Truck Transportation

Program 5791

Possibilities of truck systems

860-313

Student's name:_____

Competency 2

TABLE OF CONTENTS

Skill 2

Equipment specifics

Lesson Objectives:
- Understand the skill elements
- Recognize the main brands of trucks used
- Associate the different types of vehicles with the category of goods transported

Skill Statement: Identify the capabilities of the systems on a semi-trailer truck.

Skill 2 Introduction

1. Distinguish the characteristics of a truck.
2. LEARN ABOUT POWER UNIT CAPABILITIES
3. 3 SELECT MOTION TRANSMISSION SYSTEM MODES OF USE
4. Select performance optimization methods for the braking system.
5. Understand the capabilities and limitations of suspension and steering systems and wheels

Description

This module includes practical knowledge that is designed to ensure you are able to identify the major features of the vehicle you will be driving for the first time. You must take this into account to optimize system performance and solve any problems that may arise.

Evaluation

The test is presented in the form of a questionnaire.

From the data sheets of the systems of a semi-trailer truck, you must recognize the capabilities and limitations of the various systems according to their specifications.

Using real-life scenarios, you will be asked to identify optimal use of systems and determine potential problems and steps to be taken.

The duration of the test is two hours.

It is important that you make connections between the concepts you have learned in class and those you have learned in practice.
You are responsible for your learning. You must notify the teacher of your progress.
The success of your journey depends on your interest and involvement.

Heavy vehicle terminology

Heavy vehicles: Vehicles with a gross vehicle weight rating (GVWR) of 4,500 kg or more.

The GVWR is defined as the weight of a vehicle plus the maximum load it can carry according to the manufacturer's specifications.

Truck Classes: Trucks are classified according to their gross vehicle weight ratings (GVWR).

class 3	4,536 kg to 6,350 kg
class 4	6,351 kg to 7,256 kg
class 5	7,257 kg to 8,834 kg
class 6	8,844 kg to 11,791 kg
class 7	11,792 kg to 14,966 kg
class 8	14,967 kg and over

Truck brands: There are 7 manufacturers of Class 7 and 8 trucks in North America.

Freightliner, Western Star and Sterling (discontinued in 2008) are subsidiaries of Daimler.

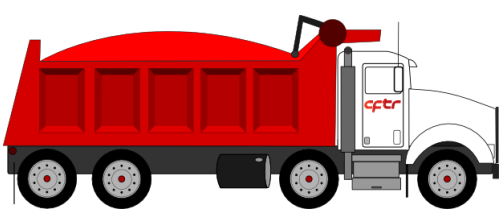
Peterbilt and Kenworth are divisions of Paccar.

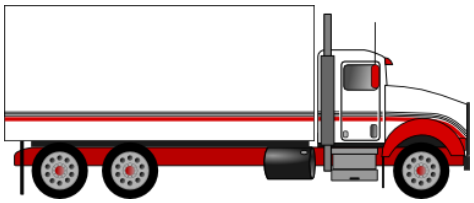
Volvo Truck and Mack are separate companies within the AB Volvo Group.

Navistar is an international truck manufacturer.

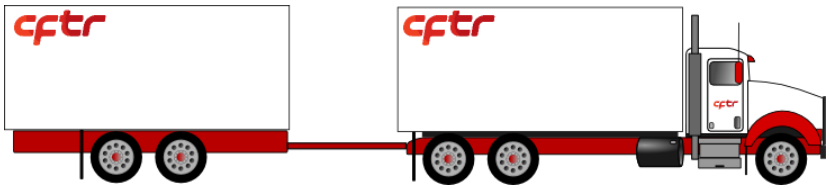
Types of trucks

Straight truck

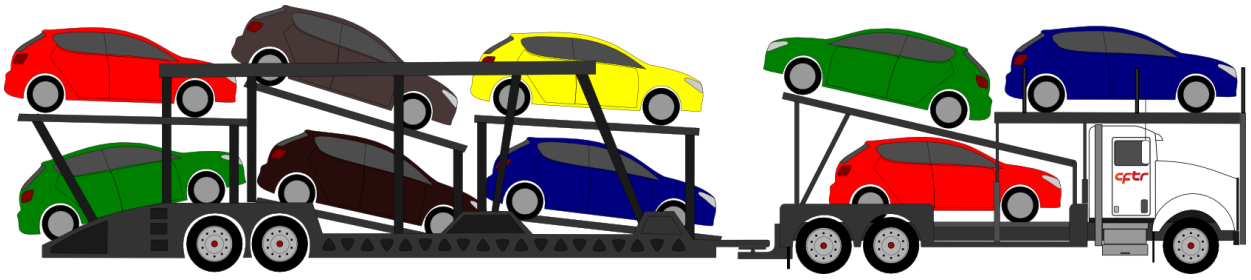


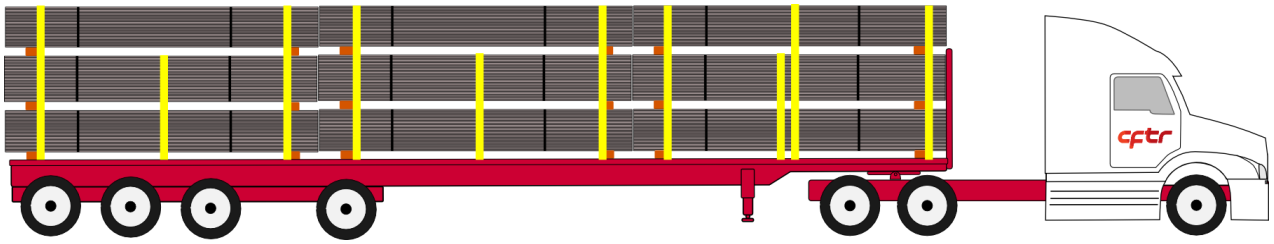


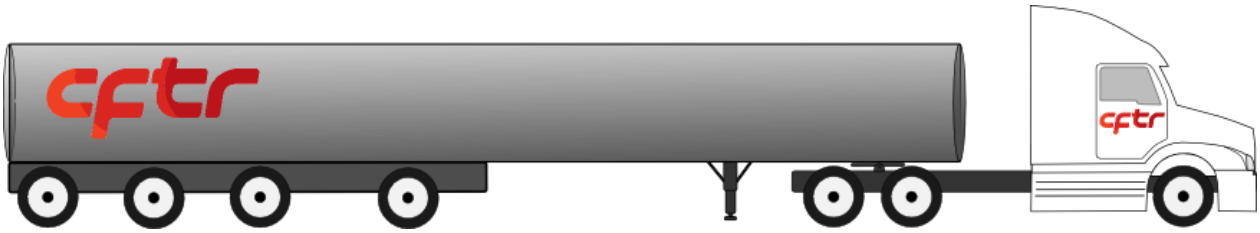
Carrier and trailer

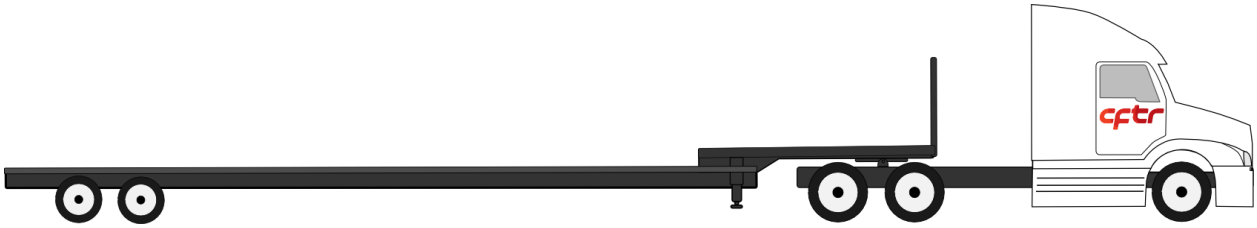


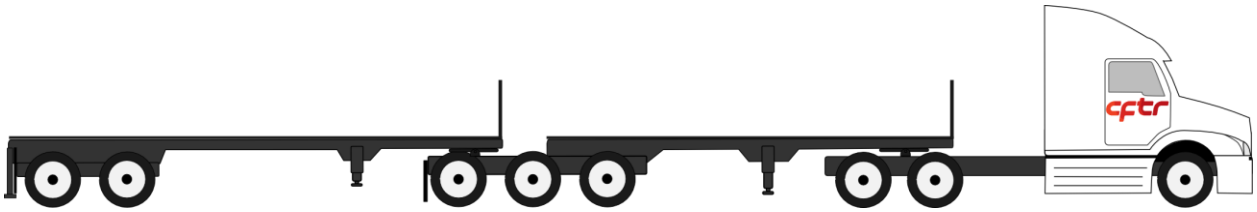
Tractor with semi-trailer



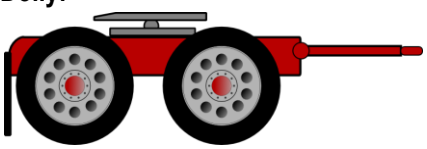








Dolly:



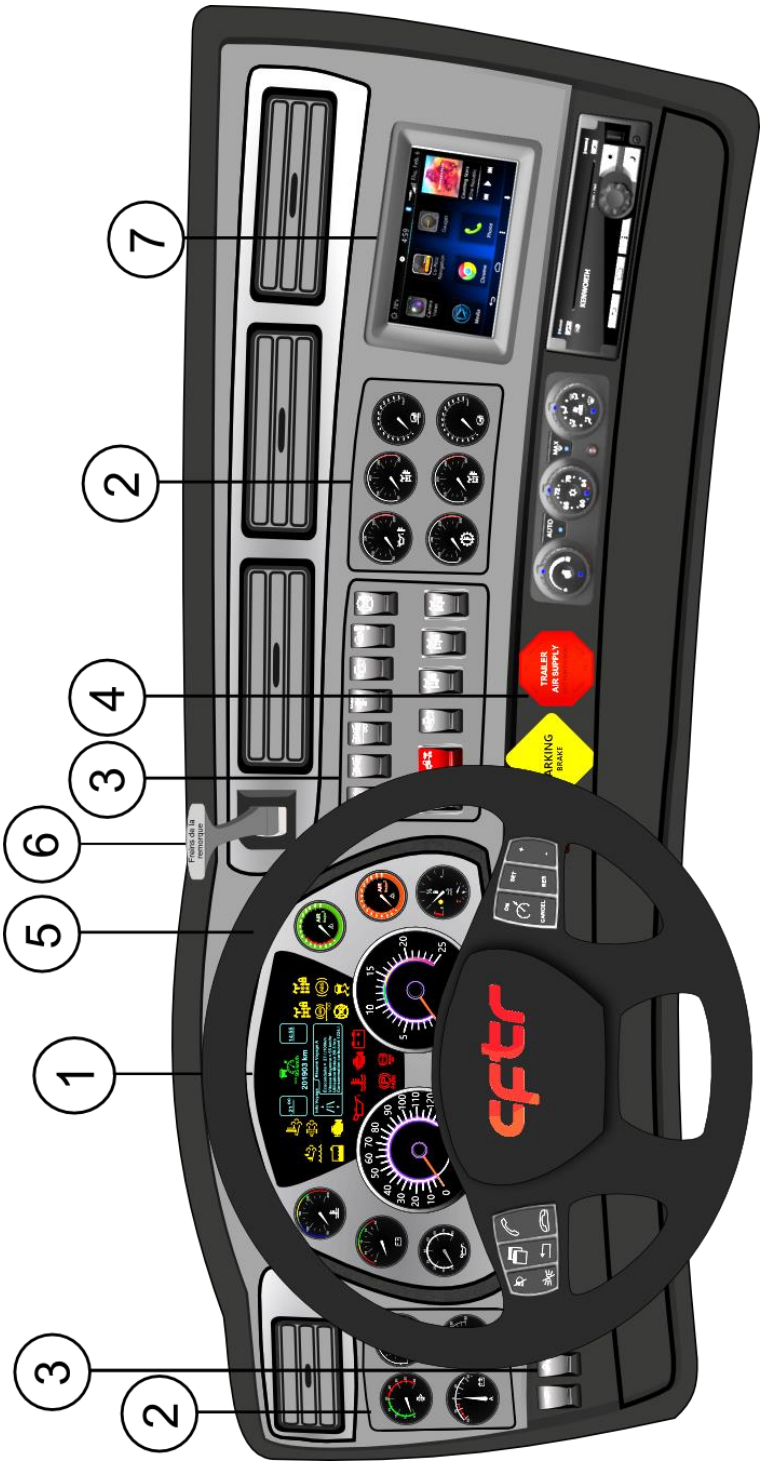
Skill 2

The dashboard

Lesson Objective:

- Recognize and locate the main items on a dashboard according to the type of truck

The dashboard



TERMINOLOGY

Warning buzzer: An audible device that alerts the driver, for example, in the event of a cooling system failure or to consult the multifunction display.

Low Air Pressure Buzzer: An audible device that alerts the driver to abnormally low air pressure.

Vacuum Gauge: Pressure gauge used to measure the vacuum in an enclosed space. Used to measure the level of clogging of the air filter. Other term: vacuum meter.

Air Intake Restriction Indicator: An instrument mounted on the housing of an air filter with a colored diaphragm that moves inside a glass window to indicate the clogged condition of the filter element.

Pressure gauge: A dial device used to measure the pressure contained in a closed space.

Air pressure gauge: Pressure gauge used to measure the pressure of the compressed air present in the various circuits of a pneumatic braking system.

Tachometer: A dial device that continuously indicates the engine's rotational speed. Another term: RPM.

Malfunction Indicator Light: A light that illuminates when the engine temperature rises or the oil pressure drops. Another term: warning indicator.

Low air pressure indicator: Indicator that lights up when there is an abnormal drop in compressed air pressure.

The dashboard is much more than just a display of instruments placed randomly on a screen. The dashboard is above all the key element of a proactive management. To do this, it is necessary to know how to interpret and control the instruments it provides to the driver.

(2.1.2)

1- The centre panel

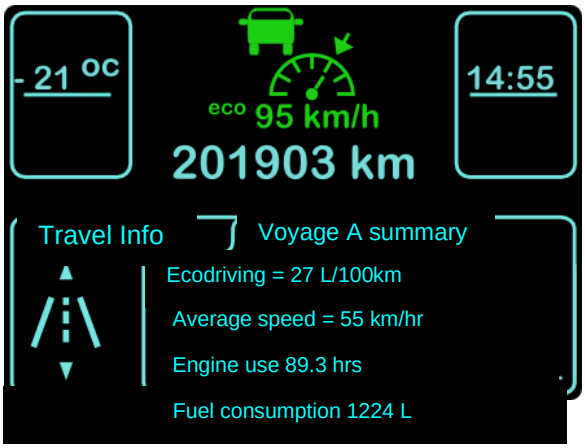
Strategically located, this panel contains the following vital vehicle indicators.

- The following dials:
  - oil pressure
  - engine temperature;
  - voltmeter;
  - air pressure;
  - fuel;
  - tachometer;
  - speedometer;
  - regeneration;
  - exhaust fluid.

- The light warnings: these are in the form of pictograms. There are two main colours. First, yellow means to pay special attention to the indicator. The vehicle can continue to be driven even if the yellow indicator remains on. Red indicates an imminent risk; driving the vehicle should stop as soon as possible.

(2.1.2)

- Multifunction display: This electronic display screen provides the operator with important information such as fuel consumption, emission control system status or the driving aid used.



2- The left and right panels

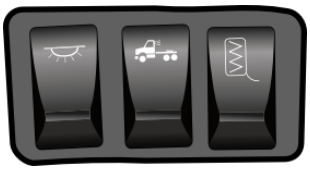
These panels include dials offered as an option with the purchase of the vehicle. Although optional, these dials provide information that is useful for operating the vehicle.

(2.1.2)

3- The switches

The trucks are equipped with several switches that can be grouped in several batches on the dashboard.

Some switches are equipped with a from protection against accidental engagement.



4- The yellow and red buttons

The parking brake button. Button in form of yellow diamond, it applies parking of the truck.

The trailer air supply and parking brake button.

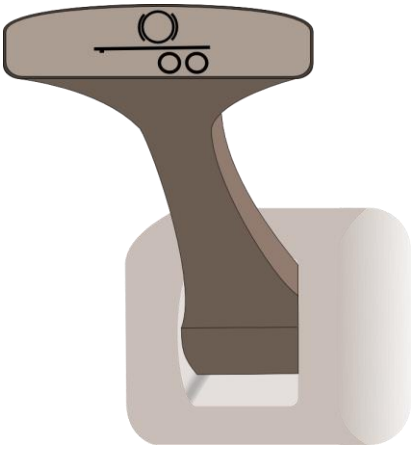
Red hexagonal button, it supplies air to the trailer when the button is pushed and applies the parking brake when the button is pulled.

5- Multifunction steering wheel controls

Modern trucks are all equipped with various steering wheel controls. There is no protocol that determines which switches are to be installed there. It is therefore up to the driver to take readings of the dashboard, the steering wheel and the various consoles and

(2.1.2)

levers of the vehicle in order to locate the controls.



6- The the semi-trailer handbrake lever

This applies the service brake on the trailer manually. It allows, among other things, to check its proper functioning. In addition, it can be used to check push rod travel, brake lights and service brake air leaks.

7- The multifunctional screen

The optional multifunction display provides the driver with access to a variety of instruments. These instruments vary from one manufacturer to another, but are similar. Here are some examples.

- GPS;
- cameras;
- additional dials;
- audio system;
- Bluetooth connections;
- Etc.

(2.1.2)

(2.1.2)

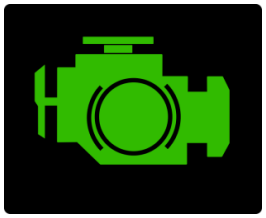
Pictograms

Pictograms are used to communicate general information regardless of the language spoken by the viewer. It is notably used in road signs, but also in the dashboards of trucks.

Truck manufacturers are attempting to standardize pictograms across the industry, but for some functions, pictograms differ from manufacturer to manufacturer.

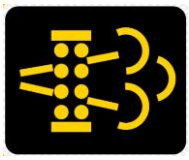
It is the driver's job to become familiar with the pictograms on their vehicle. Information on this can be found in the driver's manual.

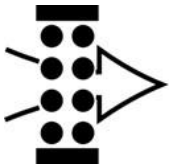
Examples of pictograms



(2.1.2)

Examples of pictograms





(2.1.2)

Skill 2

Engines (makes, models and specifications)

Lesson Objectives:
- Identify engine makes and models
- Know the methods for researching the individual capabilities and capacities of an engine

Engine Manufacturers: Related Truck Models
(Only models currently in production are shown)

X12, X15
They can be found in all truck brands. Cummins is an independent engine manufacturer. That's why its large-displacement engine is offered in most truck brands according to their customers' needs.

Engine manufacturers	Engine models	Trucks in which they are found
DETROIT	DD13; DD15; DD16	Freightliner; Western Star
INTERNATIONAL	A26	International
Mack	MP-8	Mack
PACCAR	MX-13	Kenworth; Peterbilt
VOLVO	D13	Volvo

Material Safety Data Sheet

IMPORTANT ENGINE INFORMATION	Engine No.	PACCAR MX-__ MANUFACTURED BY PACCAR Inc.

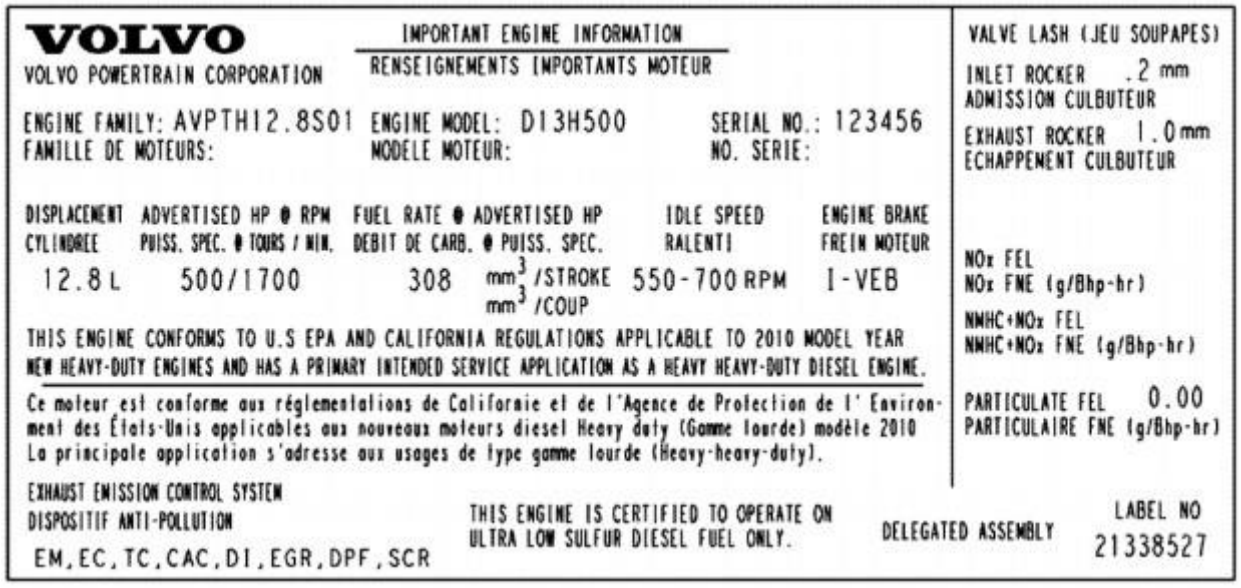
Fuel Rate at Adv. HP	XXX.X	mm³/stroke	Idle Speed	XXX - XXX	RPM
Max. Rated Speed	**2200**	RPM	Valve Lash (mm)	X.XX int.	X.XX exh.
Max. Advert. kW/hp	**320/430**	kW/hp	Max. Initial Timing		Electronic
Family	EPCRH12.9M01		Date of Mfg.	Displacement	12.9 L.

This engine conforms to U.S. EPA regulations and is applicable to 2014 Model Year New Heavy-Duty Engines.
This Engine has a primary intended service application as a heavy heavy-duty engine. This engine is certified to operate on ultra-low sulfur diesel fuel only. Exhaust Emission Control System: DDI, TC, CAC, ECM, EGR-C, OC, SCR-U, PTOX

1952313

STD	EPA
NOx	X.XX
PM	X.XX

Relevant information; **maximum** speed: 2200 rpm; **rated** power: 430 HP; 12.9 L (displacement refers to model MX-13).



VOLVO
VOLVO POWERTRAIN CORPORATION

IMPORTANT ENGINE INFORMATION
RENSEIGNEMENTS IMPORTANTS MOTEUR

ENGINE FAMILY: AVPTH12.8S01 (FAMILLE DE MOTEURS:) ENGINE MODEL: D13H500 (MODELE MOTEUR:) SERIAL NO.: 123456 (NO. SERIE:)

DISPLACEMENT CYLINDREE	ADVERTISED HP @ RPM PUISS. SPEC. @ TOURS / MIN.	FUEL RATE @ ADVERTISED HP DEBIT DE CARB. @ PUISS. SPEC.	IDLE SPEED RALENTI	ENGINE BRAKE FREIN MOTEUR
12.8 L	500/1700	308 mm³/STROKE mm³/COUP	550-700 RPM	I-VEB

THIS ENGINE CONFORMS TO U.S EPA AND CALIFORNIA REGULATIONS APPLICABLE TO 2010 MODEL YEAR NEW HEAVY-DUTY ENGINES AND HAS A PRIMARY INTENDED SERVICE APPLICATION AS A HEAVY HEAVY-DUTY DIESEL ENGINE.

Ce moteur est conforme aux réglementations de Californie et de l'Agence de Protection de l'Environnement des États-Unis applicables aux nouveaux moteurs diesel Heavy duty (Gamme lourde) modèle 2010
La principale application s'adresse aux usages de type gamme lourde (Heavy-heavy-duty).

EXHAUST EMISSION CONTROL SYSTEM
DISPOSITIF ANTI-POLLUTION
EM, EC, TC, CAC, DI, EGR, DPF, SCR

THIS ENGINE IS CERTIFIED TO OPERATE ON ULTRA LOW SULFUR DIESEL FUEL ONLY.

DELEGATED ASSEMBLY

LABEL NO 21338527

VALVE LASH (JEU SOUPAPES)
INLET ROCKER .2 mm
ADMISSION CULBUTEUR
EXHAUST ROCKER 1.0 mm
ECHAPPEMENT CULBUTEUR

NOx FEL
NOx FNE (g/Bhp-hr)
NMHC+NOx FEL
NMHC+NOx FNE (g/Bhp-hr)
PARTICULATE FEL 0.00
PARTICULAIRE FNE (g/Bhp-hr)

Relevant information; power specification (rated): 500 HP @ 1700 rpm; 12.8 L (displacement refers to model D13).

Basic information such as the model and the advertised power can help us find out the maximum torque force and its associated engine speed. These specifications presented in the form of curves are essential in the operation of a heavy vehicle.

Skill 2

The cooling system

Lesson Objective:
- Recognize the role of system components and ways to optimize its performance

The cooling system has three distinct functions:

1- To ensure the rapid heating of the engine;
2- Maintain a constant operating temperature;
3- Avoid overheating the motor.

In addition, the cooling system will make it possible to heat the interior of the truck.

Associated pictogram:

Indicator lights:

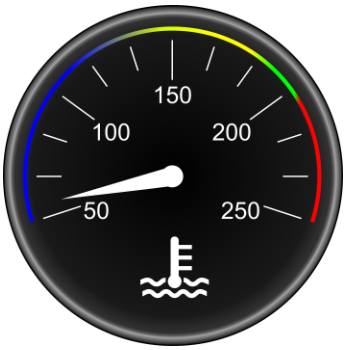
Low liquid level

(Yellow)

Motor overheating

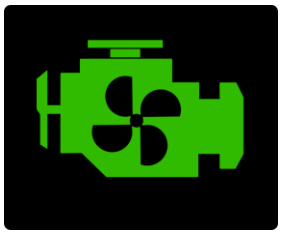
(Red)

Measures to be taken in case of overheating:
Stop the vehicle; transmission in neutral; activate the manual fan if possible; RPM at about 1100 for 2 to 3 minutes; check oil pressure, etc.



