Accidents / Derailments / Obstructions

The Locomotive Engineer must tell the Train Controller what has happened, where the train is, and follow the agreed procedures.

> **IMPORTANT**
> If the Train Controller is sending help, there must be a clear understanding between the Locomotive Engineer and the Train Controller about what kind of help is being given and when the person assisting will arrive at the train.

When assistance arrives, the Locomotive Engineer and the person assisting must decide when to communicate with each other and make any other arrangements necessary for normal running to be resumed.

14.5 Movement within Yards and Depots

It should usually be possible for a Locomotive Engineer to step on a fully prepared locomotive. The following general principles apply to movements within yards and depots.

14.5.1 Entry and Exit Roads

Entry and exit roads are designated to keep movements within depots to a minimum. Incoming locomotives have direct entry to a dropping road. Outgoing locomotives are marshalled so that piloting requirements are reduced or eliminated.

Local conditions may make it impossible to set aside entry and exit roads in some areas. In these circumstances, local arrangements will be made.

14.5.2 From the Locomotive Pick Up Point to the Yard

When the depot layout allows a locomotive to run short hood leading from the locomotive depot pick-up point to the depot / yard pilot point, the Locomotive Engineer can work alone. If there are facing points, the Locomotive Engineer is responsible for setting the route from the depot.

When the movement involves running long hood leading, a yard pilot must pilot a locomotive from the locomotive depot pick up point to the yard.

14.5.3 From the Pilot Point in an Interlocked Area to the Train Coupling (and vice versa)

A Yard Pilot will direct the locomotive from the pilot point in an interlocked area to the train coupling on a departure road. The reverse procedure will apply to locomotives from arriving trains. The Yard Pilot will direct the locomotive from the train on an arrival road to the yard pilot point in an interlocked area.

14.6 Preparing and Putting Away Duties

When locomotives are prepared for service, the radio equipment will also be tested. The times and dates of this work must be entered on the radio test card.

15. Driver Advisory System

15.1 Introduction

The Driver Advisory System (DAS) comprises a computer touchscreen mounted in the locomotive cab connected to the locomotive power supply, GPS and cellular antennas.

DAS provides a visual output of topographical and network data and information to the Locomotive Engineer about the suggested speed and operating mode.

> **IMPORTANT**
>
> Only Locomotive Engineers who have received a Staff 23 Certification in DAS operation are to use this system.

The DAS circuit breaker must always be left on to allow the unit to receive the update. Locomotive Engineers who have not been trained in DAS can dim the display unit by pressing the “-” button (the screen will also dim automatically if left logged off).

DAS Computer Touch Screen

15.2 Use of Driver Advisory System

Locomotive Engineers trained and certified in DAS use are required to use the system on all trains where the route has been verified, and the locomotive is equipped with a fully functioning DAS unit.

Periodically the Locomotive Engineer may wish to run a trip without DAS to verify their road knowledge. Locomotive Engineers should request this via their manager in advance where possible, and any request will not be unreasonably denied. Locomotive Engineers may run one trip without DAS every 3 months.

15.2.1 When not to use DAS

- Locomotive Engineers transferring into a new depot must not use DAS until route certification has been completed.
- When the DAS unit is faulty, or the advice being dispensed is unsafe. All occurrences must be recorded in the Loco 54D repair book. DAS Feedback and the Line Manager / Loco Team Leader must also be advised.
- Work Trains that are required to move in both directions for infrastructure work requirements.

15.2.2 Work Trains and Special Trains

- Work Trains. That are operating in one direction only are required to use DAS for the entire journey. If a discharge is required during the journey, the DAS advice can be manually suppressed while discharging. The Route ID can be selected from the list below.
- Special trains. These are trains that are run at short notice or are not scheduled services. The Route ID can be selected from the list below.

For example, a work train operating from Palmerston North to Otaki will use the following Route ID AKLWLG. When returning back to Palmerston North from Otaki the work train will use the following Route ID WLGAKL

15.2.3 DAS Routes

North Island	
Route ID	**Route**
AKLWLG	Otahuhu to Wellington
WLGAKL	Wellington to Otahuhu
PMRNPE	Palmerston North to Napier FC
NPEPMR	Napier FC to Palmerston North
PMRNPL	Palmerston Nth to New Plymouth
NPLPMR	New Plymouth to Palmerston Nth
WLGCCF	Wellington to Castlecliff
CCFWLG	Castlecliff to Wellington
AKLMMU	Otahuhu to Mt Maunganui
MMUAKL	Mt Maunganui to Otahuhu
MMUKAW	Mt Maunganui to Kawerau
KAWMMU	Kawerau to Mt Maunganui
KAWMUR	Kawerau to Murupara
MURKAW	Murupara to Kawerau
MBSRTW	Mission Bush to Rotowaro
RTWMBS	Rotowaro to Mission Bush
AKLMBS	Otahuhu to Mission Bush
MBSAKL	Mission Bush to Otahuhu
MMUKIN	Mt Maunganui to Kinleith
KINMMU	Kinleith to Mt Maunganui

South Island	
Route ID	**Route**
PCNMNR	Picton to Middleton
MNRPCN	Middleton to Picton
LYTOLT	Lyttleton to Rolleston
OLTLYT	Rolleston to Lyttelton
MNRIVC	Middleton to Dunedin
DUDIVC	Dunedin to Invercargill
IVCMNR	Invercargill to Dunedin
DUDMNR	Dunedin to Middleton
MNRGMN	Middleton to Greymouth
GMNMNR	Greymouth to Middleton
MNRNKW	Middleton to Ngakawau
NKWLYT	Ngakawau to Lyttleton
IVCBLU	Invercargill to Bluff
BLUIVC	Bluff to Invercargill

15.3 Prerequisites for DAS Training

Training of Locomotive Engineers in the use of DAS:

- Before receiving training in using the DAS system, Locomotive Engineers must have completed a minimum of 250 hours post-certification.

Transferring Locomotive Engineers using DAS:

- Locomotive Engineers who have transferred between depots cannot use DAS until they have been signed off as competent in road knowledge for the new area.

15.4 Operational DAS Areas

DAS can be operated in any direction on the lines below unless otherwise specified:

North Island	South Island
NAL	MNL
NIMT (Westfield – Wellington only)	MSL
Mission Bush Branch	Midland Line
ECMT	SNL
Kinleith Branch	Ohai Line
Mt Maunganui Branch	Bluff Branch
Murupara Branch	
MNPL	
PNGL (Palmerston North – Wairoa only)	
Wairarapa Line (Wellington – Masterton only)	

15.5 Operating a DAS System

15.5.1 DAS and TC Radio Interference

Issues have been reported where TC radio reception has been affected when DAS operates on DC, DF and DX locomotives. Symptoms reported include base calls not locking on and static, making transmissions difficult to understand.

Should you encounter such issues:

1. Turn off DAS at the circuit breaker and see if the problem is rectified
2. If so, log this in the 54D, including train and locomotive numbers, location, radio channel used and description of the problem (base call not locking on, static)
3. Continue to log the issue, even if this has been logged previously (this will help identify the extent of the issue)

Modifications have been successfully trialled on DC locomotives and are underway for DF locomotives.

15.5.2 DAS Unit Updates

Locomotives are configured to poll the server for new updates (when in cellular coverage) every two hours; however, the DAS update date / time will only update when new data has been downloaded and installed.

Therefore, if there is no new data to download, the update date / time will not change.

TSRs are updated automatically into the DAS server; when this occurs, sighting speed TSRs (TSRs that apply only to a locomotive) will show as normal TSRs (those that apply to the entire train) in DAS.

DAS can still be used provided the TSR information is reasonably accurate; if significant discrepancies exist, DAS should not be used, and the issue logged in the Loco 54D Repair Book.

Updates received by the DAS unit while en route will not be applied to the current journey unless a new target is selected but applied to subsequent journeys.

The red font indicates that the required updates have not been downloaded to the locomotive. This may have been caused by file corruption.

Should Locomotive Engineers encounter this, try one hard restart (at the circuit breaker) and if the problem does not clear, turn DAS off for the trip.

15.5.3 DAS2 System Release

DAS2 has key added features which include:

- Compulsory stop protection (not currently enabled)
- Heat restrictions
- Passenger trains
- Locomotive class-specific speed restrictions

15.6 Setting Target Location

15.6.1 Track Warrant Territory

Special instructions for Locomotive Engineers using DAS in track warrant territory:

When the Start Location is within or at the start of track warrant territory:

1. Enter the train data into DAS off the train work order as normal
2. Initially, set the next location in the drop-down list as the DAS target location
3. Contact Train Control for a track warrant
4. Before the read back, update the DAS target location to match the **to** location on the track warrant (or furthest location on a work between warrant)
5. Complete the DAS set to ….. section at the bottom of the track warrant form
6. Once the track warrant has been read back, add the words DAS Target Location set to [location] to the communication
7. Where DAS is not being used, mark this on the track warrant form and tell Train Control DAS is not in use

NOTE

Train Control will cross-check the DAS and confirm the set location into the TWACS2 computer system in track warrant areas other than the South Island West Coast.

When the start location is outside track warrant territory:

1. Enter the train data into DAS off the train work order as normal
2. Set the location at the beginning of track warrant territory in the drop-down list as the DAS target location
3. At the appropriate location, contact Train Control for a track warrant
4. Before the read back, update the DAS Target Location to match the to location on the track warrant (or furthest location on a work between warrant)
5. Complete the DAS set to ….. section at the bottom of the track warrant form
6. Once the track warrant has been read back, add the words DAS Target Location set to [location] to the communication
7. Where DAS is not being used, mark this on the track warrant form and tell Train Control DAS is not in use

NOTE

Train Control will cross-check the DAS and confirm the set location into the TWACS2 computer system in track warrant areas other than the South Island West Coast.

After receiving a new track warrant en route:

1. Contact Train Control for a new track warrant
2. Before the read back, update the DAS target location to match the 'to' location on the track warrant (or furthest location on a work between warrant)
3. Complete the DAS set to ….. section at the bottom of the track warrant form.
4. Once the track warrant has been read back, add the words DAS Target Location set to [location] to the communication
5. Where DAS is not being used, mark this on the track warrant form and tell the Train Controller DAS is not in use

NOTE
Train Control will cross-check the DAS and confirm the set location into the TWACS2 computer system in track warrant areas other than the South Island West Coast.

Where the limits are also the end of track warrant territory:

- Where the track warrant issued is to the end of track warrant territory, the Locomotive Engineer may set a target location beyond the track warrant limit
- When this occurs, the Locomotive Engineer is to confirm with Train Controller where the DAS target location has been set to
- Where this differs from the limits of the track warrant, the Train Controller will show this as the end of track warrant territory in the TWACS2 computer system

15.6.2 Midland Line ASR Areas

When the start location is within or at the start of Midland Line ASR areas:

1. Enter the train data into DAS off the train work order as normal
2. Initially, set the next location in the drop-down list as the DAS target location
3. Contact the Train Controller for an operating instruction
4. Before the read back, update the DAS target location to match the location of the first crossing (or to location if there are no crossings) on the operating instruction
5. Once the operating instruction has been read back, add the words DAS Target Location set to [location] to the communication

When the start location is outside the Midland Line ASR areas:

1. Enter the train data into DAS off the train work order as normal
2. Set the location at the beginning of the Midland Line ASR area as the DAS target location in the drop-down list
3. At the appropriate location, contact the Train Controller for an operating instruction
4. Before the read back, update the DAS target location to match the location of the first crossing (or to location if there are no crossings) on the operating instruction
5. Once the operating instruction has been read back, add the words DAS target location set to [location] to the communication

15.6.3 After Completing an En Route Crossing

When a crossing takes place at a location short of the 'to' location in the operating instruction:

1. Once the train being crossed has arrived, reset the DAS target location to match the location of the next crossing (or 'to' location if no further crossings) on the operating instruction

2. If there is a requirement to contact the Train Controller at that location, add the words DAS target location set to [location] to the communication
3. If there is no requirement to contact the Train Controller at that location, add the words DAS target location set to [location] to the communication at the next call

New operating instruction required en route:

1. Contact the Train Controller for a new operating instruction
2. Before the read back, update the DAS target location to match the location of the first crossing (or ‘to’ location if there are no crossings) on the operating instruction
3. Once the operating instruction has been read back, add the words DAS target location set to [location] to the communication

15.7 Train Speed

The locomotive speedometer must always be used to determine train speed. The DAS GPS train speed has not been approved as an alternative use for the speedometer.

The current code requirement for speedometer accuracy is +/- 5 km/h, so there will be times when there is a discrepancy between the speedometer and DAS.

Where the locomotive speedometer is not operating, the existing requirements for speedometer failure will apply.

15.7.1 DC Notch 6 Restrictions

When operating DC class locomotives where notch 6 restrictions are in place, select DCN6 (DC, notch 6) on the locomotive configuration screen.

15.7.2 DAS Score

The DAS scores have been disabled on the locomotive end-run display. Journey scores can be obtained from your Team Leader or on request from `<DAS-Feedback@kiwirail.co.nz>`.

15.8 DAS Advice System Suppression

The advice worm will be suppressed on the following services and grades:

Passenger Services:

- All locomotive hauled passenger services

Freight Services:

- Auckland and Wellington Metro areas due to high density of train movements

Specific Grades:

On the grades listed below the Locomotive Engineer can decide on how the grade will be descended based on good train handling techniques considering local network instructions and ROC requirements. It is however expected that the Locomotive Engineer will use either serial braking, dynamic braking or maintain braking on these grades.

Line	Meterage	Between	Direction
NIMT	367 km to 383 km	Oio and Kakahi	Up
NIMT	335 km to 316.5 km	Makatote and Ohakune	Down
Murupara	23 km to 5 km	Matahina and Kawerau	Up
Kinleith	56.5 km to 35.7 km	Tokoroa and Putaruru	Up
Midland	116 km to 102 km	Arthur’s Pass and Cora Lynn	Up
Midland	87.5 km to 80 km	Cass and Craigieburn	Up

Line	Meterage	Between	Direction
Midland	75 km to 69 km	Craigieburn and Staircase	Up
MSL	363 km to 368.5 km	Waitati and Sawyers Bay	Up and Down

16. Fuel Conservation

There is a need to reduce the amount of fuel used by improving driving techniques, reducing the amount of servicing and stationary idling times, and make better use of locomotives by having the correct horsepower operating for the job intended.

The cost of running locomotives when they are not required is an operating cost that the company can no longer sustain. KiwiRail expects that Locomotive Engineers will take every opportunity to reduce operating costs by complying with these instructions.

16.1 Presentation of Locomotives from Servicing

Locomotives must be presented from servicing locations as follows:

- Higher horsepower locomotive must be marshalled on the head.
- Any trailing locomotive(s) must be shut down and set up for trailing three pipe brake operation.

16.2 Servicing and Rolling Stock Depots

Locomotives should only be kept running in depots when required for servicing or mechanical requirements.

Where servicing staff are in attendance, the lead locomotive is to be started within 15 minutes of the locomotive's required time for the outbound train (generally one hour before scheduled departure).

Locomotive(s) off inbound trains are to be shut down by the Locomotive Engineer unless staff are on hand to receive the locomotive(s) immediately.

16.3 Trailing Locomotives

Trailing locomotives must not be started until the trailing weight (including dead locomotive) exceeds 85% of the single locomotive load.

Where there is a grade en route, but additional power is not required ex origin, the trailing locomotive can be started, but either the lead or trail locomotive must be run offline until needed.

Once the trailing locomotive is no longer required, one locomotive must be shut down or either the lead or trail locomotive be taken offline.

NOTE

Where there are concerns around the correct set-up of DL locomotives for dead running, these can be taken and left offline.

Ensure the Train Controller is aware of any planned stops to complete these activities.

16.4 No Turning Facilities

When high-horsepower / low-horsepower locomotive combinations run to a terminal where no turning facilities exist, the smaller locomotive can lead.

If not required for tonnage, consideration needs to be given to having the ability to shut down the low horsepower locomotive in one direction.

Where the low-horsepower locomotives lead and are not required for tonnage, they should be run offline.

16.5 Shutting Down Locomotives En Route

North Island

- Where a rear locomotive is shut down en route the jumper cable MUST be removed and stowed in the correct location.

> **NOTE**
> Iin DL and EF class locomotives, after the knife switch has been pulled, you must manually release each park brake unit

- If a locomotive needs to be restarted later, this must be carried out before the jumper cable is refitted.

South Island

- The jumper cable may be left in place between coupled DX or DF series locos when a trailing loco is either started up, shut down or when being towed dead.
- Before shutting down a trailing DX locomotive:
  1. Place the isolation switch in the start position
  2. Check the DID panel for any Ground relay or sticking P contactor alerts
  3. If no GR or sticking P contactor alerts show on the DID panel, it will not be necessary to centre the reverser contacts
  4. If either a GR or sticking P contactor message shows on the DID panel the reverser contacts must be centred after shutting the loco down
  5. After shutting down the diesel engine, switch off the Control Circuit breaker and open the battery knife switch
- When a trailing DX loco is started with the jumper cable connected through, the Control Circuit breaker must be left OFF, so that power for the control circuits is supplied from the lead loco. In this condition the loco can be safely started with the jumper cable inserted.
- When a trailing DF loco is started with the jumper cable connected through, the control & Fuel pump switch must be left OFF, so that power for the control circuits is supplied from the lead loco. In this condition the loco can be safely started with the jumper cable inserted.
- When a jumper cable is connected to a DC locomotive, and:
  - Where a rear locomotive is shut down en route, the jumper cable MUST be removed and stowed in the correct location.
  - If a locomotive needs to be restarted later, this must be carried out BEFORE the jumper cable is refitted.

16.6 Shunt Locomotives

Shunt locomotives (including remote-controlled shunt locomotives) must be shut down when they are not expected to be used for 15 minutes or more.

