



Saskatchewan
Ministry of
Highways and
Infrastructure

Grader Manual

May 2009



Grader Manual

Acknowledgements

Ministry of Highways & Infrastructure

04/17/2009

After you have finished studying this manual and following a practical demonstration, you will be able to:

- Identify the different grader components..... Page 1
- Perform a daily walk-around inspection..... Page 3
- Explain safety regulations concerning grader..... Page 7
- Start the grader..... Page 8
- Windrow loose materials....Page 10
- Spread loose materials..... Page 11
- Park and shut down the grader..... Page 12
- Change grader blades
- Weekly checks..... Page 13
- Certification
- Exercise Questions..... Page 15

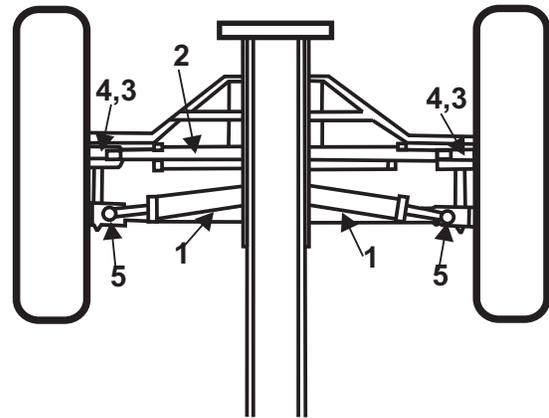
You will be able to do these things well enough to meet the standards of performance set by experienced employees.

Introduction

This study unit has been written with the new operator in mind. It contains all the basic information to learn how to operate and maintain the grader.

For a first time operator just sitting in the cab and looking around at the controls and the amount of machine around you could be overwhelming.

The grader operator has several things to think about and do all at the same time. The key to becoming a good grader operator is experience. A new operator has to be patient and take time to learn the basics.

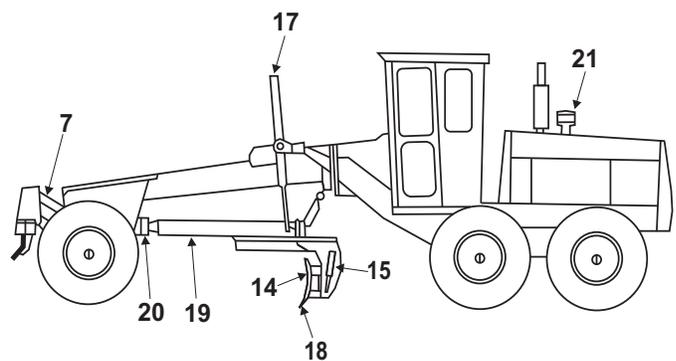
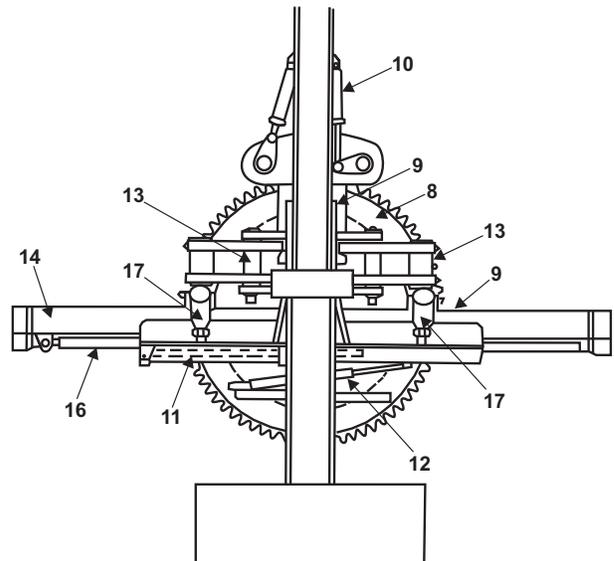


The Components

It is important for the grader operator to be familiar with the machine as well as the names of various components. Proper knowledge of the terms used can save you and the shop down time.

Front End

1. steering cylinders/gear box
2. wheel lean cylinders
3. wheel lean pins/arms
4. king pins
5. tie rods
6. wheel spindle
7. plow/scarifier cylinder
8. circle
9. wear plate and guides
10. circle drive motor (cylinder)
11. circle side shift cylinder
12. side shift cylinder arm (stabilizer arm - older machine)
13. high lift mechanism
14. moldboard
15. moldboard tilt cylinders
16. moldboard slide shift cylinder
17. moldboard lift cylinders
18. blade
19. draw bar
20. draw bar ball joint support (goose neck-knuckle)
21. air cleaner

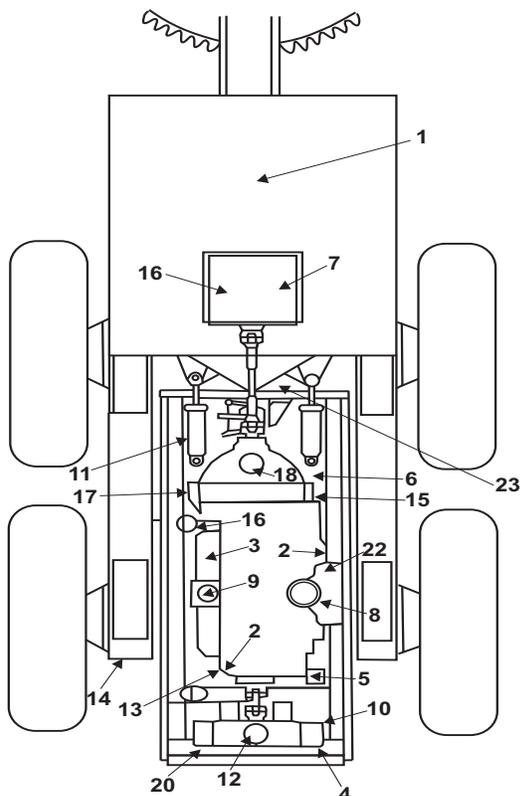


Your instructor will show you where these components are located on the grader you are going to operate. There are several types of graders and one picture can't show all the combinations but you can still use the pictures on the following page to give yourself a good idea of what to look for.