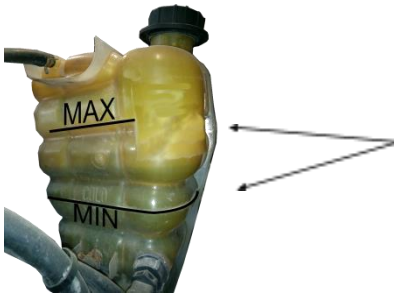
Minimum and maximum engine temperatures vary slightly from manufacturer to manufacturer.
Generally, the normal operating temperature will be indicated in green, while red indicates an overheating level.
The load imposed on the motor must be progressive according to its temperature. It's like the muscles in the human body: the more intense the exercise, the more you must warm them up.
Generally, the temperature is between 180 °F and 205 °F.

Some trucks are equipped with a switch to manually turn on the fan.



Indicates that the fan is in function.

During the inspection, I must ensure that:



The coolant level is adequate. **Before adding to it, always follow the manufacturer's recommendations.** This information can be found near the cooling system or in the manufacturer's manual.

(2.2.2)

The radiator is secure and in good condition as well as the fan and hoses.

The interior heater is directly connected to the rest of the vehicle's cooling system.
A sweet smell or consistently wet interior windows may indicate a break in the vehicle's heating system.

(2.2.2)

During the inspection, I must ensure that:

The air conditioning compressor is secure and in good condition.

The air conditioning condenser appears to be in good condition.

The visual condition of the collars, fittings and belt.

(2.2.2)

Skill 2

Engine lubrication system

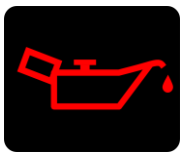
Lesson Objective:
- Recognize the main components of the system and the means to optimize its performance

Main function of the lubrication system: To reduce the resistance caused by friction of moving parts to increase the engine's efficiency.

Associated pictograms:

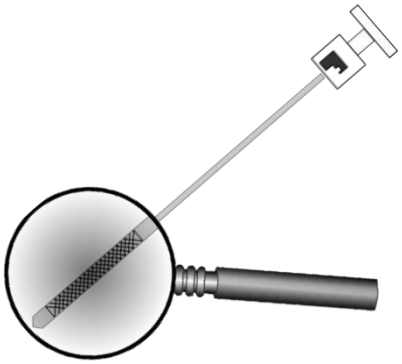
Notes:

Danger light :



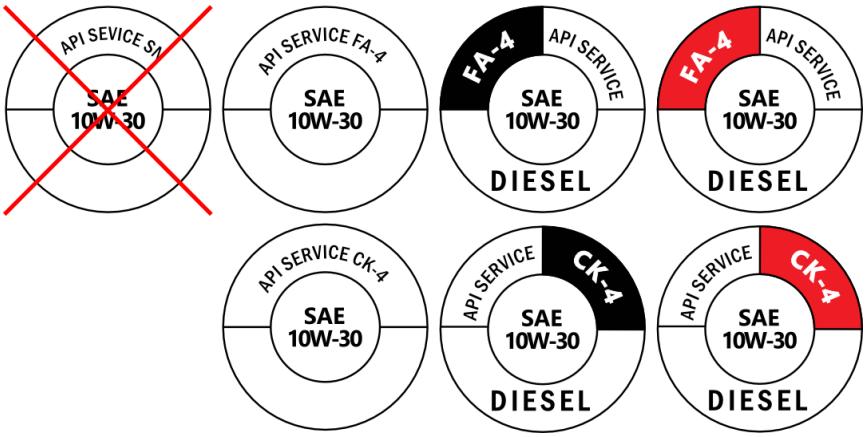
Checking the oil level

The oil level must be maintained above the minimum index without ever exceeding the maximum. Approximately four liters separate these two benchmarks.



What type of oil does my API CK-4 or API FA-4 engine run on?

The CK-4 oil grade is suitable for trucks manufactured prior to 2016 and also for late model trucks.



However, other trucks with advanced technology engines (2017 and up) are compatible with CK-4 oils but will perform better with FA-4 oils. Be careful, because this last category is not compatible with all engines.

Grades

There are different grades of oil; 10w30 is an example. This multigrade oil has long been used for automotive engines. In recent years, this industry has been reducing the viscosity (flow resistance) of oils to reduce fuel consumption, among other things, hence the appearance of grades 5w30, 5w20 and 0w20. The truck engine industry has also followed suit. The 15w40 grade of oil, exclusively reserved for diesel engines, has started to be replaced by the 10w30 grade for diesel. **It is therefore extremely important not to use 10w30 gasoline engine oil when topping up your diesel engine.**

So, how do I find my way around to make sure I'm adding the right product?

1. Look for signs on the engine (filler cap, label, etc.) that identify the type of oil required.
2. Refer to the engine owner's manual.
3. Ask the mechanic.

Notes:

Minimum and maximum oil pressures for engines vary from manufacturer to manufacturer. The driver's manual should be referred to for accuracy. At these normal operating temperatures, the idle pressure should be at least 15 psi. At cruising speed, approximately 1300 rpm, it should be between 40 psi and 60 psi.

N. B. When starting in cold weather, the oil pressure may increase significantly momentarily.

The oil temperature should remain between 200°F and 250°F.

Notes:

Skill 2

The electrical system

Lesson Objective:

- Recognize the role of system components and ways to optimize its performance

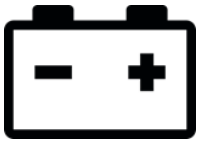
The electrical system of the trucks is composed of two main elements: the alternator and the batteries.

The role of the alternator is to generate current as soon as the vehicle is started to produce electricity to charge the batteries. In addition, it provides the power necessary for the proper operation of the vehicle's electrical components.

The batteries have a double function: first, to provide the electrical power necessary for the starter motor to start the engine, and second, to supply the truck's electrical components in case of alternator failure.

Notes:

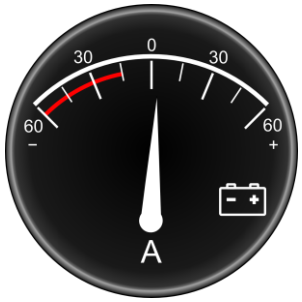
Associated pictogram:



Indicator light:

The alternator provides the current in the charging system. The voltage on the voltmeter should be between 12 and 14 volts.

An ammeter (optional dial) is used to measure the intensity of an electric current. Its normal reading is slightly above zero. If there is a high current demand, the reading will increase on the positive side. However, if the alternator is no longer working, the reading will be on the negative side.



During the inspection, I must ensure that the belt and connections are in good condition.

Notes:

As for the batteries, the inspection is done by the mechanic during the periodic inspections.

Red (positive +) and black (negative -) terminals are usually located near the motor on the left side of the spar. These terminals will be used to recharge the batteries (overvoltage) in case of failure.

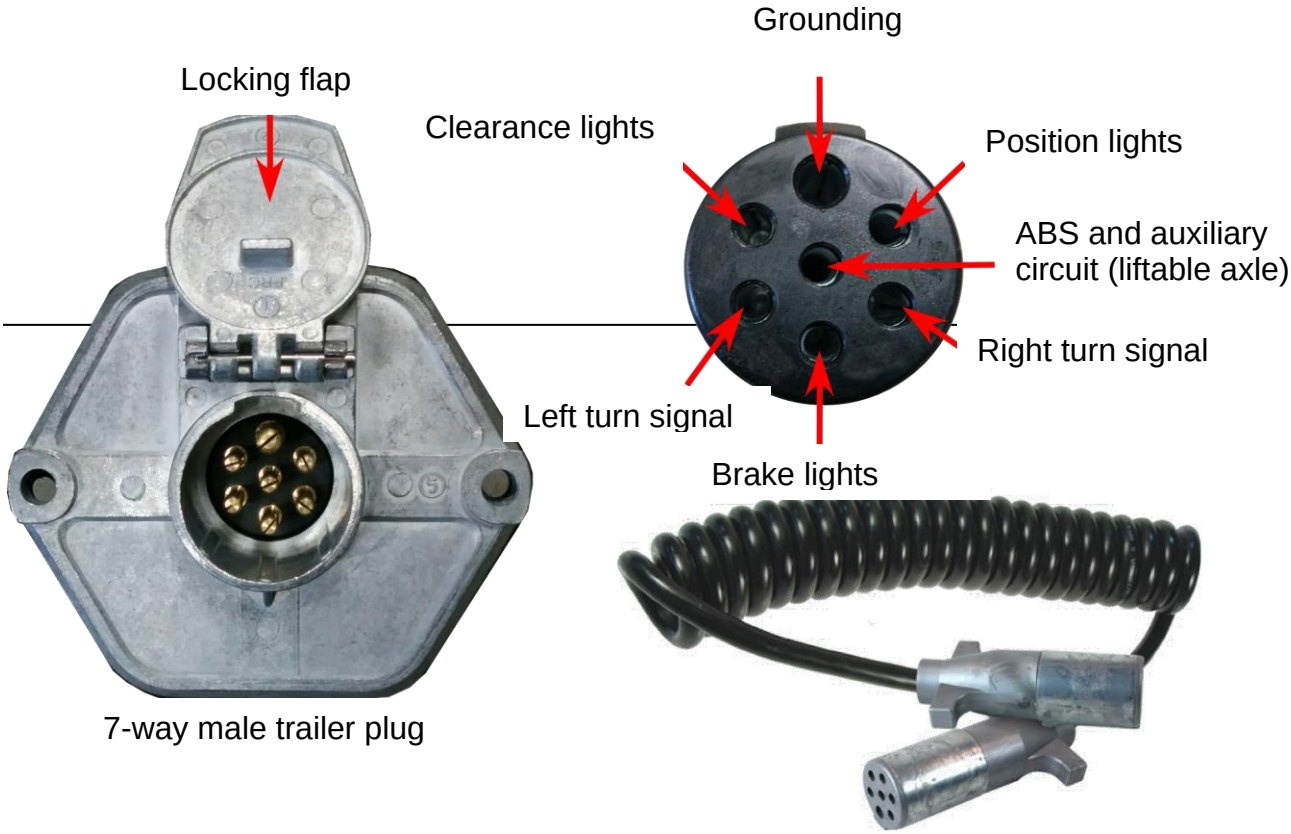
Kill switch for battery protection

This switch isolates the batteries from any source of drainage when the vehicle is not in use. Installed as an option on some trucks, this switch must be set to "ON" for it to work.

Solar panels

The use of solar panels provides energy to the batteries. Thus, during prolonged shutdowns, among other things, this equipment is designed to ensure an adequate load on the electrical system.

Trailer electrical connection



Skill 2

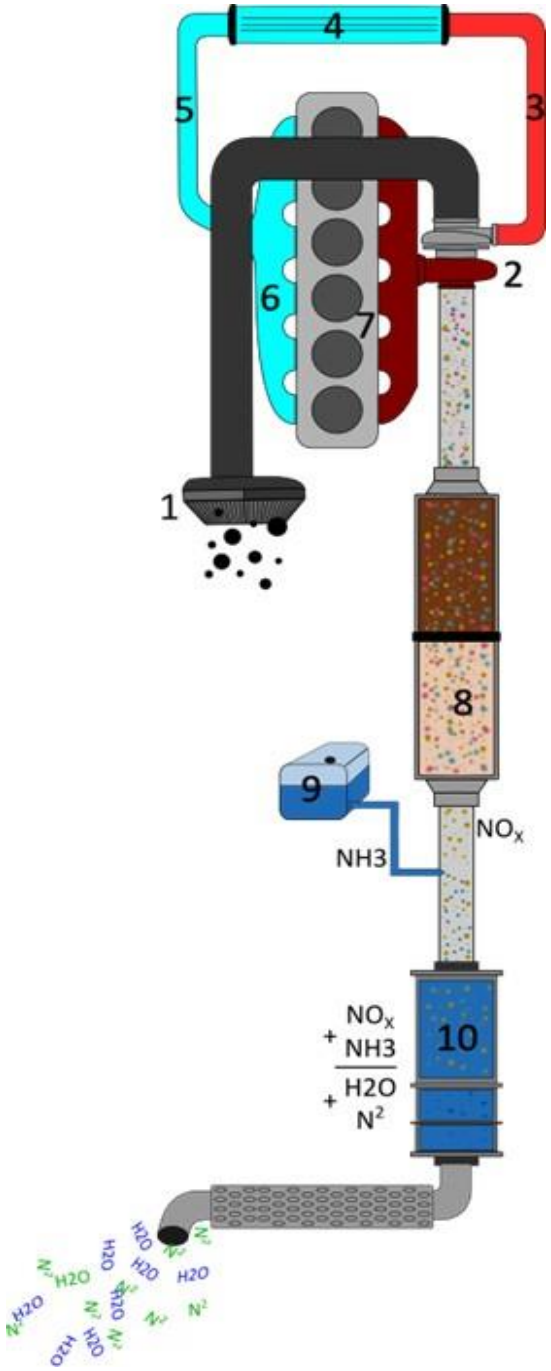
Air intake and exhaust systems

Lesson Objective:

- Recognize the role of system components and ways to optimize its performance

Air intake and exhaust system

(overview)



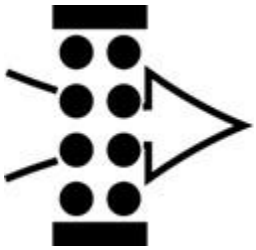
Notes:

System components and their function

Notes:

The air filter (1) protects the engine by trapping impurities in the air stream entering the engine.

Associated pictogram:



Under normal operating conditions, the reading could indicate 10 to 15 inches H_2O. When the indicator shows above 20 inches H_2O, this means that the air is dirty. This one must so be cleaned or changed. The performance of the engine will decrease if the filter is not clean.

The ambient air begins its journey by entering the air filter. Then, it goes to the turbocharger (2) (which supercharges the combustion chamber with air in order to produce a bigger detonation and thus increase the engine's power). The air is then directed to the air radiator (4) (air to air) by a flexible tube (3) (the purpose of this radiator is to cool the air passing through it in order to increase its density). The air continues to flow through another flexible tube (5) and the inlet tube (6). The air finally finishes its course to the engine (7).

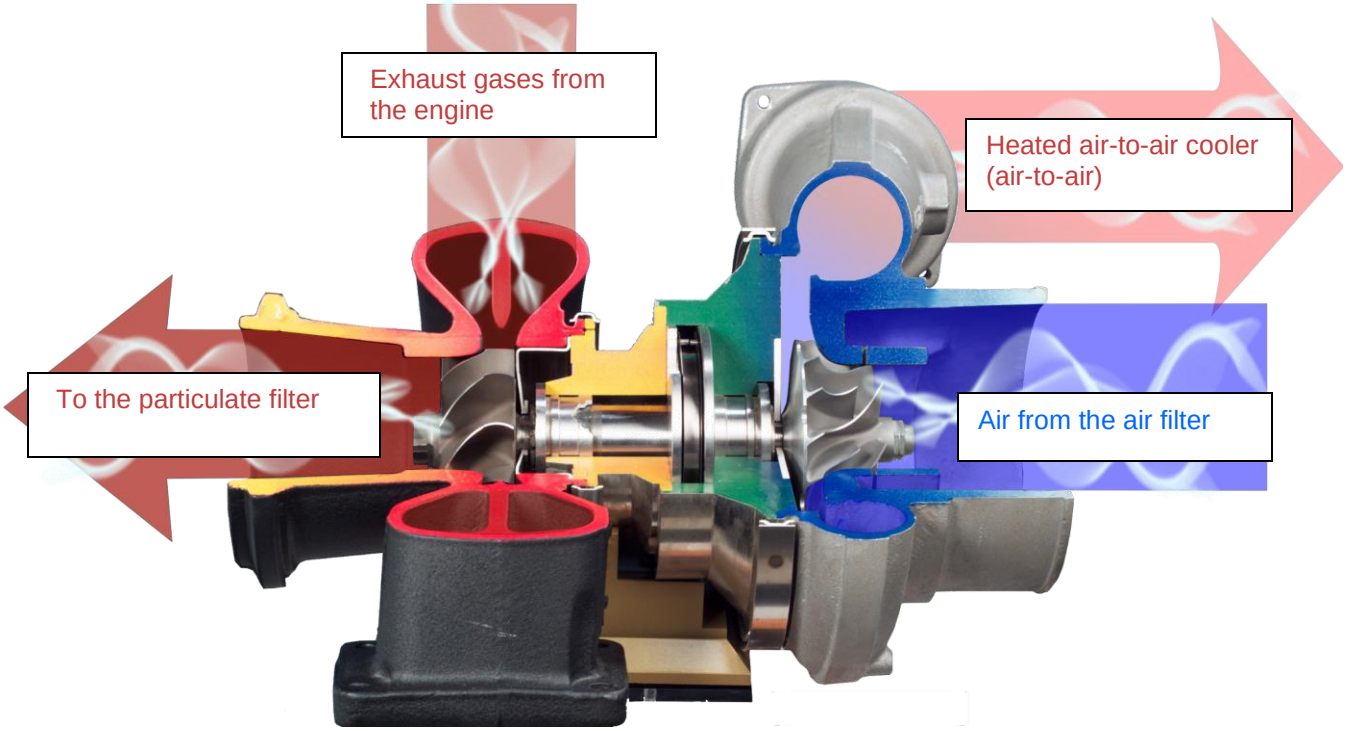
(2.2.5)

The more the engine is under load, the more the turbo pressure (2) increases. Maximum pressure varies from engine to engine (approximately 30 psi to 60 psi max). When the motor is not under load, it is normal for the pressure to be at zero. The exhaust gases drive the turbo's power turbine. These gases are directed to the particle filter (8). This filter helps reduce air pollution by trapping soot particles.
Finally, the **diesel exhaust fluid** (DEF) (9) is injected into the **catalytic converter (10)** with the aim of significantly reducing nitrogen oxide (NOx) emissions.

Notes:

(2.2.5)

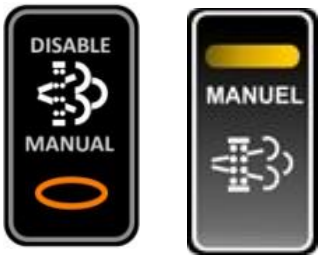
Cross-section of a turbo (2)



Types of regeneration of the anti-pollution system (after treatment)

<u>Passive (in motion): Initiated by the computer.</u> Without the intervention of the driver.

<u>Active (stationary): Initiated by the driver.</u> Driver intervention.



(2.2.5)

Driver-induced stationary regeneration

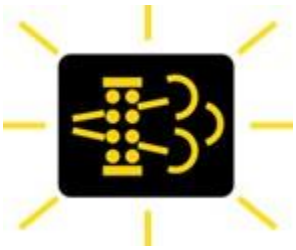
The 5 prerequisites
Park the vehicle in a safe place (parking brakes applied).
Engine temperature should be around 170 degrees F.
The transmission must be in neutral. The engine
should be idling.
The switch must be pressed for about 5 seconds.

CAUTION: Some vehicles are equipped with **inhibit switches.** Make sure it is not on.

Particle filter switch

It is used to start the regeneration process when the truck is parked. On some vehicles, it will be necessary to use the button on the multi-function display to start regeneration.

Pictograms associated with the particulate filter (8) and their meaning

Pictograms		Meaning	Actions to be taken
	**Level 1** (indicator light on)	Exhaust filter regeneration recommended.	While driving on the **highway** at permitted speeds or start the regeneration process while parked.
	**Level 2 (light on and flashing)**	Exhaust filter regeneration required.	While driving on the highway at permitted speeds or start the regeneration process while parked.
	**Level 3 (indicator light on and flashing, in addition, the** Name of the witness (e.g. "engine warning" is on)	The filter has reached its maximum capacity. Exhaust filter regeneration required. **The driving power will be reduced.**	**The vehicle must be parked. Start the regeneration process.**
	**Level 4** (indicator light on and flashing, in addition, the indicators (e.g. "engine warning" and "engine danger" are lit)	The filter has exceeded its maximum capacity. Exhaust filter regeneration required.	The vehicle must be stationary. Start the regeneration process. **The motor may stop and service may be required.**
	The exhaust can reach dangerous temperatures.	Depending on the exhaust outlet, pay attention to where you park the vehicle before starting the parked regeneration.	

Pictograms and dials associated with the diesel exhaust fluid LED (9) and meaning

Pictograms		Meaning	Actions to be taken
	**Level 1** (indicator light on)	Low "DEF" LED level, To be completed shortly.	Initial warning: the motor is operating normally. The DEF level is 10% or less. **Fill up your tank.**
	**Level 2** (light on and flashing)	Low DEF level, fill in soon.	The motor is working normally. The DEF level is 5% or less. **Fill up your tank.**
	**Level 3** (indicator light on and flashing, in addition, the engine warning light is on)	Low DEF level, fill immediately. **The driving power will be reduced.** (engine downgraded)	Engine performance is LIMITED. The DEF level is 2.5% or lower. **Fill up your tank.**
	**Level 4** (light on and flashing, in addition, the "engine warning" and "engine danger" lights are on)	Low DEF level, fill immediately. **The driving power is reduced to 8 km/h.** (decommissioned engine)	The speed of the vehicle is limited to 8 km/h. **Fill up your tank.**

The frequency of refills depends on two factors.

First, fuel consumption. In fact, the consumption of DEF accounts for about 2% of total diesel consumption. Next, the total capacity of the urea tank. Depending on the application, the tank can hold approximately 20 to 80 liters of DEF. Note that diesel exhaust fluid freezes at **-11 degrees Celsius**.

Notes:

Skill 2

Engine and auxiliary brakes

Lesson Objectives:
- Determine the usefulness of engine and auxiliary brake systems
- Know the role of engine compression
- Establish optimum performance when in use

AUXILIARY BRAKES (RETARDERS)

As a valuable tool, these reduce the strain on the service brakes and provide additional braking capacity.

For example, the majority of well-anticipated highway exits could be negotiated without using the_____. Similarly, the use of auxiliary brakes is part of the procedures for managing the descent of long slopes in a safe manner.

OPERATING PRINCIPLE

Even without an auxiliary brake system, the motor can be used as a braking system. Its effect can be seen when we practice a_____. This is known as engine compression deceleration.

There are two main types of auxiliary brakes, also called engine brakes. These systems work in conjunction with compression slowing.

1. One of these systems acts by restricting the exit of the exhaust gases. It is installed at the outlet of the turbocharger.

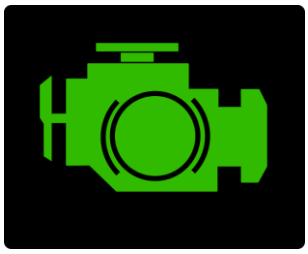
2. The other system acts by increasing compression (common name: Jacob brake). This is an optional system integrated into the engine. In addition, the thermostatic fan is sometimes used to further increase the retarding force.

The basis of both systems is to make the rotation of the motor more_____ and cause the vehicle to slow down. The engine therefore acts as a retarder rather than a gas pedal.

In both cases, the higher the engine speed_____the more effective the retarder will be.

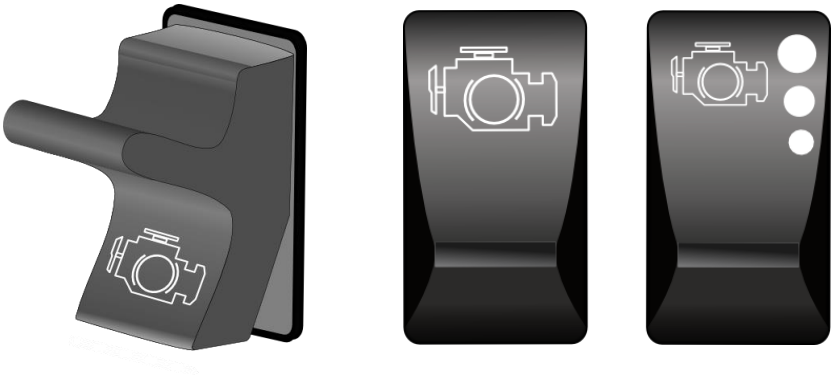
Attention! It is, however, crucial to respect the _____regime of the engine.

Associated pictogram:



Some types of switches and levers associated with retarder operation

Single switch with 2 levels of retention.
Dual switches with 3 levels of retention.



The lever of the automated transmission can also be used to control the start-up as well as the different deceleration powers. A light in the dashboard turns on when activated.

The clutch pedal and the gas pedal are also equipped with switches. These allow the motor brake to be interrupted as soon as either pedal is used. In addition, the retarder cannot be activated at engine speeds below 1,000 rpm.

(2.2.6)

Service brakes versus auxiliary brakes

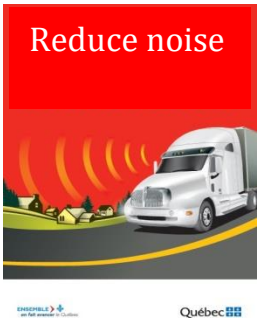
Service brakes

The air brake system provides braking capability to all wheels of the vehicle. This system is therefore much more efficient than an auxiliary braking system.

Auxiliary brakes

Auxiliary braking systems provide braking capability to the truck's drive wheels only.

ADEQUATE USE (NOISE POLLUTION)



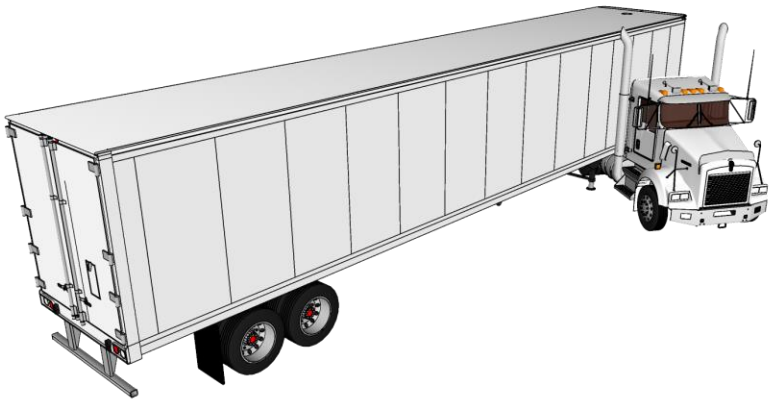
Ideally, engine braking should not be used when approaching towns or villages. Although today's auxiliary brakes are quieter and more efficient than in the past, even in areas where the use of engine braking does not appear to be reduced, judgment must be exercised in order to avoid disturbing surrounding populations.

(2.2.6)

RISKY USE

ATTENTION! When driving a vehicle equipped with an automated transmission, great care must be taken when selecting the level of_____ restraint. In fact, this level can cause intense downshifts that could surprise the driver and especially compromise the vehicle's handling, even if the vehicle is equipped with an anti-lock braking system.

Thus, on a roadway_____, the restriction offered by the truck's drive wheels could result in a loss of control of the vehicle. The higher the holding power required, the greater the risk of skidding caused by wheel lock-up_____.
The thrust of the semi-trailer, caused by kinetic energy, could eventually result in a_____.