16.7 Unusual Circumstances

From time to time, there will be a requirement to run a trailing locomotive where otherwise this would not be needed (i.e., due to weather, poor rail conditions, locomotive issues etc.). The Locomotive Engineers will need to use their discretion in such circumstances giving due consideration to train timekeeping and fuel conservation practices.

Where there is an extended delay en route, consider shutting down the locomotive(s) where it is appropriate to do so.

4.2 Air Brake and Handbrake Operation

1. General

1.1 Automatic Brake Minimum Reduction

For trains operating with direct release brakes, the least initial reduction made should be approximately 70 kPa. This will ensure all control valves are at the minimum reduction position and that all brake pistons actuate with sufficient brake block force to the wheels. The brakes may be released once the HEM shows 500 kPa or lower. It is not necessary to wait for the HEM to stop flashing after the 70 kPa brake pipe reduction.

For trains with no TEM, the brakes may only be released after equalisation has occurred.

1.2 Automatic Brake Maximum Reduction

The brakes are fully applied when pressures in the brake cylinders and auxiliary reservoirs are equal. This is an equalised reduction, and any greater brake pipe pressure reduction will give no increase in brake cylinder pressure.

1.3 Automatic Brake Emergency Reduction

The brake valve handle must be placed in an emergency position for the quickest possible stop and left there until the train stops. This position is only to be used in an actual emergency where it may prevent or minimise an accident. When used on a long train, violent run-ins of slack may occur.

When a rapid stop is necessary with a very long train, a smooth stop and only slightly longer than an emergency one can be achieved by leaving the throttle well open and moving the brake valve to full service while holding the locomotive brake off. Reduce power as the brakes take hold. Sand should be run during the stop (this method of stopping minimise the risk of pinch-off).

This method is unnecessary with short trains as power would lengthen the stop.

1.4 Alterations in Composition of Train

When rail vehicles are attached to or detached from a train at an intermediate station, the Locomotive Engineer must calculate the increase or decrease in the number of rail vehicles and the tonnage on the train. The Locomotive Engineer must not depart from the station until the correct brake test has been carried out.

1.5 Locomotives in Multiple

When locomotives are connected in multiple, the correct air hoses must be coupled, and the brake on the trailing unit(s) set up and tested in accordance with the instructions for that brake.

The trailing units must immediately be set up for the lead when locomotives are disconnected. Multiple means hoses and jumper cables are coupled and controlled from the lead unit.

1.6 Assisting Locomotives

An assisting locomotive cab is anywhere in the train except the lead and is controlled by a crew in its cab. The brake pipe hoses must be coupled between the locomotives. The Locomotive Engineer on the leading locomotive must take full control of the train's braking. The correct pressure must be maintained in the main reservoir. The Locomotive Engineer of the assisting locomotive is not to take any action in the ordinary braking of the train but must always be prepared to apply the brakes in case of emergency. A light application of the Independent brake may assist in holding the train during recharge while descending a long gradient.

When an assisting locomotive is disconnected from or connected to a train, the Locomotive Engineer of the leading locomotive must be satisfied with the correct brake test carried out from the leading locomotive that the brake valve and cocks on the locomotive(s) are in the correct position.

During each portion of the test, the brake valve must be allowed to complete one operation before being moved to start another portion of the test. It must not be moved to release while air is exhausting from the brake pipe.

1.7 Charging Train

The throttle should be advanced to a position that will maintain adequate main reservoir pressure. The train is not fully charged until the flowmeter has been steady for at least one minute.

1.8 Brake Pipe Leakage Test

Refer to **ROC Section 5.3, Instruction 6.5.7 Brake Pipe Leakage Test**.

1.9 Brake Pipe Reduction

A brake pipe reduction of 100 kPa must be made when testing brakes. The brake valve must stop exhausting, and the brake pipe pressure settles before a release is made.

1.10 Clearing Brake Pipe

Before coupling a locomotive to a train, the locomotive coupling hoses to be used must be blown out by opening and closing the coupling cock.

1.11 Brake Pipe Pressure

With the brake valve handle in release, the brake pipe pressure must be maintained at 550 kPa with no apparent fluctuations. Inability to maintain a correct pressure must be entered in the Loco 54D repair book and attended to promptly by a Rolling Stock Representative.

1.12 Dragging Brakes

If the speed of a train is retarded because some of the air brakes are not releasing, the train must be stopped (under fixed signal protection, if possible). Then a full-service brake application must be done, waiting for the HEM to stop flashing before releasing the brakes - this should reset all of the air brakes. Before the train proceeds, the brake pipe must be fully recharged.

Should a second occurrence of speed retardation occur, investigation into the cause of retardation is required.

1.13 Overcharged Auxiliary Reservoir

If the brake pipe has been overcharged, either by using the full release position of the No.4 brake valve (DSC or DSA class), it may not be possible to release the brake.

1.13.1 No.4 Brake Valve

After making a 100 kPa reduction, wait until pressures have settled, then place the brake valve handle in release (or running for No.4 valve). When pressures have again settled, make another 100 kPa reduction and proceed as above. It may be necessary to repeat this sequence four or five times. If the brakes still do not release, it will be necessary to release them by hand using the triple valve release wires.

1.14 Reporting Irregularities

Locomotive Engineers must refer any irregularities or other special or unusual circumstances in connection with the working of the air brakes to the Train Controller or, if appropriate, to the Linehaul Operations Manager / Yard Team Leader on reaching the next terminal.

They must report the matter on their return to the marshalling yard, stating the following:

- nature and location of the failure or incident, and
- number of the locomotive and train, and
- the points it was running between

When possible, they should give the number and position of the vehicle on which the fault developed.

1.15 Cutting Out Brake Apparatus and Reporting Repairs

The air brake must not be cut out unless the brake apparatus is defective. In this case, the circumstances must be noted immediately in the Loco 54D repair book and the locomotive prepared for towing. The Linehaul Operations Manager / Yard Team Leader must be notified immediately. If the locomotive is not in the marshalling yard, then the Train Controller must be notified immediately.

1.16 Holding Stationary Train

Within station limits, if the train is to stand with a locomotive attached for any appreciable time, the air brakes should be applied with a 70 kPa reduction and left applied until it is obvious that the signal to depart is about to be given. The brakes should then be released, allowing the auxiliary reservoirs to recharge before moving the train.

If a person passing between rail vehicles of the train consist closes an isolating cock while the brakes are applied, it will not be possible to release the brakes to the rear of the cock. This simplifies locating the closed cock.

1.17 Assisting Emergency Application

When a Locomotive Engineer observes (by the action of the flowmeter or otherwise) that the air brakes have been applied, the throttle must not be closed immediately.

If the grades are such that the train will stop with the brake valve in running, it is to be left there, and the throttle gradually closed, and the locomotive brake held off until the train stops.

If assistance to stop is needed, the throttle is to be left open or opened if closed, and the brake valve cut out valve turned to out on the 26L brake. On other brakes, the brake valve handle should be placed in lap. The throttle is to be gradually closed as the train stops. The locomotive’s brake should be held off. Power need not be used on very short trains.

1.18 Loss of Main Reservoir Pressure

In the event of undue loss of main reservoir pressure, the train must be stopped immediately, and the working pressure restored, if possible before the journey is resumed. If the failure occurs on a descending gradient, the Locomotive Engineer must apply sufficient handbrakes to hold the train until the main reservoir pressure is restored and recharged.

1.19 Use of Independent Brake

The Independent air brake must be used judiciously. Excessive use of this brake causes unnecessary wear on the locomotive brake blocks and overheating the tyres. As much braking as possible must be done with the Automatic brake.

The Independent brake allows the train to settle in against the locomotive and then slowly build up pressure to that required, although no more than 170 kPa should be used unless necessary.

1.20 Compressors

The compressor is driven by the diesel engine on diesel engines, either directly coupled to the crankshaft and so turning the engine revolutions, or belt driven and turning at a different speed to the engine. Electric locomotives and multiple units have a compressor driven by an electric motor.

1.21 Testing Air Compressor and Governor

The air compressor and compressor governor must be tested to confirm they are functioning correctly. The compressor should work without undue noise, stop or unload under the control of the governor, and must restart or load when the main reservoir pressure has fallen to the correct value.

Main line locomotives load or start when pressure falls to 875 kPa and unload or stop when the pressure has risen to at least 70 kPa, but not more than 100 kPa.

1.22 Intercoolers and Aftercoolers

An intercooler is provided between the low and high-pressure cylinders to cool the air. There is also an aftercooler. This is a length of pipe that may be finned between the compressor and the No.1 Main Reservoir.

This reservoir's surface area plus the pipe length from the compressor is sufficient to cool the high pressure compressed air so that a greater volume of air can be stored (hot air is less dense than cold air). Because atmospheric air normally contains water in vapour form, this is passed through the compressor and stays in vapour form. As the air cools, this water vapour condenses.

Because the condensed water mainly collects in the No.1 Main Reservoir, drain valves are fitted. They must be regularly opened during the operating shift.

Automatic drain valves should be checked by opening the manual drain valves. Any condensed water collected must be drained at least once during an operating shift.

1.23 Reservoirs

From the aftercooler, the air flows to the main reservoir system. This comprises at least two reservoirs on all locomotives, arranged so that air flows first into one and then into the others.

Reservoirs and portions of the piping are provided with drain cocks. Dirt collectors are also fitted to the piping to prevent dirt particles from being carried into the brake equipment.

A large quantity of water at the main drain indicates a defective automatic drain. This defect should be recorded in the Loco 54D repair book.

1.24 Functions of Main Reservoir

Main reservoirs have several functions:

- to store compressed air at high pressure for various locomotive functions, mainly braking
- to cool the compressed air. When the air is compressed, it becomes extremely hot through friction. In becoming hot, the air absorbs large quantities of atmospheric moisture
- to drain off oil and condensate from the stored air. As the air is cooled in the main reservoir, it will give off the water and oil held in suspension. This can then be drained from the reservoir via the drain cocks

1.25 Equalising Reservoir

This small reservoir contains a volume of air which is controlled by the Locomotive Engineer via the brake valve. This air pressure acts as a reference pressure so that the brake valve can automatically and smoothly increase or decrease brake pipe pressure in response to the brake valve handle positions.

2. Locomotives Parting

Should locomotives in multiple part because of broken drawgear, the main reservoir, equalising pipe and brake pipe hoses will be pulled apart. With the main reservoir equalising pipe being coupled to the protection valve of the selector valve, the selector valve will reposition and set up the brake for the lead position, thereby applying the brake on that locomotive and operating the sand.

2.1 Emergency Position Always Operative

Should the Automatic brake valve handle on the Trail 6-26 locomotive be moved to the emergency position, main reservoir air will be supplied to the selector valve, thus repositioning it and applying the brakes on the locomotive the train.

2.2 Dynamic Brake Interlock (DBI)

This device is fitted to all dynamic brake-equipped locomotives.

2.2.1 3 Pipe Locomotives

The DBI will automatically release any Automatic brake application on the locomotive when dynamic braking is selected.

When dynamic braking is dropped out for any reason, the automatic application will reapply, provided no Independent release is made.

If the automatic application is made after dynamic braking was put into operation, the locomotive brakes will not apply. If the Independent brake is applied during dynamic braking, the brakes on the locomotive will apply with the possible loss of adhesion and wheel slide. It should only be applied if required when selecting or suspending the dynamic brake to keep the train bunched.

2.2.2 2 Pipe Locomotives

The DBI will suspend dynamic braking if brake cylinder pressure exceeds 175 kPa.

2.3 Dead Engine Device

Because 26L brake locomotives use main reservoir air to apply their brakes when a locomotive is being hauled dead (with the compressor inoperative), and the brake pipe only coupled, some means must be provided so that the locomotive brakes will work.

Before opening the dead engine device, the No.2 Main Reservoir must be reduced to 350 kPa. Then, when it is opened, the No.2 Main Reservoir should increase to approximately 450 kPa, thus indicating that it is operating correctly. If the No.2 Main Reservoir pressure exceeds 450 kPa, wheel slide problems on the dead locomotive may occur. If the No.2 Main Reservoir is empty, it will take a considerable time to charge (via the dead engine device).

2.4 Brake Pipe Flowmeter

This device consists of two portions, a gauge that gives a visual readout of main reservoir air flowing into the brake pipe and an audible portion that emits a warning when main reservoir air is flowing into the brake pipe.

When the brake pipe is being charged or recharged after an application, the flowmeter ceases to indicate that the auxiliary reservoirs at the rear of the train will still be under charge. The air flow is so light that the airflow indicator cannot detect this condition. Wait one minute after the flowmeter ceases.

2.5 Pneumatic Control Switch (PC)

This is connected to the brake pipe. When the brake pipe pressure falls below approximately 250 kPa, the engine revs are reduced to idle and driving amps (power) are lost. If in dynamic brake, then this is suspended. The pneumatic control light will be illuminated.

When brake pipe pressure is restored above 350 kPa and provided the throttle is closed, the pneumatic control light will extinguish, and normal operations will be restored.

This feature prevents locomotive movement before brake pipe pressure can build up. If the brake pipe pressure is lost or the Automatic brake valve is placed in the emergency position, the throttle will automatically be reduced to idle, and the train will stop.

3. 26L Air Brake

The 26L brake valve is self-lapping and automatically maintains brake pipe pressure at the figure set by the handle position against reasonable leakage. This brake valve has five positions:

- Release / running
- Minimum reduction
- Service zone
- Handle off
- Emergency

3.1 Release / Running

This position is to release train and locomotive brakes and recharge the brake pipe and auxiliary reservoirs to 550 kPa.

This position is also used to maintain brake pipe pressure at 550 kPa against reasonable leakage when the brake valve is not being used to apply or release brakes.

3.2 Minimum Reduction

When the brakes are initially applied, the brake valve handle is placed in this position. A reduction of approximately 50 kPa is made in brake pipe pressure. This is the smallest amount of brake pipe pressure reduction that is effective enough to move all triple valves on the train to the service mode.

3.3 Service Zone

If it is necessary to apply the train brakes harder than achieved with a minimum reduction, the brake valve handle is moved into this zone. The further into this zone the brake valve handle moves, the greater the pressure reduction of the brake pipe.

There is no lap position because the brake valve will automatically cut off and lap itself when the necessary reduction has been made. At the maximum extent of the service zone, brake pipe pressure will be reduced by 165 kPa.

NOTE

In the minimum reduction and service zones, the maintaining feature will be operative. This feature will keep the brake pipe maintained at the reduced pressure against reasonable leakage.

3.4 Handle Off

When the locomotive is to be operated in any mode other than light, lead, or single unit, the brake valve handle must be placed in the handle off position. This prevents the vigilance device from cycling, reduces brake pipe pressure to approximately 70 kPa and performs other functions associated with the operation.

3.5 Emergency

When there is danger, the brake valve handle must be placed in this position immediately. Brake pipe pressure is reduced to zero, and brakes apply fully. The brake valve handle must be left in this position until the train has stopped. At the same time, sand is fed to the rails to give maximum adhesion to prevent wheel slide.

This position prevents the Vigilance Device from cycling and, on certain locomotives, will put the engine speed to idle. On others, the engine may stop if the throttle is left in notch 5 or 6. In addition, if in operation, the dynamic brake will be suspended.

3.6 Locomotive Train Brakes Operation

Due to some irregularities in the operation of the 26C auto brake valves, Locomotive Engineers are advised to be vigilant in case of further occurrences.

- The fault becomes evident when making a train brake application, and the handle is moved towards the release position. There should be no change in the equalising reservoir pressure until the handle reaches the release position. A train brake release will occur if the equalising reservoir pressure rises when the handle is moved towards release but is still in the service zone.
- If this occurs, the brake should be released and then reapplied as quickly as necessary to control the train. Even with the immediate re-application, at least 80% of braking is available.

Once the train is under control, the journey may continue, but care must be exercised not to move the Automatic brake valve towards release until release is desired.

- The fault should be booked in the Loco 54D repair book, and the locomotive must not re-enter service as a lead locomotive until signed off as repaired.
  - Defective locomotives may operate as trail locomotives only.
  - When this occurs, a notice must be placed in the cab advising of the fault and that the locomotive is restricted to trail unit operation only.

Routine brake code tests (carried out at locomotive C checks) test for this fault, but it appears to be intermittent, so that it may be encountered in service.

3.7 Independent Brake Valve

This is fitted to all main line locomotives and has the following features:

- According to the handle position, the brake valve applies or releases the brakes to the required extent.
- Locomotive brakes can be released on top of an Automatic brake application by pressing the brake valve handle down.
- It maintains brake cylinder pressure at desired figure regardless of leakage and brake cylinder piston travel.
- It uses only an extremely small amount of air to operate. This air is sensed by a pneumatic relay (J1 relay valve), which amplifies the air signal to deliver the necessary air pressure and volume to the locomotive brake cylinders.

Straight air and Independent brake valves do not supersede the train brakes but may be used to supplement them during certain train braking operations.

> **NOTE**
>
> A modification has been made to increase the maximum pressure of the Independent brake cylinder from 350 to 400 kPa on all main line locomotives.
>
> Locomotive Engineers should be aware that with this modification, the Independent brake may be likely to lock the locomotive wheels on a greasy track if applied too quickly.

The modification is to increase the static brake block force on the locomotives so that the ability to hold heavier trains on just the Independent brake on the steepest grades is improved.

3.8 Control Valve

This device is used when brake pipe pressure reduction is made to apply locomotive brakes only. When brake pipe pressure is increased, it releases locomotive brakes only.

The control valve senses the reduction or increase in brake pipe pressure, which sends a signal from the auxiliary reservoir to the J1 relay valve, amplifies this signal and sends main reservoir air pressure to or from the brake cylinders to apply or release the locomotive brakes.

Another function of the control valve is to respond to the Independent brake valve when its handle is depressed after the Automatic brakes have been applied. The quick-release portion operates to release the locomotive brakes Independently of the train brakes.