Rear End

The rear of the grader is just as important as the front. Your engine is located there and you must be able to locate the various components and identify them by name. These components include:

1. cab
2. engine oil filter/dipstick/filler cap
3. fuel filter(s)
4. steering pump
5. hydraulic fluid filter/dipstick/sight glass/filler cap
6. clutch cylinder
7. transmission fluid filter/dipstick/sight glass/filler cap
8. fuel injection pump
9. turbo charger
10. hydraulic pump/drive/tank
11. articulating cylinder
12. radiator filler cap/coolant filter
13. water pump
14. tandems/level indicator/filler plug/breather
15. differential/level indicator/filler plug/breather
16. transmission/dipstick/level indicator/filler plug
17. battery disconnect
18. fuel filler cap/tank
19. alternator
20. safety lock/pivot area (articulating grader)

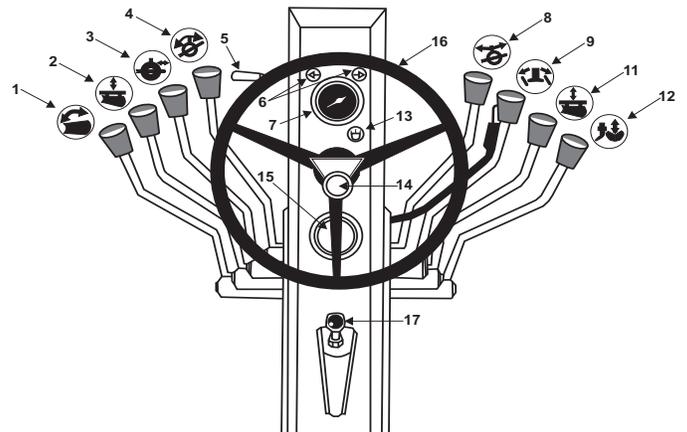


In Cab Orientation

Even the experienced operator will tell you that it takes time to become familiar with the controls when they change graders. If you are a new operator you may find the grader cab is confusing at first.

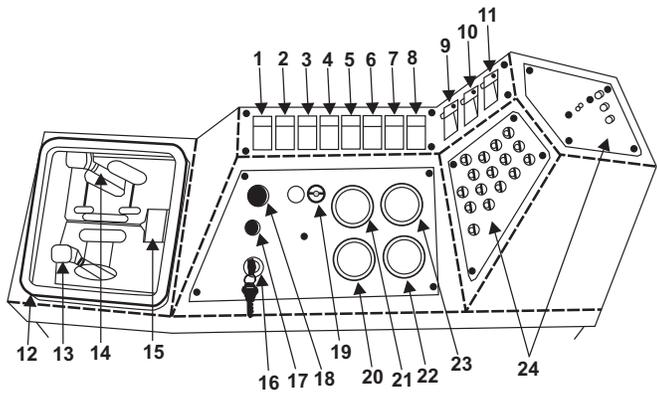
Take your time and make sure that you know where the following controls are, and their functions. Lever positions will vary depending on make and model.

1. moldboard tilt lever
2. left hand blade lift lever
3. moldboard slide shift lever
4. circle turn lever
5. signal light switch
6. signal indicator light
7. tachometer
8. circle side shift lever
9. front wheel lean lever
10. articulation switch/lever
11. right hand blade lift lever
12. accessory control lever
13. high beam indicator light
14. pedestal tilt button
15. articulation gauge
16. steering wheel
17. hand throttle



Ask your supervisor or consult the operator's manual for more information on controls

1. revolving light
2. headlight/parking lights
3. extra headlights
4. work lights
5. rear floodlights
6. front windshield wiper
7. rear windshield wiper
8. windshield wiper
9. heater blower
10. front defroster fan
11. rear defroster fan
12. transmission controller
13. pulser lever (gear change)
14. mode lever (F/N/R)
15. digital display
16. ignition switch
17. cold start switch
18. horn button
19. warning light-trans. lube
20. voltmeter
21. engine temperature gauge
22. fuel level gauge
23. engine oil pressure gauge
24. circuit breaker panel



 REAR MAST OPERATION	 MOLDBOARD TILT	 MOLDBOARD LIFT
 CIRCLE TURN	 DRAWBAR SHUT-DOWN	 FRONT LEAN WHEEL
 ACCESSORIES OPERATION	 WATER TEMPERATURE	 DRAWBAR SHUT-DOWN
 FRONT MAST OPERATION	 MOLDBOARD SIDE SHIFT	 DIRECTIONAL
 ARTICULATION	 ETHER	 AIR FILTER

Daily Circle Check

Now that you are familiar with the proper terminology and know where everything is, you will be able to follow the rest of this manual with little difficulty. If you are not sure about certain terms, go back to the first part of this manual or ask your instructor.

The grader has to be checked each day before setting out for work. This part of the work may seem long at first but with a bit of practice you will find that the daily circle check takes about 10-15 minutes. These are well spent minutes because they may save you a lot of problems later in the day.

Controls and Instruments

 PARKING BRAKE	 TRANS/CONVERTER OIL PRESSURE	 ENGINE OIL PRESSURE
 TRANS/CONVERTER OIL TEMPERATURE	 FUEL SHUT-OFF	 LOCK/UNLOCK DIFFERENTIAL
 RIPPER OPERATION	 WINDOW ELIMINATOR	 WING TILT

Check Your Grader Daily Before Starting Up

- Check The Ground For Leaks

Leaks may develop in the following areas:

- all hydraulic components including hydraulic gear box drive shaft
- transmission
- tandem housings
- engine (oil)
- engine (coolant)
- clutch booster
- steering booster
- brake booster

a look at the grader will tell you if the body, windows and the lights are clean and in good condition. Inspect lights and lenses, hand holds and steps, and make sure your sign is clean and in good condition.

- document all defects in circle check book
- report all damage and defects to your supervisor

- Check the Wheels and Tires

be sure to pay attention to the inside of the tires as well as the outside and inspect the wheels to make sure the nuts are in place, the wheels are tight and that the tires are free of defects.

- Inspect the Moldboard and the Blades

pay special attention to the blade wear, cracks, loose or missing bolts and nuts. Look at the wear plates and guides on the circle for unusual wear.

- Check Front End

check for damage to the tie rod ends, wheel lean and steering cylinder.

