

3. PREVENTIVE MAINTENANCE

Daily and weekly preventive maintenance (P.M.)

After you have completed the basic safety steps, the next stage is to conduct a thorough preventive maintenance inspection of the dump truck. The importance of this procedure is to provide a level of safety and security to you and the State Highway, as well as the taxpayer that shares the interstate with you.

The operator's manual and owner's guide contains guidelines for P.M. checks which should be made before, during, and after operating the dump truck. Most policies on the subject of P.M. state that the order of checks or inspections is not important. There should be some routine order established by the operator to be certain nothing is missed.

SHA has introduced a new, conforming form titled, "Operator's Daily Checklist & Equipment Service Request" (SHA 71.0-FS-5, 3/98), which sets up a sequence of daily checks during P.M.. Following the sequence on the back side of the form; the operator, on the front side, places a √ if the component is okay, and an "X" for any defects found. For more information on this form, please review SHA's Forms Workbook.

The operator will give the yellow copy to the shop with the "Repairs Required" box marked to change the "Operator's Daily Checklist" into an "Equipment Service Request" for any defects found.

The purpose of the Equipment Service Request is to give the shop automotive specialist a precise idea of where or what the problem is on the defective equipment. It is important that the distribution be made immediately for any problem discovered so that the shop can schedule timely repair or maintenance.

The first inspection that you will perform is the pre-trip inspection. A post-trip inspection will be performed at the end of the work day. The ending odometer and ending hour meter reading is entered on the ODC/ESR during the post-trip inspection. The meters readings are entered during the pre-trip inspection if the truck requires service that would prevent it from being used the entire day.

The pre-trip inspection is broken down into a pre-start and a pre-operation inspection. The following is a detailed description of these two inspections.

Pre-start inspections

1st walk around

This inspection can be done as you approach the truck. Look for water, fuel, and lubricant leaks on the ground under the truck. **Never** start the truck if there are any noticeable leaks in any of the fluids (motor oil, coolant, fuel, hydraulic). Check for flat tires, loose or broken wires, broken glass, weld breaks in frame, steering defects, etc. Continue with all checks that can be made with the engine off. The operator should always use common sense and be thinking "**SAFETY**" when conducting any pre-start inspection.

Any time that you conduct a preventive maintenance check on any piece of State heavy equipment; you must always accurately and completely fill out the Operator's Daily Checklist / Equipment Service Request. If you feel that you need to review how to complete this form, please review the SHA Equipment Forms Workbook.

Engine oil level and condition

Oil level should be maintained between the "ADD" and "FULL" marks on the dipstick. Oil should be visually inspected for presence of contamination. To check that the oil is clean and at the proper level, pull the dipstick twice. The first time to check for contamination and the second for a true reading of the oil level. If you see foam or condensation, it may indicate that there is a presence of fuel or coolant contamination. If grit or filings are found it may indicate that the air filter is bad or there is abnormal engine wear. Be particularly wary of an over-full level on the dipstick. This condition could indicate fuel or coolant contamination. Oil and filter change should be done immediately upon confirmation of contamination and the engine monitored closely afterward for recurrence. If oil must be added to the crankcase of the dump truck, use the manufactures or SHA's recommended oil weight.

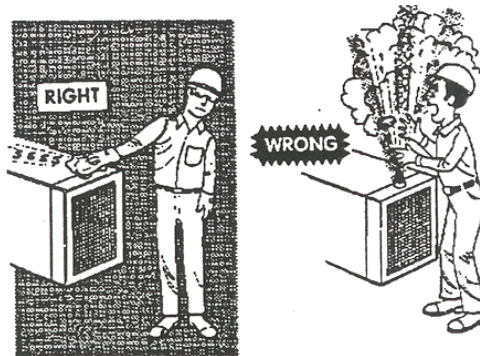
Automatic transmission

Oil level should be maintained between the "ADD" and "FULL" marks on the dipstick. Oil should be visually inspected for presence of contamination. To check that the oil is clean and at the proper level, pull the dipstick twice. The first time is to check for contamination and the second for a cold reading of the oil level.

Automatic transmission oil level will have to be checked again after engine warm-up for true level.