IMPORTANT: At the beginning of a skid caused by the action of an engine brake, as for a skid caused by a the first thing to do, while counter-steering, is to press the clutch pedal to cut the restriction offered to the drive wheels and thus keep the of the vehicle

_____

_____

_____

_____

_____

_____

(2.2.6)

Skill 2

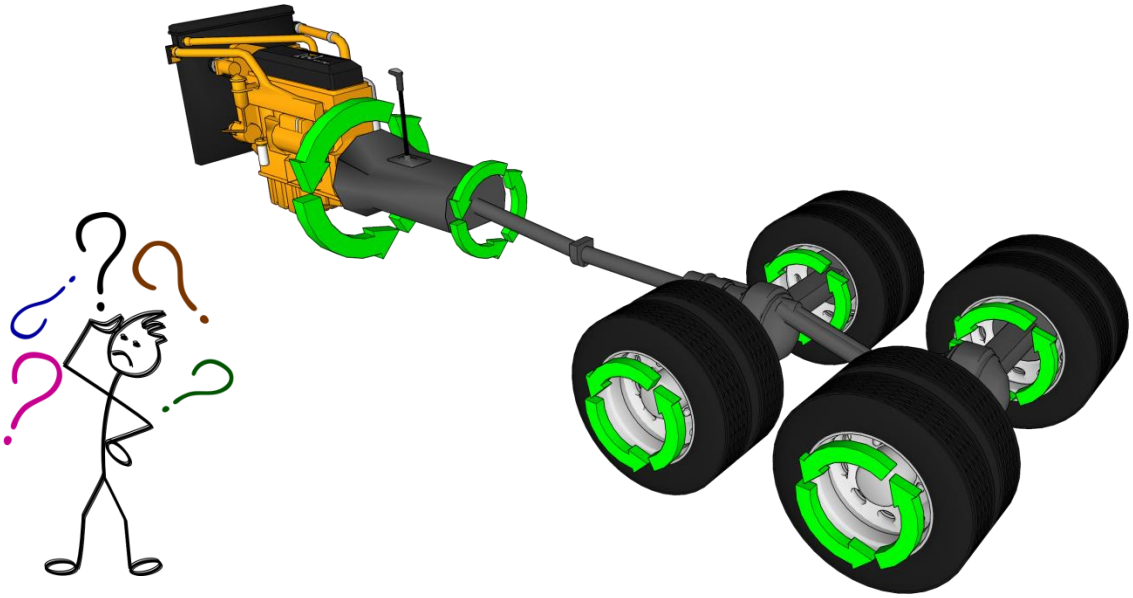
The engines

Lesson Objectives:

- Associate the use of the engine according to its capacities
- Determination of ways to optimize service life and performance

Power transmission

The engine produces the power needed to move the truck. This power is then transferred to the transmission, which has the role of multiplying it. From the transmission, it will continue its course through the differential systems that will change the direction of rotation of the movement to finally reach the wheels.



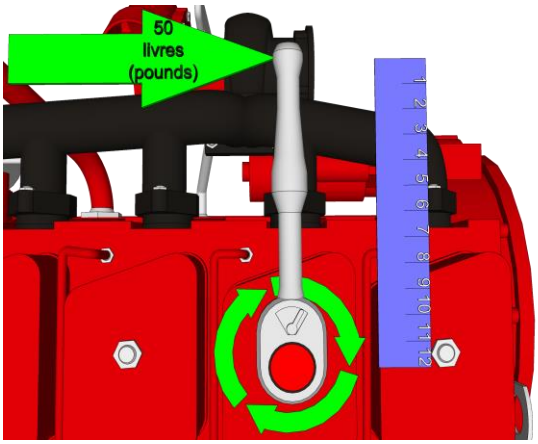
Couple or HP?

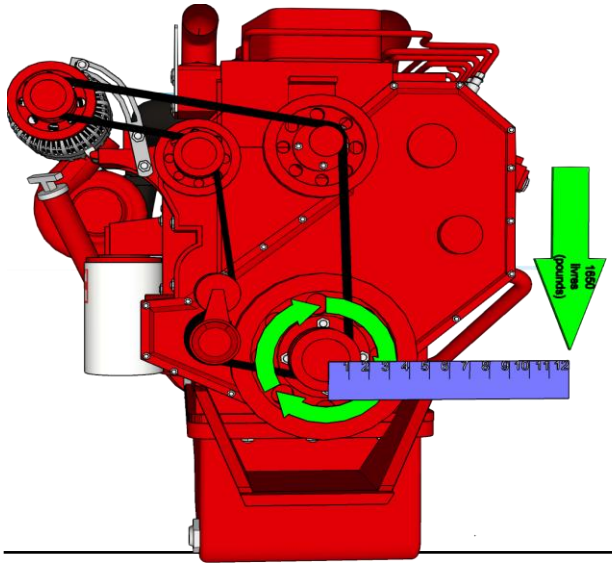
In order to get the most out of the engine, the driver must understand how it works.

It is preferable to perform truck operations with torque force rather than HP. On the one hand, today's engines are designed for this purpose; on the other hand, the energy efficiency gain is a very important result. However, there are certain circumstances when working with HP may be necessary.

What is torque force?

The torque force is a rotational force applied to an axis. It is measured in pounds/feet (imperial system) or in newtons/meters (metric system). In the example to the right, the bolt will be tightened with a torque force of 50 lb/ft.





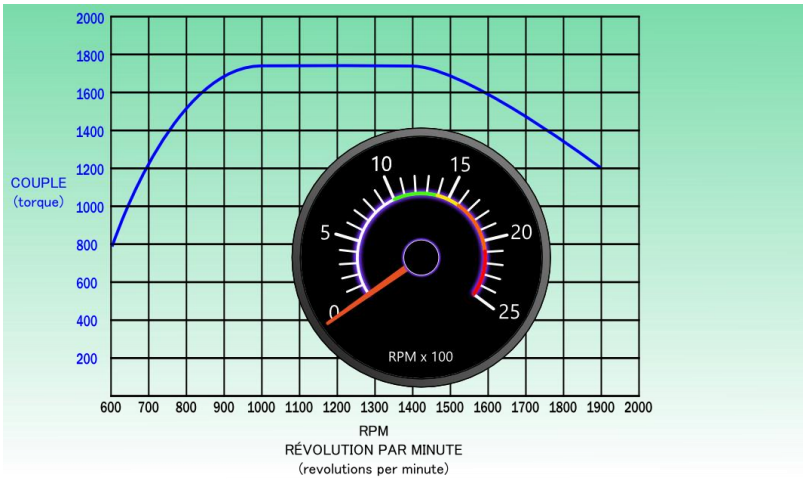
The power of a motor is calculated in the same way. In the second example, the motor develops a rotational force of 1,650 lbs/ft. Truck engines typically produce between 1,250 and 1,850 lbs/ft of torque.

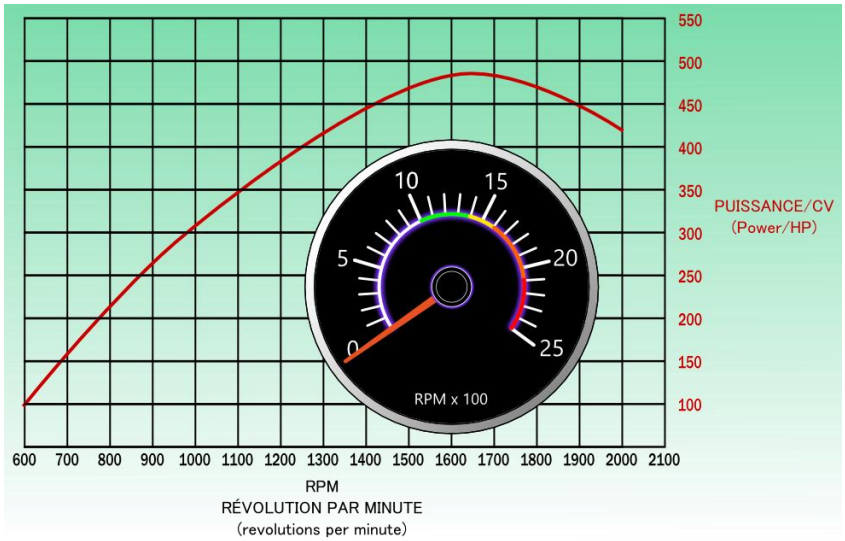
Unlike the electric motor, the torque of the diesel engine is variable according to the engine speed (RPM).

In the example to the right, the motor torque ranges from 800 to 1750 lbs/ft of torque.

Its maximum torque reaches a plateau that extends over a range of **400 RPM ranging from 1.000 to 1.400 RPM.**

The number 1000 represents the minimum speed to be respected when the engine is under load.

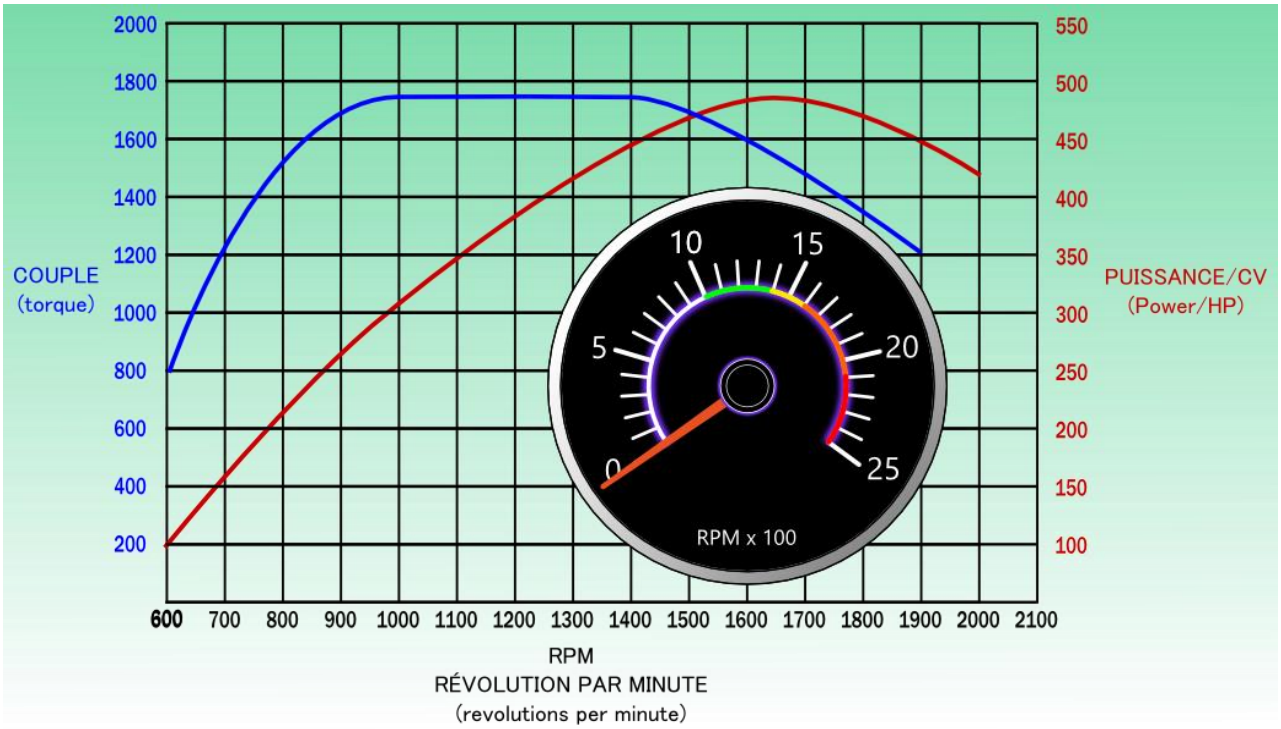




In the example on the left, the engine develops **485 HP @ 1650 rpm.**

The number 1650 represents the maximum speed to be reached to obtain the maximum power from this engine.

Below is a table of two previous examples combined.



TERMINOLOGY

1. Progressive gear shift	Gear shifting technique that combines efficiency and fuel economy. The aim is to achieve the lowest possible engine speed for the gear change.
2. Rated torque	Specified or advertised by the manufacturer Peak Torque. Maximum motor capacity established according to the work to be done. Reflects the ability to climb slopes. Can be found in the above example in the range of 1000 to 1425 rpm.
3. Ideal range	Ideal operating range (sweet spot), represents the range of the nominal torque. It is also the economic range of revolution for the use of a motor under load. **When dimming on the upper bearing, the <u>recovery speed</u> must be within this range.**

4. Power

Unit of measurement: HP (horse power).
The ability of an engine to produce work in a given time.

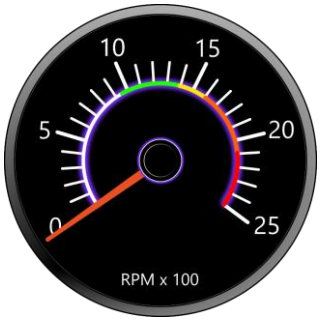
5. Maximum power

Highest degree of power developed by an engine generally reached around 1,800 rpm (example: DD 13). Engine speed at which the work is done most quickly. Also called power rating.

6. Engine speed

Motor rotation speed (RPM - Rotation Per Minute), expressed in revolutions per minute (rpm).

7. Tachometer (rev counter) — Instrument measuring the motor speed.



8. Idle speed — Minimum programmed motor speed. Approximately 650 rpm (idle).

9. Turn on fast idle for 30 minutes. — Increases the engine speed when a period of prolonged idling is necessary. Approximately 1,000 rpm (fast idle).

10. Maximum speed — Maximum speed determined by the manufacturer of an engine. **Therefore, never exceed the speed during operation.** Speed used for maximum engine compression slowdown.

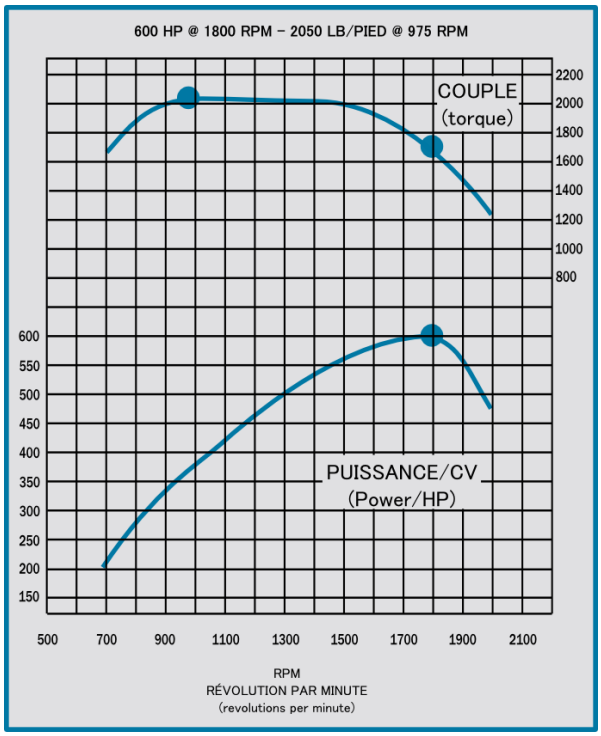
The truck owner can lower this limit by programming.

11. Engine under load

Expression which means that the engine is operating at a significant effort. At low temperatures, it is important to accelerate gradually to allow the engine to warm up before giving its maximum effort.

12. Cruising speed

Engine revolution speed that promotes fuel economy while taking these applications into account. Ex. between 1,100 and 1,300 RPM.



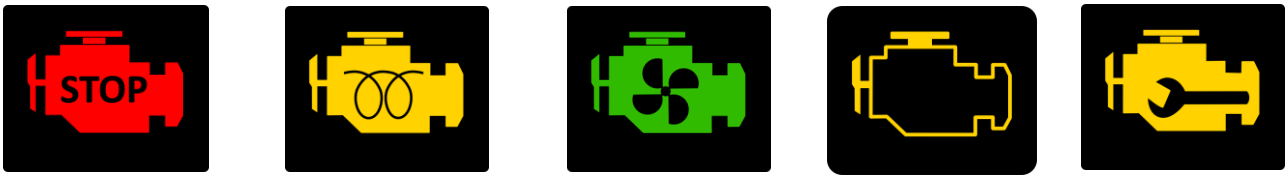
In this example, the 16L engine develops **2,050 lbs/ft of torque @ 975 rpm**.
In this torque range, which extends over approximately 400 rpm, the number 975 therefore represents the speed_____to be respected under load.

In addition, this engine develops **600 HP @ 1800 rpm.**
The number 1800 therefore represents the _____ system reached to get **maximum engine power.**

Explanatory videos

DAF ECO TRAINING EPISODE 1,2,3

Indicator lights and warning lights



Digital display

The digital display provides a wealth of information dedicated to the driver. In particular, when an indicator light appears, relative information can be communicated on this screen. Messages can be presented as a warning, caution or remark.

Note that some of the warning lights that cause the shutdown engine to stop are pre-programmed by default, while others can be pre-programmed at the request of the buyer.

Warning CAUTION Note

SHUTDOWN OVERRIDE SWITCH

When the "stop engine" light is on, the driver should turn off the engine as soon as possible. Otherwise, the protection system will proceed, after about 30 seconds, either to a reduction of the "derate" power or to the complete stop of the engine.

If this is the case, it may be necessary to use the "Shutdown Override" switch to restart and move a vehicle that is stuck in an awkward position. The allotted time is approximately 30 seconds.

This switch is usually associated with the Detroit Diesel engine (ex. : DD13).

Skill 2

Energy savings

Lesson Objectives:

- Recognize the different elements and technologies that influence energy consumption
- Interpret data from an on-board computer in relation to fuel consumption

ECONOMICAL USE OF HEAVY VEHICLES

DID YOU KNOW...?

19% of greenhouse gas emissions come from heavy vehicles.

For every liter of diesel burned, 2.8 kg of carbon dioxide are released into the atmosphere.

Exhaust fumes cause most of the smog.

The particles emitted are potentially carcinogenic.

Fuel costs are the second largest operating expense of fleet operations (after labor costs).

Several accessories are available to reduce fuel consumption.

Several mechanical improvements have been made in recent years.

Some companies offer **bonus programs** for fuel-efficient drivers.

SOME EQUIPMENT DESIGNED TO REDUCE FUEL CONSUMPTION

Wide-band tires: Savings of up to 5% (rolling resistance) Approximately 400 kg less for 5-axle equipment.

Tire pressure regulation system. Tractor 6 x 2 (one traction axle).

Deflector for driving axles. Wheel cover.
Mesh fenders: Savings of over 2%.

Side skirts.
Rear deflector for tractors and semi-trailers: Savings of up to 5%.
Use of load-shedding axles.

Various electronic tools (e.g.: Coach ISAAC).

MECHANICAL IMPROVEMENTS

Cruising engine speed lowered closer to engine torque.
Predictive cruise control.
Idle management system for extended stops.

(2.2.8)

Control of the gap between the tractor and the trailer. Use of
more efficient lubricants.
Better control of equipment wheel alignment.

DID YOU KNOW...?

Despite all the improvements presented, the driver remains the most important factor of all in fuel economy.

Up to 25% improvement can be achieved by adopting good **driving** habits.

DRIVING HABITS TO ADOPT

Avoid unnecessary idling: an idling engine consumes about 4 litres/hour. One hour of idling for an engine is equivalent to two hours of wear at cruising speed.

POSSIBLE SOLUTIONS

Warm up the engine by moving slowly and gradually until the engine reaches **engine operating temperature.**

Turn off the engine during basic maneuvers. (RDS, coupling, uncoupling, storage...)

Turn off the engine during waiting periods: customers, customs, refueling...

Run the last few minutes of a trip without putting the engine under load to allow it to cool down. Thus, it will be possible to turn off the engine as soon as you apply the parking brake.

(2.2.8)

SOME FIGURES!
One hour of unnecessary idling per day:

- 4 liters of fuel/day.
- 250 working days/year.
- 1,000 liters/year.
- 1,000 liters at $1.40 = $1,400/year.

For a fleet of 100 trucks:
100 trucks x $1,400 = $140,000/year.

CONDUCT HABITS TO ADOPT

Knowledge of the mechanical specifications of the truck, your vehicle.

Use of the motor torque.

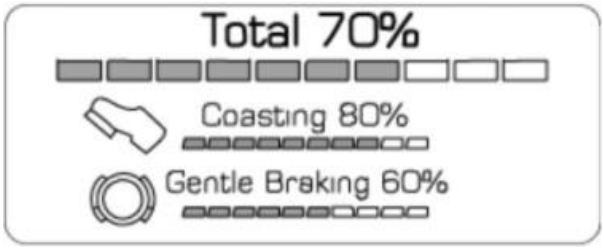
Use of dials and fuel consumption data in the dashboard.

Progressive gear changes.

Anticipation of changes in road situations.

Lowering the cruising speed

RELEVANT DATA PROVIDED BY THE DASHBOARD



(2.2.8)

USE OF AUXILIARY POWER UNIT (DIESEL AND/OR ELECTRIC). THESE ITEMS ARE OPTIONAL AND OFFERED BY ORIGINAL EQUIPMENT MANUFACTURERS (OEM) OR AFTER MARKET.

These units significantly reduce extended idling periods.

ALTERNATIVE ENERGY VEHICLES

Electricity using hydrogen
NICOLA ONE; NICOLA TWO.

100% electric
VOLVO ELECTRIC VNR; TESLA;
FREIGHTLINER E-CASCADIA.

Liquefied natural gas (LNG).

Compressed natural gas (CNG) "CNG".

Examples of major fleets using CNG

EBI; 200 trucks.
UPS.
Waste Management.
CTS.
FEDEX.
CAT; 100 trucks.
EXPRESS MONDOR; 23 sleeper trucks, target 50.

(2.2.8)

Compressed Natural Gas for Vehicles: Natural Gas Overview

- Practical and safe, it is the most used format for trucks.
- Composed of 95% methane.
- Extracted from the soil or generated by biomethanization (decomposition, burial, etc.).
- Odorless, mercaptan (rotten eggs) is added to facilitate its detection.
- Less greenhouse gas emissions than diesel or gasoline.
- Lighter than air, it disperses into the atmosphere when released.
- It costs less than $0.60/litre.
- The price at the pump is stable.

Statistics

Natural gas fleet
Worldwide: 27 million.
United States:
150,000.
Canada: 5,000.
Quebec: 515*

*Quebec has a total of 800 natural gas vehicles (small, medium and large, CNG + LNG). Of these, 515 are Class 6-7-8 trucks powered specifically by CNG.
(Data = ENERGY 2020.)

Environment

• Very low pollutant emissions.
• No risk of spills or soil contamination.

Circle check

The very high auto-ignition temperature of CNG, compared to traditional fuels, makes it much safer in an accident:

Diesel = **210°C**; gasoline = **280°C**; CNG = **538°C**.

Tanks are much more resistant than gasoline/diesel tanks. Their expected life span is 15 to 20 years.

Tanks have a pressure relief valve (PRD) that opens when exposed to intense heat, preventing overpressure and explosion.

(2.2.8)

Features

Pressure variation versus autonomy. Example 1

At **-15 °C** At **+20 °C**

Gauge reading is different, despite an identical range of 800 km.

Noise pollution
Since the combustion principle is closer to the gasoline engine than to the diesel engine, the CNG engine is very quiet. We are talking about a reduction of at least 10 decibels.

Refuelling: Private or public stations

- Much cleaner refueling.
- No risk of spillage on the ground.
- One filling point, no matter how many tanks you have.

Two modes to choose from

Quick
Allows filling during the shift (10-12 min).

Slow **(2-8 h)**
Allows for gradual filling over several hours between shifts (most often at night).

Engine manufacturer

In North America, **Cummins** is the only manufacturer of CNG engines.

The future

Hybrid electric truck with CNG generator.
Very promising future given its torque force (2,500 lbs/ft).

(2.2.8)

Skill 2

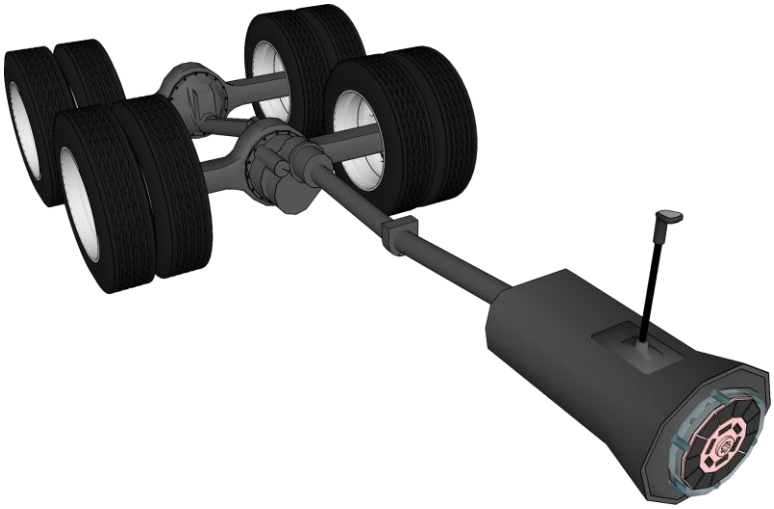
Transmission of movement (clutch)

Lesson Objectives:

- Identify the components of a truck's motion transmission system
- Recognize the role and proper use of the clutch

Movement transmission system

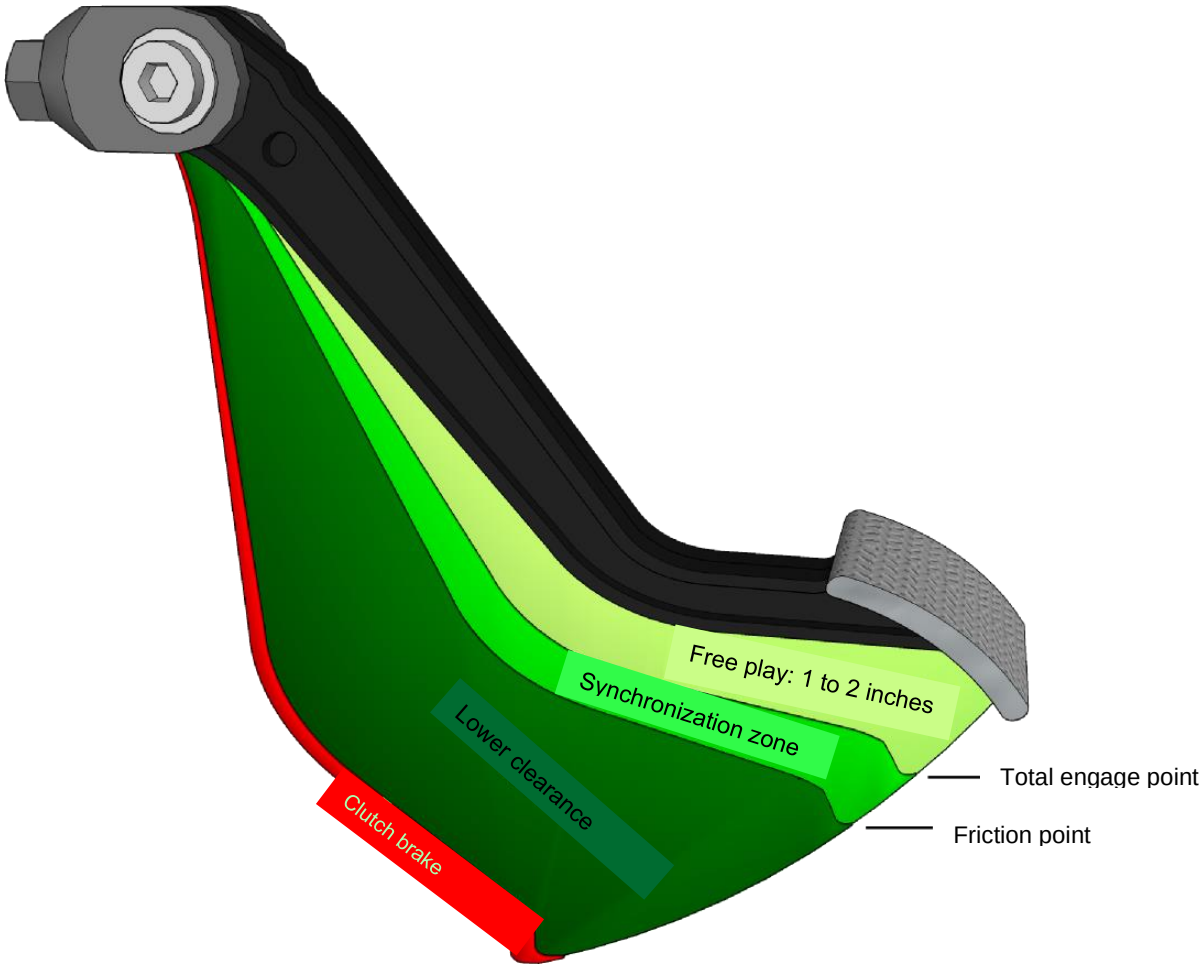
Clutch, gearbox and rear axles.