- Check All Fluid Levels

all fluid levels have to be checked either visually (sight glass) or with a dipstick. Make sure you check the following daily:

- brake fluid
- fuel level
- engine oil level
- engine coolant level
- hydraulic fluid level

- transmission fluid level
(powershift transmission must be checked when fluid is hot)
- windshield washer fluid level

- Check Belts And Hoses

check all belts for tension and wear; check radiator and hydraulic hoses for cracks.

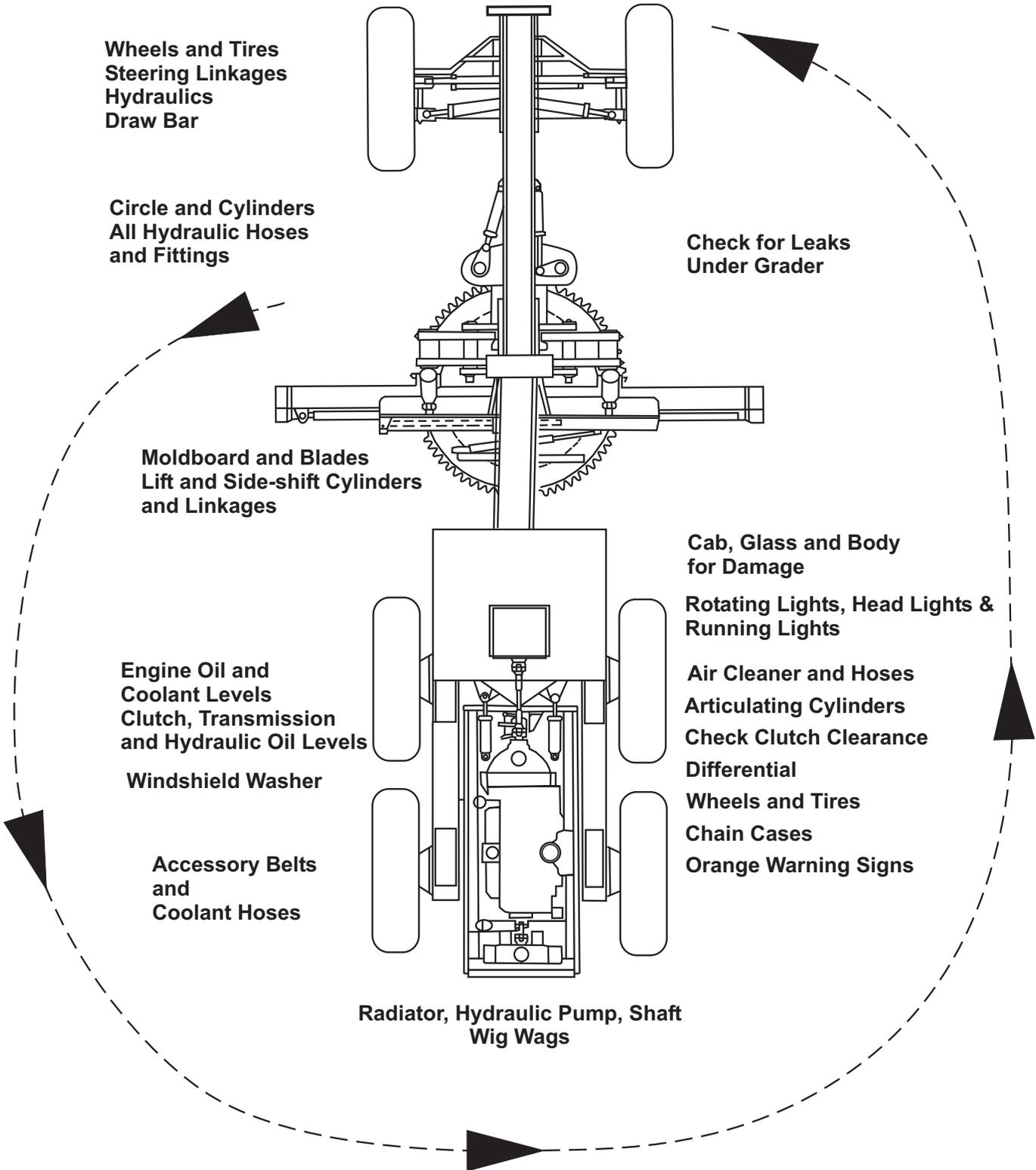
Check The Air Filter

check the restriction indicator to make sure the air cleaner is not restricted. If it shows a small green dot in the indicator window, the element is good. If the window is completely red, the element is clogged and must be replaced. If equipped the air pre cleaner dust bowl must be serviced daily. Consult operators manual for details.

- when removing the element do so as gently as possible. Bumping it when it is still inside the housing may leave dirt and dust.
- always clean the inside of the housing carefully. Use a clean damp cloth to wipe every surface.
- always clean gasket sealing surfaces of the housing. Remove all hardened dirt ridges on the bottom and top of the cleaner. An improper gasket seal is one of the most common causes of engine contamination.
- always check a new air filter - it must be replaced with one that has the exact same dimensions.
- always make sure that the gasket is sealing evenly. Check the sealing surface again for dirt and that the seals are free of cracks.
- check connection and ducts for a leak-tight fit. check that all clamps, flange joints, and cleaner mounting bolts are tight. All duct joints, from the air cleaner to the engine must be tight.

You have to be certain that the grader is ready to go to work. Do a complete check every day. Hard working machinery can develop little problems in the strangest places which can be detected long before they turn into major breakdowns. Whether you work around the city or way out in the country, you would not want to be stuck out there just because of that five minutes you tried to save during the morning walk around. Do it properly the first time and you may avoid serious breakdowns.