3.9 The J1 Relay Valve

This allows the main reservoir to supply an almost unlimited amount of high-pressure air to the brake cylinders when either an automatic or Independent application of brakes is made. It is self-lapping and is also used to release the locomotive brakes. When the locomotive acts as a trailing unit, the brake cylinder equalising pipe will operate the J1 relay valve.

3.10 MU2A Valve

This is only provided on locomotives equipped for multiple unit operation. It has three positions and is placed low down on the brake pedestal. The valve is a push to turn type that pops out again when positioned. Ensure this occurs.

The positions are:

- **Lead or dead**: Used when the locomotive operates as a light, lead or single unit, a dead locomotive or as an assisting locomotive behind the train locomotive but without multiple units working.
- **Trail 6 or 26 or Trail 3-pipe**: This position is used only when all three pipes are coupled between the locomotives, and the unit is to run at the rear of another 3-pipe 26L brake locomotive.
- **Trail 4 or 24 or Trail 4-pipe**: This position is used only when all four air pipes are coupled between the locomotives. The locomotive is to run at the rear of another 4-pipe 26L brake locomotive or when a 3-pipe locomotive trails a 4-pipe locomotive.

When the MU2A valve is placed in trail, it isolates the Independent brake.

3.11 Brake Valve Cut off Valve

This device is manually operated. It is placed on the front of the brake valve and has two positions:

- **Cut in**: In this position, the brake valve is operational for lead, light, or single locomotive.
- **Cut out**: The brake valve is non-operational except for the emergency position. The Independent brake valve remains operational.

3.12 F1 Selector Valve

This device operates in conjunction with the MU2A valve. When the MU2A valve is in trail position, the selector valve prevents the automatic application of brakes on a trail locomotive. It allows the brake cylinder equalising pipe to apply the trail locomotive's brakes.

> ⚠ **CAUTION**
>
> If a locomotive were operated as a light, lead, or single unit with the MU2A valve in a trail position, the locomotive brakes would not respond to an Automatic or Independent brake application.
>
> They will apply only in response to an emergency brake application.

4. Handbrakes

4.1 Hand / Park Brakes

Hand / Park brakes are provided for the primary purpose of preventing a rail vehicle from rolling away when unattended. The brake is not designed to act as a stopping brake, although, at low speeds, a brake may stop or slow a moving vehicle.

It is important to apply the hand / park brake before leaving a MPU unattended, irrespective of whether the rail vehicle is still active (or live).

To ensure the locomotive handbrake has been applied, check that the lower chain is tight. If it is not tight, then the handbrake is faulty, and the locomotive must be left attached to a braked vehicle or chocked.

The fault must be entered in the Loco 54D repair book, and a note to this effect is left in the locomotive cab. It is also important that the handbrake is released before the locomotive is moved, irrespective of being active or dead.

Failure to release the handbrake can result in serious damage resulting in the locomotive being withdrawn from service for major repairs due to:

- burnt out brake blocks and/or shoes
- overheated tyres or disc wheels that can crack
- loose tyres
- skidded wheels - scaled or severe flats
- damaged brake units (Class 30 loco)

In some cases, tyres that came loose have shed the Gibson Retaining Ring and have come off the wheel disc leading to derailments. Therefore:

- apply handbrake when parking the vehicle
- release the handbrake before moving the vehicle
- if towing a dead vehicle, always couple up before releasing the handbrake and vice versa

Locomotive Engineers must be familiar with the different handbrakes fitted to MPU’s and wagons.

4.3 Train Handling and Associated Instructions

1. Track-Train Dynamics

The track-train dynamics encompasses the dynamic interaction of a train consist with track as affected by operating practices, terrain, and weather conditions.

Trains cannot move without these dynamic interactions. However, such interactions sometimes result in undesirable and costly results.

Previous efforts to reasonably control these dynamic interactions are reflected in current operating practices and in the design and maintenance specifications for track and equipment.

Although track-train dynamics is not a new phenomenon, the increase in train lengths, vehicle sizes, and loadings has emphasised the need to reduce excessive dynamic train action wherever possible. This in turn, requires a greater effort to achieve more control over the stability of the train as speeds have increased.

2. General Procedures

Good train handling is dependent on three major factors. The first and the most important, being the judgement and skill of the Locomotive Engineer. To properly control the train the Locomotive Engineer must anticipate and plan ahead, so that no matter what problem arises it is the Locomotive Engineer's prompt assessment and reaction that ensures smooth and proper train handling rather than damage to customers freight, a parting, or a derailment. The skill of the Locomotive Engineer will be enhanced if the Locomotive Engineer adheres to the following procedures on proper use of the air brakes (both automatic and independent), Dynamic brake, and combinations of air and dynamic braking and judicious use of the throttle.

The second factor is the condition of the locomotive and vehicles equipment, particularly in regard to the braking system.

A third but also very important factor is for the Locomotive Engineer to have a thorough knowledge of the physical characteristics of the territory to be traversed.

A train is a complex mechanical system of vehicles, loads and springs and interacts with itself and the track in many ways. These interactions are in turn dependent on various factors including the arrangement of vehicles within the train (particularly the placing of empty or lightly loaded vehicles in the train), length of the train, curvature of the track, weather conditions, speed of the train, and characteristics of the locomotive consist.

Because no two trains handle the same, the Locomotive Engineer must pre-plan brake and throttle handling so that speeds established by timetable or bulletin are not exceeded.

Preplanning is particularly important when approaching curves, turnouts or restricted speed areas so that authorised speeds are not exceeded, and in-train forces are minimised while traversing these areas.

3. Slack Movement in a Train

3.1 Train Slack

Good train handling is that which makes the best running time consistent with safety, the prevention of injuries, and damage to track structure, equipment and freight. Slack is present in most trains and in varying amounts. Severe slack action is the cause of much serious and avoidable damage. Even though slack action cannot always be eliminated, it can usually be controlled so as to avoid damage and prevent personal injury to train crew and passengers.

3.2 Cause and Effect of Slack Action

Slack action is created when one portion of a train moves faster or slower relative to other portions of the train.

When this difference in speed has taken up all the slack, (run-in or run-out) portions of the train must suddenly and instantly attain a uniform speed resulting in shock. Slack action is greatly affected by the difference in time between brakes applying and releasing at the ends of a train:

- changes of brake block friction with change of speed
- difference in braking capabilities of empty as compared to load wagons
- length, weight and make-up of trains
- changes in grade and curvature, and the rate at which Dynamic brake and power are increased and reduced

3.3 Drawgear Movement

Drawgear is seldom pushed in or pulled out smoothly and gently. More often it is driven in or jerked out by sudden and violent slack changes. The severity of such movement cannot always be judged by any shock felt by the Locomotive Engineer on a heavy locomotive. A parting can readily occur without any indication on the locomotive that severe slack movement has taken place.

3.4 Free and Draftgear Slack

There are two kinds of slack, free slack and draftgear slack, which work together.

Free slack is clearance (generally within the couplings) which can be run-in or run-out without compressing the rubber or the spring draftgear.

Draftgear slack is the additional amount of movement that can occur when the free slack is taken up as the draftgear is compressed and which then rebounds and drives all slack in the opposite direction.

3.5 Slack Movement

Conventional draftgears, to which the couplers are attached, act to absorb shock and impact. They have from 50-75mm movement built in. Therefore, a sizeable movement is possible within a train between front and rear ends as illustrated in the following table:

Train Length	Free Slack	Draftgear Slack	Total Slack Movement
190 metres	0.7m	3.2m	3.9m
380 metres	1.3m	6.4m	7.7m
750 metres	2.5m	12.7m	15.2m

As slack runs in or out rapidly within a train, damaging shock results from the draftgear having to make the speed of the entire train uniform the instant the slack is all in, or all out. How heavy this shock will be depends mainly on the difference in speed that must instantly be made uniform, and on the weight involved.

Weight is important, but a change in speed is more so. A sudden change in speed (acceleration or deceleration) will cause shocks as detailed in the table on the next page. (Notice the rapid increase of force because the destructive force or shock increases with the square of the speed).

When a stationary wagon is struck at a speed of 2 km/h, the shock or destructive effect is four times that of a speed of 1 km/h. Similarly:

Impact Speed	Shock or Destructive Effect
3 km/hour	9 times that of 1 km/hour
5 km/hour	25 times that of 1 km/hour

Impact Speed	Shock or Destructive Effect
10 km/hour	100 times that of 1 km/hour

So, it is obvious why control of slack is of prime importance, particularly when handling passenger trains.

3.6 Injuries and Damages

Impacts at up to 7 km/h are generally absorbed by the draftgear. Impacts at speeds above this are generally absorbed by the carriage or wagon, resulting in injuries to passengers and/or damage to the freight or wagons.

3.7 Train Partings

Trains often part by a run-out of slack causing the brake hoses to part and set the brakes in emergency. Most train partings occur as the train is accelerated after being reduced in speed by braking, especially combined dynamic and air braking.

Train slack cannot be changed both gently and quickly. When the slack must change because of the grade, use of power, or braking while stopping, starting or running, time must be allowed for the slack change to be completed before doing anything that would hasten that change.

3.8 Causes of Slack Action

The following factors affect the development of drawgear slack action:

Vehicle Resistance

Vehicle resistance to movement can vary considerably in different parts of the train.

Heavy Wagons

Heavy wagons tend to run ahead easier on down grades and are harder to pull on upgrades than empty or lightly loaded wagons.

Curves

Curves create more resistance than straight track. The curve resistance has the same effect on the train as if the vehicle on the curve were travelling up a grade. The sharper the curve the greater the effect, especially with heavy power applied at a speed slower than the rated curve speed, or conversely, sudden braking at the rated or greater speed.

Train Marshalling

Loaded and empty wagons and wagons with different drawgear types in a train have a major effect on slack action.

Marshalling Loaded Wagons behind Empty Wagons

Placing loaded wagons in the rear can result in a very severe run-in of train slack when the brakes are applied. Rebound of draftgear in a train usually results in broken drawgear.

Marshalling Empty Wagons behind Loaded Wagons

Marshalling empty wagons behind loaded wagons can create a severe run-out of slack during a brake application that is, in many instances, beyond the capacity of the Locomotive Engineer to avoid entirely. There is however, much that can be done to minimise its effect.

Creating Severe Slack Action

Quickly accelerating or decelerating a train which is either compressed before accelerating or stretched before braking, particularly dynamic braking, will create major variations in speed between wagons resulting in severe slack action.

3.9 Drawgear Slack Action during an Automatic Brake Application

Brake Pipe Reduction - Apply

The brakes at the head of the train start to apply before the brakes at the rear of the train. The brake cylinders on each wagon fill with compressed air at a controlled rate. The speed of the reduction rate through the train is much faster for diaphragm triple valves than slide valve triple valves.

Brake Pipe Recharge - Release

The brakes at the head of the train start to release before the brakes at the rear of the train. The compressed air from the brake cylinders on each wagon is vented to atmosphere at a controlled rate. The recharge rate of the release signal through the train is faster for the newer type of triple valves.

Wagon Loading

Empty wagons decelerate faster than a loaded wagon for a given brake application.

Locomotive Brake Efficiency

If the brakes on the locomotive are allowed to apply during brake applications, the deceleration rate for a locomotive for a given brake pipe reduction is generally quicker than the deceleration rate for freight wagons, particularly loaded ones.

3.10 Defective Drawgear

It can be taken for granted that the Locomotive Engineer who is continually breaking drawgear is the one who, by rough handling of trains, is also creating defects in new drawgear.

4. Sanding

SO05 Faulty Track Circuit Operations 5. Interference with Track Circuits applies.

Sand can be applied by any of the following methods:

- manual operation of the sanding valve
- automatically during wheel slip
- automatically when wheel slide occurs during dynamic braking or when an emergency / penalty brake application has been applied

Generally, the manual application is used when starting or during heavy brake stops. The optimum quantity of sand for maximum effectiveness is a single layer one particle thick. To lay down a layer of sand this thick at a speed of 25 km/h requires a delivery rate approximately 125 grams per minute. In practice, sand boxes are adjusted to deliver approximately 400 to 500 grams per minute.

4.1 Advantages of Sanding

Adhesion

One of the principal factors affecting the attainable tractive effort of a locomotive is adhesion. This is defined as the co-efficient of friction between the wheel and the rail for acceleration, maintaining speed and deceleration.

Adhesion is influenced by many conditions. However, the condition of the rail crown surface can have the greatest individual effect on adhesion.

To overcome the adverse effect of contamination of rail by oil, dirt, water, ice, insects, and other substances, all locomotives are equipped with sandboxes so that sand can be delivered to the rail by manual or automatic control.

4.2 Disadvantages of Sanding

Too much sand creates a build-up of sand on the rail head over which the wheel must climb, thereby reducing the maximum adhesion which can be achieved between wheel and rail.

Sand must be used sparingly. On short trains, such as less than 230 metres in length, loss of detection of the train can occur in track circuited areas if all the wheels in the train are supported by sand. It is particularly important not to stop a train on a layer of sand, for example, after sanding to a stop.

Sanding to eliminate wheel slip is not restricted to when the train is moving at higher speeds. However, sand should be applied only when it is required and preferably not continuously.

To reduce the risk of loss of train detection when stationary, the following procedures should be used:

NOTE

When there is excessive sanding in an automatic signalling or automatic level crossing alarms area, the train will lose detection, and protection will be necessary.

The Train Controller must be advised.

For light engines

Avoid using sand. Stop by using brake applications less than half of the available maximum Independent brake application.

When sand must be applied in conjunction with a heavy brake application, brake to a stop, then immediately move the locomotive forward. Move all, or as many as possible of the locomotive wheels off the layer of sand. If moving forward is not possible, the Locomotive Engineer must advise the Train Controller of their location.

For short trains

Avoid sanding continuously at low speed to a stop by applying less than a 100 kPa train brake application. If it is necessary to manually apply sand to avoid skidding wheels on the locomotive then apply sand intermittently when bringing the train to a stop to avoid a continuous layer of sand under the complete train.

Where sand is applied continuously to a stop, for example during emergency / penalty brake applications, then as soon as possible after stopping (with the train brake system sufficiently recharged) move forward at least one locomotive bogie length to move the wheels off the layer of sand.

If moving forward is not possible the Locomotive Engineer must advise the Train Controller of their location.

For longer trains

Avoid sanding continuously at low speed to a stop, by using up to 100 kPa Independent brake application where possible.

If sand has been continuously applied under the complete train when stopping then the Locomotive Engineer must advise the Train Controller of their location, or if practical, move forward at least one locomotive bogie length to move the wheels off the layer of sand. This should be done as soon as possible after stopping, (with the train brake system sufficiently recharged).

When stopping, and if sand will be later required for starting the train, apply sand for a short distance under the locomotive wheels just prior to becoming stationary.

When starting the train only apply sand when necessary and intermittently to prevent wheel slip.

5. Dynamic Brake

The Dynamic brake is used as a retarding brake to control the speed of a train. The Dynamic brake alone will not always limit the train to the required speed. At times, the automatic train brakes may have to be applied in conjunction with the Dynamic brake to control the train.

The Dynamic brake, although similar in effect to an independent air brake application, is fully electrical and does not produce friction between the brake shoes and wheels, thus avoiding heat and wear on these components.

There are two systems used to control the amount of retarding force developed by the Dynamic brake. These are the flat system and the taper system.

Flat System (GE Locomotives)

The amount of retarding force developed with this system is controlled by the position of the brake lever. It must be placed in Position 8 in order to develop maximum retarding force. This system provides better control of the application and release of the Dynamic brake, particularly when operating at higher speeds.

Taper System (GM Locomotives)

The amount of retarding force developed with this system is controlled by the speed of the locomotive and the position of the brake lever. The higher the speed the greater the retarding force developed for a given position.

Locomotive Consists with Units Having Both Taper and Flat Control Systems

At speeds below 30 km/h, the application and release rate will be approximately the same for both systems.

At speeds above 30 km/h, the taper control units will develop a stronger retarding force than the flat control units for a given position. The higher the speed, the greater the difference becomes.

To increase the retarding force when operating from a taper control unit, with one or more trailing units equipped with flat control, advance the lever towards position 8. This should be done even though the taper control unit may be developing maximum output. As the lever is advanced, the taper control will automatically be limited to maximum amps and the flat control will increase its retarding force.

5.1 Dynamic Brake – Maximum Effective Speed for Diesel Electric Locomotives

With standard range Dynamic brake, braking effort reduces as train speed increases or decreases from approximately 30 km/h.

5.2 Extended Range Dynamic Brake

With extended range Dynamic brake, braking effort is constant for speeds between 16 km/h and 36 km/h for DXR locomotives and between 20 km/h and 70 km/h for EF locomotives.

5.3 Dynamic Brake verses Brake Cylinder Pressure

A full application of the Dynamic brake at speeds between 20 km/h and 60 km/h produces approximately the same braking force as maximum pressure in the brake cylinders on the locomotive.

5.4 Dynamic Brake Interlock (DBI)

When automatic train brakes are used in conjunction with the Dynamic brake to reduce train speed, an interlock prevents an automatic application of the locomotive brakes. Consequently, it is not necessary to use the independent release function to release the locomotive brakes.

5.5 Emergency Braking

In an emergency air brake application, the Dynamic brake is automatically released, and the Automatic brake applied on the locomotive when the brake pipe pressure is reduced below 310 kPa.

5.6 Independent and Dynamic Brake Combined

The independent air brake may be applied on the locomotive at any time.

However, the Dynamic brake and the independent air brake should not be used together except in an emergency, or when setting up or suspending Dynamic brake.

Excessive braking effort, due to both the dynamic and Independent brake being applied, may result in wheel slide and flats on the locomotive.

5.7 Train Handling: Dynamic Brake Operation

Compressive Forces

When Dynamic brake is used to control train speed on descending grades, without using the train air brake, the braking effort provided by the locomotive causes compressive forces to be applied to the drawgear of the leading vehicles on the train.