Clutch

The clutch is a device located between the_____and the gearbox that allows the coupling and uncoupling of these. It also allows engagement and shifting while the engine is running when the vehicle is stationary. Thanks to a good choice of initial ratio, the coupling will be loaded progressively while limiting vibrations. Otherwise, the engine could_____, and this could lead to breakage of some of the components of the motion transmission system.

Clutch stroke



Hydraulic operation

Some vehicles use a mechanical clutch system, while others are equipped with hydraulic assistance. For these trucks, it is therefore normal to have little _____ free on the clutch pedal.

The indication of a clutch to be adjusted is the loss or low efficiency of the_____clutch. It should be noted that these vehicles are usually equipped with a self-adjusting clutch, so little or no adjustment should be necessary.

The oil level in the tank must be checked _____. In our example, DOT4 brake oil should be used. Always check the manufacturer's specifications and notify the mechanic of any drop in level.
Some manufacturers also offer air-assist combined with hydraulics, which makes it much easier to use the clutch pedal.

Use
The use of the clutch brake is essential for engaging the initial gear. As its name indicates, it brakes the gears of the_____which are linked to the engine and run like it at around 650 rpm. Thus, when the vehicle is stationary, it is easier to match the stationary gears, which are connected to the rear axles, with the gears, which are connected to the engine.

Setting the friction point in an appropriate ratio is essential for smooth movement. It is not necessary, nor is it recommended, to press the gas pedal when releasing the clutch pedal. The couple _____ of a diesel engine at idle is sufficient to get the vehicle moving, even on an uphill slope.

When performing very low speed maneuvers (for example, a two-trailer re-center or even when approaching fuel pumps), it is very important to choose the most_____possible rather than letting the clutch slip into second or third gear.

Double clutch

The main purpose of using the clutch is to reduce the risk of mechanical damage during gear changes. The momentary break in engine torque on the transmission makes it easier to exit and enter gears properly.

Pressing the clutch in and out of gear synchronizes the gears when the clutch is released, thus promoting smooth gear changes. This virtually eliminates the risk of damage to the transmission, drive shaft and rear axles.

Anomalies

Driving the vehicle with your foot constantly on the clutch pedal _____ the life of the thrust bearing. It is therefore important to get into the habit of putting your foot back on the ground as soon as you stop changing _____. Similarly, when reversing, the fact that the manoeuvre is carried out by letting the _____ causes overheating and premature wear.

The purpose of the practice of moving with the friction point is to ensure that the vehicle is stationary when using the clutch brake. In fact, using the clutch brake while the vehicle is moving would _____ its lifespan by a lot. Thus, once in poor condition, engagement of the initial gear would be very difficult, as the transmission gears connected to the engine would be constantly in motion.

Setting the vehicle in motion with your foot on the gas pedal or with a gear ratio that is too high causes excessive slippage, which leads to wear _____ of the clutch mechanism. In addition, operating a vehicle with a clutch that requires adjustment could result in a significant reduction in clutch life or even failure.

Skill 2

Motion transmission (manual transmissions)

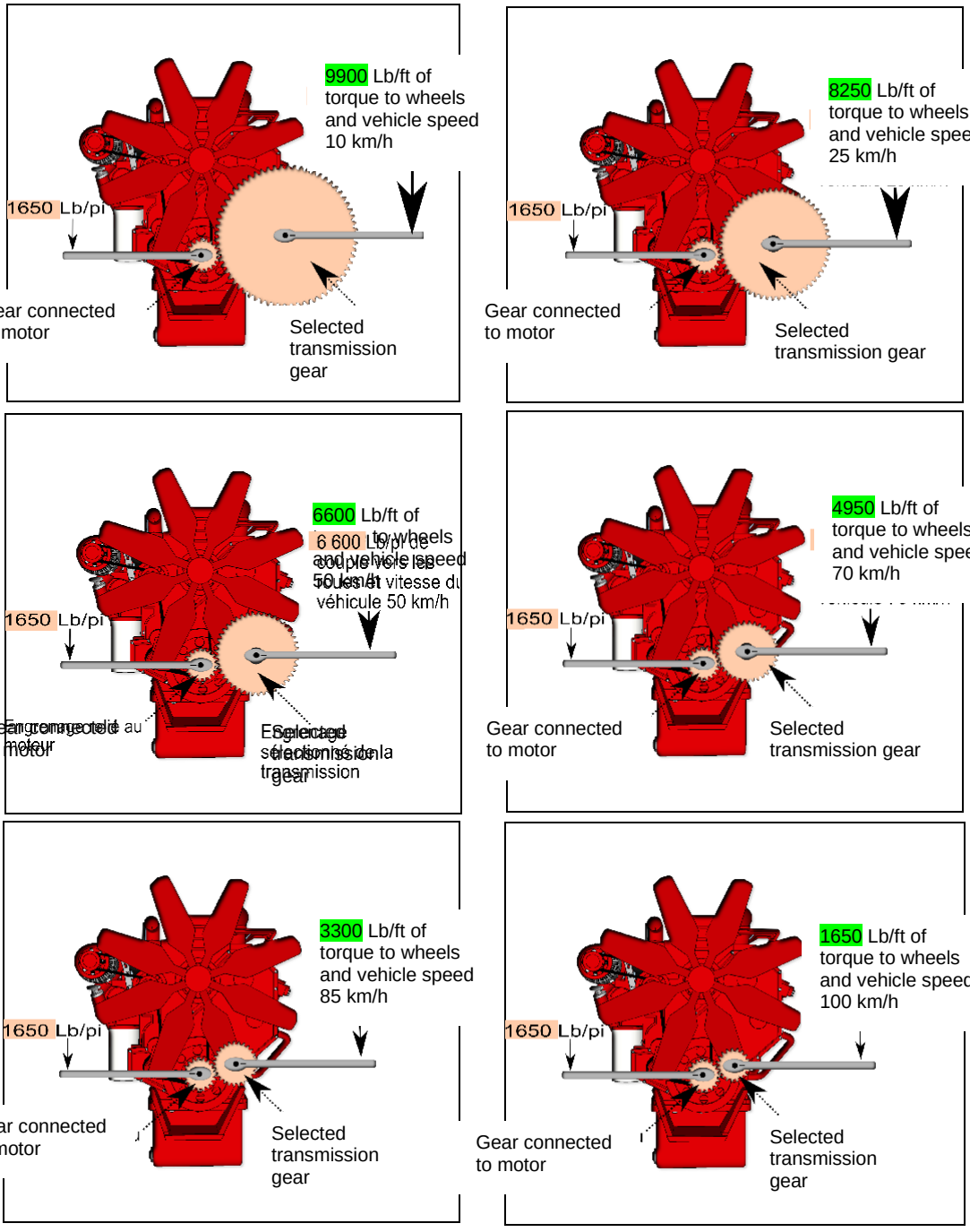
Lesson Objectives:

- Determine the types of manual transmissions, their capacities and possibilities according to the applications in use
- Determine means of synchronization

Role of the transmission

The transmission adapts the rotation speed and the engine torque according to the conditions imposed on the truck (starting, climbing, load, speed). It does this by multiplying, as needed, the torque force.

The multiplication of the torque force provided by the transmission:



Description of the engine torque multiplication of the transmission

Simple example of the application of the principle

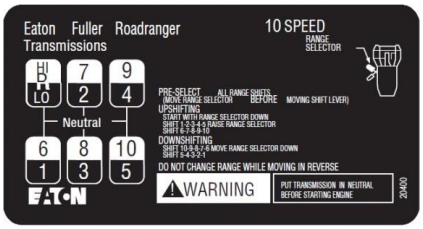
When putting a tractor and a semi-trailer in motion_____you will probably need to select the _____report.
During another set in motion, but this time with a tractor that is not coupled with a semi-trailer (thus_____to be drawn), you will be able to select the second or_____ _____ report.

The higher the speed of a vehicle, the more you have to_____the torque capabilities of the _____. Where does the technique of_____reports in combination with a gradually increased diet.

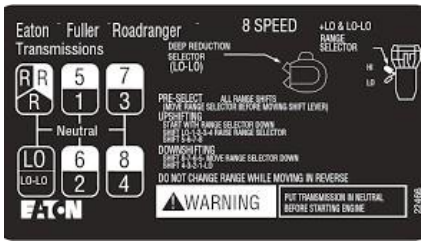
(2.3.2)

The knobs and auxiliary selectors of the manual transmissions associated with their operation diagrams

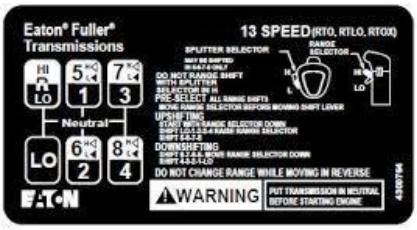
10 reports



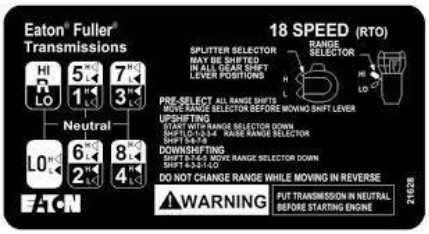
8 reports (LO and LO-LO)



13 reports



18 reports



(2.3.2)

Model families and gearbox functions

Eaton-Fuller manufacturer table

Family of models	Forward speed	Long distance transport	Heavy transport							Construction	Pick-up and delivery
				Security logging	Method of use	Oil fields	Waste collection	Agricultural applications	Off road		
Series EN	10										
8LL	8 + 2 bottom										
Super 13	13										
Super 18	18										

As a driver, you will have to know the_____transmission models in order to get the most out of their performance according to the____.

When the_____that you operate is not perfectly_____to the type of transportation you will be doing, you will still be able to recognize its limits.

Notes:

_____

_____

_____

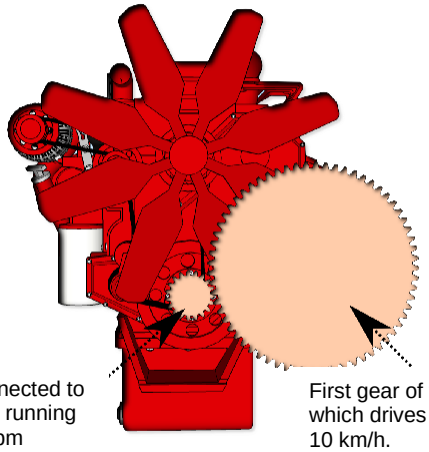
_____

_____

_____

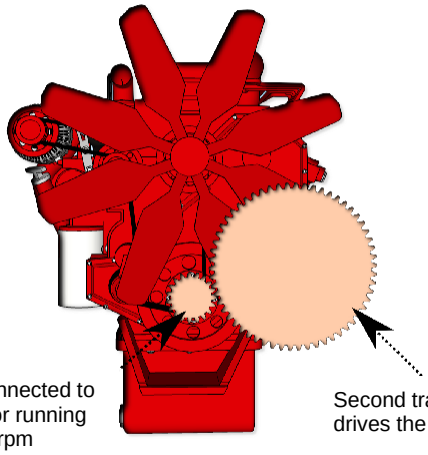
(2.3.2)

Principle and method of gradation synchronization



Gear connected to the motor running at 1500 rpm

First gear of transmission, which drives the vehicle at 10 km/h.



Gear connected to the motor running at 1100 rpm

Second transmission gear, drives the vehicle at 10 km/h

Example to switch from first to second gear:

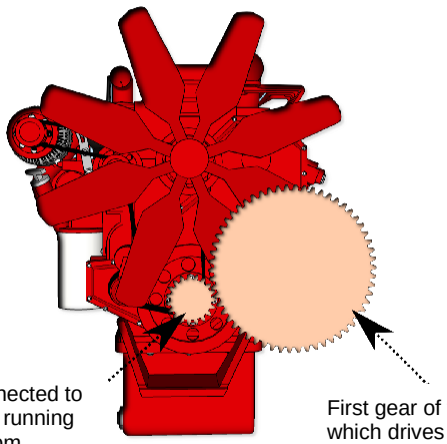
Video Viewing: Make the links below to computer or mobile device to view the videos or scan the QR codes.

Animated demonstration "Virage" (gradation)

CFTR Golden Knob (demonstration on simulator)

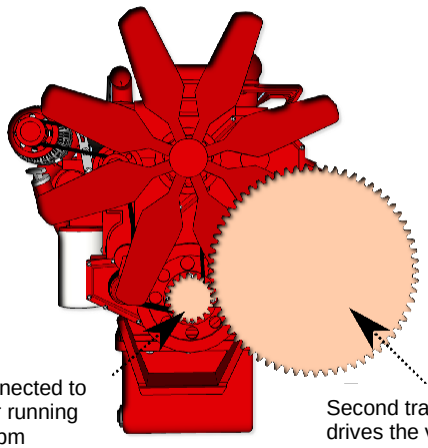
(2.3.2)

Principle and method (double clutch) of synchronization in downshift



Gear connected to the motor running at 1100 rpm

First gear of transmission, which drives the vehicle at 10 km/h.



Gear connected to the motor running at 1500 rpm

Second transmission gear, drives the vehicle at 10 km/h

Example for shifting from second to first gear (the reverse of gradation):

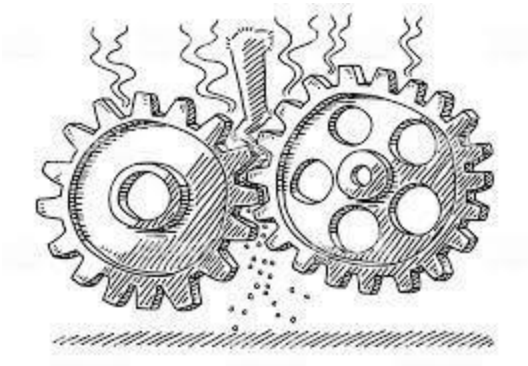
Video Viewing: Follow the links below on your computer or mobile device to view the videos or scan the QR codes.

Animated demonstration "Virage (demonstration)

CFTR Golden Knob (demonstration on simulator)

(2.3.2)

Potential problems caused by misuse



Of course, anyone can imagine that when the gears are out of sync during gear changes, this causes a_____of the latter in the transmission.

Causing a squeak at_____during a working day is considered acceptable and will not cause a great reduction in the life of a transmission.

On the other hand, in a way_____, this greatly reduces its life span and will result in _____additional maintenance costs for the company. So, it's on the _____ that a reduction in these costs is based. Be sure to_____with your maneuvers.

_____

_____

_____

_____

_____

(2.3.2)

Instructions and advice from the manufacturer Eaton-Fuller to avoid other potential problems caused by transmission misuse

- Always select a ratio of providing sufficient torque multiplication for the load and terrain.
- Use normal dual clutch procedures when using the shift lever to make changes.
- Never the gearshift when selecting gears.
- Never drive with the gearshift lever in the .
- Never move the gearshift lever to the when you are in the upper level.
- Never move the bearing selector with the gearshift as long as the vehicle is moving at high speed.
- Never make a change of level or half speed (HI-LO) during a run. .
- Never at too high an engine speed.
- In most cases, depending on the engine and axle ratios, you can save valuable fuel by driving the vehicle at an engine speed in a continuous way.
- Do not let your hand on the gearshift lever when gear changes are not required. This causes a premature of the transmission selector forks.

(2.3.2)

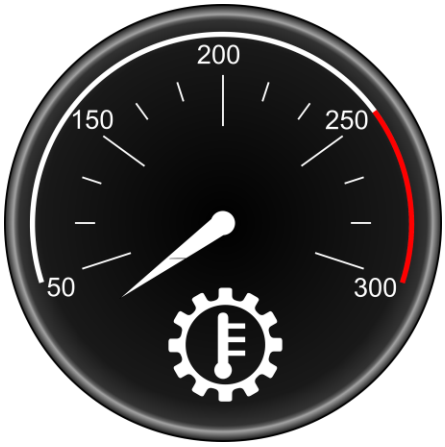
- Transmissions should not be used for_____above 120°C (250°F).

- Operating at temperatures above 120°C (250°F) will cause the gears to ____.

- Temperatures above 350°F (177°C) will eventually_____heat the gears.

- The following____can_____operating temperatures above 250°F (121°C).

- Operate _____at low speed;
- High ambient temperatures;
- Restricted air circulation around the transmission;
- Consistent use of the maximum power (HP) of the motor;
- Overuse of the_____Engine



(2.3.2)

Skill 2

Transmission of movement
(automated and automatic transmissions)

Lesson Objective:
- Determine the type of transmission, automated or automatic, as well as their capacities according to the applications in use

AUTOMATED TRANSMISSIONS

This type of transmission combines a manual gearbox with a shift actuator and a traditional computer-controlled clutch. It is widely used in the field of transportation.

Its advantages are: more latitude for the operator, facilitates the driving of a semi-trailer truck and eliminates related stress at gear changes.

Disadvantages: operation in reverse **may be** more difficult and prolonged maneuvers at very low speeds may **cause the clutch to overheat**. Moreover, it **trivializes the driving of the heavy vehicle**. Indeed,

Since driving is similar to driving a car, the notion of **anticipating maneuvers** can be quickly forgotten. For example, since the driver does not have to downshift, this can result in cornering at **too high a speed**.

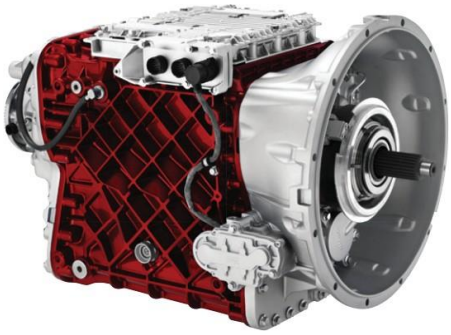
MANUFACTURERS

Eaton (10 to 18 forward speeds)

Control selector usually installed at Freightliner for use with this transmission. Positioned under the steering wheel and ergonomic, it also allows the management of the gears manually. It has a Low mode.

Mack MDrive and Volvo I-Shift (12 to 14 forward speeds)

Reference document on the use of this transmission.

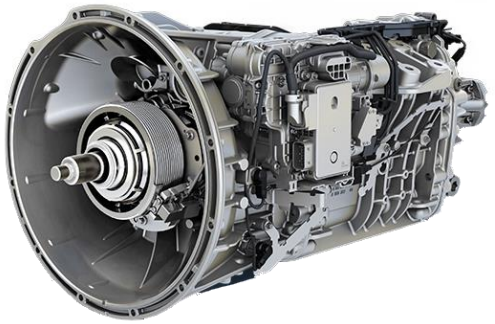


Mack M-Drive control switch found on the dashboard.

Control selector installed at Volvo. Positioned near the seat, it allows manual gear management in addition to having an Eco/Performance mode.

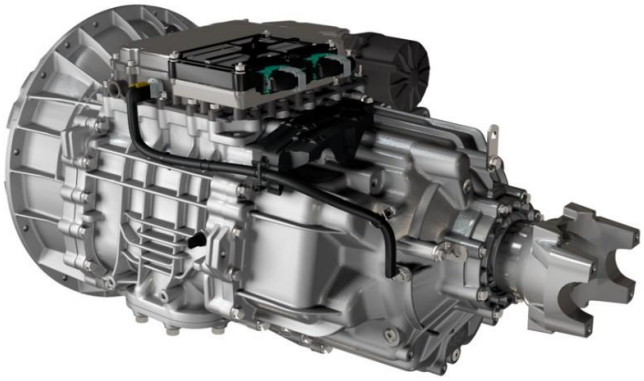
(2.3.3)

Detroit DT12



Detroit DT12 control selector usually installed at Freightliner and Western Star. Installed under the steering wheel and ergonomic, it allows the management of the gears manually as well as the operation of the engine brake.

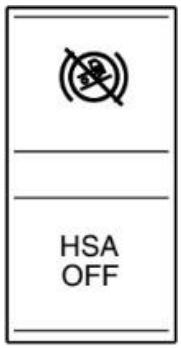
Eaton-Cummins Endurant and Paccar (Eaton-Cummins) (11-12 forward speeds)



Control selector usually installed on Kenworth and Peterbilt. Positioned under the steering wheel and ergonomic, it allows the manual gear as well as the operating the engine brake.

(2.3.3)

HSA Specialty Order



These transmissions usually have a **hill start aid**. When starting on a slope, the operator has, by default, a delay of about 3 seconds to press the gas pedal after the release of the service brakes. After this time, the brakes will be released and the The vehicle will move according to the slope's inclination. However, it is possible to cancel this hold by pressing the **HSA-OFF** or **HSA-OVR** switch.

USE: Recommended transmission operation methods to prevent overuse and from the clutch overheating.

When driving <u>at very low speeds</u>, especially if you are loaded, avoid constantly stepping on and off the gas pedal. Instead, use the programmed low-level speed control mode or choose a lower gear.

During long stops, reduce the "disengaged" time. Instead, use the dead center.

When waiting for a slope to be set in motion, do not use the gas pedal to prevent the vehicle from moving. Always use the service brake.

When the vehicle is in reverse and you need to move forward, first use the service brake to stop the vehicle, then resume the throttle.

(2.3.3)

Always comply with the manufacturer's limits for total weight in use. Some drive train versions (e.g. DT-12 "Direct Drive") have a maximum operating capacity of only 36,300 kg (80,000 lbs) "GCW" (Gross cargo weight).

Watch out for clutch overuse indicators.

When these indicators light up in the instrument panel, it means that the clutch is overheating and may stop working. A protection system can then momentarily disengage the clutch to allow it to cool. It will therefore be impossible, under these conditions, to move the truck.

Automated transmission

Automated transmissions also allow the use of new technologies such as :

- Adaptive cruise control;
- Predictive cruise control;
- Controlling the engine brake while using the cruise control;
- E-Coast;
- Multiple use programs;
- And a lot of development possibilities to make vehicles more and more autonomous.

(2.3.3)

AUTOMATIC TRANSMISSION AND CONTROL SELECTORS

Allison

This type of transmission is similar to that of automobiles. It generally has fewer gears than automated transmissions, between 5 and 10. They are mostly found in the vocational transport sector: school and city buses, garbage and recycling trucks, municipal services, etc.; therefore on vehicles affected by very frequent departures/stops.

Control selectors

Advantages: very efficient low-speed operations (especially in reverse), excellent performance in difficult conditions and very robust.

Disadvantage: None for the operator.

(2.3.3)

Skill 2

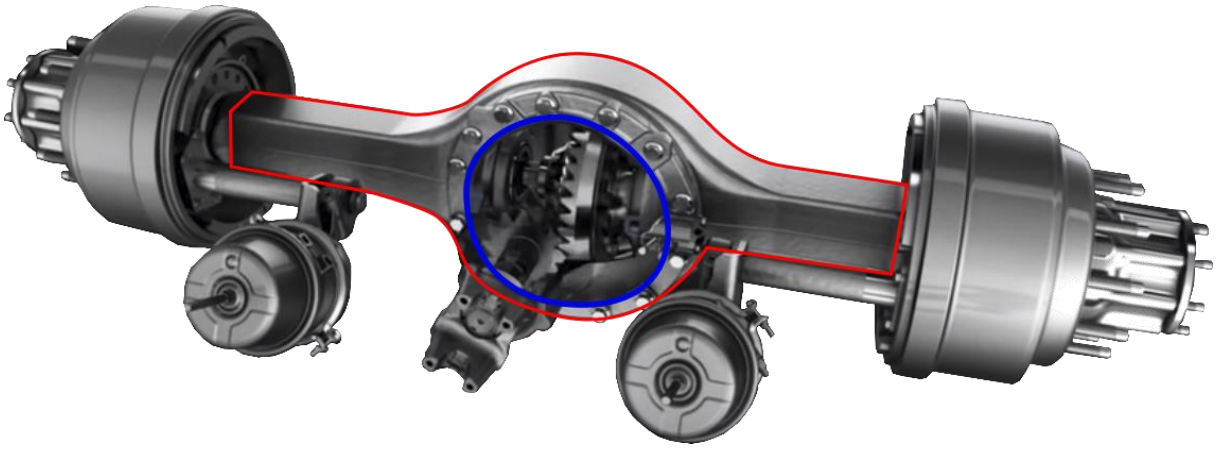
Power transmission (power dividers, differentials and traction control)

Lesson Objectives:

- Determine the procedures for the use of interlocking power divider as well as for interwheel locking differentials and the use of the traction control system
- Determining what to do in the event of getting stuck or skidding

Differential

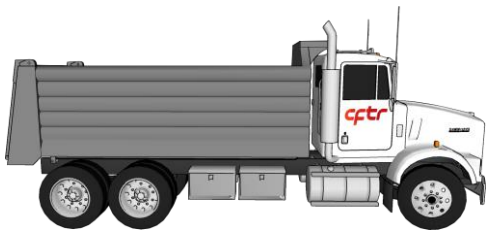
The differential is a gear system (circled in blue in the illustration).