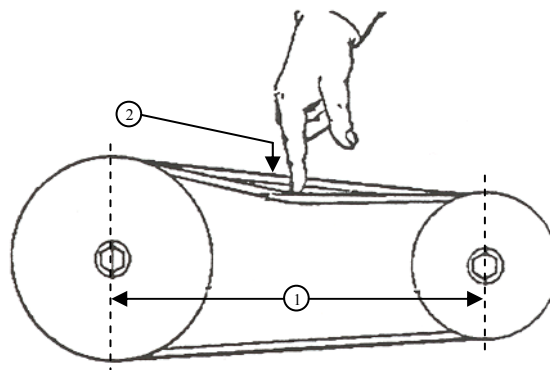
Coolant level, hoses, and radiator

Make sure the coolant is at the proper level in the fill tank. This level mark is usually $\frac{3}{4}$ of an inch from the top of the radiator. One way to check the coolant for the proper level is to unscrew the radiator cap and feel for coolant liquid. **Remember NEVER unscrew the radiator cap while the radiator is hot!! Wait until the radiator is cool.** Another way to check the coolant level is to visually check the radiator overflow jug. The operator should look for the coolant level on the jug to be between the minimum line and the maximum line. Some radiators have a sight glass mounted in the side of the radiator to indicate the presence of coolant. Inspect all engine and heater system hoses for wear, leaks and loose hose clamps.



Belts

Inspect fan and accessory drive belts for proper tension and wear. Accurate tension checks should be made by shop personnel. The operator should be alert to cracking or looseness which could lead to electrical system discharge, overheating and/or other engine problems. To get an idea of what the tension factor should be for checking tension, the following illustration is provided. Remember that the illustration below is only a guide for tension deflection.



- 1 Belt Free Span
- 2 See Table for Deflection

Belt Deflection Chart	
Belt Width	Deflection per 1 foot of span
1 1/16" (17.5 mm)	13/32" (10.3 mm)
7/8" (22.2 mm)	1/2" (12.7 mm)
3/4" (19.1 mm)	7/16" (11.2 mm)
1/2" (12.7 mm)	13/32" (10.3 mm)
1" (25.4 mm)	9/16" (14.3 mm)

What this conversion states is that if the width of the belt is say..1/2 inch, the deflection of the belt can be no greater than 13/32". In other words, when the operator checks the tension of a 1/2" belt, it cannot be "pushed in" more than 13/32" of 1 inch. (see the illustration above).

" = inch (standard measurement)
mm = millimeter (metric measurement)

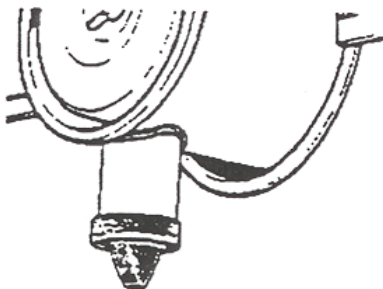
Air Filter

Make sure the air filter is clean. Because of the various types of dump truck in SHA, be sure to check either the dusk cover or air restriction gauge.

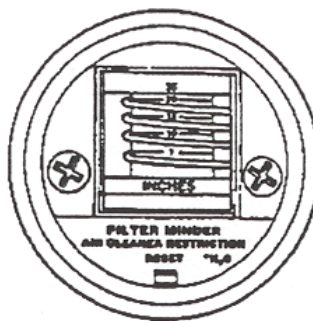
Older SHA dump trucks will have a dust cup located at either end of the air filter container. The operator should "flick" the cover to check that the air filter is clean.

When the air filter gauge reads above **15** inches, it is a good indication that the air filter is due for replacement.

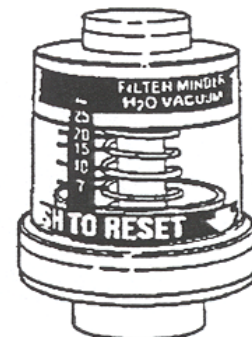
Push the reset button after the air filter has been cleaned or replaced with a new one.