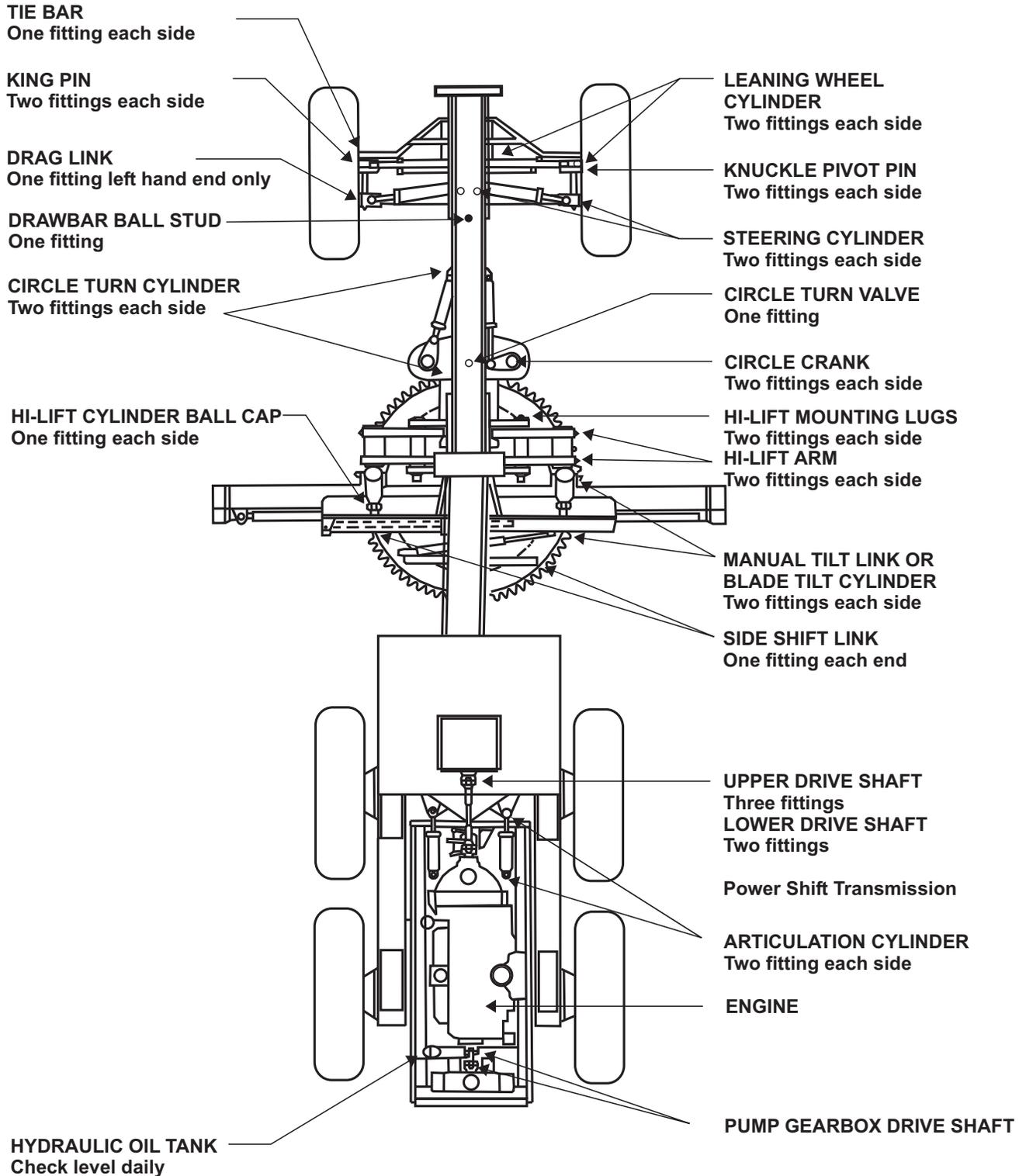
DAILY WALK-AROUND



Daily Greasing

There are several high wear points which have to be greased daily:

- clean all fittings before applying the gun to them
- pump in grease to expel old grease, water dirt, etc.



It is important for a grader operator to know and observe all safety regulations concerning the operation of the grader.

Your concern for safety starts early in the morning when you prepare for work. You have to dress properly so that you can deal with all possible situations. Don't rely on the fact that you have had no problems before.

- **always dress for the part**

wear approved footwear - dress for the season, making sure you can survive long periods of isolation if exposed to adverse weather conditions.

- **carry gloves at all times**

make it a habit to carry gloves with you at all times; you will have to perform routine maintenance on your grader and gloves offer necessary protection.

- **wear your safety vest**

although you are under no obligation to wear the vest when you are inside the cab, you must wear it when you are outside.

- **your safety hard hat**

the comments about the safety vest apply to the safety hard hat as well. Any time you step out of the cab in accordance with section 200-1200 which states "an operator must wear a hard hat".

- **hearing protection**

many graders, especially the older ones, exceed the maximum acceptable noise levels (85dba). Hearing protection must be used in these cases. Look for the warning label which indicates noise level. Even if the grader you are operating is in the safe noise level range, hearing protection is available and should be used by all grader operators.

The grader has built-in safety features which are designed to protect the worker. You must use and maintain this equipment.

- **air conditioning**

the air conditioning system is an important part of your safety equipment. You must make sure that the system is in good condition in order to protect your lungs against dust. Check all window and door seals often and make sure that pedals, rods and the steering column do not allow dust to infiltrate your cab.

**Protect Your Lungs, Protect Your Health
Always Keep Doors And Windows Closed
When Working In Dusty Conditions**

- **seat belt**

Seat belts shall be used at all times.

As you can see, there is a concern for your health and safety. The many pieces of personal protective equipment are designed to help you stay healthy and productive. The final responsibility is yours; you have to make sure you use all the protective equipment supplied and that you follow the regulations.

- **clean cab**

it is important to keep the cab free of tracked-in dirt which becomes airborne when dry. Remember, constant exposure to dust can become a serious health hazard.

Make sure you store all your tools in the proper place; don't get into the habit of throwing things in the cab where they can get stuck in the controls or hurt you in the event of an accident. All tools and equipment must be stored in tool boxes.

- **travelling**

always make sure that the moldboard and scarifier are fully raised when travelling. Make sure the toe of the moldboard is higher than the heel and toe is on the curb side.

- **creeping**

beware of creeping! As hydraulic systems get older, they have a tendency to move slowly by themselves (creeping). Pay attention to the position of the moldboard to make sure that it is still in the position you want it to be. Don't forget that the wing must be secured by the safety chain when you are travelling and parking.

- **road signs**

Saskatchewan Highways & Infrastructure follows the Traffic Control Devices Manual and Sign Matrix for correct signing of each work activity.