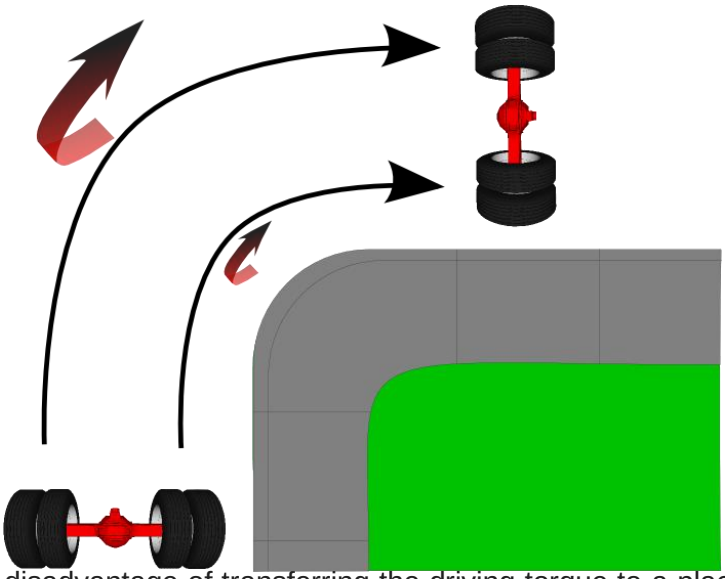
It is located in a box called a bridge (highlighted in red in the illustration).

Here are examples of trucks with single axle (single rear axle)

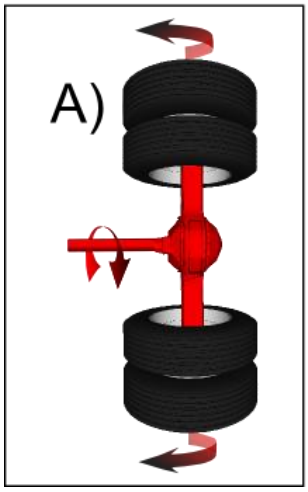
and with double axle (double rear axle), or tandem axle.

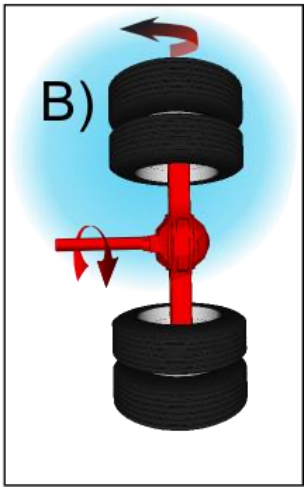


The role of the differential is to transfer engine power to the vehicle's wheels while allowing a difference in rotation between the tires on each side.



This mechanical procedure has the disadvantage of transferring the driving torque to a place that requires the least effort. As a result, when a group of tires lacks traction, they tend to spin in a vacuum, eliminating any traction effort.

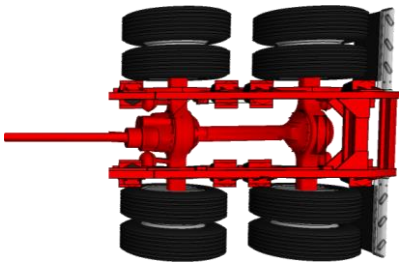




In illustration A, the tire grip is equal on each load-bearing tire. However, in illustration B, the grip of the right-hand tires is reduced. Therefore, all power is directed to this group of tires.

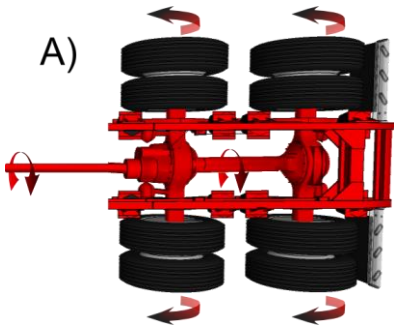
Inter-bridge differential (power divider) "PDL"

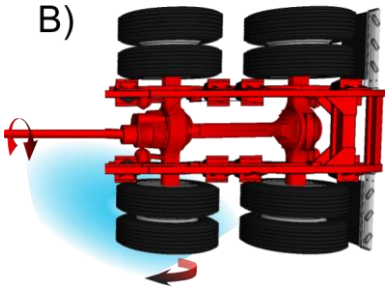
All double decks are equipped with an inter-bridge differential. This one is located in the front deck of the double deck. Observe the difference between the two bridges.



The role of the interaxle differential is to transfer engine power to the vehicle's axles while allowing a difference in rotation between the front and rear axles.

This mechanical process also has the disadvantage of transferring the driving torque to the place that requires the least effort. As a result, when one tire loses traction on slippery ground (e.g., ice), it tends to spin in a vacuum, eliminating any traction effort.





Manufacturers have equipped trucks with systems to overcome these disadvantages: the _____ of the inter-axle differential, the inter-wheel differential lock, which we will see later, and various traction control systems.

Inter-bridge differential (power divider) "PDL

The "inter-axle" differential is equipped with a non-optional locking system that ensures equal distribution of driving power to the front and rear axles of the vehicle, regardless of the road surface's grip conditions. An indicator light (and/or sound very rarely) indicates that the system is in use.

It is the driver who activates the control with the switch.

Dashboard indicator when activated.

Generally, there is no speed limit for its use. It must still be _____ when no longer in use.

Hazards

- Do not engage the inter-axle differential if the tires _____,a mechanical breakdown __ could follow.
- If you use this system on a long period of time when the pavement is dry, you could _____ the locking mechanism or overheat the tires.

“Axle Lock or Diff Lock" inter-wheel differential lock

The interwheel is an integrated differential lock system. It is optional when you purchase the vehicle. On double deck trucks, the inter-wheel option can be found on a single _____or both.

The driver activates the locking control(s) (of the three options) using
switches on the dashboard.

Indicators on the dashboard when the lock is activated.

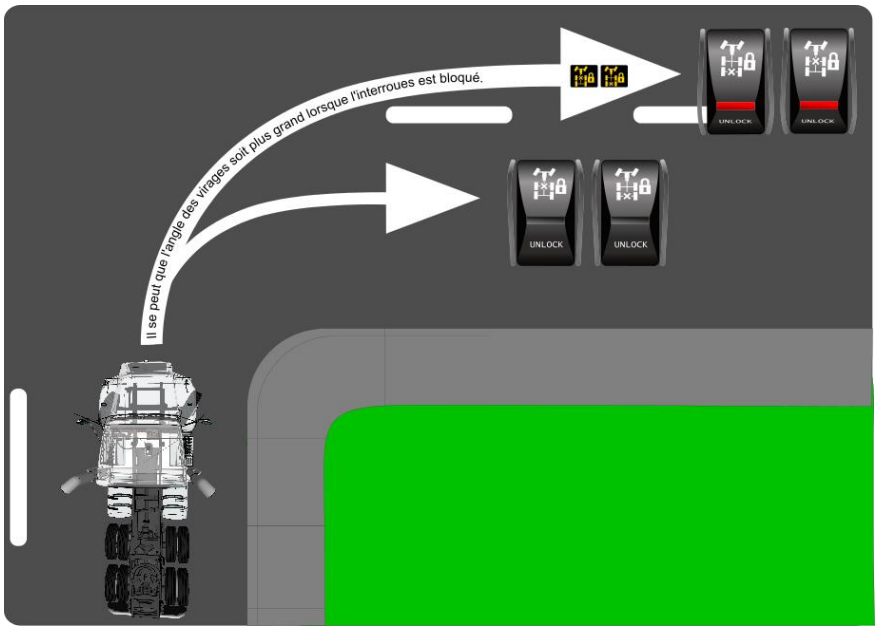
When equipped, the driver has the option of engaging the inter-wheel differential(s) to_ _____traction in specific situations.

Examples of situations

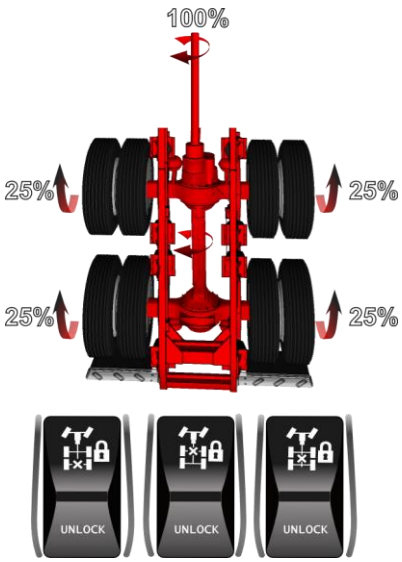
- On approaching a snowy, icy slope;
- When coupling or uncoupling a semi-trailer;
- Roadway, uneven terrain.

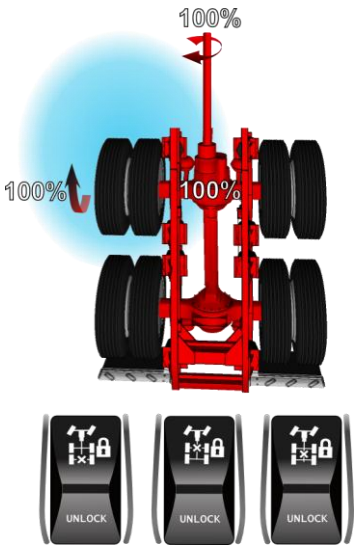
Dangers

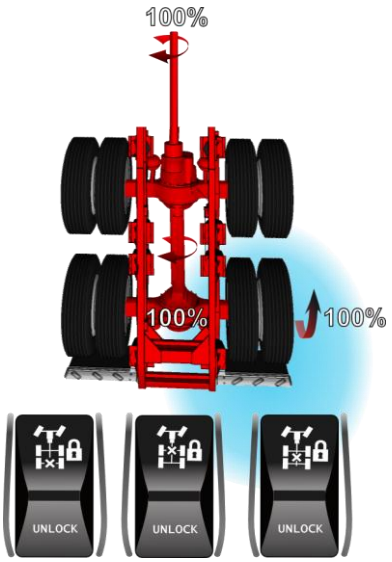
- Do not exceed_____km/h with the interwheel engaged, this could result in mechanical damage.
- When turning corners and the differentials are locked, the vehicle may tend to under-rotate and go straight ahead.
- High possibility of skidding if all tires are spinning.
- Do not use on dry pavement, mechanical breakage could result.
- Do not use when going downhill.

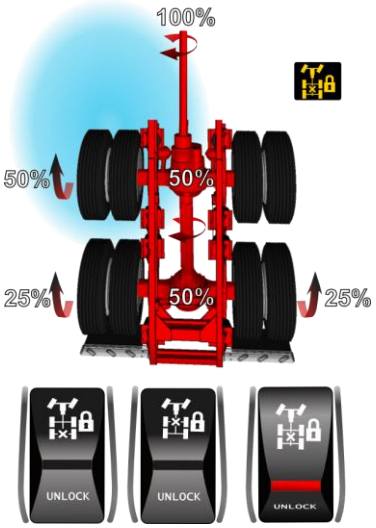


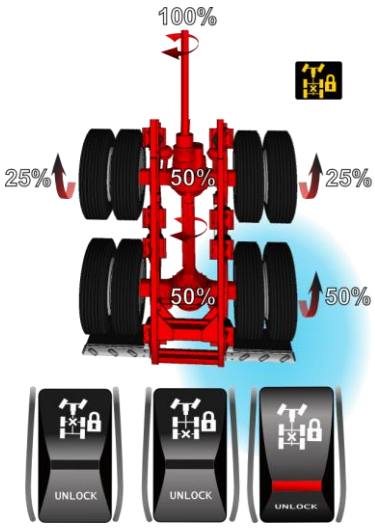
In summary, the following are examples of the interactions that occur depending on ground adhesion and inter-wheel and inter-bridge locking systems.

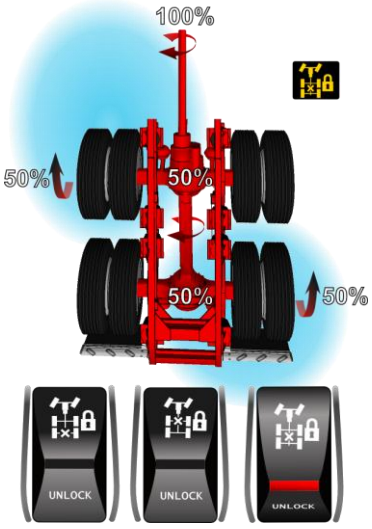


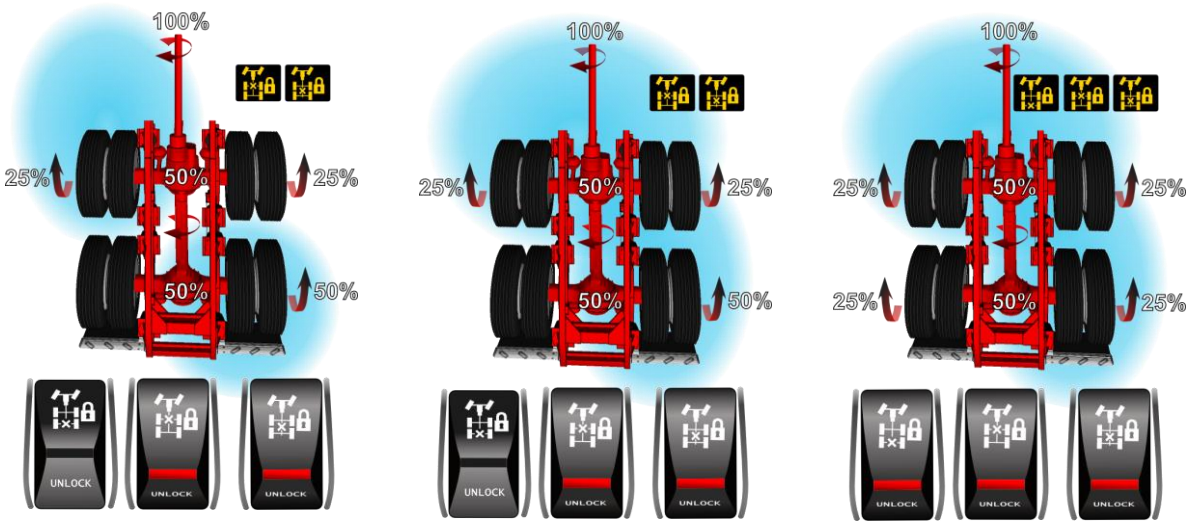












Procedure for engaging blockages (stationary or moving)

- Ensure the tires are not spinning and that you are not making a turn.
- Engage the "lock" switch.
- Release and resume the throttle (optional, press the clutch pedal).
- When the system is engaged, a light and/or sound indicator warns the driver.

Procedure for disengaging the system (while stationary or in motion)

- Make sure the tires are not spinning and that you are not making a turn.
- Disengage the "unlock" switch.
- Release and resume the throttle (optional, press the clutch pedal).
- When the system is disengaged, the indicator light and/or sound goes out.

Note that some truck brands include speed limits for automatic engagement and/or disengagement of these systems.

Note: Instructions for use may differ from one manufacturer to another. Refer to the Operation and Maintenance Manuals for more information.

TRACTION CONTROL SYSTEM

The traction control system controls wheel slip during acceleration to improve traction. It intervenes automatically by applying the brakes on the wheel that is slipping. This intervention forces the transfer of power from the engine to the other wheels which have better_____. This can be useful to limit the risk of getting stuck.

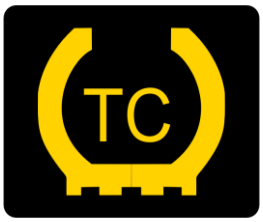
If all wheels want to spin, the system reduces engine power and limits engine speed to improve traction. This action can be done at any speed.

In the driver's seat, you can find different names for this system, for example: **TC, TCS, ATC, ASR, TRAC CTRL.**

Note that the operation remains the same for each system.

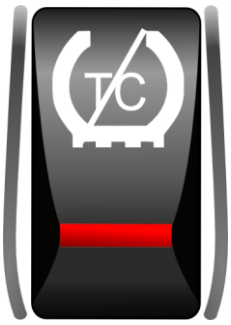
INDICATOR LIGHT

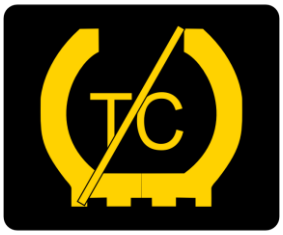
- Lights up and goes out when the ignition is turned on (start).
- It will flash rapidly to indicate that the system is interacting.



SYSTEM DEACTIVATION

When stuck in deep snow, slush or mud, the switch can be used to partially disable the traction control function. This will result in increased power to the wheels and limited braking. Therefore, the clearance will be more_____. Some manufacturers use the name **mud/snow** or **off road**.





When the traction control function is deactivated, an indicator light in the instrument panel indicates this. It will flash slowly, every 2 to 3 seconds.

An example of a situation where the ATC system could be disengaged is when a semi-trailer is hitched to a slippery road.

When the system is deactivated, it leaves the choice of maneuvers to the driver.

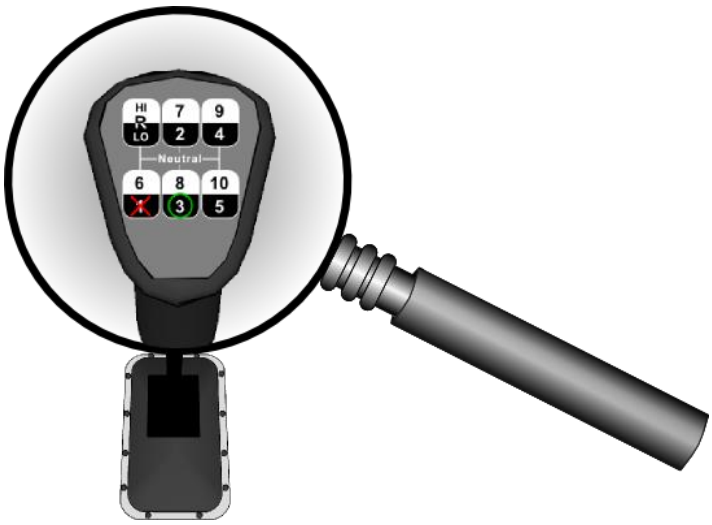
ADVANTAGES: The ATC system detects and reacts much faster than the _____ when tire slippage occurs, thus limiting the risk of skidding and improving vehicle traction.

Please note that the ATC system will not work if the ABS system is _____ because they share the same sensors.

Danger

Prolonged use of ATC can cause the drive wheel brakes to overheat. Vehicle speed or engine torque should be reduced to eliminate wheel spin and to avoid excessive use of the ATC system.

Despite all these systems, your vehicle may remain stuck. At this point, other means of increasing the friction under the vehicle's tires will be required.



- Increase the speed ratio. Increasing the speed ratio reduces the torque force imposed on the wheels. This reduces the risk of skidding.

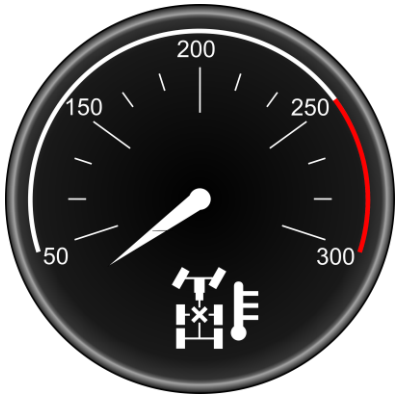
- Put skid plates under the tires or any other material that can increase tire grip (sand, abrasive, chains, etc.).

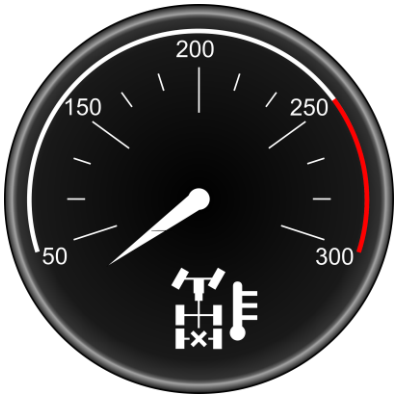
TEMPERATURES

The gears of the differential are sometimes heavily loaded. Curves, slopes, heavy loads at low speeds for a long time can cause the gears to overheat.

Optional temperature dials can be installed in the truck. Normal operating temperatures range from 150 ^{o}F to 250 ^{o}F . The outside ambient temperature plays a large role in this variation.

In all operations, the maximum temperature should not exceed 250 ^{o}F.





Skill 2

The braking system 1

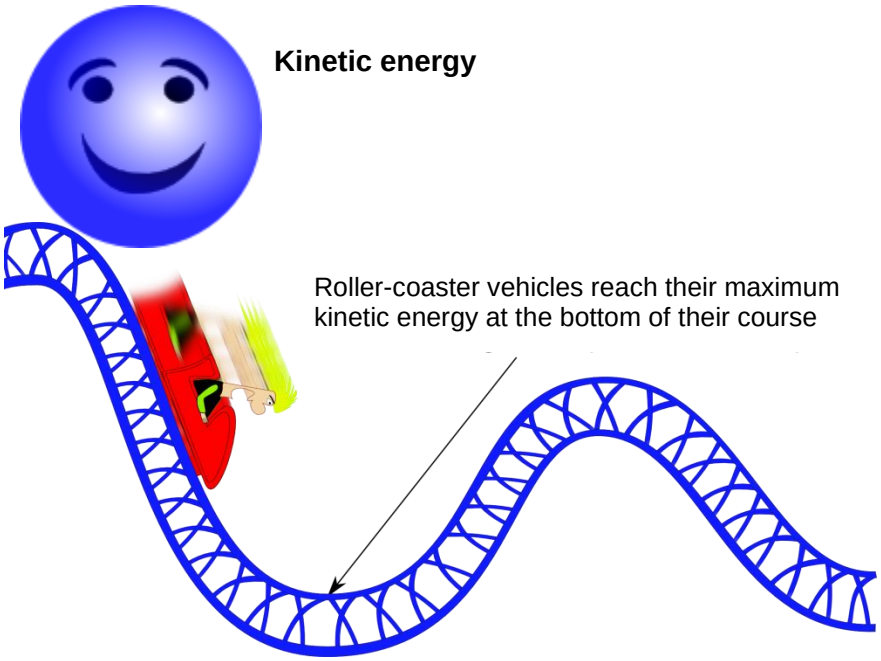
Lesson Objectives:

- Get to know the operation of the pneumatic braking system of a truck
- Prepare for the SAAQ air brake theory test

Let's start with some physics! Energy

In physics, energy is a measure of the capacity of a system to produce work leading to motion.

Diesel fuel is just one form of raw energy. Once transformed (engine combustion), it is used to move the vehicle. When the vehicle is in motion, this energy accumulates in the vehicle. This is called kinetic energy. It is this force that we have to fight against when braking.



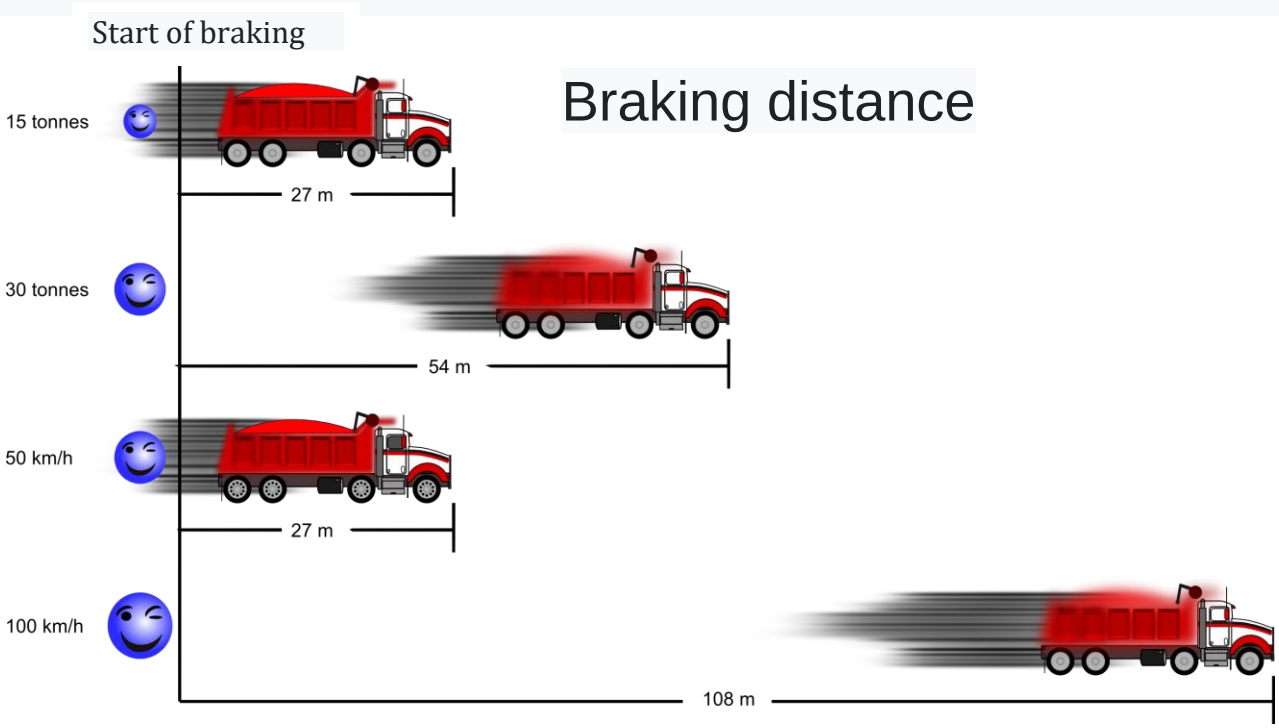
Kinetic energy

Roller-coaster vehicles reach their maximum kinetic energy at the bottom of their course

In mathematical calculation, at a given speed, the accumulation of this energy is **doubled** when the weight of the vehicle is doubled.