When more than one locomotive with operating Dynamic brake is hauling the train, and the Locomotive Engineer is using a high Dynamic brake setting, the forces which develop in the drawgear of the leading vehicles of the train are much higher than can be developed by a single locomotive.

This is particularly important where the locomotives are equipped with extended range Dynamic brake, which has maximum effect over a wider speed range than the Dynamic brake fitted to other locomotives.

The following settings should be used:

- curves > 2/3 maximum DB effort when in multiple
- turnouts > 1/2 maximum DB effort when in multiple

until at least half of the train has passed the curve or turnout

Rough Train Handling

In an extreme case of rough train handling, severe run-in of drawgear slack, due to high dynamic braking forces, can result in a derailment. Dynamic brake must be applied slowly and smoothly through the full range to maximum braking effort, otherwise train surging will result and, in extreme cases, derailments.

Run-Out of Slack

The Dynamic brake must also be released slowly through the full range to minimum braking effort otherwise a severe run-out of drawgear slack can occur in the train.

Using Dynamic Brakes on Long Trains

The longer the train the more slowly the Dynamic brake must be both applied and released. Longer trains take more time to change their slack condition.

Excessive Slack Action

If the Locomotive Engineer has difficulty in controlling the drawgear slack on a train while in Dynamic brake operation, the Dynamic brake application should be carefully reduced, and the automatic train brake application carefully increased or vice versa.

Automatic Coupler / Standard Drawgear

Where all vehicles on the train are fitted with automatic couplers, high levels of Dynamic brake can be safely used to control train speed under most conditions. Where the train is comprised of wagons with mixed drawgear, the Locomotive Engineer must ensure the level of Dynamic brake applied is not excessive under the train conditions which are applicable at the time.

5.8 Factors Affecting Train Surging

- track profile
- track quality
- train make-up
- vehicle drawgear
- Locomotive Engineers' skill

6. Braking Effect on Long Trains

6.1 Skidded Wheels

Skidded and overheated wheels caused by dragging brakes locking the wheels from turning, reduce service life of both rolling stock and track, and in some cases, can cause a derailment. Correct driving methods can greatly reduce the incidence of skidded and overheated wheels.

6.2 Train Brake Releases

When train air brakes are applied, the wagon auxiliary reservoir pressures are reduced to the train brake pipe pressure. When the train air brakes are released, the amount of forcing pressure (rate of recharge) moving the wagon triple valves to release is dependent on the degree of train brake application.

6.3 Air Pressure Differential

The release of a wagon air brake application is controlled by the difference in air pressure in the brake pipe and the auxiliary reservoirs. Where the rate of increase of brake pipe pressure at the rear of the train is low due to insufficient pressure difference created during the brake application, the brake pipe and auxiliary reservoir pressures can increase to the normal running pressures without a release of wagon brakes, for example dragging brake.

6.4 Avoiding Dragging Brakes

The rate of increase of brake pipe pressure at the rear of a long train during a brake release must be sufficient to move the triple valves to the release position. To prevent dragging brakes following an air brake application, the Locomotive Engineer must make the brake pipe reduction large enough to ensure all triple valves will operate when the train brakes are released.

6.5 Brake Pipe Stabilised

The Locomotive Engineer must not release the train brakes until the train brake pipe pressure and auxiliary reservoir pressures have stabilised on the vehicles at the rear of the train.

6.6 Reducing the Incidence of Skidded and Overheated Wheels

The following driving principles must be observed:

Throttle Modulation

Locomotive Engineers must regulate the speed of the train with throttle control or Dynamic brake and without the use of light brake applications, whenever possible. Throttle control is the preferred method.

Application Rate of Triple Valves

On long trains the brake application rate through the train is low. As a result, the brakes on the lead wagon are effectively applied before the rear end brakes begin to apply. Therefore, to prevent severe run-in of train slack during the brake application, the brake is to be applied first with the throttle power being reduced after the brakes are set on the train. In this way, the tractive power of the locomotive is used to keep the train stretched and prevents run-ins.

Light Brake Applications

Where light brake applications are used to control train speed on long and steep descending grades the brake pipe reduction is to be increased to at least 70 kPa minimum on the lower part of the grade. This is to ensure all the triple valves are activated when the train air brakes are released. No attempt is to be made to release the train air brakes until at least 20 seconds after the final brake pipe reduction to allow brake pressures on the train to stabilise or until the brake valve has stopped exhausting.

Checking Train Speed

Where a brake application is used to check the speed of a long train (approximately 500 metres and longer), the total brake pipe reduction is not to be less than 70 kPa. No attempt is to be made to release the train brakes until the train brake pipe has stabilised, as indicated by the termination of the blow at the brake valve secondary exhaust nipple 20 seconds after the final brake pipe reduction. Dragging brakes may occur on the rear portion of the train if either of these procedures are not followed.

Normal Slowdown and Stop: Brake Pipe Reductions

These should be completed with not more than 100 kPa total brake pipe reductions. This will reduce the braking forces and provide reserve braking. The use of full service braking leaves no reserve braking.

Sufficient Reduction When Stopping

Where a train is brought to a stop on a light brake application of less than 70 kPa, a further application must be made to increase the total brake pipe reduction to 100 kPa before initiating the brake release.

No attempt is to be made to release the train brakes until the train brake pipe has stabilised, as indicated by the termination of the blow at the secondary exhaust nipple or 20 seconds after the final brake pipe reduction.

This is to ensure there will be sufficient pressure differential between the auxiliary reservoirs on the vehicle and the brake pipe to actuate all the triple valves when the brakes are to be released.

Powering Against Brakes

The application of locomotive power for other than short periods while the train brakes are applied may cause overheated wheels. A maximum of notch 4 should be used for other than short periods to prevent a long train from stalling. **ROC Section 1 Motive Power Restrictions Instructions** will detail any variations to this instruction.

Restarting a Train

When starting a train after it has been brought to a stop on an Automatic brake application, allow at least 40 seconds for short trains, and 60 seconds for long trains after the brake valve handle has been placed in the release position before carefully advancing the throttle. The time required to release the brakes on the rear wagons of the train is dependent on the length of the train and type of brake equipment.

No attempt should be made to move the train until the brakes have been released on the rear wagon.

7. Holding Trains Stationary on Descending Grades

7.1 Sufficient Independent Braking Power

Where the locomotive compressors are operating and the independent braking power of a train is sufficient to hold the train stationary on the grade, use the Independent brake without applying handbrakes. This is permissible provided the automatic air brake on the train is recharged and operational and can be used to apply additional braking power if required.

7.2 Traction Motor Failures

When a train is stopped with the Dynamic brake applied, the throttle or brake and power controller must be promptly returned to Idle or off to prevent damage to the traction motors. Failure to return the Dynamic brake to idle or off while stationary is a major factor in traction motor failure.

Delay Before Restarting a Train

Allow at least 60 seconds after the flowmeter has settled before restarting the train.

⚠ **CAUTION**
The application of excessive power to move the train before the brakes are released on the rear wagons can result in drawgear failure and skidded wheels.

8. Starting the Train

8.1 Starting Procedure

The method used for starting a train depends upon many factors such as:

- type of locomotive(s)
- weight and length of train
- amount of slack in the train
- weather conditions
- gradients

Since these factors are variable, specific train starting instructions are also variable. There are, however, certain general considerations that must be observed such as:

Release Brakes before Starting

Locomotives generate very high starting tractive effort; therefore it is imperative that train brakes are fully released before any attempt is made to start the train.

If the train has been stopped by an Automatic brake application, or an Automatic brake application has been used just prior to starting, enough time must be allowed for the brakes of all vehicles to release before any attempt is made to start the train. On long trains, allow at least 60 seconds after the flowmeter has settled and after the Automatic brake valve handle has been placed in the release position before advancing the throttle. Always refer to the flowmeter indications before starting.

Tractive Effort Versus Drawgear Strength

Many multiple locomotive units can produce tractive effort forces in excess of what the drawgear of the average train in less-than-ideal conditions can withstand. Therefore, extreme caution must be used when starting these trains to avoid partings.

There are separate Local Network Instructions concerning the notching up of multiple locomotive combinations when starting from some stations e.g., Up trains at Otira.

Tractive Effort When Starting

A train being started with as low a throttle position as possible will:

- reduce the total tractive effort forces
- allow all train slack to be removed slowly until the complete train is stretched and in motion
- reduce draft forces on the drawgear

Sanding

When adhesion levels are low the locomotives may experience wheel slip when starting. If sanding is required, it must not be used in excess.

As the throttle is advanced, depress the sand button to place a light layer of sand on the rails and continue to hold it depressed until the momentum is such that wheel slip has stopped and is unlikely to reoccur.

Excessive Wheel Slip

If one or more of the locomotives in a multiple consist starts to slip or lurch intermittently while starting, tractive effort must be reduced by easing the throttle back one, two, or more notches. If the slip cannot be rectified by this method, it is better to close the throttle and start over again, gradually stretching the train.

Train Partings

If the slip and lurch is not corrected as quickly as possible, the surges in tractive force from one locomotive to another may result in momentary excessive strain on drawgear in the train. When the front part of a train is tightly stretched the effect of wheel slip, and lurches may result in partings.

Stall Burns

If the locomotive cannot move the train the ammeter must not be allowed to build up and remain consistently high or serious damage may be done to traction motor brushes and commutator bars. This is known as stall burn.

8.2 Recommended Start Procedure – Level Terrain

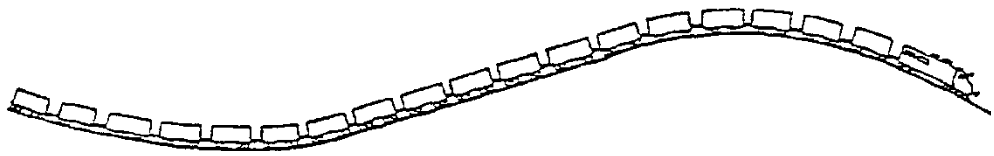
Release the automatic and Independent brakes. After all brakes have been fully released, open the throttle to notch one and check on the ammeter that the amperage is increasing. After a few seconds pause, the throttle may be advanced to notch two if additional power is needed to start the train.

The train may start at either one of these two throttle settings. With some locomotives it may be necessary to regulate starting speed with the Independent brake to keep the locomotives moving at a slow, uniform speed of about 5 km/h until the entire train is moving. Extreme care must be used when releasing the Independent brake under these conditions so that slack action is not created by sudden run-out of the locomotives.

If required, the throttle may be advanced one notch at a time up to three or four to start the train. Occasionally it may be necessary to advance the throttle beyond notch four, depending on the locomotive consist. However normally the throttle should not be advanced as long as the ammeter indicates the amperage is increasing in the present throttle position. Wait until the train has absorbed the power from the present throttle position before advancing the throttle to the next higher position. Continuing to advance the throttle before the train has started may cause a parting, rail burn, and/or damage to the locomotives such as brush burns to the traction motor commutators.

If the train does not start after ample power has been applied, the throttle should be returned to idle. Check to determine that all brakes are released. If all brakes are fully released it may be necessary to take slack to start the train.

8.3 Starting on Undulating Grades



When in doubt about the exact location of the rear portion of the train, always start without taking slack (for example bunching of the train before moving off in the forward direction). All the slack in the train must be run out slowly.

The Recommended Starting Procedure to be used is:

1. With the Independent brakes fully applied, place the throttle in notch one and note the increase on the ammeter
2. Gradually release the Independent brake until the locomotive begins to move
3. Hold this partial application of the Independent brakes until the complete train has stretched and started to move
4. After a few seconds' pause, advance the throttle to notch two and again note ammeter indication
5. Move the train with the least amount of drawbar force as possible. If the train can be started in notch one, allow the entire train to start before advancing the throttle to notch two. If the major portion of the train is on descending grades, little power will be required to move it and keep it moving
6. Fully release the Independent brake

8.4 Starting – Light Ascending Grade

Starting - Slack Stretched

After the train brakes are fully released, advance the throttle one notch at a time to a position sufficient to hold the train. Then release the locomotive brakes. If required, the throttle may be advanced one notch at a time to three or four to start the train. It may be necessary to advance the throttle beyond four, depending on the locomotive consist. However, the throttle should normally not be advanced beyond four as long as the ammeter indicates the amperage is increasing in the present throttle position. Wait until the train has absorbed the power from the present throttle position before advancing the throttle to the next higher position.

Reduce the throttle and if necessary, apply sand if there is an indication of wheel slip.

If the train does not start when sufficient power is applied, reduce the throttle to a level that will hold the train, apply locomotive brakes, reduce throttle to idle, and determine the cause of the train not starting.

Starting – Slack Bunched

Release the Automatic brake and the locomotive brake. Open the throttle sufficiently to begin starting the train one wagon at a time as the brakes are releasing. The throttle should be manipulated to keep the locomotive speed at about 5 km/h until the entire train is moving. Simultaneously observe the ammeter to limit the amperage to a level that will prevent a train parting.

Whichever starting method is employed it may be necessary to control the starting speed with light Independent brake applications or by throttle manipulation until the entire train is moving. Extreme care must be used when the Independent brake is released to avoid excessive in-train forces.

8.5 Starting – Heavy Ascending Grade

It is assumed that the train has been stopped on the heavy ascending grade using slack stretched method.

With the Automatic brake valve in release, advance the throttle one notch at a time to a position sufficient to hold the train, and then release the locomotive brakes.

If required, the throttle may be advanced one notch at a time to three or four to start the train. Occasionally it may be necessary to advance the throttle beyond four depending on the locomotive consist. However, do not advance the throttle as long as the ammeter indicates the amperage is increasing in the present throttle position. Wait until the train has absorbed the power from the present throttle position before advancing the throttle to the next higher position.

Reduce the throttle and apply sand if there is an indication of wheel slip.

If the train does not start when sufficient power is applied, reduce the throttle to hold the train. Apply the locomotive brakes, reduce the throttle to idle and determine the cause of the train not starting.

⚠ **CAUTION**

If conditions are unfavourable, consideration should be given to double banking rather than experiencing a possible train parting. The train must be started promptly after power is applied to avoid stall burns to traction motor commutators or to avoid rail burns caused by excessive wheel slip.

Sand should not be used before the locomotive has begun to move in order to prevent build-up of sand blocks in front of the locomotive wheels.

8.6 Starting – Light Descending Grade

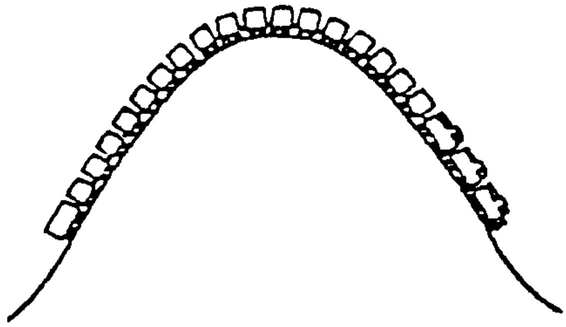
Employing Gradual Independent Brake Release Consistent with Gradual Dynamic Brake Application

Use the Independent brake to hold the train on the light descending grade. With the Automatic brake fully released, gradually release the Independent brake until the head end begins to move. Speed of the head end should not exceed 5+ km/h until the entire train is moving. Initial acceleration of the train is controlled by the Independent brake. The Dynamic brake is not applied until the train is accelerating.

Employing Throttle and Automatic Brake – Dynamic Brake not Available (train stopped with slack stretched)

Release the Independent brake. Place throttle in notch one and release Automatic brake. Leave throttle in notch one or two until the entire train is moving.

8.7 Starting on a Cresting Grade



A cresting grade is a long ascending grade which changes to a long descending grade, both significant (usually 1.5% (1:75) or greater).

NOTE

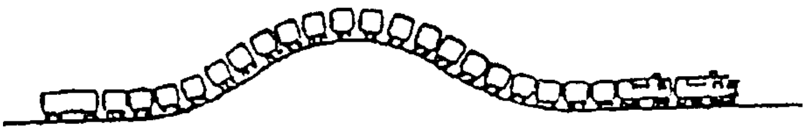
1.0% = 1:100, 1.5% = 1:75, 2.0% = 1:50, 2.5% = 1:40.

For example, 1:100 means for each 100 metres distance the grade rises by 1 metre.

The procedures for starting on a cresting grade are the same as for light or heavy ascending grades.

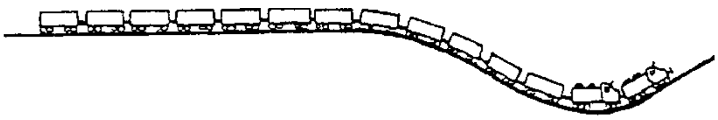
Extreme care should be taken while advancing the throttle when starting to avoid excessive stress in the drawgear at the summit of a cresting grade. This is due to the weight of the portion of the train on each side of the crest opposing each other. The drawgear at the crest will be supporting both portions of the train plus the force exerted by the locomotives. The ammeter should be monitored constantly and the throttle advanced only after the amperage falls to a moderate level.

8.8 Starting on a Hump



There are no special requirements for starting on a hump. The starting procedures are the same as for starting on an ascending grade.

8.9 Starting a Train in a Dip



1. Open the throttle to notch one and note the amperage increase on the ammeter
2. Wait for the Independent brakes on the locomotive to release
3. After a few seconds pause, advance the throttle to notch two and again note ammeter indication
4. If acceleration is too rapid, reduce the throttle one or more positions
5. When the complete train is in a stretched condition and in motion, slowly advance the throttle as required

9. Accelerating

Throttle Advances

After the complete train has been started, the throttle is advanced one position at a time to the required operating position.

Ammeter Indications

The ammeter provides the best guide for throttle handling when accelerating a train. The ammeter on diesel electric locomotives moves towards the right (increased amperage) as the throttle is advanced. On electric locomotives the six ammeter indicators will rise as the throttle is advanced.

Increasing Power

As soon as the increased power is absorbed and the ammeter indicator moves to the left (or falls on electric locomotives), the throttle may be advanced again.