**Always Be Sure That Your High Visibility
Signs Are Clean and Visible**

Start -Up

Once you are satisfied that the grader is ready to go, you can start up the engine. In some cases you may want to complete the walk-around inspection while the engine is warming up; if this is what you intend to do, make sure that you complete the under-the-hood engine checks before you touch that starter button.

Never Start An Engine Without Doing Under-The-Hood Checks

Starting Aids

Many graders are kept outside and although they are plugged in all night, they may present problems on start-ups. Ether is an acceptable starting aid even though the engine may be very cold.

Use Ether In Small Quantities And Only When The Engine is Cranking

Some engines also have pre-heating devices which raise the temperature in the cylinders, or the temperature of the air coming into the cylinders. You activate these pre-heating devices for 10 - 30 seconds, depending on the outside temperature. If your grader is equipped with a pre-heating device you will not need to use ether.

Never Use Ether On An Engine Which Has a Pre-Heating Device

Starting Procedure

- ensure that the transmission is in neutral
- ensure that the parking brake is on
- depress the clutch pedal (other than models equipped with a hydraulic clutch, which cannot be depressed until the engine is started)
- activate starter

If the engine doesn't start up on the first attempt, don't forget that you have to allow 1 - 2 minutes for the starter to cool off before trying again.

Never Crank An Engine For More Than 10 - 20 Seconds

As soon as the engine starts, check these various gauges to make sure that the engine is operating properly:

- check the oil pressure gauge
shutdown immediately if oil pressure fails to build up within 30 seconds
- check the alternator (voltmeter/ammeter)
the needle should return to the center gauge soon after start up

Check The Tachometer

- adjust the idle rpm for warm-up
- never rev a cold engine due to poor oil circulation

Warm Up Procedure

- warm ups are critical to the diesel engine
a diesel engine should not be put to work until the temperature is up. Always allow the engine to run for ten to fifteen minutes (depending on the outside temperature). Operate at light load until operating temperature is reached.

Never Try To Operate A Cold Engine

- contrary to what many people think, a diesel engine should not be left idling for long periods of time because it cools down and wastes fuel.
- gear selection

a diesel engine must be operated within the designated operating range. Always select a gear which allows the engine to run at proper rpm.

Remember these points and your diesel engine will give you thousands of hours of trouble-free service.

Note: Adjust engine rpm if the engine has to be left running (about 1000 rpm) for short periods of time. (5 min)

Do Not Leave Your Unit Running Unnecessarily This Wastes Fuel And Increases Engine Wear

The Turbo Charger

Many graders have turbo chargers which increases the output of an engine by forcing air into it. Turbos are powered by the exhaust system and turn at a very high rpm. Proper warm-ups and cool-downs are critical to the life of a turbo charged engine. Since they use the same lubricating oil as the engine does, it is very important to remember the following:

- warm up the engine to make sure oil is getting to the turbo.
- give the engine a chance to cool down. Avoid shutting off a super hot turbo and preventing the required oil circulation. Shutting off an engine with the turbo turning at a high rpm will cause excessive wear due to no oil circulation.

Always Warm Up And Cool Down A Diesel Engine Properly

Before You Begin Operation

While your engine is warming up, you have time to run the final checks on your grader. You have to make sure that you are ready to do your day's work.

- check all warning labels inside the cab
- check all lights for proper operation
- check your personal protection equipment - first aid kit
- report any missing tools and defects to your supervisor and enter in the log book
- check high visibility and warning signs
- clean cab and don't leave any tools on the floor
- clean your windows and mirrors
- make sure regulation flags are in place and in good condition
- make sure you have enough spare blades, bolts, nuts and lockwashers for the day
- turn radio on, adjust squelch, and make sure it is on the scan mode
- Make sure you fill out your daily circle check book

Operating The Controls

Since the grader engine provides power for the operation of the hydraulic components, you have to make sure that the engine is warmed up properly.

With your grader in a stationary position check out all controls:

- ensure you know what each control does and operates properly

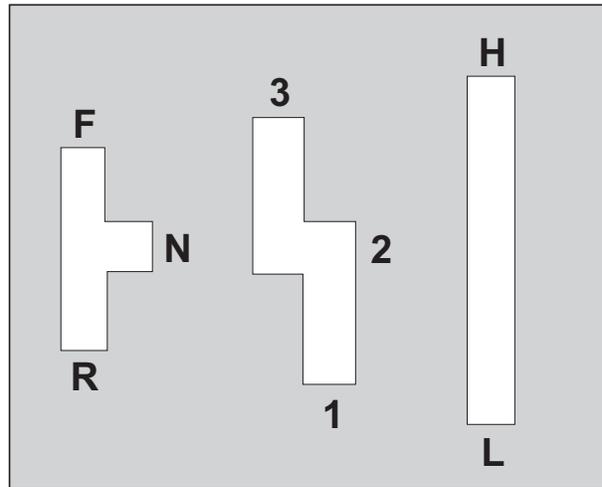
Operating The Grader

The first thing to remember is keeping the moldboard away from the tires. Tires have been ruined by being stabbed with a moldboard. With time and practice you may be able to cut it close but if you are a beginner, keep the moldboard clear of the tires at all times. Don't forget to check both ends of the moldboard.

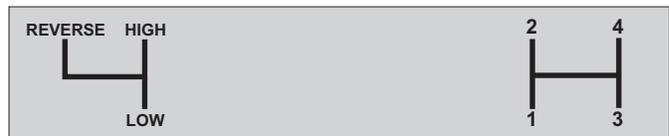
At first, you will have an opportunity to drive around, practice turns and using the wheel lean, and get used to the feel of the grader.

Proper gear selection is a good part of the skill of an operator. With a bit of practice you will be able to estimate your rpm just by listening to the sound of the engine.

There are two types of grader transmissions, the power shift and the manual. The power shift transmission has a lever to control the direction of travel (forward and reverse) and a lever to select the gear. The direction of the travel lever must be in neutral before selecting a gear. Some power shift transmissions may also have a range selector as shown below, in some cases the range selection must be made when the grader is stopped.