The accumulation of this energy is also **quadrupled** when the vehicle speed is doubled.

This affects braking distances.



Friction

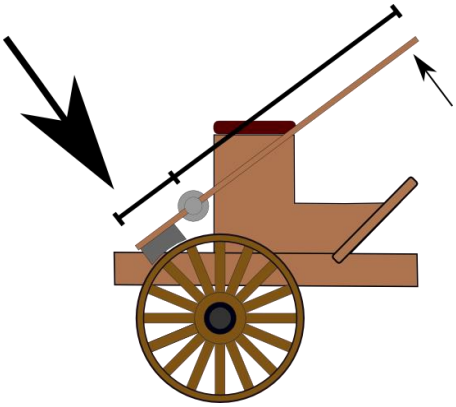
The coefficient of friction between the tires and the road also affects the braking distance. It is also through the process of friction that braking of the vehicle occurs.

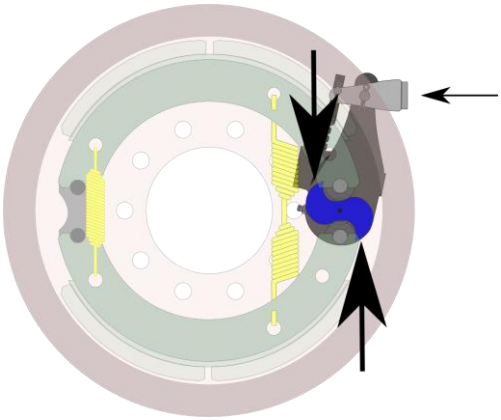
Braking power

Of course, the simple pressure of the foot on the brake pedal is clearly insufficient to develop all the power needed to brake a truck. To do this, the pneumatic braking system is composed of parts that act as force multipliers.

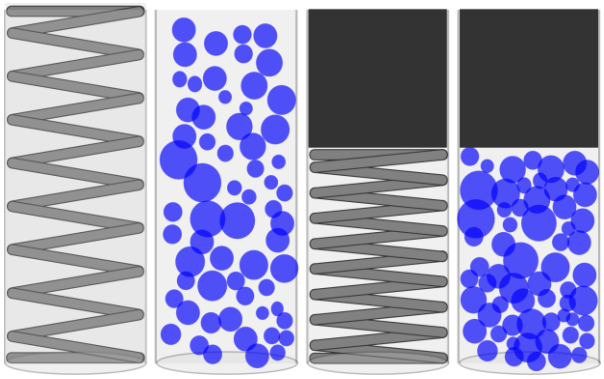
(2.4.1)

Adjustable lever and leverage

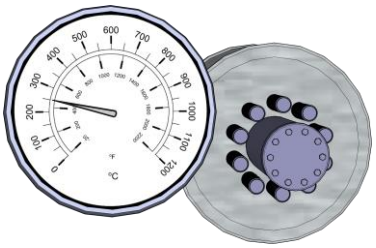


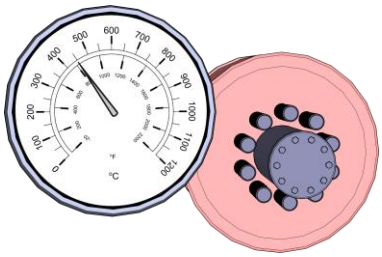


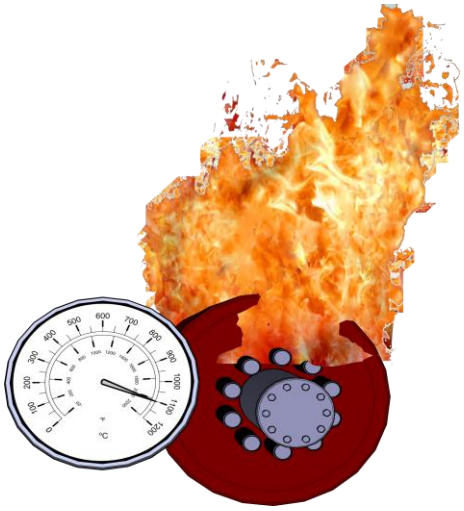
Compressed air



Heat



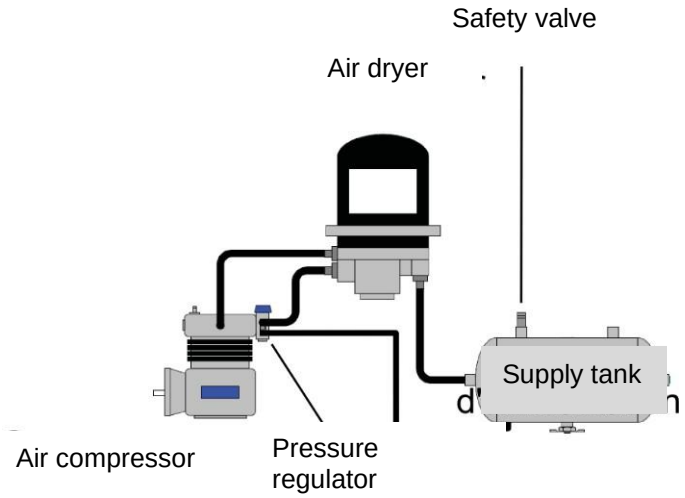




(2.4.1)

Compressed air systems and their

Power supply circuit



Identification of the parts of the supply circuit and their roles

In an air brake system, part of the power required for braking comes from compressed air. The _____ pumps air under pressure into tanks.

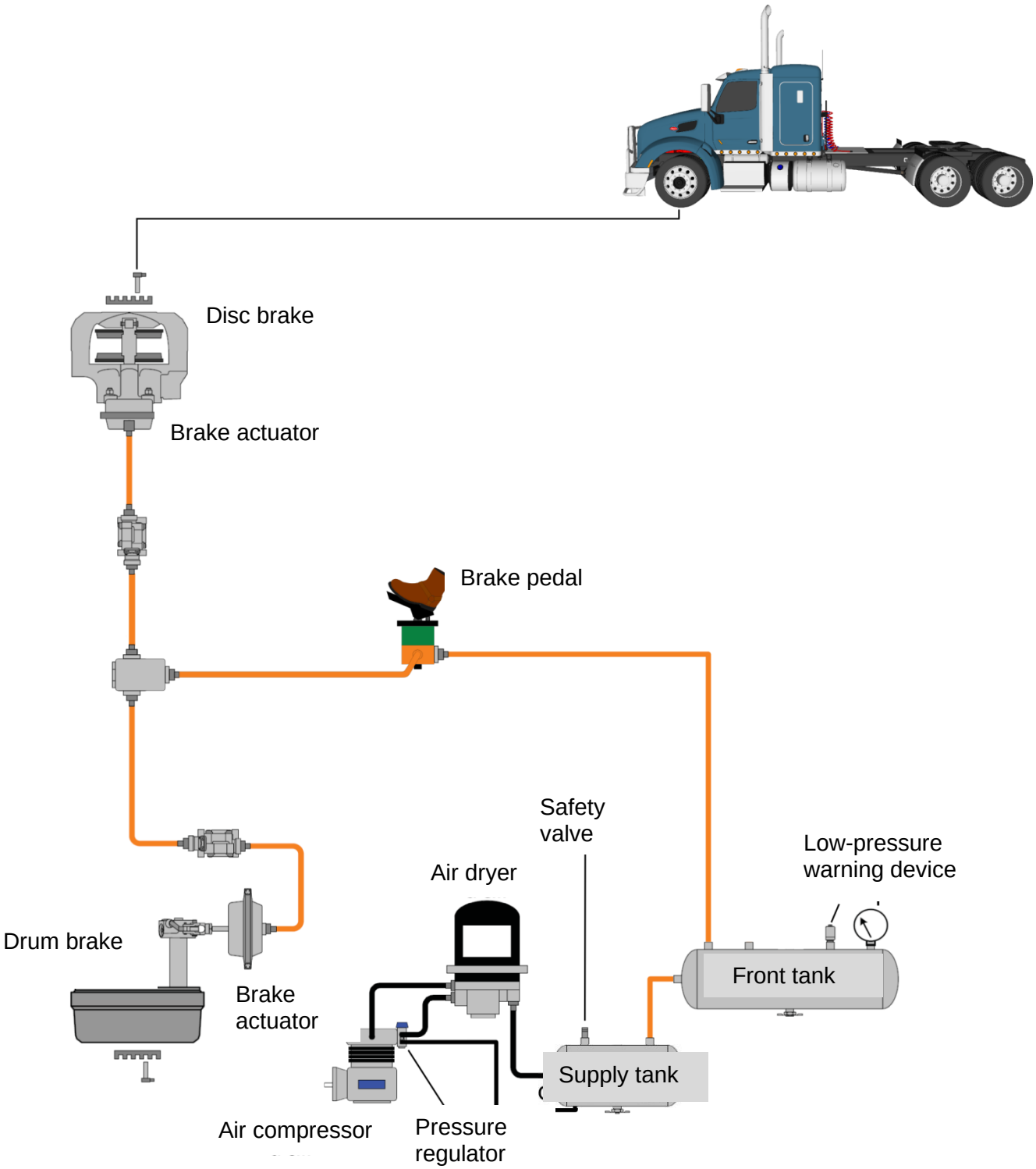
The_____installed between the compressor and the tank
The supply air filter removes moisture from the compressed air.

The _____ stores the air compressed air from the compressor.

The_____allows the compressor to be switched on and off and also controls the purging of the air dryer (desiccant).

(2.4.1)

Secondary circuit of service tanks (S or 2)



(2.4.1)

Identifying secondary circuit parts and roles

The _____ stores air compressed from the supply tank.

The_____allows the driver to operate the brakes.

The_____acts as a force multiplier using compressed air to apply pressure to the adjustable lever.

The_____also acts as a force multiplier through its leverage effect

The_____applies pressure to the brake linings.

It is through the process of friction between the brake linings and the _____which causes the vehicle to brake.

_____

_____

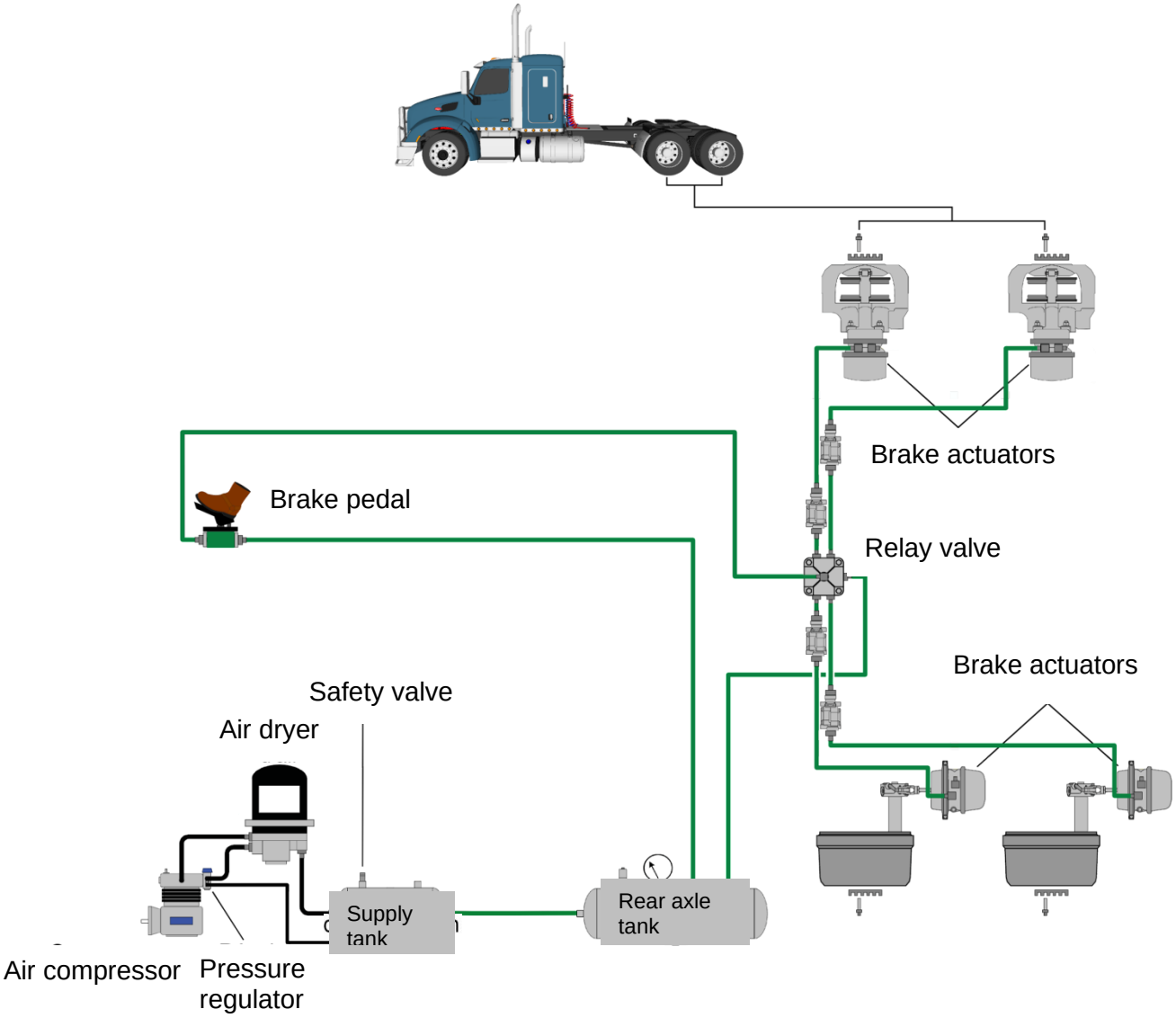
_____

_____

_____

(2.4.1)

Primary circuit of service tanks (P or 1)

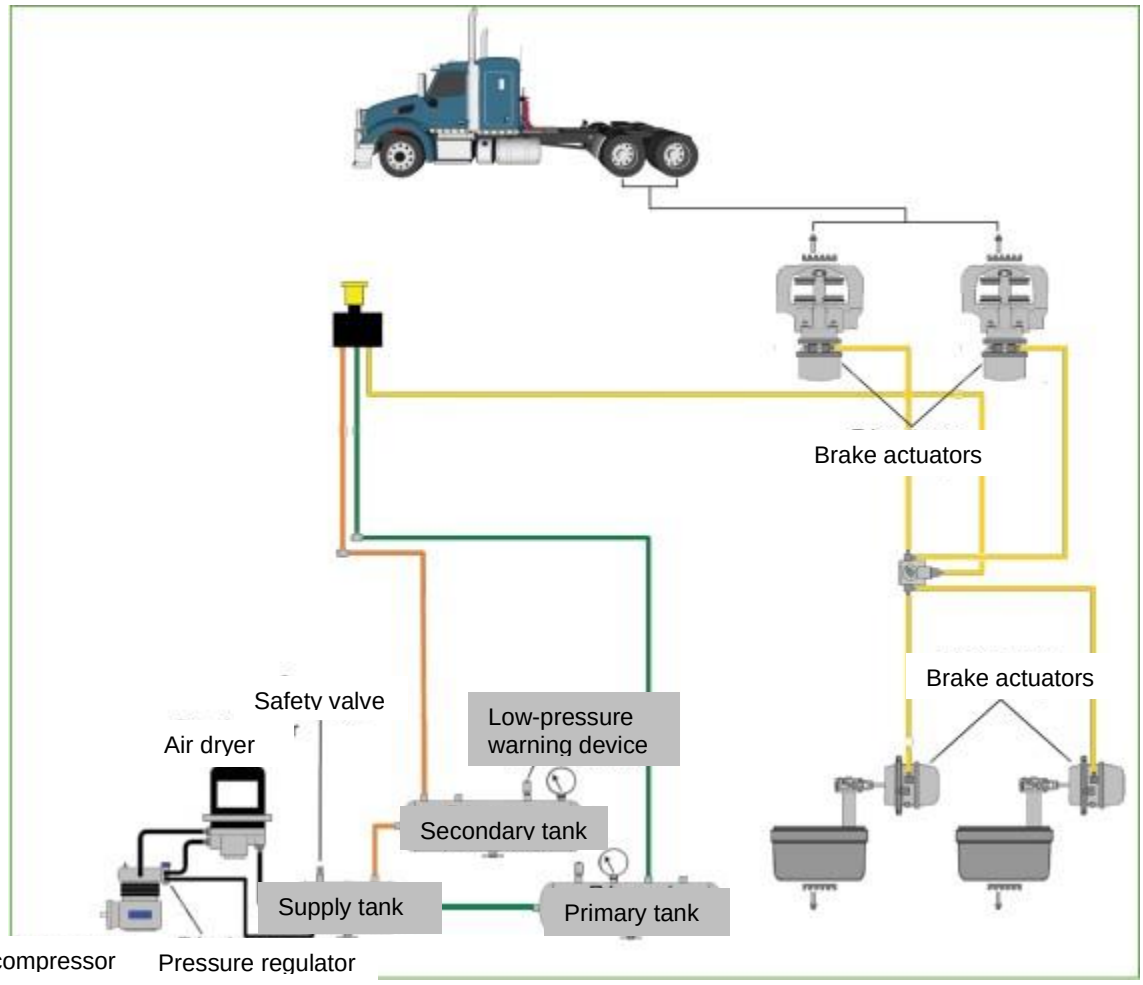


(2.4.1)

The_____operates the parking brake in addition to performing the same action as the single brake receiver.

When pushed, the_____ disengages the vehicle's parking brake.

Parking brake circuit (emergency)



(2.4.1)

Operating the emergency brake

In the event of a failure of the air brake system, i.e. a significant drop in air pressure in the service reservoirs, the emergency brake activates to bring the vehicle to a stop.

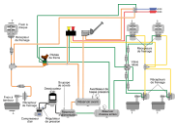
For example, the brake linings begin to press against the brake drums or rotors as soon as the air pressure drops to about 70 psi. When this pressure drops below 35 psi, the parking brake control returns to the applied position and air is exhausted from the dual brake receiver, causing the parking brake to automatically apply.

	A	R	A	É	MI	S	S
	Horn	Rendement	stop	Water tightness	se en marche	Stationnement	Service
	66 psi (380 kPa) Minor if one or other of the alarms does not work Major if both don't work	90 lb/po^2 620 kPa	117~137 lb/po^2 805~945 kPa	Straight truck 3 lb/po2 (20kPa) Tractor + 8-R 4lb/po2 (28kPa) Straight truck 6lb/po2 (40 kPa) Tractor + 8-R 7 lb/po2 (48 kPa)	80 lb/po^2 550 kPa	N/A	N/A
Type of defect							
Parts covered by the verification							

Warning devices:

Performance:

Stop



Water tightness:

Start-up

Parking

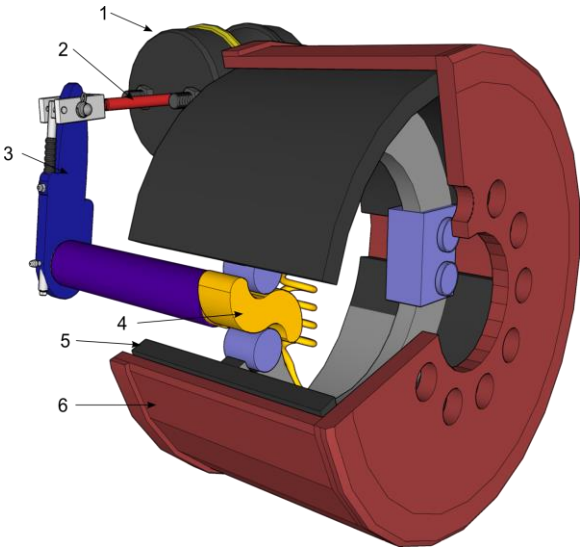
Service

(2.4.1)

Skill 2

The braking system 2

Lesson Objective:
- Choose ways to optimize brake system performance



System specifications of the drum brake

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

Operation

When the driver wants to slow down or stop the vehicle, he must dissipate the kinetic energy stored in the vehicle. It is through the process of friction that this action is accomplished.

In the case of drum brakes, pressure is applied to the brake linings which rub against the inside of the drum. Since the drum is in direct engagement with the vehicle wheel, vehicle deceleration can occur.

The drum brake system is the oldest form of brake used on motor vehicles.

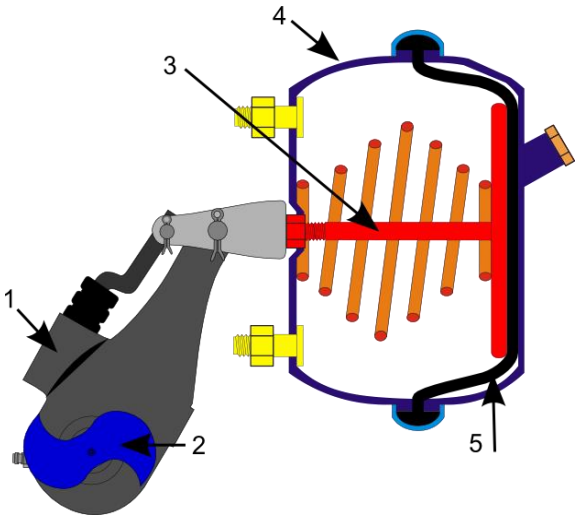
Special features

_____

_____

_____

_____



System specification of the braking receiver:

1 _____

2 _____

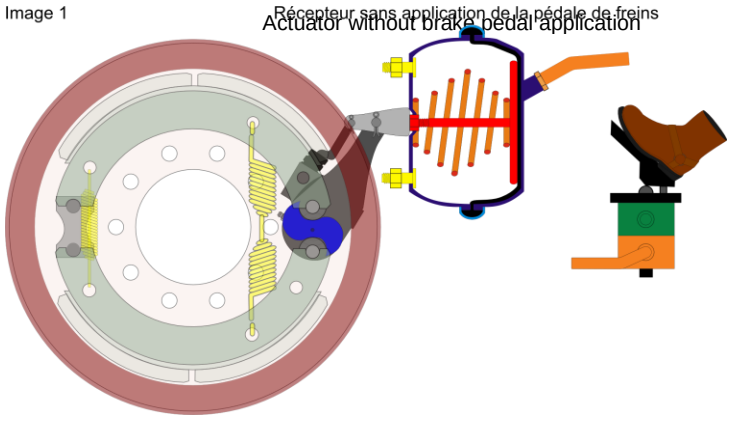
3 _____

4 _____

5 _____

Operation of the air brake system

Image 1



When the driver presses the brake pedal, he or she chooses to open a valve that allows air pressure to pass through. The more pressure you apply to the pedal, the more air pressure it allows to pass.

The compressed air is then directed to the braking receivers through the pipes.

(2.4.2)

The compressed air puts pressure on the diaphragm contained in the braking receiver.

Image 2 Actuator with moderate brake pedal application
Récepteur avec application modérée de la pédale de freins

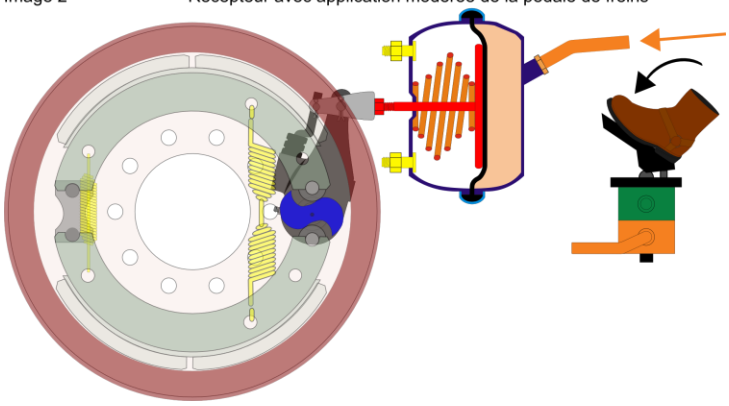
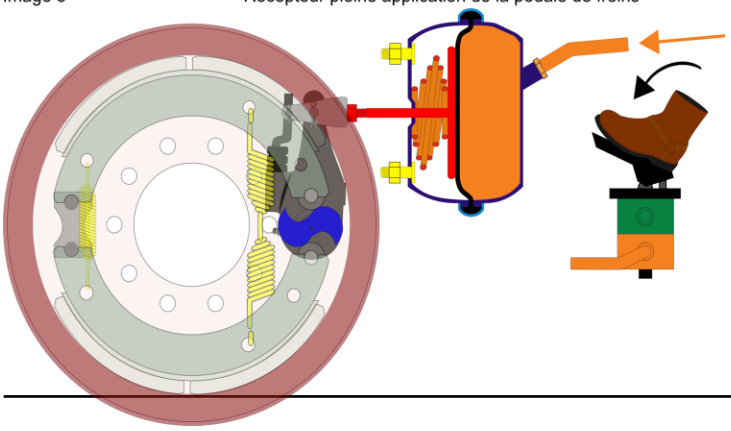
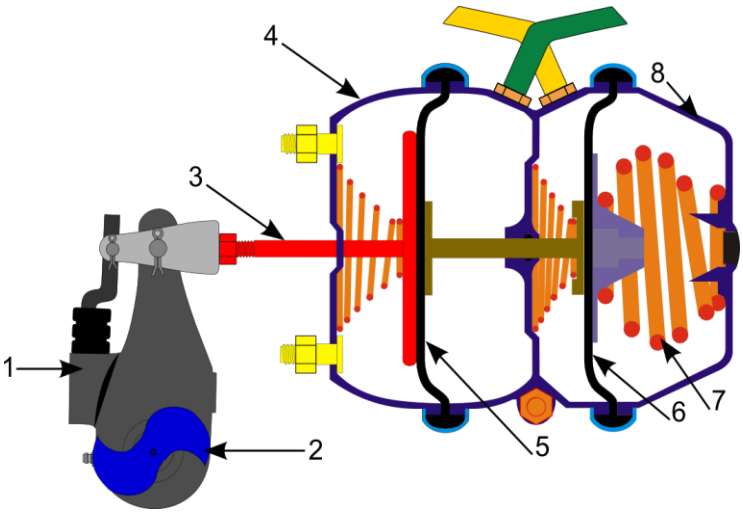


Image 3 Actuator with full brake pedal application
Récepteur pleine application de la pédale de freins



The higher the air pressure, the more load the diaphragm puts on the push rod, which in turn puts pressure on the adjustable lever. The adjustable lever imposes a rotating force on the "S" camshaft. It is the action of this rotation that acts on the brake shoes and causes the brakes to apply.