The rate at which the throttle is advanced to accelerate a train depends on the type of locomotives, the train make up and terrain involved. In general advance the throttle only one notch at a time.

The ammeter and speedometer provide a guide for throttle handling when accelerating. As the train accelerates and the amperage stabilises or begins to decrease, the throttle can be advanced another notch until sufficient power is being produced to reach the required speed.

CAUTION

Excessive tractive effort can produce high in-train forces, particularly at lower speeds. To avoid wheel slip and/or train partings, the throttle must not be advanced too rapidly.

9.1 Accelerating – Descending Grade

Employing Preset Dynamic Brake and Gradual Independent Brake Release

With the entire train in motion the Independent brake is gradually released to allow the train to accelerate yet will retain adequate retardation at the head end to ensure that the slack remains bunched while the Dynamic brake is becoming effective. By the time the Dynamic brake becomes effective, the Independent brake should be in full release position.

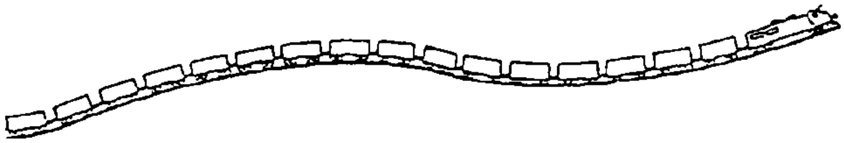
The slack must be maintained in a bunched state during the release of the Independent brake and the application of the Dynamic brake. Any delay in applying the Dynamic brake will allow the slack to run-out and cause high dynamic forces in buff as the Dynamic brake applies and the train returns to a bunched condition. There is also the possibility of wheel slide if the combination of Independent brake and Dynamic brake during the changeover exceeds adhesion levels.

9.2 Accelerating – Undulating Grade Country

Acceleration of a train in undulating country is a very critical operation. Because the slack is constantly adjusting and cannot be kept entirely stretched, acceleration of a train will be a time-consuming operation. Acceleration must be at a much slower rate than is normal on most other grade conditions, and throttle manipulation techniques must be used.

10. Control of Train When Running

10.1 Undulating Grade Territory



Definition of Undulating Grade Territory

A section of track which changes grade so often that an average train passing over the track has some wagons on both ascending and descending grades.

Curves

An undulating grade with train curvature of more than two changes in curve direction should be treated with special consideration.

Slack Reaction

On undulating grades, train slack is always adjusting because wagons on descending grades roll faster than those on the ascending grades. In some areas, the track profile is of such severity that it is virtually impossible to control slack action without generating high drawgear levels within the train. Skilful operation by the Locomotive Engineer can reduce the severity of the slack changes.

To properly negotiate undulating country, it is essential that the Locomotive Engineer understand the following operating characteristics:

- makeup of the train including number of wagons, length, tonnage, and locomotive consist
- the power loading characteristics of each type of unit in the consist
- the dynamic braking characteristics of each type of unit in the consist
- location of terrain features, sidings, and speed restrictions by km post

Always knowing the exact location of the rear portion of the train in relation to the ascending and descending grades is particularly important when operating over undulating country.

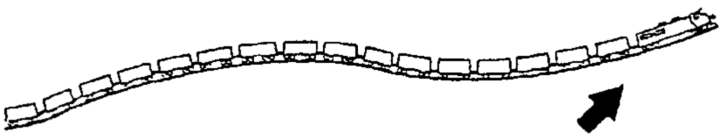
The most reliable procedure is to reduce speed and power prior to entering the series of undulating grades and to operate at a constant speed throughout the undulating area by throttle manipulation.

When Approaching Undulating Grades

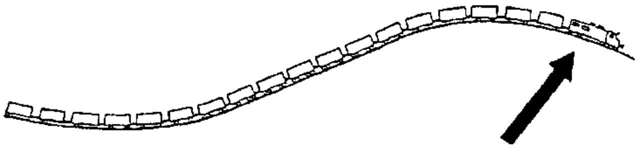
The Locomotive Engineer should concentrate on the location of the rear end of the train, the traction amperage, and the speed and pull of the train.

The important steps for throttle manipulation are:

- reduce power on approach to the undulating grades
- concentrate on the location of the rear end of the train
- increase power when the locomotives approach an ascending grade
- decrease power when the locomotives approach a descending grade
- maintain a uniform speed throughout the undulating grade section
- as the locomotive consist approaches an ascending grade, slowly increase power just enough to top the grade without a reduction in speed

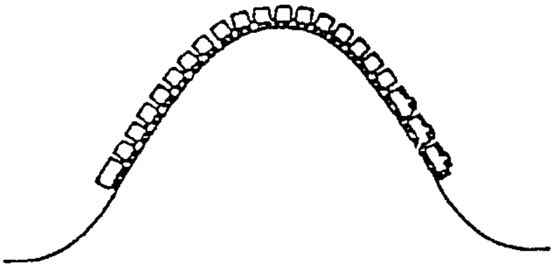


- increase power when locomotives are at the point shown in the diagram above. Maintain a uniform speed
- as the locomotives begin the descent, gradually reduce power, taking advantage of the weight of the locomotives and low traction amperage to keep the train stretched and running at a uniform speed



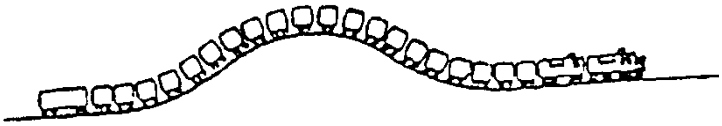
- decrease power when locomotives are at the point shown in the diagram above. Maintain uniform speed

10.2 Negotiating a Cresting Grade



These grades require a change in train handling procedures when the grades are steep.

10.3 Negotiating a Hump



When negotiating a hump, slack action and run-in forces can often be reduced by the following throttle modulation:

As the locomotive starts up the hump, increase the throttle setting to avoid bunching the slack at the leading end and maintain this stretched condition until the locomotive reaches the crest of the hump. To achieve this, it is good practice to approach the hump with reduced power thus providing a margin for throttle increase and for stretching the train as the locomotive starts up the hump.

As the locomotive passes the hump and starts to pick up speed, the drawgear will tend to stretch out. To keep slack action to a minimum, reduce power to keep speed constant by throttle manipulation to suit loading on the train and the grade conditions.

10.4 Negotiating a Dip

A dip is a rapid decrease in grade followed by an increase in grade sufficient to result in abnormal slack adjustment.

Approaching a Dip

To control slack when moving through a dip, the train speed must be allowed to reduce before the train moves into the dip and throttle manipulation used to negotiate the territory. This is accomplished by reducing power and speed before reaching these areas dependant on the length and grade of the dip.

Dynamic Braking Through a Dip

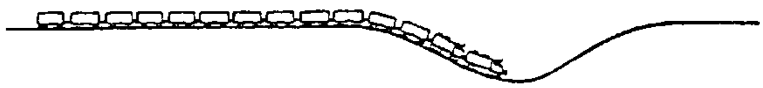
A dip does not allow for Dynamic brake operation since the grades are not long and there is not enough time to correctly set up, and apply, and then release the Dynamic brake. The use of Dynamic brake will also adversely increase the adjustment of slack in the train. It is for this reason that Dynamic brake must not be used for freight trains and must not be used for passenger trains.

Reducing Slack Action

The object of reducing speed is to enable the train to be pulled through the dip at a constant speed and prevent what would otherwise be a severe slack run-in as the rear portion of the train accelerates on the descending portion of the grade, and a severe run-out and possible parting as slack runs out when the rear portion of the train decelerates on the ascending grade.

The Recommended Procedure for Negotiating a Dip is:

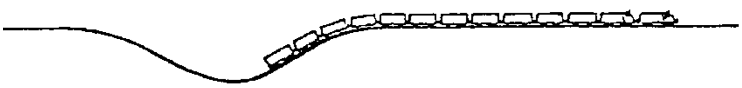
- Reduce the train speed when approaching the dip by reducing power. Road knowledge and experience will indicate the power reduction necessary to operate through each dip without exceeding the maximum authorised speed and with sufficient power in reserve to keep the train stretched throughout.



- Continue to reduce power to prevent speed increase as the head portion of the train begins descending into the dip.

- Just before the leading portion of the train reaches the ascending grade, begin to advance the throttle gradually.

- Continue to advance the throttle one notch at a time until the rear portion of the train approaches the base of the dip. This should result in the train maintaining speed and prevent slack run-in from the rear.



- Reduce power as the rear portion of the train starts on the ascending grade out of the dip permitting slack to adjust gradually.

10.5 Coasting

Due to the rising cost of fuel, coasting over suitable terrain is becoming a preferred method of train handling with many rail companies throughout the world.

Definition:

When the locomotive throttle is returned to the idle position while moving forward. The train's forward momentum is maintained by the weight of the train combined with the geographical features of the terrain, including curves and gradients.

Locomotive Operation During Coasting:

Coasting is best suited to trains that are dynamically stable, e.g., unit freight and intermodal train services, or trains where the weight is evenly distributed throughout the entire length of the consist. It may not be suitable where heavily loaded wagons are marshalled at the rear of a train with lightly loaded wagons on the front.

Using the locomotive controls:

Locomotive Engineers being guided by the Driver Advise System (DAS) must operate the throttle, Dynamic brake and airbrake system where required as per code instruction.

When Approaching Coasting Areas:

- The throttle should be notched back gradually, pausing between notches to avoid unnecessary or excessive in-train forces.
- Care should also be taken to avoid notching back prematurely, causing the train speed to fall too low when transitioning into coast.

When in Coasting Mode:

- Train speed should not be allowed to reduce to a level where excessive throttle will be required to regain line speed when coasting mode is suspended.
- If train speed must be reduced while in coasting mode, it is preferred that dynamic or regenerative braking is used for optimal speed control.
- Moving the dynamic / regenerative brake control to the set-up position prior to slowing the train ensures a smoother transition between coasting and braking mode.
- When suspending braking, the dynamic / regenerative brake controller should be returned to the set-up position before being suspended fully and power applied. When dynamic / regenerative braking is unavailable, care must be taken when the air brake is applied to prevent the train experiencing excessive draught or buff forces. Operators need to use their skill and road knowledge to minimise these forces. It may be necessary to apply light power settings to the locomotive prior to an airbrake application to reduce the possible in-train forces.

Concerns Raised By Locomotive Engineers:

- I have been trained to keep my train stretched
- Shutting off power means I have no control of the in-train forces (run-in's / run-out's)
- Train partings will occur due to bridles and hooks lifting
- I am already a fuel-efficient driver
- The train will run late, and I cannot make up time

Extensive practical testing on scheduled train services and the locomotive simulator has proven that in-train forces are well within acceptable limits. Locomotive Engineers are encouraged to practise coasting wherever possible.

High In-Train Forces During Coasting:

If high in-train forces are experienced during coasting, the Locomotive Engineer must use their judgement, skill and road knowledge to reduce these forces. This could be by throttle manipulation, dynamic or stretch braking and using the terrain to best control in-train forces.

1.10.6 Unexplained Loss of Air

When experiencing an unexplained loss of air, keep the power on as long as possible and bleed off the locomotive Independent brakes until the train comes to a stop to reduce the potential of collision from the rear portion of train.

NOTE

Once air pressure drops below 250 kPa, driving amps will be lost through the PCS switch opening.

11. Slowing the Train

Regulating Speed

Whenever possible, Locomotive Engineers should try to regulate the speed of the train with the throttle in conjunction with road knowledge, without the use of light brake applications.

Braking

When an air brake application is used to check the speed of the train, the total brake pipe reduction should not be less than 70 kPa before the train brakes are released.

Braking in Heavy Snow Conditions

Where snow is above the railhead, Locomotive Engineers should make a minimum reduction at least one minute (but not so early as to allow the brake blocks to ice up) prior to requiring a brake application and ensuring the brakes take hold.

The timing of the minimum reduction must consider the gradient and the time required for release and recharge.

Brake Before Reducing Power

To prevent severe slack run-in during the slowing process, always apply the brakes before reducing power. In this manner, tractive effort is used to maintain the train in a stretched condition while the brakes are applying. As soon as the brakes are set and slack is adjusted, power may be reduced to the required level. The ammeter should not rise.

Releasing Brakes

No attempt should be made to release the train brakes until the brake pipe pressure has stabilised. This is indicated by the termination of the blow of air from the brake valve exhaust. If this procedure is not followed, the brakes may not release towards the rear end of the train.

Releasing Brakes and Applying Power

Always lightly apply power when the brakes are applied (before the release is initiated) so that slack is gradually stretched throughout the train from the front end as the brakes release.

11.1 Using Train Brakes to Slow Down

- Apply a minimum brake application with power applied
- Pause to allow brakes to set and slack to adjust
- Gradually reduce power to required level
- Further increase the brake application
- Avoid a light total application

NOTE
If power is not reduced after the brakes set, stress would set up towards the leading end of the train which may result in drawgear failure.

11.2 Releasing Brakes after Slowing Down

- gradually apply light power with brakes still applied
- release brakes and wait for slack to gradually adjust before increasing power

Releasing Brakes at Low Speeds

The minimum speed at which the brakes can be released without causing severe coupling slack action and possible partings depends on several factors.

These are:

- how heavily the brakes have been applied
- the length of the train
- whether the coupling slack is then bunched or stretched, and
- whether track conditions such as humps or curves do, or do not favour releasing

These conditions must be assessed by the Locomotive Engineer. Where adverse releasing conditions are present the Locomotive Engineer should, if necessary, allow the train to come to a stop before releasing.

IMPORTANT
Steep grades should not be descended under power when carrying out this instruction.

11.3 Using Dynamic Brake to Slow Train

Engaging Dynamic Brake

While the speed of the train is relatively low, place the throttle in the idle position, pause for a minimum of 10 seconds to allow the traction motor magnetic fields to decay, then move the Dynamic brake controller to set up to establish Dynamic brake circuits. Allow sufficient time for the train to settle.

The Dynamic brake controller can then be moved slowly away from the set up position as required to control the speed of the train.

Releasing Dynamic Brake

When releasing the Dynamic brake, move the controller slowly to notch 2 or minimum position. Ensure that the ammeter is stationary or indicating a reduction in braking effort. Slowly move the Dynamic brake controller to the set up position. Pause in this position for at least four seconds then move the controller to the off position.

Applying Power

Allow sufficient time for the train to settle before moving the throttle away from the idle position to allow for adjustment in train slack. Slowly open the throttle one position at a time while observing ammeter readings.

11.4 Using Both Air Brake and Dynamic Brake to Slow Train

Engaging Dynamic Brake

When the required speed is reached, engage the Dynamic brake and allow time for train slack to adjust before making a brake reduction with the Automatic brake valve. Dynamic braking levels or the size of brake pipe reduction may be increased to obtain the required braking effort.

Brake Pipe Reduction with Dynamic Brake Applied

If ½ or ¾ Dynamic brake effort in conjunction with air brake operation will not control the speed, increase the train brake application by a further 15 kPa before decreasing Dynamic brake effort.

> **NOTE**
> The application and release of Dynamic brake must be varied slowly and smoothly, to prevent severe run-in or run-out of drawgear slack.

Special Care when Releasing Air then Dynamic Brake

After reducing the speed to the required rate, release the air brakes and continue to use the Dynamic brake to retard the movement of the train. Do not reduce the Dynamic brake effort until the automatic train brakes have fully released throughout the train otherwise train partings may occur.

Applying Power

Pause before moving the throttle away from the idle position to allow for train slack adjustment. Then move the throttle one notch at a time to the required power position.

11.5 Slowing on Undulating Grades

Applying the Brakes

With power applied, make a minimum reduction when the locomotives have topped a grade and while the train is stretched. The locomotive brakes must be kept fully released.

As the speed decreases and brakes apply throughout the train, power should be slowly reduced to the amount required.

Preventing Run-outs

When speed has been reduced to that required and the rear portion of the train has crested the ascending grade, the train brakes may be released.

Drawgear Failure

If the train brakes were released while the rear portion was ascending and the lead portion was on a steep descending grade, tension on the drawgear would occur at the crest of the grade if excessive power was applied on the locomotive. This may cause drawgear failure.

11.6 Slowing on Level Terrain

A train may be slowed on level terrain by employing either the slack stretched or slack bunched method. Judgement as to which method is used should be based on train speed, braking available, train make up, and the state of slack prior to initiating the slowdown. Any unnecessary changing of slack conditions to conform to either stretched or bunched braking will increase slack action.

Employing Automatic Brake and Throttle (slack stretched method)

1. Make an initial brake pipe reduction of 50 kPa while in power. Keep the locomotive brake released.
2. After the Automatic brake becomes effective throughout the train, gradually reduce the throttle. Maintain sufficient throttle to keep the train stretched. Properly reducing the throttle also ensures that in-train forces are kept to a minimum.
3. Additional light brake pipe reductions of 15 to 25 kPa may be made if needed to slow the train. Keep the locomotive brakes released. At least a 70 kPa total reduction should be made to ensure that train brakes will fully release.
4. When the necessary speed reduction has been achieved, the train brakes may be released if speed is high enough to allow the brakes to fully release before the train speed falls to about 20 km/h. After placing the Automatic brake valve in the release position, gradually reduce power so that in-train forces remain at a safe level throughout the train as the Automatic brake is releasing.
5. Since the train will continue to slow as the Automatic brake releases, the brake valve should be placed in the release position before the speed falls to the required level. In a properly executed slow-down the Automatic brake will just be releasing on the rear end as the train reaches the required speed.

No attempt should be made to accelerate until the Automatic brake has had time to release throughout the entire train.

Stopping the train is preferable to attempting a running release on long trains operating at low speeds, on trains which have been slowed with a heavy brake application, or on trains which have developed excessive leakage.