Manual transmissions require the use of the clutch to go from one gear to the other. These transmissions are usually operated by two levers. One lever controls the range and the other the gear. Look at the illustration below. You will notice that there are six forward gears and six reverse gears and you are in neither LOW or HIGH range when in reverse, you must go into neutral before going into REVERSE. The grader must be stopped before attempting to shift into reverse.



There are many transmission models and the shifting pattern will differ from one grader to the other. **Make sure you read the operator's manual before attempting to shift a transmission**, so that you can learn the strengths and weaknesses of each power train.

After the engine temperature is within operating range the way is clear to proceed:

- raise moldboard and scarifier to travel position (leading edge of moldboard must be away from traffic)
- release parking brake
- depress clutch
- select gear
- select range (high, low - direction of travel)
- release clutch and increase the engine rpm gradually

With some power shift transmissions you may not have to use the clutch for changing gears but the procedure described above still applies.

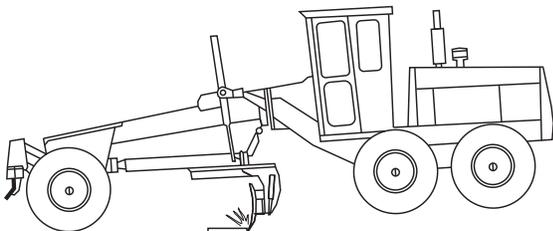
The Clutch Is Not A Foot Rest, Always Operate With The Clutch Fully Engaged

One problem with a grader is the poor view from the operator's station. Some graders are better than others but, even with the best of them, you have to remember that there are blind spots. Although you may not be driving in traffic at first, you have to become aware of these blind spots and remember that people and small cars have a way of disappearing from view around graders.

Stay Alert When You Are Backing Up And Make Sure That There is Nothing Behind You

Always Wear Your Seat Belt

Keep your moldboard and your scarifier FULLY raised when travelling. This would prevent hanging up on an obstacle as shown in the diagram below.



It is recommended that you check your tires often, as a flat tire especially in the back may not be obvious to the beginner. A walk around at regular intervals is a good practice.

Keep The Moldboard Away From The Tires

Windrow Loose Materials

By now you may have come to the conclusion that the grader is a complicated piece of equipment. Operations such as snow blading or grading of roads require both a good knowledge of the machine and close attention to traffic around you.

Don't be surprised if your supervisor asks you to perform your first job in the yard or other convenient place where there is little traffic to worry about and where you'll have time to develop your skills at the controls.

Your supervisor/trainer will give you a demonstration; he may make it look easy but don't forget that it takes time and practice to become good at it.

Here is a recommended procedure; your supervisor/trainer will have other suggestions to help you.

- adjust the circle so that the heel of the moldboard discharges outside the rear wheel (never run over your windrow with your back wheels)
- adjust the tilt of the moldboard so that the material rolls
- slide shift the moldboard to the right
- adjust the moldboard for proper cut
- do not overload the moldboard (two easy passes are more productive than one hard pass)
- turn around and repeat the procedure feathering out the windrow.
- use the correct angle for the material and discharge.

CAUTION: Be Aware Of Overhead Lines And Underground Utilities Dial Before You Dig

Appropriate Utility Must Be Contacted

It is important to get into the habit of adjusting the angle of the moldboard so that you move a large quantity of dirt without overloading the grader.

Most beginners don't give the moldboard enough of an angle and tend to overload the machine.

Signs of overloading are:

- **engine lugging**
make sure you select the proper gear and range for the work to be done
- **front end shifting in the direction of the toe of the moldboard**
you may have to use the wheel lean in the opposite direction to compensate
- **spinning wheels**
you should never allow the wheels to spin; ease the load on the grader by raising the moldboard or increasing the angle

It Is Always Better To Do Several Light Passes Than To Overload The Grader

Front Wheel Lean

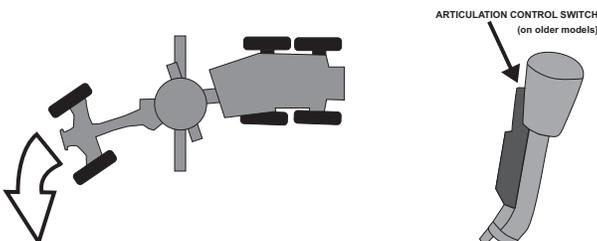
You can reduce the turning radius of your grader by using the front wheel lean lever. Lean the wheels in the direction you turn. Wheel lean also compensates for side pull.



FRONT LEAN WHEEL

Articulation

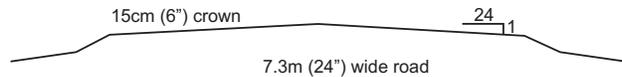
If your grader has an articulated frame, you can reduce the turning radius even further. Use the articulation switch to articulate the grader in the direction you turn.



Spread Loose Materials

As you know, dirt and gravelled roads have a crown on them as illustrated below. The purpose of this crown is to make sure the water runs off the road.

The skill of a grader operator is measured by the finished product left behind. The materials you spread should be smooth and have a slight angle to form the crown of the road.



The crown of the road has a 5% slope which means that the centre of the road is half an inch higher for every foot measured from the centre line to the edge. A 7.3 metre (24 foot) wide road would have a fifteen centimetres (6 inch) crown.

The grader operator has to acquire a feel for this 5% slope so that he/she can grade roads properly. This is why you will be asked to spread material from the windrow and use the appropriate angle to the moldboard.

Your supervisor/trainer will show you what the 5% slope looks like.

Desirably, the loose gravel should be spread uniformly across the highway surface so that no windrow remains after the final pass. Windrows left on the shoulder of the highway create a hazard for the motorist and can create erosion problems.

During dry conditions only rough or pitted areas should be bladed. Major reshaping of the gravel surface should be done after a rain when the surface can be cut.

Preparation for winter months requires moving excess material off the road surface onto the side-slope of the sub-grade.

The above material is stored on the side slope for the winter months and in the spring is pulled backup onto the road surface and used again.

You will soon notice that the tilt of the moldboard as well as the angle can change the performance of the grader. Changing conditions such as humidity, type of material and compaction will have an effect on the speed, angle, and tilt of the moldboard. Your supervisor/trainer will explain the different applications as conditions change.