(2.4.2)



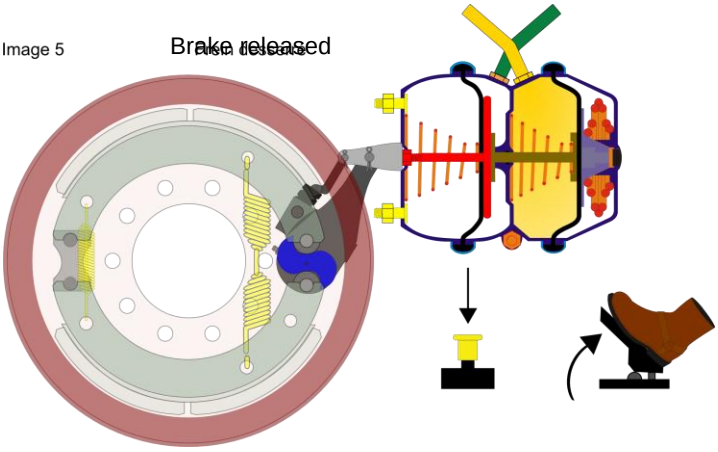
List of specifications of the double braking receiver

1	
2	
3	
4	
5	
6	
7	
8	

Operation

The parking (emergency) brake is a mechanical brake, not an air brake. The brakes are applied by the action of a powerful spring.
The spring rests on the floating rod, which in turn rests on the push rod that applies the brakes.

Image 5

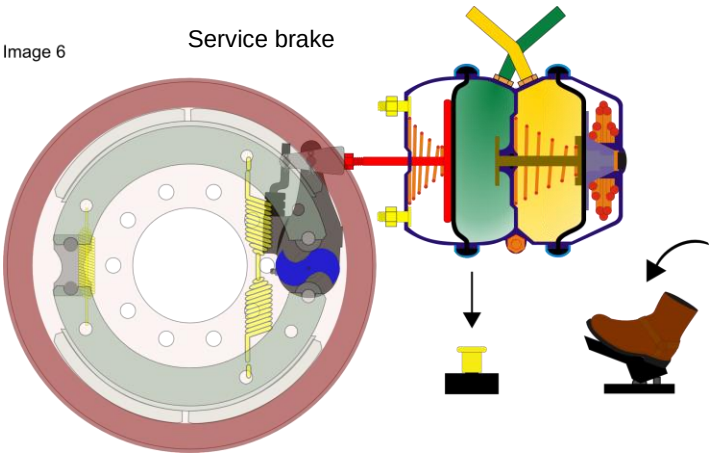


By pushing the yellow button, air enters the cylinder and pushes on the diaphragm, compressing the parking brake spring and releasing the brakes.

(2.4.2)

The picture shows that the parking brake spring is compressed by the air pressure from the parking brake button and the service brake is applied by the air pressure from the brake pedal.

Image 6 Service brake

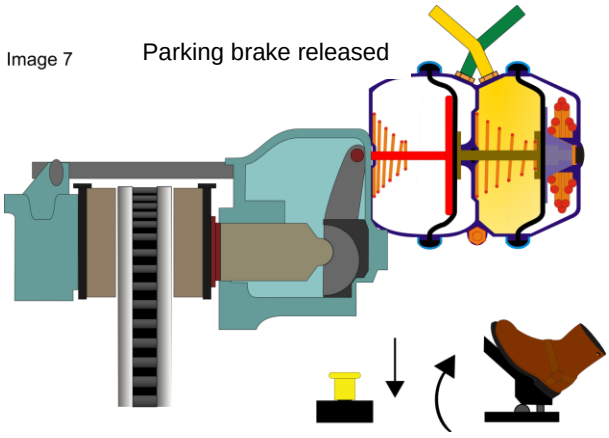


Disc brake

On a vehicle equipped with air disc brakes, the role of the brake actuator remains the same as that of a drum brake. Note, however, the fact that the receiver is mounted in parallel with the axle rather than transversely.

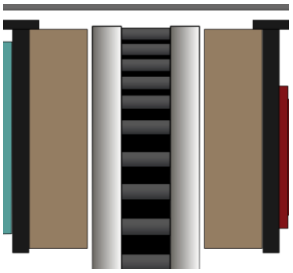
Operation

Image 7 Parking brake released



In the case of the disc brake, the friction is produced by tightening the pads on each side of the disc, thus slowing down the vehicle.

On image 7, we can see that the brake is loose. There is space between the pads and the disc.



(2.4.2)

In **image 8**, the parking brake is **applied**; the pads then clamp the disc.

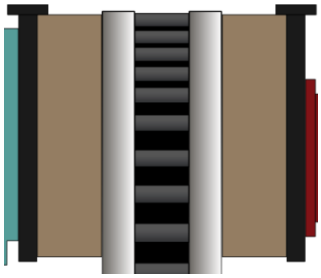
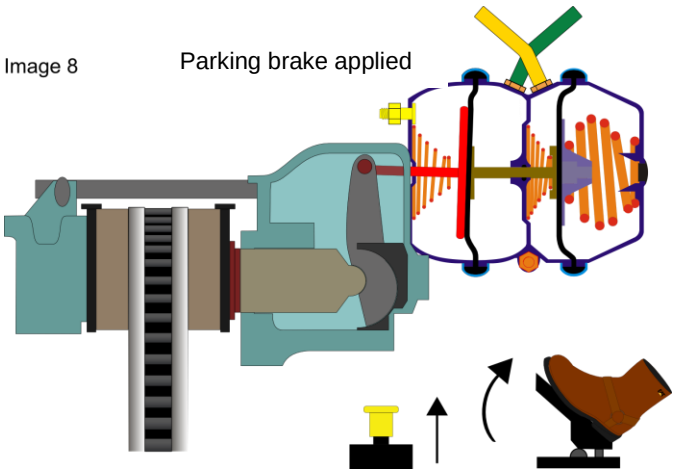
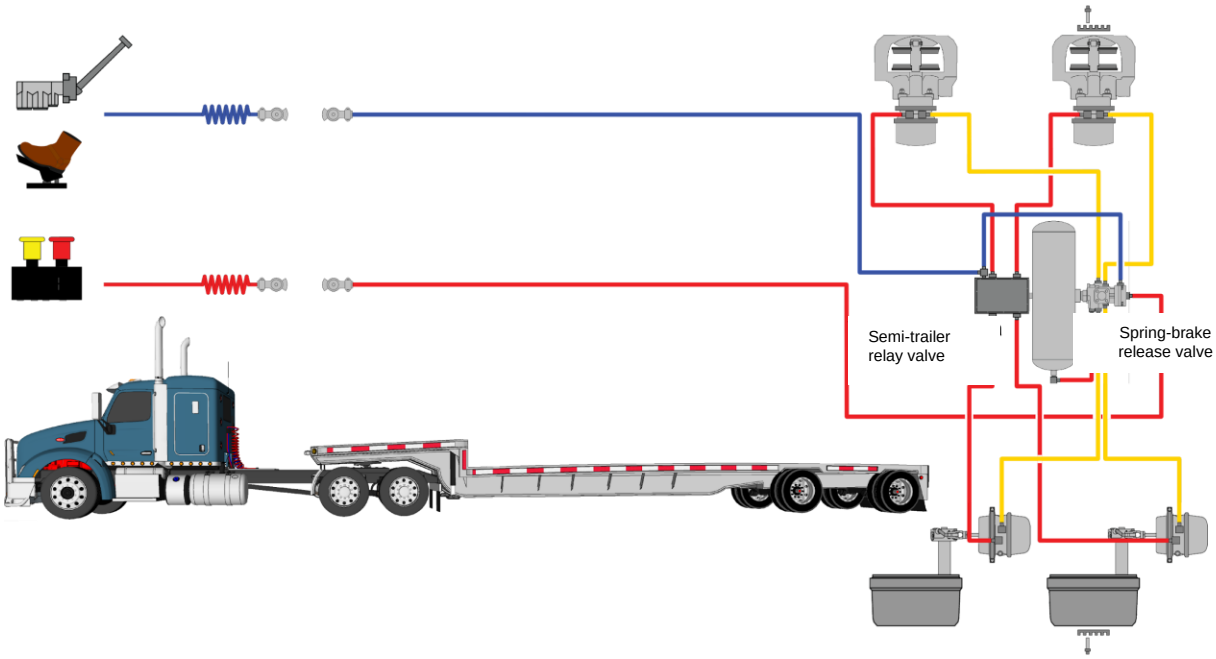


Image 8 Parking brake applied



Features

(2.4.2)



When the red button is pushed, the trailer is supplied with air. When the pressure is sufficient, the parking brakes are loosened.

The air supply to the trailer is provided by the red hose.

When the service brake is

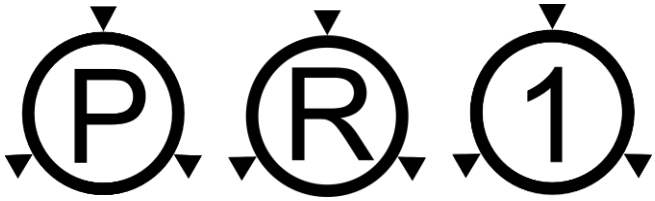
When the brake pedal or the lever (*Bendix*) is applied, air pressure is sent through the blue hose and controls the pressure of the desired braking application.

(2.4.2)

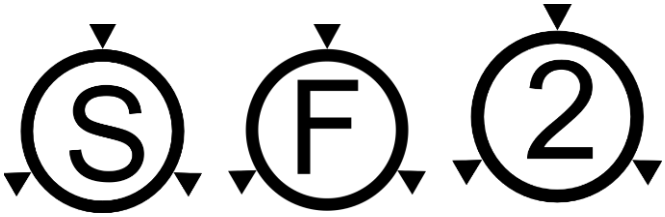
Pictograms associated with braking systems

The pictogram showing arrows in opposition to the circle represents pressure.

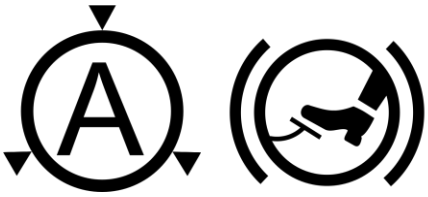
For the pneumatic system, the primary circuit is identified by the letter P or by the number 1. **R "Rear" (on older vehicles only).** The green color represents the primary circuit.



The secondary circuit is identified by the letter S or by the number 2. **F "Front" (on older vehicle only).** The red color represents the secondary circuit.



As an option, some trucks can be equipped with a dial that indicates the brake application pressure. The following pictograms accompany these dials.

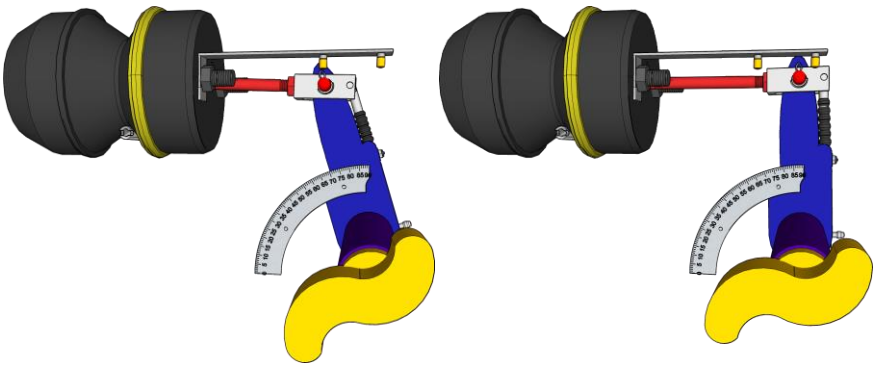


Danger indicators and warning lights

(2.4.2)

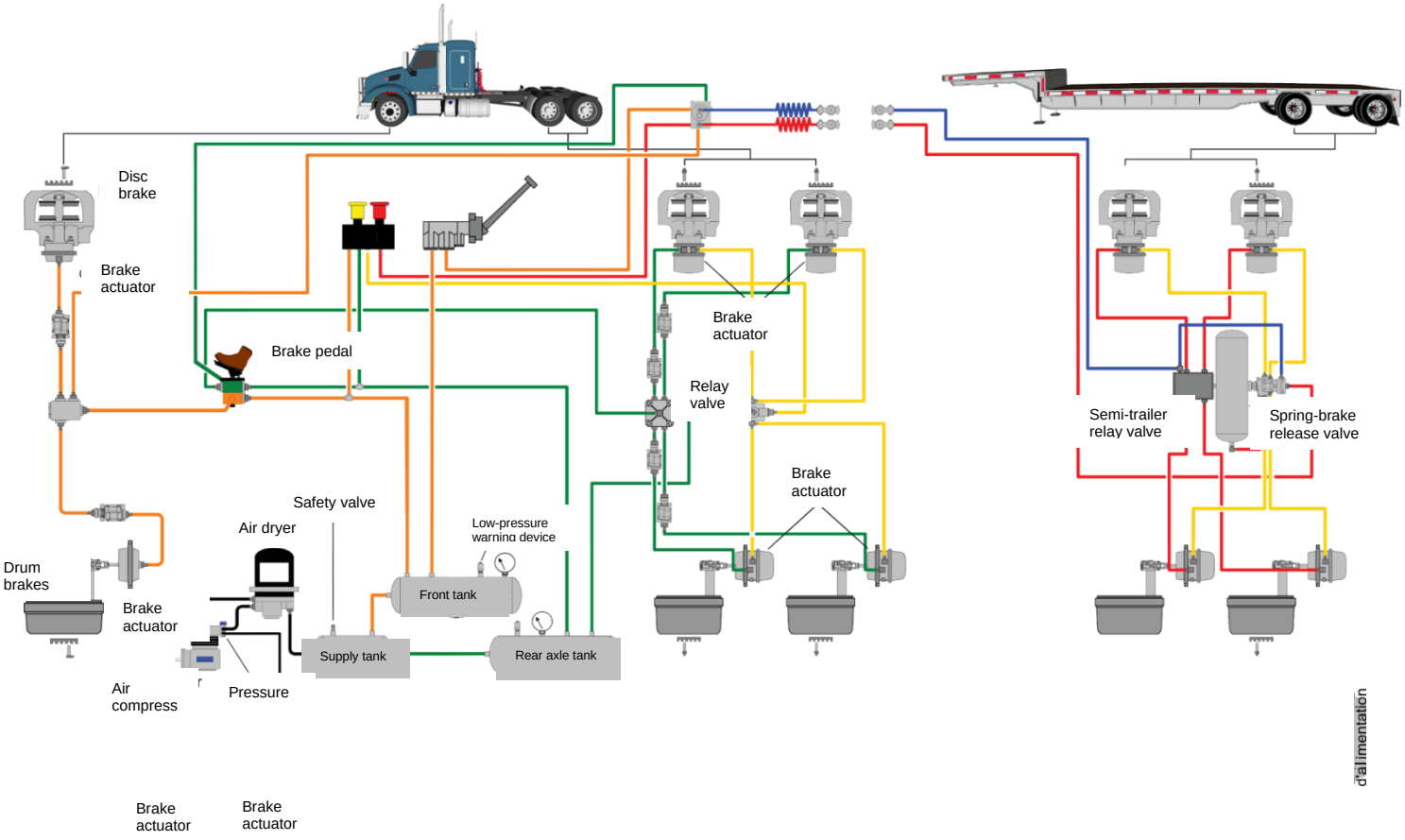
Dials

Brake verification and adjustment



Slack adjustment procedure for vehicles with drum brakes

(2.4.2)


Disc brake
Brake actuator
Brake pedal
Brake actuator
Relay valve
Brake actuator
Semi-trailer relay valve
Spring-brake release valve
Safety valve
Air dryer
Low-pressure warning device
Drum brakes
Brake actuator
Front tank
Supply tank
Rear axle tank
Air compress
Pressure
Brake actuator
Brake actuator
Brake actuator
d'alimentation


PULL TO EVACUATE
TRAILER AIR SUPPLY
NOT FOR PARKING
PUSH TO SUPPLY

(2.4.2)

Skill 2

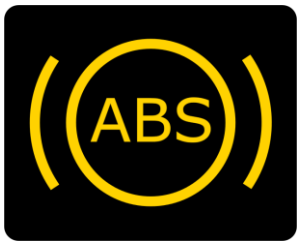
The braking system 3

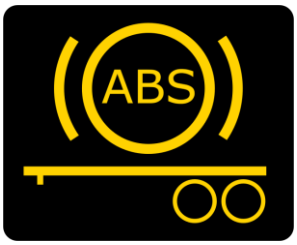
Lesson Objectives:
- Determine relevant means of optimization
- Prepare for the SAAQ air brake theory test

ANTI-LOCK BRAKING SYSTEM

ABS (anti-lock braking system)

The Anti-lock Braking System (ABS) is a driver assistance system designed to help the driver maintain control of the vehicle and prevent it from skidding during braking. When traction is lost, the ABS computer uses wheel speed sensors to determine if one or more wheels are about to lock up during braking. Before a blockage occurs on a_____, the compensator valve releases the brake pressure on the valve several times per second. The constant rotation of the wheels prevents skidding and maintains steering control.





Operation indicator

The ABS indicator light usually changes color_____lights up in the dashboard for a few seconds when the ignition is turned on, then goes out. Two witnesses can be present: one for the truck and one for the trailer. However, if the light on the dashboard or on the trailer remains on all the time, it is telling the operator that the ABS computer has detected a fault in its components and that the system is in _____. However, the conventional brakes work normally. It will then be essential to adapt the driving of this vehicle accordingly. In addition, since the ABS system is mandatory on all heavy vehicles, it must be repaired as soon as possible.

Driving assistance systems

Some vehicles are equipped with driver assistance systems. **These systems allow, for example, lane keeping, detection of danger in front of the vehicle, assisted braking (adaptive cruise control) or the emission of safety warnings; sound and/or vibrations. Their goal is to avoid situations that can lead to an accident.**

Among other things, they use the vehicle's braking system to improve control of the entire equipment. A pictogram in the dashboard indicates their presence. It lights up for a few seconds when the ignition is turned on, then goes out. The light flashes at each maneuver that requires its intervention. If it stays on all the time, the system is inactive and should be repaired as soon as possible.



ESP (Electronic stability program) Electronic stability system

The system can include anti-rollover and anti-skid functions.

RSP (Roll stability program) Anti-rollover system

Anti-skid system (Yaw control)

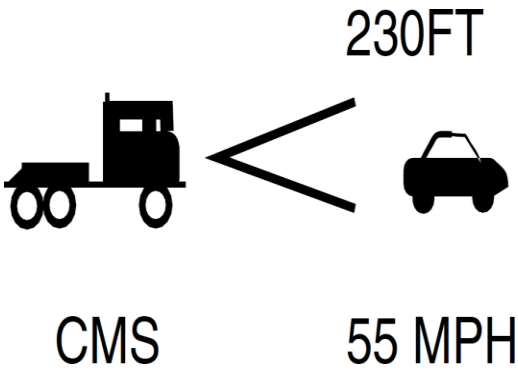
These systems can reduce engine torque, engine braking and apply service brakes strategically to try to avoid the worst.

Condition of the coupling Meritor WABCO's OnGuard collision reduction system

CMS (collision mitigation system)

This optional system uses a radar located in the front bumper. The radar determines the position and speed of vehicles in front of the tractor. It informs the driver of potential hazards by first changing the color of its _____ and then emitting an audible signal. Finally, if the risk of collision increases, he can apply the _____ up to 50% of its maximum power.

In the following example, a vehicle is detected in front of the truck at 230 feet (70 m) and is traveling at 55 miles per hour (89 km/h).



What you need to know about these systems

They are not infallible and can lose effectiveness when the steering angle is distorted and the load is unstable.

They become less active in "ABS off-road" mode and inactive when the ABS/ATC system is in diagnostic mode or faulty.

They can record events. Thus, as soon as that one of the driving assistance systems intervenes, it can create a reports according to its level of intervention.

These driving assistance system will never replace the professional and safe maneuvers of the driver.

BRAKING TECHNIQUES ON SLOPES AND ON THE FLAT

Highway exits

Anticipation of highway exits is paramount. In order to optimize the stability of the truck, it is preferable not to brake when the truck is in the curve. The slowdown must therefore be completed before crossing the_____. If well anticipated, an exit can even be negotiated without the use of service brakes. The motor brake (jacob) must be used properly.

Traffic lights

When approaching a traffic light, it is strongly recommended that you do not over speed. **Anticipation of traffic lights and traffic patterns reduces the need for service brakes by reducing major slowdowns and unnecessary stops.**

Short descents

As you approach the descent, ease off the throttle to reduce your speed. Thus, the acceleration caused by gravity on a slope will allow you to regain your cruising speed without exceeding it. The motor brake (jacob) must be used with discretion.

Long descents

As we approach the descent, we must carefully observe the_____as well as the environment. This will make it easier to determine how much deceleration is needed for the vehicle under the circumstances. Then, the combination of braking and downshifting will allow the ideal gear to be reached before negotiating the_____.

This **anticipation**, combined with the use of engine braking (retarder), makes it possible to cross the slope without using the service brakes. In fact, the service brakes should be used only occasionally on certain portions of the grade to prevent the engine speed from exceeding the _____recommended. In this way, braking problems caused by too high of a rise in temperature in the brake drums and/or discs are eliminated.

Skill 2

Steering

Lesson Objectives:

- Determine the steps for using this system properly
- Recognize potential problems caused by misuse
- Know the physical principles related to the steering system

Checking the direction

Steering wheel

_____

_____

_____

Liquid level* on a transparent tank.

_____

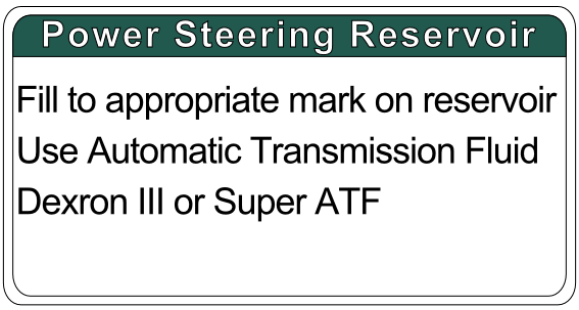
_____

_____

Gauge identification on an opaque power steering tank

Level to be respected hot and_____.

Type of liquid to be used; usually Dexron III



In the above example, it is recommended to use the automatic transmission fluid **Mercon or Dexron.** The color_____is a good indication, but not always true.

If the information on the type of fluid to be added is not visible on the power steering tank, you must consult the truck manufacturer's operating manual. If not available, ask the transport company's mechanic. It is not necessarily always automatic transmission fluid that is used in the power steering system. *** The term liquid is used because of its pressure function.**

_____

_____

_____

Power steering housing and linkage

_____

_____

_____

Checking the condition of the parts and the presence of leaks

Instructions for the proper use of the steering system

1. Avoid turning the steering wheel when the truck is not in motion.
2. Avoid turning the steering wheel while applying the brakes.
3. Avoid turning the steering wheel as far as it will go and forcing it into this position.
4. Make sure the harness is properly lubricated.
5. Avoid riding on curbs or sidewalks when turning.

Recognize a steering problem when the truck is in motion

When driving at high speeds, the truck should be going in a straight line when the steering wheel is not turned. If the vehicle is headed to one side of the road or the other, the alignment of the wheels may be at issue.

Skill 2

Tires

Lesson Objectives:
- Recognize the characteristics of tires
- Know the physical principles related to tires
- Recognize potential problems

Some definitions

Tread: a thick and adherent rubber layer in contact with the road, allowing the transmission of torque and guidance in
the curves.

Wear indicators: small bumps located at the bottom of the tread grooves to warn the driver of the end of the tire's useful life.

Sidewall: lateral zone of the tire made of a soft rubber capable of withstanding deformation with each turn of the wheel and resistant to shocks and friction.

Cold pressure: tire inflation pressure displayed on the sidewall, which must be taken when the tire is cold in order to avoid a false reading.

Applications of the tires according to their treads, thus their position. Some tires have a specific position, while others are called all-position.

1. **Tires for steering axle**

2. **Tires for twin drive axles**

3. **Tires for semi-trailer axles in twin version**

4. **Wide-band tires for semi-trailer axles and drive axles**

(2.5.2)

There is also a type of tire that is called a recap. It is a worn tire on which a new one is applied. _____has been glued on the used one in order to save money. All tires seen above can be retreaded. However, in Quebec, the law does not allow the use of these on the _____ axle of a heavy vehicle. A used tire can be recycled up to three times according to Bandag (tire retreading specialist).

MAXIMUM DIMENSIONS ALLOWED

Tires of size 11 R 22.5 are the most common on the market.
The number 11 represents the approximate width in inches of a section, from side to side.
The R stands for the type of casing (radial), while the 22.5 stands for the diameter of the wheel in inches.

The industry is constantly developing new new products, models and dimensions more and more specific. Nowadays, there are many metric-sized tires: for example, the 445 50 R 22.5, a tire with a_____.
This type of tire is used, among other things, for its lower rolling resistance, which translates into a reduction in fuel consumption of_____.
Another important advantage is the weight reduction due to its simple mounting. Here, the width is 445 mm. Then, the number 50 represents the height of the flank expressed in % (50% of 445 mm).
This tire can also be installed on a 22.5 diameter wheel.

(2.5.2)

Pressures and capacities

The maximum inflation pressure is indicated on the _____ of the tire by the tire manufacturer. This indication can also be found in the door frame of the truck. This pressure must be respected if the maximum loads allowed by law are to be reached. In conjunction with the tire representative, the carrier can determine a lower pressure that reflects the value of the loads being carried. This will optimize tire performance. **The CFTR uses 105 psi for the steering axle and 80 psi for the drive and trailer axles. Recommendation: It can be difficult to tell when a dual tire is flat when the** second tire of the assembly is in good condition. So, to check if a dual tire is flat, it is necessary to It is recommended to hit it with a hammer or similar object. **CVL page 397**

Tire inflation

It is normal for a tire to have a slight drop in air pressure. Inflating is then recommended. However, some precautions should be taken. First, the adjustment must always be done cold. **Never adjust the pressure of a hot tire because of the high risk of explosion (sidewall flashover) of the tire.** If the tire has a decrease in _____ of more than 20%, it should be disassembled and inspected prior to reinflation. Then, it is recommended to use a jawed inflation chuck and a hose extension with a control valve and a pressure gauge. The extension cord allows you to stand at **at least one meter from the tread and not facing the sidewall of the tire.**

(2.5.2)

Some vehicles are equipped with tire pressure monitoring systems. These systems constantly regulate the pressure inside the tires to ensure optimal performance.