Employing Dynamic Brake and Automatic Brake (slack bunched method)

When the Dynamic brake has been applied to within ½ to ¾ of the available Dynamic brake capacity, make the minimum brake pipe reduction of 50 kPa. The locomotive brakes will be released due to the DBI being activated. Additional brake pipe reductions of 15 to 25 kPa should be made as needed to assure a minimum total reduction of at least 70 kPa.

When the necessary speed reduction has been achieved, the Automatic brake should be released with sufficient Dynamic brake left applied so that the slack will remain bunched throughout the train.

After the Automatic brakes are fully released, the Dynamic brake may be gradually released, and the locomotive controls returned to power.

The advantage of using the Automatic brake in conjunction with the Dynamic brake is that steady state forces throughout the train may be reduced. When only the Dynamic brake is being used to slow a train there are high in-train forces in the wagons immediately behind the locomotives because the entire weight of the train is bunched against the locomotive. Supplementing the Dynamic brake with an automatic air brake application will normally require lowering the Dynamic brake setting as each wagon contributes to the slowing of the train. This distributes braking and in-train forces throughout the train rather than concentrating them at the rear of the locomotive.

Employing Automatic Brake (modified slack bunched method)

At a sufficient distance ahead of the point at which a slow-down is required, begin reducing the throttle one notch at a time allowing enough time between the throttle reductions to permit the slack to adjust to an essentially bunched condition.

Make a minimum reduction of 50 kPa. Keep the locomotive brakes released.

Additional reductions of 15 to 25 kPa may be made as necessary to complete the slowdown. Keep the locomotive brakes released.

When the required speed reduction has been achieved, release the Automatic brake ensuring adverse slack changes do not occur as the brakes release.

11.7 Slowing: Maintaining Braking

Maintaining braking is when a heavy train is brought down a steep grade with a single air brake application. This is usually a minimum reduction or slightly heavier which, combined with about ¾ dynamic effort, is just enough to prevent acceleration. Maintaining braking results in a steady speed descending the grade but depends for its effectiveness on the brake valve maintaining brake pipe pressure against leakage. Without dynamic braking in operation, it is rarely possible to exactly balance the train. However, it may be possible to descend a grade while losing speed at a slow rate so that the foot is reached before a release is needed. Any release made while on the grade must be at the correct releasing speed. The locomotive brake may be lightly applied for short periods to assist in balancing.

Assuming that a 50 kPa reduction plus ¾ dynamic will prevent acceleration the brake pipe and all auxiliary reservoirs will be steady at 500 kPa and all brake cylinders will be at approximately 125kPa. As no release is necessary, the train cannot be placed in a situation where an emergency arises just after a release, for example when auxiliary reservoir pressures are low. This is one of the dangers with serial braking. With maintaining braking, auxiliary reservoir pressure is high; all brake cylinder pistons are out and blocks already on the wheels. A movement of the brake valve handle to emergency will result in very rapid action, should this be needed.

The most common uncertainty with this method is the ability of the blocks and tyres to withstand the heat generated by the long application. Tyre heat measurements have shown the temperatures are in fact less than those obtained with serial braking. With maintaining braking the only energy to be dissipated as heat is that needed to prevent acceleration. In serial braking this energy plus that absorbed in pulling down the speed, must be turned to heat.

This heats the blocks and tyres to a higher temperature. These do not cool to any great degree before the next application. It has been found however, that high block temperature does not result in lower braking effort.

Other objections raised are that leakage on individual wagons can cause loss of braking on those wagons. This does happen but the incidence of leakage is low. Generally, only about 5% will leak off in a short period. Whether leakage is from the brake cylinder or the auxiliary reservoir, after the brakes have been released, the auxiliary reservoir remains charged at the brake pipe pressure at that time. This pressure is available in an emergency. The type W triple valve automatically maintains against reasonable leakage from either the brake cylinder or auxiliary reservoir. The use of only about ¾ of the maximum dynamic effort allows sufficient to make up for any wagons which leak off.

Maintaining braking is not suitable for light trains or easy grades. Under these conditions even a minimum reduction with Dynamic brake will cause the train to slow down. If this is the case dynamic braking should be used and the air brake used to assist as required to control speed.

Maintaining braking is most suitable and should be used where the grade is at least three kilometres long, fairly steep and the train is heavily loaded.

> **CAUTION**
> Steep grades should not be descended under power.

It is important that the brake pipe leakage test, has been carried out and that leakage is not excessive.

Good road knowledge is important so that places where track conditions will cause an increase or decrease in speed can be anticipated well in advance.

The speed at which the grade is to be descended will be determined by the location and any local instructions.

Start down the grade with the locomotive in Dynamic brake and with amps at ½ to ¾ of maximum before the air brake is needed. As speed approaches the required figure, make a minimum reduction or more if experience shows that more is necessary.

While the air brake is taking effect it will probably be necessary to increase dynamic to maximum until the air brake takes hold. As speed settles reduce dynamic to ¾. Speed should now be at the required figure. Should the steep grade be approached by an easy falling one, go into dynamic well back and make a minimum reduction at a point which will bring the train on to the steep grade at the required speed.

If full dynamic is not sufficient to hold a steady speed the air reduction is not heavy enough. Make a further very light one. This is best done by gently tapping the brake valve handle towards service. By this means reductions of 5 kPa may be made. Watch the EP gauge, not the BP one.

Now reduce dynamic to ¾ and check that speed is steady. This must not be hurried. It is advisable to aim at a speed a little lower than maximum authorised to give more time to get the train set. The tendency is to make a further reduction of several kPa if the first one is not quite holding. This is certain to be too much and will slow the train down, requiring a release and recharge.

Once the train is set with air and ¾ dynamic, balancing acceleration due to grade, road knowledge will dictate the next moves.

If the train is approaching sharp curves which will have a retarding effect, ease dynamic as they are entered, so that they do not reduce the speed.

Should there be a steeper section, increase dynamic up to maximum so that speed does not rise unduly, and then ease dynamic when coming off it.

If there is an easing of the grade, approach it with dynamic eased well off so that speed is up to that permitted.

During the descent, if one or two wagons release, there will be a slight tendency to accelerate. A small increase in dynamic effort will balance this. If it is necessary to hold dynamic at maximum for any length of time to balance the speed, make a further reduction of 5 kPa.

Should dynamic fail during the descent, an immediate heavier air brake reduction must be made so that speed is held, or slowly reduced and serial braking introduced. On some grades special instructions in the Rolling Stock Restrictions section apply in the case of Dynamic brake failure.

Should there be a speed restriction on the grade; the appropriate action will depend on the circumstances. A restriction near the bottom of 25 km/h or higher can often be met by holding maximum dynamic well in advance and bringing speed down in that manner. Otherwise travel over the restriction in the normal manner and release when coming off at a low speed so that a full recharge is obtained. Then start maintaining braking.

When nearing the foot of a grade which has been descended on a minimum reduction, ease Dynamic brake to bring speed up to the maximum permitted. Increase the reduction to one of 70 kPa or more, decrease Dynamic brake again and release the air brake. The heavier reduction will assist the release at the rear of the train.

> **WARNING**
> If for any reason it becomes necessary to release brakes before the foot of the grade is reached, speed must be down to the correct release figure for the grade as set out in Section 1, Maximum Length of Trains.

11.8 Slowing: Light Ascending Grade

Employing Throttle Reduction

Normally power will already be applied and a slow-down may be accomplished by gradually reducing the throttle. Sufficient time should be provided between each throttle reduction to allow the train to remain stretched.

Employing Automatic Brake (slack stretched method)

If throttle reduction does not adequately retard the train, the Automatic brake should be used as follows:

- Make a minimum reduction of 50 kPa. Keep the locomotive brakes released.
- As the speed decreases the throttle should be reduced gradually to prevent an excessive increase in amperage
- Additional light brake pipe reductions of 15 to 25 kPa should be made as required. Keep the locomotive brakes released.
- A total brake pipe reduction of not less than 70 kPa should be made to avoid dragging brakes once the Automatic brake is released.
- When the required speed has been attained the brakes may be released if the train speed is high enough to allow the brakes to fully release before the train speed falls to about 20 km/h. The throttle may then be carefully advanced one notch at a time until the balance speed is again reached.
- Stopping the train is preferable to attempting a running release on long trains operating at low speeds, or trains which have been slowed with a heavy brake application.

11.9 Slowing: Heavy Ascending Grade

A slow-down may normally be accomplished by gradually reducing the throttle allowing the speed to decrease. Allow sufficient time between throttle reductions for the slack to adjust and remain stretched. When the required speed is reached, the throttle may be advanced as needed to maintain that speed.

> **CAUTION**
> Care should be taken when reapplying power following slow-downs on heavy grades to reduce the possibility of wheel slip and to avoid a heavy increase in drawgear forces that may cause train partings. The throttle should be advanced only one notch at a time. Pause sufficiently between increases to allow the amperage to stabilise before again increasing the throttle.

11.10 Slowing: Cresting Grade

In most cases trains on a cresting grade may be slowed by reducing the throttle while the train is on the ascending portion of the grade. When using this method throttle reductions on the grade will slow the train without causing unnecessary or severe bunching of slack.

If the majority of the train's tonnage has crested the grade, it will frequently be necessary to use the Automatic brake to slow the train. Make a minimum reduction of 50 kPa. Keep the locomotive brakes released. Make additional light reductions of 15 to 25 kPa as needed to slow the train, continuing to keep the locomotive brakes released. The Automatic brake should not be released until a 70 kPa total brake Pipe reduction has been made.

⚠ **CAUTION**

When slowing using the Automatic brakes, care must be taken to ensure the combined forces caused by the locomotive tractive effort, grade, and brake resistance of the train do not combine to cause a train parting at the crest of the grade.

11.11 Slowing: Descending Grade

Often, slow-downs can be accomplished with only the Dynamic brake.

Employing Dynamic and Automatic Brake

With the train operating in the bunched mode and the maximum Dynamic brake utilised, make a minimum brake pipe reduction of 50 kPa to supplement the Dynamic brake. Make the minimum reduction at a sufficient distance to ensure the train slows safely before reaching that point. Additional light Automatic brake applications of 15 to 25 kPa may be made to further supplement the Dynamic brake. Prior to releasing the Automatic brake, a total brake reduction of not less than 70 kPa should be made to avoid dragging brakes.

When the speed reduction has been achieved, the Automatic brake should be released while the Dynamic brake remains applied to keep the slack bunched during the release of the Automatic brakes throughout the train. After the train brakes have been released, Dynamic brake modulation can be used to maintain the required speed.

⚠ **CAUTION**

Supplementing the Dynamic brake with an Automatic brake application will normally require lowering the Dynamic brake setting because each wagon will add additional braking force to that already being generated by the Dynamic brake.

This will cause the train to slow and stop unless dynamic braking is reduced by an amount equal to the total braking of the Automatic brake application.

Use of the Automatic brake in this manner in conjunction with the Dynamic brake distributes braking and in-train forces throughout the train rather than concentrating them at the rear of the locomotive.

Supplementing dynamic braking with an Automatic brake application should be considered whenever Dynamic brakes are used in curved terrain.

11.12 Serial Braking

Descending Gradients – Serial Braking to be Used Only When Dynamic Brake is Not Operating

Make a minimum reduction of 50 kPa. When this has taken effect increase the reduction to 70 kPa. This ensures that sufficient brake cylinder pressure is applied to take a firm hold of the train. The locomotive brake should be kept off while the train brake is applied. This gives some reserve braking always available. It is permissible during serial braking for speed to come down only very slowly.

It must not rise when the Automatic Brake is applied.

When speed is down to the correct releasing speed as stipulated in the Rolling Stock restrictions for steep gradients, release and recharge.

Just before the release, the locomotive brake may be lightly applied to lengthen the period of recharge. The locomotive brake is effective at low speeds. However, once speed has risen towards 30 km/h, it should be gradually released so that the train is running free before each application is made with the locomotive brake held off.

At each application following recharging, speed must be pulled down promptly. If this takes greater reductions each time, then the auxiliary reservoirs are not being recharged to a satisfactory figure. Stop by making an emergency application if necessary and recharge. Hold the train on the locomotive brake and handbrakes if necessary, and do not move off until the train is fully charged.

Proceed down the grade bringing speed much lower than previously at each release. When releasing at the correct speed with a very long train, the speed will fall very low before acceleration starts. Do not attempt to speed the train up. The low speed is essential with long trains to gain adequate time for recharge.

Serial Braking – Process Change Descending Grades

The serial braking advantages include:

- With the locomotives brake applied up to 100 kPa the actual brake pipe reductions on the train vehicles will be of a smaller size:
  - which means less friction on the wagons
  - less heat on the brake block
  - better recharge times
- More air available to stop trains if necessary, which makes for a safer operation.
- Currently suppression of the vigilance device occurs when the locomotive brake cylinder pressure exceeds 160 kPa, this will be increased to a 200 kPa threshold so that trains travelling down a grade do not have the vigilance suppressed.

11.13 Slowing: Undulating Grade Country

The manner in which the train will be slowed will depend on the method of train handling in effect prior to initiating the slow-down and will also depend on the characteristics of the grade. If in power, refer to **11. Slowing the Train.**

Employing Throttle Manipulation

If handling the train with throttle manipulation only, an attempt should be made to accomplish the slow-down by taking advantage of the retarding effect of the ascending grades. This is done by using lower throttle settings when the train is on the ascending portion of the grade.

> **CAUTION**
> Untimely throttle reductions will result in severe slack action. The throttle should be carefully manipulated through the undulations. The throttle should be advanced when the locomotive is on the ascending portion of a grade and reduced when the locomotive is on the descending portion of the grade.

Employing Automatic Brake and Throttle Manipulation

If the Automatic brake is not already applied as the train enters the grade, a minimum reduction of 50 kPa should be made when the locomotive begins to descend the first grade. Keep the locomotive brakes released.

If necessary, additional light reductions may be made. Continue to keep the locomotive brakes released. Considerable care must be taken when making running releases in this type of terrain and it may be necessary to stop the train before releasing the Automatic brake in order to avoid severe slack changes.

Employing Dynamic Brake

If it is necessary to slow a train using the Dynamic brake, it is recommended that the train be stopped before the Dynamic brake is released unless the entire train has negotiated the undulations.

In general, the Dynamic brake should not be used to slow a train in undulating grade territory. The train should generally be slowed before reaching the area so that it may negotiate it at the required speed.

12. Stopping

12.1 Graduated Brake Application

Generally, trains are stopped with one graduated brake application. A minimum reduction of 50 kPa should be made to ensure gradual, positive response from the brake equipment.

Additional brake pipe reductions can be made as required allowing enough time between each reduction for the wagon's brake and drawgear slack to become adjusted.

Depending on the train consist it may be necessary to allow the locomotive brakes to apply on the second and following reductions.

12.2 Preventing Run-ins

When using the Automatic brake valve to reduce brake pipe pressure, the Independent brake valve handle should be depressed to prevent applying the locomotive brakes. If the locomotive brakes are not maintained in the released condition, severe run-in can occur.

12.3 Stopping a Train

While using sufficient throttle to maintain a slack stretched condition, make an initial brake pipe reduction of 50 kPa. Keep the locomotive brakes released.

After the Automatic brake application becomes effective throughout the train, gradually reduce the throttle one notch at a time to control train speed and in-train forces.

Make a final brake pipe reduction just prior to stopping. Allow the locomotive brakes to apply with this final reduction.

Place the throttle in idle and apply the Independent brake after the train comes to a stop.

> **CAUTION**
> While this method of stopping applies to most trains, special consideration should be given in the cases of trains with head end heavy, or tail end heavy make-up. When stopping a head end heavy train, the lighter rear end will tend to slow more rapidly and thus cause the head end to run-out at the stop and create high draft forces.

In this case it is better to allow the locomotive brakes to apply when making the final reduction in order to reduce these draft forces and to prevent a parting in the rear portion of the train.

For a train with a tail end heavy make-up, the wagons at the front of the train will slow more quickly than those at the rear. Consequently, throttle manipulation with the locomotive brakes kept released when making the final reduction will keep the head end stretched as much as possible to prevent the build-up of excessive buff forces as the heavier tail end wagons tend to run into the front end.

12.4 Low Speed Stops

Train brake power is higher at low speeds than at higher speeds. When a train is moving slowly, it is quite possible for the leading end to have stopped while the rear end is still in motion.

To overcome this situation, a stretched stop should be made so that the train will remain stretched out, thus preventing the run-in from the rear end, until the brakes on the rear end have set. Throttle should be notch 4 maximum.

Under these circumstances, avoid the use of excessive throttle as the train comes to a stop, otherwise drawgear failure may occur.

General Steps

- Open the throttle to the required position before making the brake application.
- Watch the ammeter closely as speed reduces to avoid excessive drawgear strain.
- Close the throttle gradually to prevent the ammeter from rising.
- Do not allow the locomotive brake cylinder pressure to build up during the stop.

12.5 Stopping Procedure using Both Air Brake and Dynamic Brake

Plan the Stop Well in Advance

Engage the Dynamic brake and increase braking effort slowly until the required rate of retardation is obtained.

The automatic air brake should be applied with a minimum reduction and further reductions in brake pipe pressure stepped at time intervals of not less than 20 seconds.

From normal speeds this is identical with the methods described for slowing down, as far as the stretched braking application is concerned. When power is used amperage should be reduced as the speed falls to prevent overloading the drawgear. Just before the stop, power should be right off, and the Independent brake applied at the instant of stopping.

If Dynamic brake is in use, the slack is in and must be held that way against the pull of any empty wagons at the rear. A minimum reduction must be made first, followed by a series of further light reductions as soon as the preceding one takes effect.

When speed falls below 15 km/h, apply 100kPa independent air brake to the locomotive.

Just prior to the stop, make a further automatic reduction timed so that the brake valve is still exhausting as the train stops. This will prevent the bunched slack running out again. Dynamic brake should be dropped out just prior to the stop, and the locomotive brake cylinder pressure increased to between 200 - 250 kPa.