When blading a windrow across the road surface the maximum length should not exceed 8 to 10 kilometers.

The normal output for a days work is 11 to 30 kilometers.

Note:

The practical applications previously suggested have been selected so that operators can demonstrate basic skills on the grader. If it is the more convenient and practical, your supervisor/trainer may take you out on a quiet side road where the same skills may be practiced and demonstrated.

Park and Shut Down

The grader operator's day does not end when he drives into the yard or the parking area because there is maintenance work still to be performed.

Refuelling

The grader must be fuelled before parking for the night.

It is important to keep your tanks full in order to prevent condensation. In winter this water could freeze up the fuel lines and cause engine failure.

As with any other vehicle, you should avoid over-filling the fuel tank especially if the grader is parked indoors. Cold fuel expands when it warms up. If you were to fill the tank to the brim, it would overflow after a few hours in a warm garage.

- **parking the grader**

after parking the grader, make sure that all hydraulic components are resting on the ground. Never leave any hydraulic component up in the air without proper blocking or chaining (to avoid damaging a soft surface you have to use blocks to support the weight of the blade).

Shut Down The Engine

It is important to remember that a diesel engine must not be shut down before the temperature gauge reads normal. If your grader engine has been working hard before shut down, allow it to idle for a few minutes until the temperature gauge shows normal. This procedure is important; serious engine damage could result.

Shut Down Procedure

Make sure the following steps are part of your shut down routine.

- fuel unit
- drive to parking area
- lower all hydraulic components to the ground
- put the transmission in neutral
- apply parking brake

- turn off all lights
- allow engine proper cool down time
- turn radio off
- shut down engine
- remove key
- lock cab
- if your grader has a snow wing - ensure the safety chain is attached

Post Shift Circle Check

Before you leave the area, walk around your grader once more to assess the general condition of your machine. Many small problems which develop during the day can be corrected immediately so the grader is ready for the next day's operation.

Blade Changing

There are occasions when you cannot get help to change your blades so you have to learn to do this job by yourself. Most operators end up changing blades in the middle of the day somewhere by the side of the road.

Recommended Method

- **pull off the road - into an approach**

Always park in a safe location and apply parking brake to change blades

- **position moldboard**

first you have to position the moldboard for easy access to the blade retaining bolts by fully raising the moldboard and blocking it

- **shut down the engine**

to make sure that the grader can't be operated accidentally and there is no hydraulic power to operate the moldboard

**Ensure Moldboard
Is Properly Positioned And Securely Blocked**

- **remove worn blade**

loosen all bolts, remove all but end bolts on each blade. Remove end bolts one at a time lowering that blade end to the ground. Repeat with other blades

Check Condition Of Frog And Clean Mounting Surfaces

Installing New Blades

A blade wrench can be used to align and hold one end of blade temporarily. Then lift other end and install bolts and nuts.

Replace bolts and nuts that have thread damage (replace bolt, nut and lock washer)

Tighten fasteners after all blades and bolts are installed.

Changing blades may appear to be a simple job but you have to be aware of all the possible dangers involved.

Don't forget that a new grader blade is quite heavy and that you have to be careful when you lift it. Use your legs when lifting and avoid over-reaching. Drag the blade with one end on the ground if you are unsure of your footing.

Use Personal Protective Equipment When Changing Blades

Recommended: Safety Boots - Safety Glasses
Gloves - Hearing Protection
Head Protection

Alternate Methods

Some operators extend the moldboard sideways as far as possible to change one side and repeat the procedure on the other side. This method is also acceptable and it is outlined in the check list. You should try out both methods and find out which one suits you best.

Always Use A Safe Method When Changing Blades

Weekly

Weekly Checks

In addition to the daily checks many areas of the grader require checking and greasing on a weekly basis.

Fluid Levels

- transmission
- final drive
- chain casings
- clutch
- brake

Greasing

- pivot pins
- wheel bearings
- latch pins
- parking brake

- tandem sleeve thrust plate
- articulation pivot upper and lower (if so equipped)
- pivot blocks
- drive line U - joints

Operation Checks

This check will be a combination of the daily and weekly checks to insure they have been pointed out to each operator.

Fluid Levels

Check all levels and at what intervals daily or weekly

Greasing

Point out all areas to be greased and at what intervals Daily or Weekly



on the certification walk around sheet indicates grease point

Keep in mind that with all types of equipment that the operators manual is the best guide to each individual make of equipment. It should be read before operating that specific equipment.

Practical Operation

Motor Grader Practical

Start Up Procedure

- Raise All Lowered Equipment**
- Scarfier
 - Blade
 - Ripper
 - Check all around

Back Up

- Slowly

- Check Operation of Control**
- Wheel Lean
 - Blade Lift
 - Blade Tilt
 - Circle Turn
 - Slide Shift
 - Blade Slide