As soon as the trailer is supplied with air, the system can intervene as needed. When a tire has an air pressure below the preset standard, the system supplies the tire with the necessary volume of air from one of the____semi-trailer. A warning light on the front of the trailer indicates that the pressure regulator is working. The manufacturer reports that when the light is on constantly for more than 10 minutes, it means that one or more tires are deflated or that the system is defective.

Anomalies

Foreign bodies with or without puncture

(2.5.2)

Uneven wear

These deformations are usually caused by mechanical problems in the suspensions or by parts or shock absorbers in bad condition as well as defective wheel parallelism (alignment). Inadequate air pressure in the tires also causes unevenness.

Flat spot

This type of anomaly usually occurs on a trailer, when the operator fails to check the free movement of all wheels before setting off. Also, such minor wear can occur during emergency braking or during a blockage caused by a defective braking system.

(2.5.2)

Damaged sidewall or tread

Several cracks can be found on the different surfaces of the tires. However, only imperfections that expose the reinforcing fabric or steel belt will be considered anomalies. For sidewall dents and repairs already made, tolerances should be checked by qualified personnel.

(2.5.2)

Alert: Tire explosion - pyrolysis

Hazards

Pyrolysis is the thermochemical decomposition of organic material that can occur at high temperatures in the absence of oxygen. This decomposition process requires only the presence of rubber and heat. Once started, the decomposition process is irreversible. There is no visual indication that the decomposition process is taking place. Depending on the particular circumstances, an explosion may occur immediately, within minutes or several hours after exposure to the heat source.

In many cases, an explosion can cause the tire and/or its components to be thrown great distances, resulting in serious injury and/or death to workers as well as significant property damage.

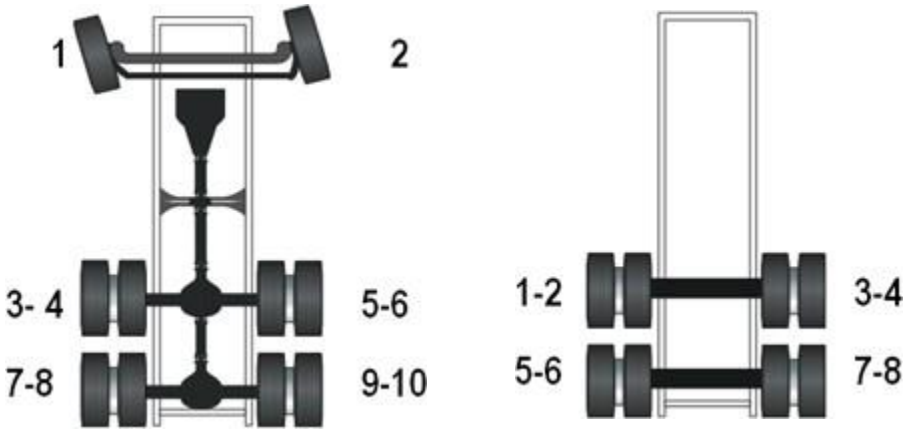
Three situations can cause your tires to pyrolyze:

1- Overheating of the brakes;

2- Driving long distances with under-inflated tires; 3- Overloading.

(2.5.2)

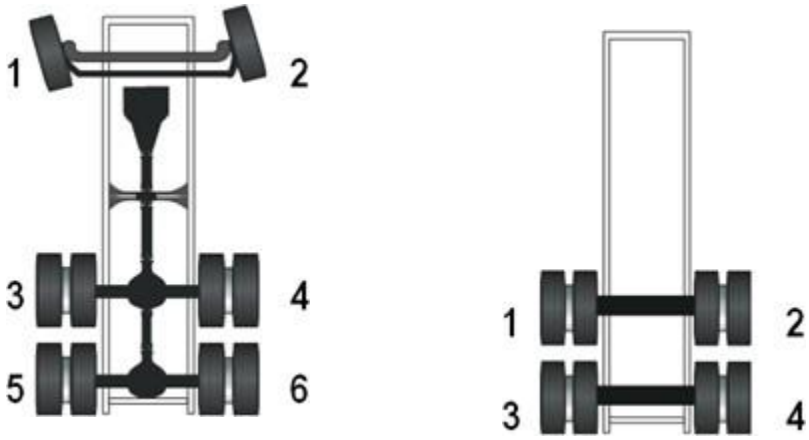
Truck **Trailer**



Tire location code used at the CFTR, among others

Wheel and wheel assembly location code at the CFTR

Truck **Trailer**



(2.5.2)

Skill 2

The wheels

Lesson Objectives:
- Recognize the types of wheels and their condition
- Recognize the types of hubs and their condition

Some definitions

Dual wheels: Wheels mounted in pairs on either side of a rear axle on some heavy vehicles.

Drive wheel: Wheel mounted on a drive axle. (English: drive axle wheel)

Steering wheel: Wheel mounted on a steering axle. (English: steering axle wheel)

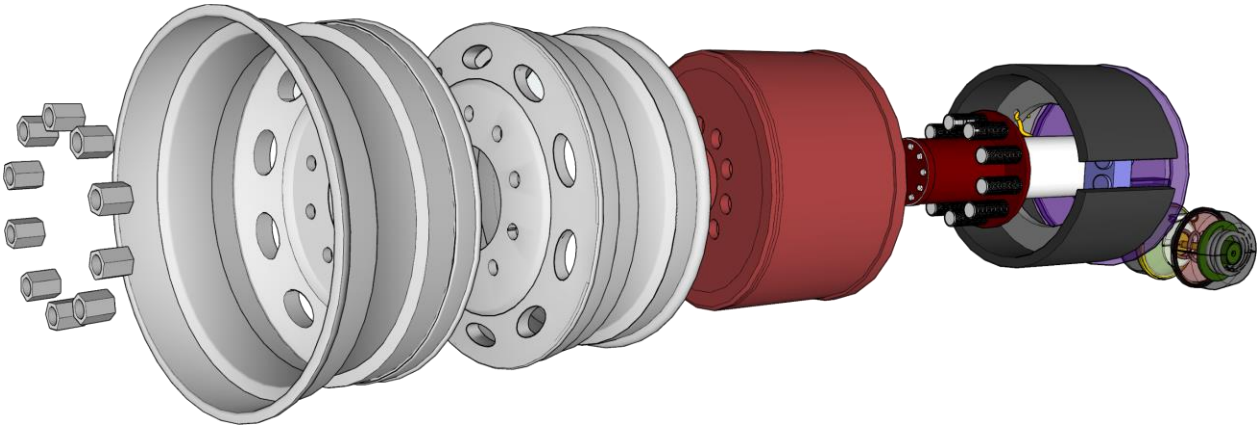
Disc wheels: (common name: Budd wheel)

Rim: Circular part of the wheel where the tire sits.

Notes:

There are two types of disc wheels, either steel or aluminum.

Dual wheel assembly



Disc wheel inspection

It is necessary to check the presence of____on the wheels.

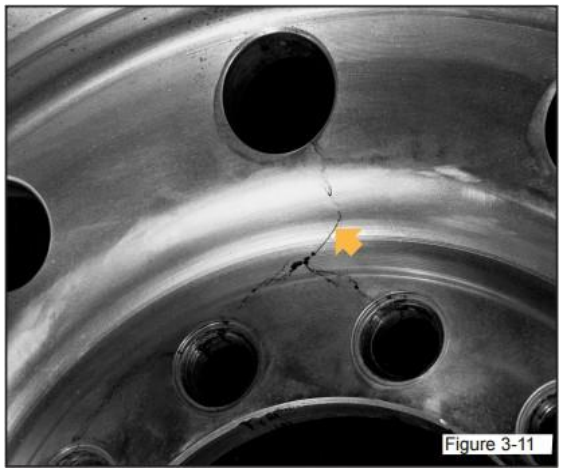


Figure 3-11

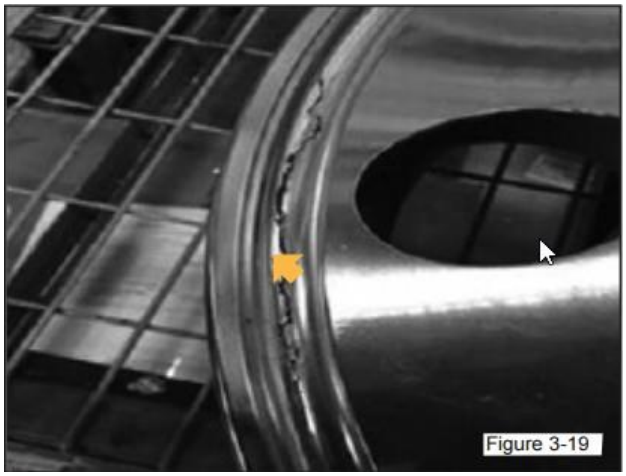


Figure 3-19

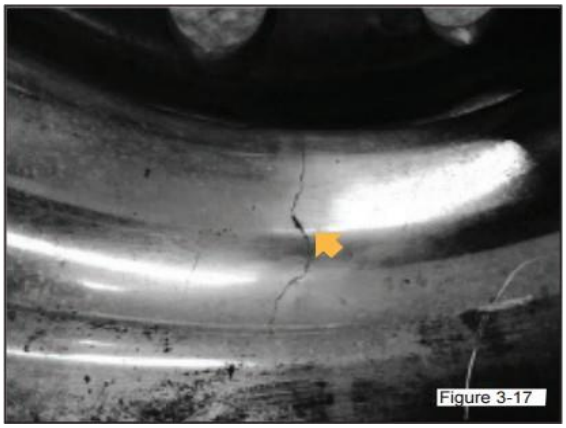
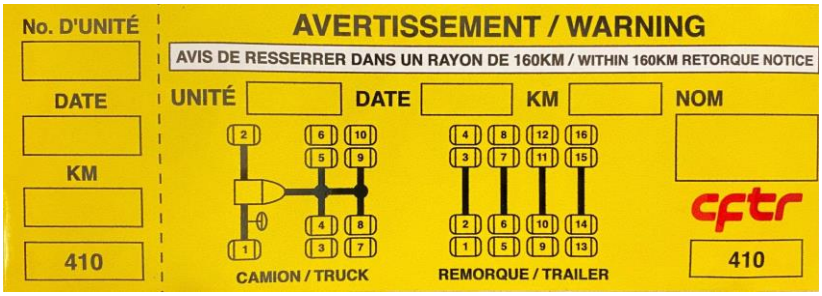


Figure 3-17

Notes:

Loose or missing nuts

A heavy vehicle with loose or missing lug nuts should not be driven until the repair is made. The _____indicators are very useful for the driver who is doing his safety patrol. If one of them is no longer_____it is easy to recognize the defect. Rust around the bolts on a steel wheel is also a good indication that a nut is loose.



Tightening label

When this label is affixed to a piece of equipment at the CFTR, it indicates that one or more wheels have been recently . For security reasons and/or to **To comply with the law in other provinces, all newly installed wheels must be re-torqued to the manufacturers' specified torque.** In the following example, you are required to have the torque checked by a mechanic within 160 km. A couple between _____**and**

_____ **lb/ft must be applied with a torque wrench.** Obviously, policies and procedures differ from company to company (e.g. Kenworth). It is the responsibility of the____to ensure its application.

The SAAQ recommends tightening between 80 km and about 160 km.

Notes:

Suitable liquid to be added to oil lubricated wheel hubs

Two types are used.

It is a generally synthetic gear oil with a viscosity_____.

A mineral oil of grade 80w90 can also be used.

Follow the manufacturer's recommendations or consult your mechanic. These oils have a particular odor, which facilitates the detection of leaks during the security round. Leaks can occur on either side of the wheels,
Hence the importance of checking both sides whenever possible. **He It could be very dangerous to drive with a wheel hub without oil.**

Notes:

Wheel mounted odometer (common name: Hubodometer)

Notes:

IMPORTANT: The presence of a meter must not be an obstacle to verifying the the oil level of the hub.

Examples of defects caused by seal leakage.

Sealed wheel hub, lubricated with semi-liquid grease; therefore no risk of leakage.

Anomalies

Skill 2

Suspension systems

Lesson Objectives:
- Determine the use and limitations of different types of suspension systems
- Know the physical principles related to each suspension system

Suspension

The suspension of a truck is used to absorb the shocks caused by bad road conditions. It also ensures better road _____ regardless of the load. However, it has its limitations given the significant physical forces associated with driving a heavy vehicle. In addition to offering comfort to the _____, in some cases, it must protect the cargo, such as the transport of furniture, electronic devices or any other fragile goods. But more importantly, the modern truck suspension is designed so that each load-bearing wheel carries as much of the same load as possible and has the same traction and braking force. In the case of an axle assembly, the suspension system shall be designed to equalize, to within 1000 kg, at all times, the _____ that can be measured under its wheels.

The P.N.B.E.


MANUFACTURED BY/FABRIQUÉ PAR:

TYPE:_____ DATE:_____

GVWR/PNBV_____KG. V.I.N./N.I.V.:_____

GAWR/PNBE KG	TIRE/PNEU-DIMENSION-RIM/JANTE	COLD INFL. PRESS/ PRESS. DE GONFL. À FROID PSI/LPC KPA

La capacité maximale d'un essieu au sens du Règlement sur la sécurité des véhicules automobiles.

- PNBE : Poids nominal brut sur l'essieu
- GAWR : *Gross axle weight rating*

Question 04: Road Vehicle Load and Size Limits Guide

The maximum capacity of the front axle is indicated on a sticker usually glued to the driver's door frame. Also included are the manufacturer's maximum allowable weights of all axles in pounds and kilograms.

_____

_____

_____

_____

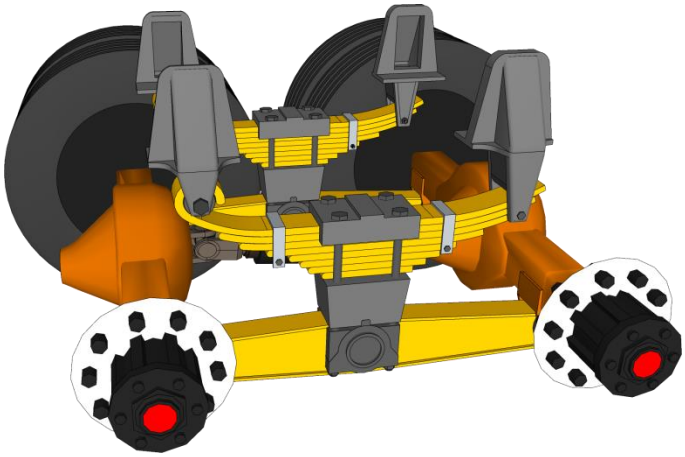
_____

_____

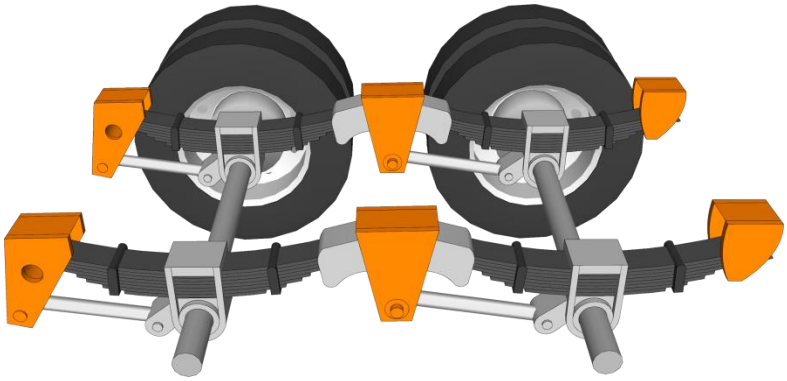
Types of suspensions

Leaf spring suspension

Steering axle



Drive axles



Semi-trailer axles Composite leaf springs can also be used.

Verification

_____

_____

Rubber coil springs driving axles

Checking :

_____

_____

_____

(2.5.4)

Driving axle and semi-trailer air springs
Verification:

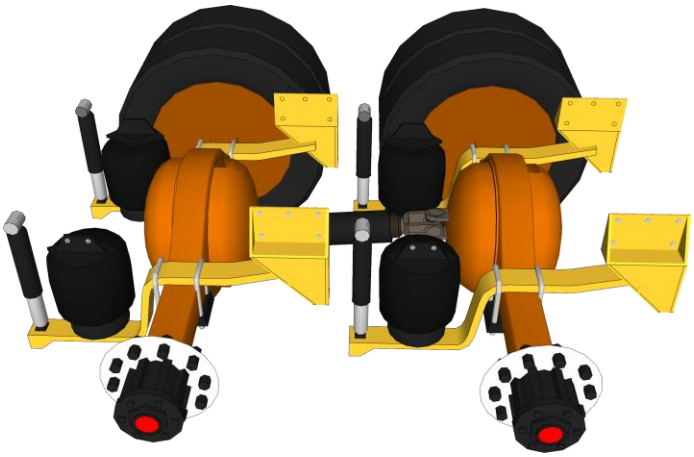
_____

Anomalies:

_____

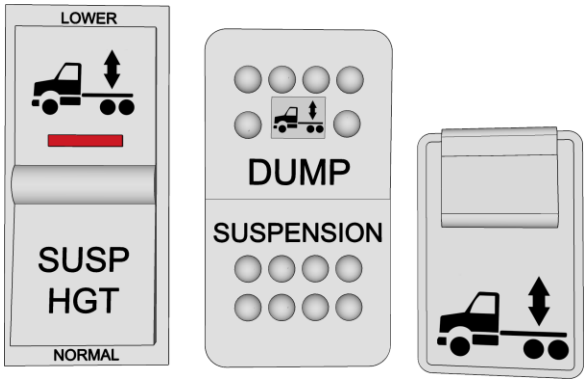
_____

_____



Switches

Some switches use a similar pictogram that illustrates the vertical movements of the back of the truck as the deflation or inflation of the__is controlled by the operator. The abbreviation HGT (height) translates into the height of the back of the truck. The abbreviations LOWER or DUMP represent the action of lowering ↓ the suspension.



Use;

When uncoupling the trailer, the operator will use his switch before releasing it. The purpose of the maneuver is to reduce the _____inside the balloons to avoid excessive stretching of the entire suspension. Thus, the integrity of the shock absorbers, balloons and height valve is maintained. The deflation time is proportional to the load supported. The switch can also be used EXCEPTIONALLY when coupling a trailer that is much too low.

Shock absorbers

Roles

Absorb oscillatory movements of the suspension springs and thus improve the stability and handling of the vehicle.

(2.5.4)

Verification:

_____

_____

_____

Indicator lights

Some indicator lights are integrated into the switch itself, while others will be visible in the dashboard or directly in the multifunction display.

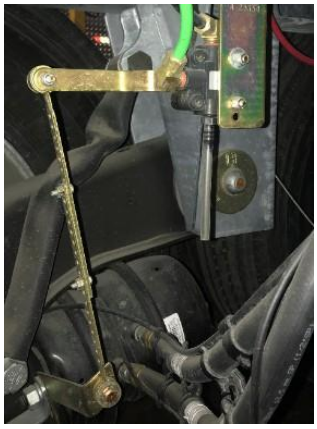
Indicators

The first (left) type in the form of a manometer shows the air pressure in PSI present in the _____ (deflated) from the truck. The second

The indicator (on the right) shows, like a scale, the approximate weight in KG under the rear wheels, i.e. 3,700 kg for a single bobtail tractor. The equivalent pressure in PSI is usually close to 10.

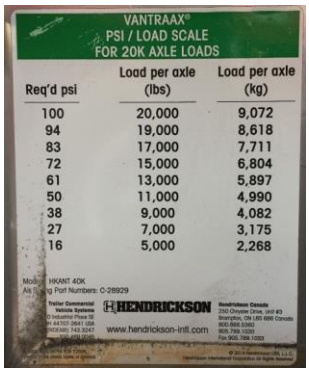
Height valve

All axles or axle groups with air suspension have at least one height valve. The latter allows the vehicle to be kept constantly at the same _____. Thus, as the load on the vehicle is increased, the air pressure in the balloons will increase.



(2.5.4)

Control of the trailer



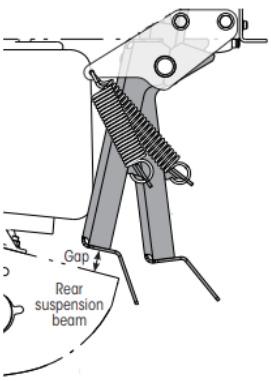
The control on the semi-trailer allows, just like the switch on a truck, the activation of the air suspension. Both inflation and deflation can be operated in the following ways_____or automatic.

Use

In addition to the pressure gauge, the control box is usually equipped with a_____. This one allows to determine approximately the mass under the wheels.

Optional equipment

Some semi-trailer suspensions are equipped with anti-sway mechanisms called "Surelok". This mechanism prevents the suspension of a stationary semi-trailer from collapsing and therefore from moving unexpectedly to the side._____**"Dock walk.** Thus, as its name indicates, it will allow to benefit from a higher loading threshold when the configuration of the platform requires it. In addition, it increases the life of the landing gear (loaded stationary trailer) and the bumper stops.

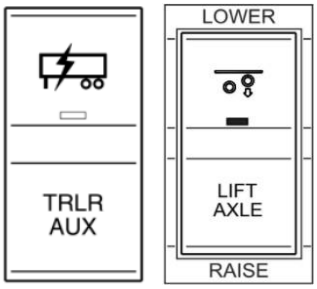


(2.5.4)

Lifting axle

The lift axle of a semi-trailer is part of an optional configuration available on some semi-trailers. This one has as a primary function to support more weight on the equipment (versus tandem). When installed on the front axle of a tridem, the operator has the opportunity to use it to reduce the pressure in the balloons of this axle during a _____ tight. In addition, it is possible to keep it in position_____when the load carried requires fewer axles on the ground.

The switches



(2.5.4)

Self-steering axle

As the name implies, the self-steering axle turns automatically as the equipment moves. On a semi-trailer, it is installed at the front of the triple axles (in Quebec) and can be mounted in single or twin. It is constantly on the ground when turning, at least when the load being transported requires its presence. However, it should be noted that when reversing either automatically by a mechanism or with the intervention of the driver.

Verification

Detachable axle

It is an axle installed on a semi-trailer equipped with an automated control device "SMART LIFT AXLE", which lifts the axle when the load on it is insufficient. Thus, the system works completely automatically without any operator intervention. This system reduces operating costs related to suspension, tires and fuel consumption. Currently in Quebec, its use requires a special traffic permit.

(2.5.4)

Lexicon

Suspension: All of the vehicle's components that provide a flexible connection between the chassis frame and the axles.

Air spring: A rubber device, with variable flexibility, replacing leaf springs in an air suspension. Common term: suspension ball.

Air suspension: Suspension with air springs. Common term: air suspension.

Carrier axle: A set of wheels symmetrically arranged on the same axle beam, intended to support a part of the load.

Steering axle: A load-bearing axle whose wheels, connected to the steering system, are mounted on parts that can pivot about axes carried by the ends of the central beam of the axle.

Single axle: Wheel set with a single axle.

Tandem axle: A wheel set with two load-bearing axles. (Legislation: must balance at 1000 kg or less).

Tridem axle: A wheel set consisting of three equally spaced load-bearing axles attached to the same suspension.
(Legislation: must balance at 1000 kg or less).

Self-steering axle: Auxiliary axle with a fixed central beam whose wheels are equipped with a spring device allowing them to adapt to the trajectory of the vehicle.

Lifting central axle: Lifting auxiliary axle mounted between the landing gear and the running gear of a semi-trailer. Common term (Anglicism): Air lift.

(2.5.4)

Competency 2

Preventative review

This 180 minute period will be used to review the content of lessons: 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.2.5, 2.5.1, 2.5.2, 2.5.3 and 2.5.4.

Depending on the needs (difficulties) related to these lessons, the instructor will provide you with a review questionnaire.

List of lessons to be covered.

Lesson 2.1.1 Truck Features Lesson 2.1.2
The Instrument Panel
Lesson 2.2.1 Engines (makes, models and specifications) Lesson
2.2.2 External Cooling System Components
Lesson 2.2.3 External Engine Lubrication System Components Lesson 2.2.4
External Electrical System Components
Lesson 2.2.5 External Air and Exhaust System Components Lesson 2.5.1 Steering
Lesson 2.5.2 Tires
Lesson 2.5.3 Wheels
Lesson 2.5.4 Suspensions

Happy review!

Skill 2

Preventative review

This 60-minute period will be used to review the content of lessons: 2.2.6, 2.4.1, 2.4.2, and 2.4.3.

Depending on the needs (difficulties) related to these lessons, the instructor will provide you with a review questionnaire.

List of lessons to be recovered.

Lesson 2.2.6 Engine and Auxiliary Brakes Lesson

2.4.1 The Brake System 1
Lesson 2.4.2 The Brake System 2
Lesson 2.4.3 The Brake System 3

Happy review!

Skill 2

Preventative review

This 60 minute period will be used to review the content of lessons: 2.3.1, 2.3.2.

Depending on the needs (difficulties) related to these lessons, the instructor will provide you with a review questionnaire.

List of lessons to be recovered.

Lesson 2.3.1 Transmission of Motion (The Clutch)
Lesson 2.3.2 Transmission of motion (manual transmissions)

Skill 2

Preventative review

This 120 minute period will be used to review the content of lessons: 2.2.7, 2.2.8, 2.3.3, 2.3.4. and the entire competency.

Lesson 2.2.7 Engine
Lesson 2.2.8 Energy Conservation
Lesson 2.3.3 Power Transmission (Automated and Automatic) Lesson 2.3.4 Power Transmission (Power Dividers, Differentials and Traction Control)

Skill 02

Evaluation for completion purposes

Lesson Objective:

- Demonstrate your understanding in relation to the competency "Semi-trailer truck systems capabilities".

Duration of the evaluation: 2 hours (duration of the reading of the instructions included in the 2 hours).

Student notebook allowed: No
Personal course notes allowed: No
Calculator: Yes
Cell phone: No
Passing grade: 80%

Skill 02

(Recovery)

Lesson Objective:
- Recover specific and/or deficient skill elements from struggling students

Recovery time before the evaluation resumes.

Validate the acquisition of the skill, "Identifying the possibilities of the systems of a semi-trailer truck" by a written evaluation in the form of questions and situations.

Distinguish the characteristics of a truck:

- Learn about the capabilities of the power unit
- Choose the modes of use of the motion transmission system
- Select ways to optimize performance of the braking system.
- Understand the capabilities and limitations of suspension and steering systems and wheels