12.6 Stopping on a Cresting Grade

If possible, avoid stopping on a cresting grade. A stop on a cresting grade can lead to excessive drawgear stress on the wagon at the crest when attempting to restart the train, especially when the train is being operated at the drawgear limit.

If a stop must be accomplished, do so in accordance with the stopping procedure for light or heavy descending grades.

When stopping on a cresting grade, always make sure that the brake application used to stop the train is the lightest possible, thus reducing drawgear forces particularly on the apex of the crest. Increase the brake pipe reduction to a stabilised 100 kPa after stopping and before initiating the brake release.

12.7 Stopping on a Hump

When a stop is to be made on a hump, care must be taken that the brake application does not result in severe run-in with the trailing portion of the ascending grade running into the lead portion with fully set brakes. To avoid harsh slack bunching on the hump, the train should be stopped with the throttle opened far enough to maintain the train in a stretched condition.

1. Have the throttle opened to the required position before making the brake application.
2. Monitor the ammeter closely as speed reduces.
3. Endeavour to time the brake application so that the stop is made while brake pipe pressure is still exhausting at the brake valve and while the brake pipe gauge is still falling.
4. Do not allow locomotive brake cylinder pressure to build up before the train has stopped.
5. When stopping on a hump, always make sure that the brake application used to stop the train is the lightest possible, thus reducing drawgear forces. Increase the brake pipe reduction to 100 kPa after stopping and before initiating the brake release.

12.8 Stopping on Ascending Grade

Throttle Reduction

The throttle should be gradually reduced to idle, and the train allowed to slow down under natural resistance.

When nearing the point of a stop, make a minimum reduction to complete the stop and prevent train slack from running out. Increase the brake pipe reduction to 100 kPa after stopping and before initiating the brake release.

The locomotive Independent brakes should be applied immediately the train comes to a stop.

Use of the Automatic Brake

1. While under power, make a minimum reduction of 50 kPa. Keep the locomotive brakes released.
2. As the speed decreases the throttle should be reduced gradually to prevent an increase in amperage.
3. Make additional light reductions of 15 to 25 kPa as required. Keep the locomotive brakes released.
4. About 60 metres from stopping, apply sand so that the locomotive stops on sand. As the stop is completed, apply the Independent brake and reduce the throttle to idle. Sand must be shut off when the locomotive stops.

A total reduction of not less than 100 kPa should normally be made to avoid dragging brakes on release of the Automatic brake.

12.9 Stopping on Descending Grade

Use of the Automatic Brake Only – Dynamic Brake not Available

While using sufficient throttle to maintain slack stretched condition, make a minimum reduction of 50 kPa. Keep the locomotive brakes released.

Additional light reductions of 15 to 25 kPa should be made as needed to stop. Keep the locomotive brakes released and allow sufficient time between reductions for slack to adjust.

A final reduction should be made just prior to stopping, allowing the locomotive brakes to apply. The brake pipe should be exhausting from the final reduction and the Independent brake should be applied as the stop is completed. Sand should be used as required.

CAUTION
While this method of stopping applies to most trains, special consideration should be given in the cases of trains with head end heavy or tail end heavy make-up.

In the case of stopping a head end heavy train, the lighter rear end will tend to slow more rapidly and cause the head end to run-out at the stop and create high draft forces.

In this case it is better to allow the locomotive brakes to apply when making the second and subsequent reductions to reduce these draft forces and prevent a parting in the rear portion of the train.

For a train with tail end heavy make-up, the wagons at the front of the train will slow more quickly than those at the rear.

Consequently, throttle manipulation should be used, and the locomotive brake kept released when making the final reduction to keep the head end stretched and prevent excessive buff forces as the heavier rear wagons run into the front end.

12.10 Risk Triggered Commentary and Stabilised Approach

A stabilised approach process coupled with the Operator’s non-technical skills training programme has been proven to reduce SPAD likelihood.

Active monitoring of the operational environment is critical to achieving and maintaining situational awareness.

To achieve situational awareness the Operator needs to:

- anticipate signal locations through accurate recall of route knowledge
- visually detect signals, noticeboards, Track Warrant limits etc., and
- make decisions on braking response to ensure the train is brought to a safe stop

Key braking principles:

- plan ahead to provide sufficient time for full BP recharge
- apply braking in stages
- increase braking in increments to stop 50 metres before the signal / board location
- use full service if approach gate speed is, or will be, exceeded
- use emergency if in doubt and when approach cannot be stabilised

Train Crossings – Clearing the main line at the rear:

The initial stop must be 50 metres before the signal / board.

If required to pull in clear of the signal at the rear, the following process must be applied:

1. apply full Independent brake
2. apply the loco park brake (DL & EF class locomotives where fitted)
3. release the train's brakes and obtain a full brake pipe recharge before movement commences
4. identify a secondary stopping point of 2 bogies before the signal with the final stopping point being no closer than 1 bogie length before the signal
5. advance the train at a speed not exceeding walking pace and stop the train at the identified secondary stop point

If the train length prevents the berthing train from being able to safely clear the main line at the rear, then the Train Controller must be contacted for direction.

The Stabilised Approach Gates and RTCD Procedure for freight trains and locomotive hauled passenger services are shown in Figures 1 and 2

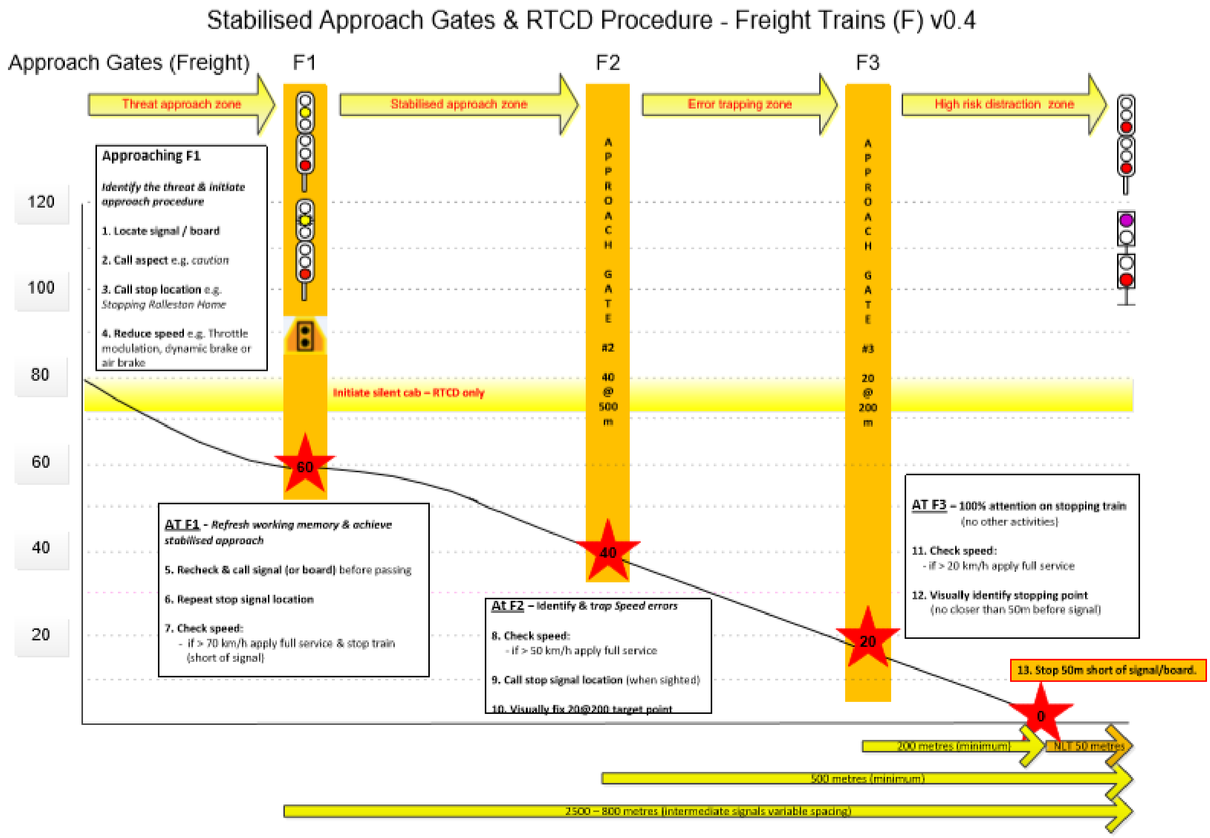


Figure 1

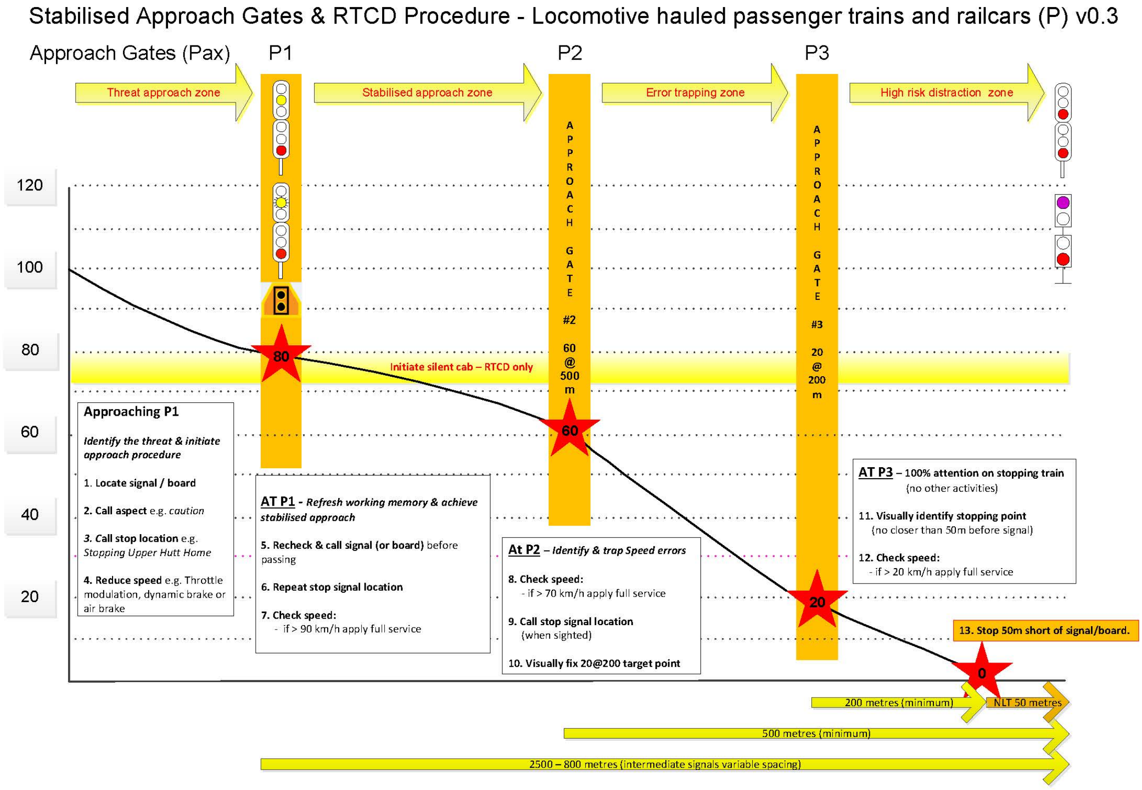


Figure 2

13. Reversing

The following factors must be considered when making a reversing movement:

- total tonnage being reversed
- train length
- type of locomotive
- grade conditions
- curves
- turnouts
- level crossings

Starting a Train

All trains start easier if the wagons are started one at a time. Train slack must be stretched on stopping if each wagon is to be started separately in the reversing movement.

Buff Forces

During a reversing movement, high buff forces are concentrated directly behind the locomotive. Locomotives can develop enough force to cause jack-knifing in the train.

Ammeter Readings

When reversing, the throttle should be used sparingly to limit ammeter current. The ammeter can be used as a good guide of the total starting force of the locomotive.

Power Requirements to Start the Train

More power is required to start a long train than a short train and heavy trains require a higher starting effort than light trains. Reversing a train standing on a descending grade will require a much greater starting effort than one standing on an ascending grade.

13.1 Starting a Reversing Movement on a Level Grade (Train Stretched)

Allow time for train brakes to release before applying power. Wait at least 60 seconds after the flowmeter has settled.

Use only enough power to start the locomotives and keep them moving very slowly until the entire train has started to move.

Observe the ammeter and note slight variations in current as slack closes and all wagons are moving uniformly. Watch for any unusual changes in amperage which may be the result of train buckling. If this occurs, apply the automatic train brake and close the throttle.

13.2 Stopping a Reversing Movement

1. Make a minimum reduction while light power is applied.
2. Keep the locomotive brakes released.
3. Continue to reduce brake pipe pressure, pausing between reductions to allow time for the previous reduction to take effect. Allow the locomotive's brakes to apply automatically providing the brake cylinder pressure is kept low. Avoid heavy reductions in brake pipe pressure.
4. Keep light power applied to prevent the end of the train from running out, particularly following the first brake application. This could result in drawgear failure towards the front of the train as speed reduces.
5. As the train comes to a stop with brake pipe pressure exhausting from the brake valve, allow the locomotive brakes to apply then close the throttle.
6. Apply the Independent brake.

13.3 Starting a Reversing Movement Down an Ascending Grade

When reversing down an ascending grade, the train should be held stationary with the train brakes applied until ready to start the reversing movement. The brake application should be a minimum reduction, or just heavy enough to hold the train on the grade.

Release the Automatic brake, then 60 seconds after the flowmeter has settled, gradually release the Independent brake allowing the weight of the train to start the movement.

13.4 Stopping a Reversing Movement Down an Ascending Grade

Make an initial reduction in brake pipe pressure of 50 kPa and permit the locomotive brakes to apply with the train brakes.

After allowing sufficient time for the brake application to become effective, additional reductions may be made to stop the train. Avoid heavy reductions when stopping a reversing movement.

13.5 Drawgear Failure While Reversing

When too much power is applied, bunch up occurs compressing the drawgear slack and the train will surge away from the locomotive as the slack decompresses.

When heavy brake applications are used, brakes on the wagons near the locomotives apply first and with force. Those at the other end of the train, which have not yet effectively applied, run free and cause a surge away from the locomotive.

Ensure All Brakes Have Released Before Moving in Reverse

1. Apply power gradually. Do not use any more power than required to smoothly start the train.
2. Stop with the brake pipe pressure still exhausting at the brake valve and the brake pipe gauge needle still falling.

3. After stopping, further reduce the brake pipe pressure and apply the Independent brakes before releasing the automatic train brakes.
4. Ensure a total brake pipe reduction of at least 100 kPa is made before releasing.

14. Passenger Services

In handling a passenger train the conventional issue of slack control is reduced considerably due to the reduced slack that exists in the yoke, and free slack within each carriage knuckle. Most rough handling occurs at low speeds and extreme care must be used to avoid heavy brake applications at the lower speeds.

Most passenger trains consist of only a few vehicles. In this case the locomotive brake must be allowed to apply. If this is not done, the few vehicles on the train will be asked to do an undue share of the braking.

If the locomotive's weight is 80 tonnes and if there are only four vehicles on the train, each vehicle would need to brake 20 tonnes of locomotive as well as itself. In this scenario very heavy reductions would be needed, resulting in high brake block wear, rough stops, and damage to wheelsets with scaling and flats. With such short trains the locomotive must do some of the braking either with the air brake or with dynamic braking where this can be used.

Long-distance passenger services may also include a buffet or dining vehicle. With these trains it is essential that they be handled in such a way that jolts are avoided.

On all trains, curve speed must not be exceeded. Where curves are known to be rough, speed must be adjusted accordingly. Such curves must be reported. When approaching curves or speed restrictions which require a considerable speed reduction, it is important that enough brake effort is developed soon enough to reduce the speed down in time.

Throttle Usage

Keeping the throttle wide open whilst braking to keep the train stretched is unnecessary for braking a train of high-class passenger equipment. It is a waste of fuel, and an abuse of equipment to attempt to accelerate and decelerate at the same time. If excessive slack exists in the train, it may be necessary to use the throttle while braking to keep the train stretched. Observe the ammeter and gradually reduce power to prevent current increasing while the train brakes are applying.

Brake Applications While Running a Passenger Train

The first Automatic brake valve reduction is 50 kPa (minimum), the throttle must not be above notch 1.

The locomotive Independent brake application can be partially bled off during the initial brake application, this action will ensure the locomotive remains part of the braking consist.

After equalisation has occurred the throttle must be closed.

The locomotive Independent brake must not be bled off during any further Automatic brake applications but must be allowed to apply in tandem with the reduction.

14.1 Stopping on Level Track

Passenger trains of more than six vehicles should be kept stretched at all times. Holding the locomotive brake off at the first reduction with a little power will keep the slack out. Then shutting power off and allowing the locomotive brake to apply at the second and following reductions will keep slack out but not stretched so tightly that the rear cars move up after they stop. All passenger trains should have the locomotive brake applied when braking pressures are low at the instant of the stop to prevent the locomotive running back onto the vehicles. The point of release requires some judgement but if a reduction of 100 kPa or greater has been made, the speed at release should rarely be below 15 km/h and on level track may be 20 km/h. If the reduction is less than 100 kPa, then there is less brake cylinder pressure to exhaust and so the speed when moving the brake valve to release must be less.

If the release is too late the train will stop with a jolt and as the brakes release with the train stopped, the drawgear being heavily in tension will pull the rear vehicles ahead and cause a jerk at the rear when starting. Release at the correct speed allows the drawgear to adjust to a lightly stretched condition before coming to rest.

Apply the Independent brake as the locomotive stops.

Rough stops are caused by not taking hold of the train soon enough to be able to make the stop with low brake cylinder pressure.

This will often result in a final reduction being made at a point when in fact a release should be made if a smooth stop is to result.