Blade Road Surface

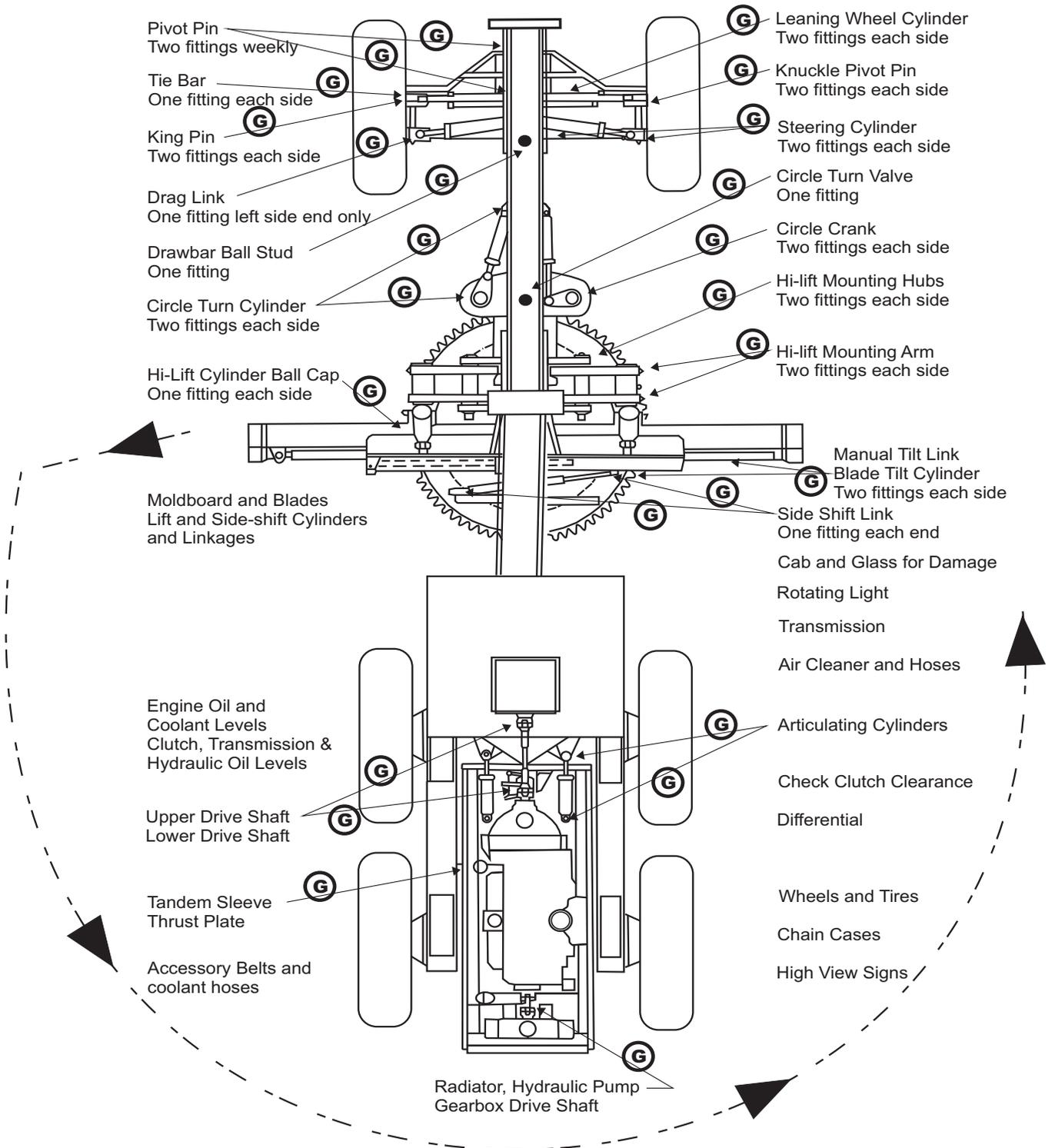
Set Blade

Cut Pass

Spread

- Maintain Crown
- Have Windrow on Crown
- Feathered
- Windrow

Pre-Shift WALK - AROUND



Grader

Exercise Questions

Instruction

The following exercise questions have been prepared to help you study **Grader**. Read the opening statement carefully and select the best answer. After you have decided which matches the opening statement best, check with the exercise question correction key which is located on the last page of this manual.

If your choice doesn't correspond to the correction key, go back to the study material and review the information. You will succeed in the knowledge test if you know and understand the answers to the exercise questions.

You are given four choices for each statement. You have to select a,b,c or d depending on which one you think is the best choice. Some choices may appear to be correct under special conditions but the real answer is the one which is always true.

Here is an example:

Most Saskatchewan Highways & Transportation graders are primarily used

- a) for patching
- b) for construction of new roads
- c) in the summer
- d) to maintain dirt and gravelled roads

As you can see, all of the above are true but the choice (d) is the best choice because MOST of our graders are used on dirt roads.

1. Grader operators have to wear a safety hat

- a) at all times
- b) when they step out of the cab
- c) only in the yards or the shops
- d) in situations where there is danger to the employee

2. Hearing protection must be used

- a) if you are going to operate for more than one hour
- b) if the noise level exceeds the maximum acceptable level
- c) while travelling at high speed
- d) especially if working in noisy areas

3. You are required to wear your seat belt

- a) at all times
- b) while grading
- c) while plowing snow
- d) at speeds of more than 40 km/h

4. The safety chain across the door

- a) must be used to secure the door in the open position
- b) must be used when travelling above 30 km/h
- c) must be secured when working with the door open
- d) should be used anytime you are wearing a seat belt

5. Anytime you park the grader it is important to

- a) secure or lower all hydraulic components
- b) shut down the engine
- c) disconnect the PTO
- d) put the 4 way flashers on

6. One of the most important gauges in the grader cab is the engine oil pressure gauge which

- a) should always indicate a maximum pressure
- b) should always register a constant pressure
- c) should register oil pressure immediately after start-up
- d) is often replaced by a warning light

7. Ether is a product used for starting cold engines and should be used

- a) only when the engine doesn't want to start
- b) at temperatures below -40 C
- c) only when the engine is cranking
- d) when the battery is weak

8. When the grader is parked for long periods of time

- a) the engine should be left running to keep it warm
- b) the revolving light should be left on
- c) the door must be locked
- d) the engine should be shut down

9. The crown of a road is

- a) near the shoulder
- b) a high point in the middle of the road
- c) a lip on road surface to prevent water from running off
- d) a way of spreading fresh gravel

10. **The wheel lean is used to steer and** .
- a) compensate for front-end shifting
 - b) increase the angle of the moldboard
 - c) allow to drive faster
 - d) reduce wear on the front tires.
11. **The grease points which have to be serviced daily** .
- a) must be lubricated with daily walkaround
 - b) must be lubricated at the end of day
 - c) must be lubricated when they show evidence of dirt
 - d) must be given more than one or two shots of grease
12. **It is important to park a grader overnight** .
- a) indoors
 - b) with the engine heater plugged in
 - c) with all doors locked
 - d) with a full fuel tank
13. **Before shutting down your grader** .
- a) always allow the engine oil pressure to return to normal
 - b) make sure the lights are in good working order
 - c) check the operation of all hydraulic components
 - d) let it idle for 2 - 5 minutes to cool it down

Correction Key for the Exercise Questions

- | | | |
|-------|-------|--------|
| 1 - B | 5 - A | 09 - B |
| 2 - B | 6 - C | 10 - A |
| 3 - D | 7 - C | 11 - B |
| 4 - C | 8 - D | 12 - D |
| | | 13 - D |