When a stop location is displayed on a platform, it is a guide so that the vehicles will stop reasonably close to the same place on each occasion. It is better to stop short or over-run a little, than to stop with a jolt.

Two-Application Stop

The two-application method may be used. In this case a fairly heavy application is made to pull speed down to about 30 km/h then release with locomotive brake off and power off, or at a minimum amount. A light automatic application will then stop the train at the required point and is not released until the train is almost stopped.

14.2 Stopping Using Air Brake / Dynamic Brake

Approaching a stopping point the train should be taken hold of in good time. While not essential, the best control is obtained by setting the locomotive up into Dynamic brake after making the Automatic brake reduction. Pull down speed so that a release of the Air brake can be made at about 40 km/h with some distance still to go. Then running along the platform with speed being reduced by Dynamic braking until approaching the stopping point with a light reduction, then stop the train at the correct point. A similar technique can be used without using Dynamic braking, but control is not as positive.

Only a minimum reduction will be necessary for the stop, and this need not be released until the train has almost stopped. If a heavy reduction has been made which results in about 300 kPa in the brake cylinders, the release will need to be made when speed is above 15 km/h, or the air will not escape from the cylinders in time to bring pressure down.

Descending Grades

On descending grades dynamic braking should be used to hold the train. This gives a much smoother descent of the grade than frequent application and release of the air brake.

When stopping on descending grades, release the brake to give a smooth stop and immediately reapply the Automatic brake as soon as the train is at rest, so the slack does not run-in again.

This will hold the train stretched during the stop. The brake should be released when it is seen that the Train Manager is about to give the signal to start.

14.3 Starting on Level Track

Starting passenger trains present little difficulty. Long-distance passenger services all have automatic couplers which have a lesser amount of slack and if the Dynamic brake has been used, this small amount of slack will be in. The locomotive must move off very slowly holding the Independent brake on lightly if necessary to prevent the locomotive tugging out with a jerk.

Once the train is moving, the controller can be advanced as circumstances demand, the only limitation being the rate of current rise and its upper limit.

For trains departing Otira for Arthurs Pass, refer to **KiwiRail Local Network Instructions L6.1 Otira Tunnel 5. Passenger Train Instructions**, as special requirements are necessary.

14.4 Drifting

With these trains, as in fact with all trains, it is an advantage to drift unless about to stop or go into Dynamic brake.

14.5 Graduated Release Brakes

Operation

Graduated release brakes are fitted to some classes of passenger cars.

This system allows a gradual increase in brake pipe pressure. It removes the need to fully release and then re-apply braking.

When the brake handle is moved towards release the system reduces the braking on each car and the locomotive in proportion to the rise in brake pipe pressure.

The brakes will not fully release until the brake handle has been restored to the release / running position.

To operate the graduated brake the locomotive brake valve must be in the Pass position.

Locomotive Engineers who have not been certified to operate trains in graduated release mode must ensure the locomotive brake valve cut-out cock is set in the cut-in or freight position and operate the train in direct release.

Platform Stops

This technique is intended to protect against platform overruns resulting from:

- excessive train speed approaching platforms
- a loss of braking effort through excessive wheel / brake block heat – known as brake fade.

To achieve a controlled stop at station platforms the following technique must be applied:

1. The braking sequence must ensure the train is travelling at approximately 40 km/h, when the locomotive reaches the beginning of the station platform. The speed at platform entry can be varied to compensate for gradient provided the stop is achieved in a controlled and conservative manner
2. Wait at least 10 seconds before reaching the point at where the speed is to be reduced
3. Reduce power to idle
4. Make an initial 50 kPa reduction to set up the brake rigging and blocks
5. At the points where the speed is to be reduced make a second reduction sufficient to bring train speed down to approximately 40 km/h entering the platform
6. Dependent on platform length or gradient, increase and decrease brake pipe pressure by manipulating the Automatic brake valve handle in the service zone to drift the train to a smooth stop

NOTE

As a guide, 100 kPa brake cylinder pressure at the instant of stopping ensures a smooth stop.

Should it be evident that the train is going to stop short

- If driving from the locomotive:

   1. Move the Automatic brake valve handle to the minimum position
   2. If this is insufficient, depress the Independent brake valve handle and release sufficient brake cylinder pressure on the locomotive to allow further run on
   3. As a last resort apply notch 1 or 2 power to assist in running on
   4. Just prior to the desired stopping point re-apply the Independent brake to approximately 100 kPa
- If power is used:
  - It must be no more than notch 1 or 2
  - The Automatic brake valve handle must be in the minimum position with little or no brake cylinder pressure on the locomotive
- If a release is required:

   1. Ensure speed is sufficiently low to allow time for the brakes to be applied
   2. Move the Automatic brake valve handle back to the running / release position
   3. Re-apply the brake to stop at the correct point

14.6 Dynamic Brake on Long Descending Grades

Transitioning from a Stretched State to a Bunched State on a Passenger Train

Using Dynamic brake on a passenger train:

1. Make a minimum Automatic brake application, bleeding off the Independent Brake Valve
2. Engage Dynamic brake and slowly increase resistance to gather up all of the slack in the drawgear throughout the consist against the minimum Automatic brake application
3. The Automatic brake application can then be released, with the passenger train descending the grade on Dynamic brake and light Automatic brake applications as required

Transitioning from a Bunched state to a Stretched State on a Passenger Train

Suspending Dynamic brake on a passenger train:

1. As the train nears the bottom of the grade using Dynamic Brake the Locomotive Engineer is to apply 50kPa of Independent Brake Valve, this will hold the loco snug against the leading vehicle
2. Dynamic brake can then be suspended, using light Independent brake to hold the train during the transition from bunched to a stretched state
3. After waiting for the amps to diminish, the throttle can be moved in power (N1, then N2) against the 50 kPa of Independent brake. This is to control the amount of pull the loco will have on the drawgear as amps build and the train moves from a bunched state to a stretched state
4. When all buffers are stretched, the Independent brake is moved to the release position

15. Power and Prolonged Braking

Power braking is where the train brakes are applied while the locomotive is still in power. This is wasteful because more braking effort is required to slow the vehicle than if the power was shut off. This generates more heat from friction and causes the wheels to heat up excessively.

Stretched braking is power braking and is necessary for successful train handling. Stretched braking does not result in overheating of the wheels if applied correctly.

Prolonged moderate to heavy braking is also wasteful as it is usually the result of entering the top of a grade at too high a speed.

Both power braking and prolonged heavy braking can result in overheated tyres and solid disc wheels. These braking situations have resulted in:

- loose tyres - in several cases, the tyre came off, resulting in derailment
- solid disc wheels becoming loose on the axle and moving, resulting in derailment
- cracked tyres

- spalled treads
- burned out brake blocks and shoes (Class 30 - burned out brake unit)

Locomotives hauling passenger trains must not use power braking above notch 2.

In the case of light locomotives, it is best to crest the top of the grade at a minimum speed and at idle throttle, and then let the speed build to a safe maximum. Safe maximum will be dictated by the next curve. Use a short but moderately heavy brake application to pull the speed down well below the curve speed, releasing the brake preferably before the curve and drift around the curve, utilising curve resistance to control speed. Continue to use this procedure until the bottom of the grade is reached.

16. Assisting Locomotives on Trains

16.1 Starting and Stopping Trains

Special care must be used when starting and stopping a train worked with one or more assisting locomotives to prevent the breaking of couplings. The Locomotive Engineer of the leading locomotive is responsible for the working of the automatic air brake.

16.2 Observance of Signals and Instructions

The Locomotive Engineer of any assisting locomotive must follow the directions given by the Locomotive Engineer of the leading locomotive and must also observe all signals affecting the safety of the line and working of the trains.

The Locomotive Engineer of an assisting locomotive must be advised of any instructions in connection with the passing of fixed signals at stop.

16.3 Applying Power

When there is a locomotive assisting in the front of a train, the leading locomotive must have the train moving or the couplings stretched before power is applied in the second locomotive.

When there is a locomotive assisting in the rear, power must be applied to that locomotive when the train is started so that the weight of the locomotive in the rear is not taken by the train draw gear. At the same time care must be taken to ensure that the rear locomotive does not suddenly bunch the train, as this may cause damage to vehicles, or derailment.

17. Breakdown Procedures

Locomotive Engineers must know and implement, without delay, requirements of Rules relating to accidents, failures and obstructions.

- All spare equipment carried on a locomotive must be maintained in good condition and correctly located so that it is available for immediate use. Locomotive Engineers must report shortages in this equipment immediately they are detected.
- In the event of a breakdown, it should be remembered that other personnel are also concerned with protection of the train, the clearing of the line, avoidance of unnecessary delays, and working the disabled unit to its destination.
- When a breakdown occurs on the main line, opposing and possibly following trains may be held up and every effort should be made to reach a siding as soon as possible. Only sufficient repairs to allow the train or locomotive to be run slowly to the nearest siding should be carried out on the main line. Repairs necessary to allow the locomotive to run to its destination should be deferred until a siding is reached. Any broken parts should be taken to the depot.
- Full particulars of the breakdown must be reported to the OIC, the Train Controller and Linehaul Operations Manager / Marshalling Yard Team Leader stating whether additional locomotive power, relief personnel or breakdown equipment is required. Assistance should be called for when it is clear that repairs cannot be performed by the locomotive crew and a serious delay is inevitable.
- Before disconnecting a locomotive from a train all necessary steps must be taken for the safety of the train, including the application of handbrakes on rolling stock.

> **CAUTION**
> When handbrakes have been applied after a full air brake application and the train locomotive is detached or shutdown, the handbrakes will be difficult to release unless the air brake system is recharged and the air brake applied prior to releasing the handbrakes.

- Prepare the locomotive for towing if it is not in a fit condition to run under its own power.
- Locomotive Engineers must keep themselves familiar with each type of locomotive on which they work and know the location and use of fuses, cut out cocks, circuit breakers, and switches.

17.1 Fault Location

As many faults can be quickly rectified when found, Locomotive Engineers should carefully follow the sequences given so that time is not wasted in random searching.

It must be clearly understood that Locomotive Engineers are not expected to interfere with equipment of which they have little or no knowledge. This might cause damage and prolong the delay. Locomotive Engineers are only expected to carry out checks and rectify faults which are within their scope.

When a fault does occur, always ensure that all simple causes, such as a blown fuse, tripped circuit breaker, or a switch turned off have been checked first.

When altering the position of any isolating cocks, always ensure that the correct cock is operated, and always check that the cock is turned the correct way. On occasions wrong cocks have been altered so that, instead of clearing a fault, another one has occurred.

Faults occur at different times such as when starting the engine, when moving after a brief stop, or when notching up again in power after using dynamic braking. They can also occur when operating normally along the road, after wheel slip has taken place or after coupling two locomotives together.

Always remember what was done, or what happened just before the fault occurred as this may have been the cause, for example turning the wrong switch off.

When changing fuses always ensure that the new fuse has the correct rating marked on it and test the fuse first before inserting it.

On occasions a blown fuse has been replaced by a defective fuse and the fault has remained. This causes additional unnecessary delays while other tests are made to locate the fault.

After changing a fuse always book the blown fuse to be rewired in the Loco 54D repair book. Identify it as defective and do not put it back where the spare fuses are kept.

> **NOTE**
> All information about defects must be logged in the Loco 54D repair book. Providing maximum information / details about defects gives Rolling Stock Representatives the best opportunity to identify the fault.

17.2 Road Overspeed Device

These are used to protect the traction motors from over-speeding or to prevent the traction motors from operating at speeds which are outside stable commutating conditions.

Road overspeed devices are not fitted to prevent the locomotive from exceeding line or curve speed limits. That is the responsibility of the Locomotive Engineer, who must also ensure that the locomotive does not exceed the published maximum line speed.

Under such conditions, the road overspeed device should never be tripped.

17.3 Ground Relay

This relay is connected to the high voltage traction circuits and is designed to trip when a ground occurs. This fault may be due to an insulation breakdown or a traction motor flashover. When the relay trips, the traction power is cut off, an alarm bell or buzzer sounds, an indicator lamp (or flag) is displayed, and the engine goes to idle.

The following is the standard action to be taken on all locomotives except DFT and DC locomotives after a ground relay fault.

Throttle to Idle, reset ground relay on affected unit, and notch up carefully.

Record the following in the Loco 54D repair book:

- amperage
- speed
- throttle position
- wheel slip and if wheel slip light illuminated (or buzzer if fitted in place of the light)
- location or grade
- tonnage
- weather
- single, double or triple unit
- position in consist
- condition of track
- type of track, such as points, road crossing, curves, track lubricators etc.
- any relative remarks, such as number of ground relays, fire etc.

Subsequent ground relay trips can be treated as above, but if persistent, operate in a lower notch, in accordance with the paragraph below.

Ground relay trips do not disable the locomotive until one of the following conditions are reached:

- four ground relay trips occur within 15 minutes. In some locomotives, automatic ground relay reset is locked out after four trips within 12 minutes. On locomotives fitted with a motor cut-out switch, that procedure should now be adopted
- persistent wheel slip after any ground relay trip
- ground relay trips with obvious fire in a traction motor or electrical cabinet
- otherwise carry on to destination. All ground relay trips will be investigated when the locomotive is fully serviced by Rolling Stock Representatives.

17.4 Dynamic Brake Warning Relay or Over Voltage Relay

If the warning light for the Dynamic Brake Warning Relay (BWR) or Over Voltage Relay (OVR) illuminates, reduce dynamic braking until the light extinguishes. The normal control systems on the locomotive should prevent excessive Dynamic brake currents being generated, so if the BWR (or OVR) light illuminates, there may be a problem in the control system or inside the Dynamic brake grids.

Record the following details in the Loco 54 repair book:

- Dynamic brake current
- road speed
- numbers of the other locomotives if running in multiple

This information is required as the brake warning light is trainlined and the warning may have come from any of the locomotives in the consist. Consequently, Rolling Stock Representatives must be able to examine and test all locomotives involved.

17.5 General Faults

Also refer to fault finding flow charts and guides in each locomotive code supplement.

- Mechanical faults, such as broken or leaking fuel and oil lines, which are obvious, and are usually found by visual inspection.
- Air faults, such as lack of air pressure to operate certain devices. These are often caused by isolating cocks being incorrectly positioned. Often the device can be checked by operating its magnet valve by hand. This can be done by pushing down the small button placed on top of the magnet valve. Air pressure gauges on some locomotives show the air pressures in different reservoirs and these can be quickly checked.
- Electrical faults, such as blown fuses, tripped circuit breakers, incorrect positioning of switches.

Fuses can be tested and changed. Circuit breakers can be reset, and switches carefully positioned.

What the problem was, and the action taken must be recorded the Loco 54D repair book. This will help the Rolling Stock Representative in locating and repairing the problem.

18. Recharge Charts

The following charts are provided to assist in train handling. All timings are from the movement of the automatic air brake handle to release.

The first chart gives the time taken for the rear wagons auxiliary reservoir to reach 530 kPa for bogie wagon trains, for various lengths and following various brake pipe reductions. 530 kPa in the auxiliary reservoir is sufficient to give a fully effective brake compared to a fully charged auxiliary reservoir.

The second chart indicates the start of brake cylinder release on the last vehicle, but it should be realised that 30 seconds will be added to this time for the brake blocks to come off the wheels.

The third chart will enable the Locomotive Engineer to use the end of train monitor to indicate when the rear-most vehicle auxiliary reservoir has reached 530 kPa. To use this method, the timings given on the chart are taken from when the brake pipe pressure at the rear reaches 530 kPa.

18.1 Rear Auxiliary Recharge All Bogie Wagon Train

Table 1. Time for rear vehicle's auxiliary reservoir to reach 530 kPa

Train Length Metres	Brake Pipe Reduction	Minimum Reduction	75 kPa	100 kPa	125 kPa	150 kPa	Full Service
150		7 secs	16 secs	27 secs	31 secs	32 secs	34 secs
300		7 secs	20 secs	31 secs	34 secs	37 secs	39 secs
450		13 secs	27 secs	38 secs	43 secs	47 secs	51 secs
600		23 secs	37 secs	53 secs	1 min	1m 4s	1m 9s
750		25 secs	47 secs	1m 6s	1 m 22s	1m 27s	1m 31s
900		40 secs	1m 8s	1 min 38s	1m 59s	1m 57s	2m 8s
1000		43 secs	1m 32s	2 min	2m 20s	2m 28s	2m 32s

18.2 Rear Vehicle Brake Cylinder Release All Bogie Wagon Train

Table 2. Time for rear vehicle's auxiliary reservoir to reach 530 kPa

Train Length Metres	Brake Pipe Reduction	Minimum Reduction	75 kPa	100 kPa	125 kPa	150 kPa	Full Service
150		2 secs	3 secs	2 secs	2 secs	3 secs	4 secs
300		3 secs	3 secs	3 secs	4 secs	5 secs	7 secs
450		4 secs	3 secs	4 secs	6 secs	9 secs	11 secs
600		8 secs	5 secs	5 secs	11 secs	14 secs	16 secs
750		13 secs	7 secs	7 secs	9 secs	14 secs	19 secs
900		16 secs	10 secs	8 secs	17 secs	22 secs	25 secs
1000		26 secs	26 secs	10 secs	19 secs	34 secs	44 secs

18.3 Delay of Auxiliary Reservoir Behind Brake Pipe All Bogie Wagon Train

Table 3. Time for rear vehicle's auxiliary reservoir to reach 530 kPa

Train Length Metres	Brake Pipe Reduction	Minimum Reduction	75 kPa	100 kPa	125 kPa	150 kPa	Full Service
150		5 secs	13 secs	23 secs	26 secs	25 secs	27 secs
300		14 secs	19 secs	18 secs	17 secs	18 secs	18 secs
450		1 sec	4 secs	3 secs	3 secs	4 secs	4 secs
600		0	0	0	0	0	0
750		0	0	0	0	0	0
900		0	0	0	0	0	0
1000		0	0	0	0	0	0