Dust Cup

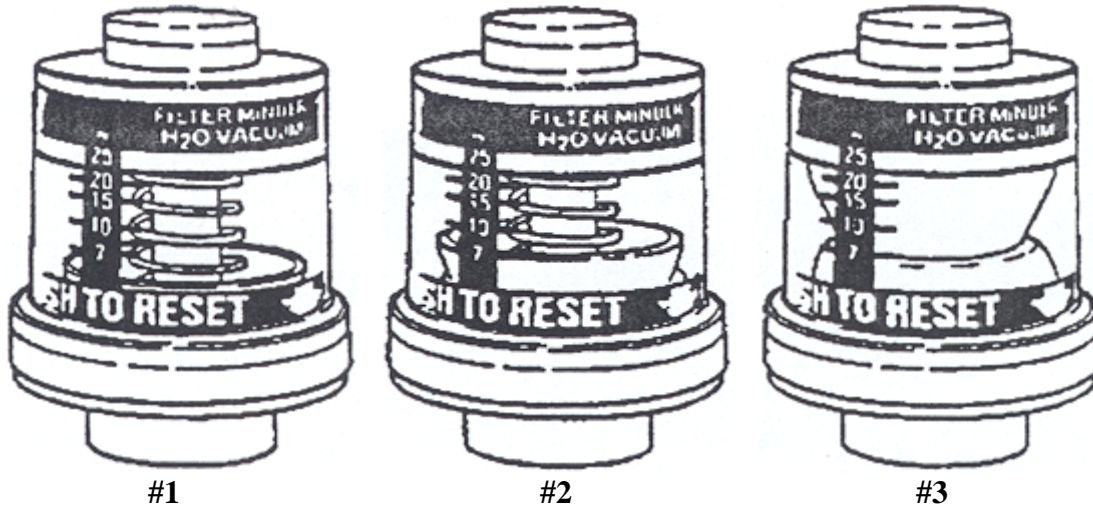


Dash mounted



Air filter mounted

The following are three pictures of air filter gauges, showing different readings of the air filter. As the air filter becomes clogged with dust and contaminants, the indicator rises to indicate how many inches of dust and contamination are in the air filter. When the air gauge has a reading as in picture #3, it means that the air filter is due for a change. Normal clean air filter reading is between 0 and 5 inches.



Power steering oil level and condition

Oil level should be maintained between the "ADD" and "FULL" marks on the dipstick. Oil should be visually inspected for presence of contamination. Pull the dipstick twice to check oil for impurities and at the proper level. The first check is for contamination and the second for a true reading of the oil level.

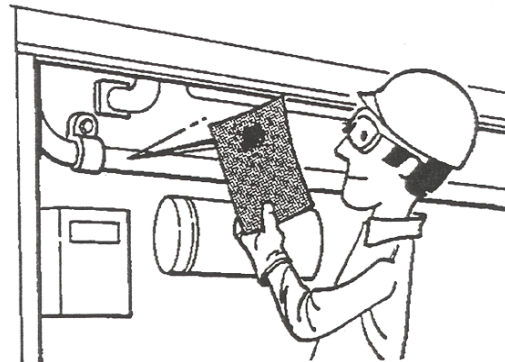
Batteries

Electrolyte levels should be maintained at the indicator level in each cell of the battery, the battery case should be checked for cracks or leaks. Check terminals (corrosion-free), and make sure that the cable clamps are tight. On maintenance free batteries, check the green or blue dot. If the dot is faded or turned white, have the automotive mechanic re-charge or replace the battery.

Hydraulic oil reservoir

The hydraulic oil for the dump truck must be checked before operation and during pre-operations steps. Make sure the site glass is clean and that you get a hydraulic reading of "Run". Check the hydraulic oil for color and dirt particles floating in the site glass. After checking the hydraulic oil, check for leaks in the hydraulic hoses and hose connections.

Warning: If a leak is suspected, do not use your hand to find a pinhole leak. Escaping fluid under pressure can penetrate the skin and cause serious injury! Use a piece of cardboard, paper, or board to search for leaks.



Tires and wheels

Check all tires for cuts, abnormal wear, and proper air pressure. Check the tire sidewall for the precise air pressure requirement. Use an accurate tire pressure gauge and check the tires when they are cool. Check for cracked rims and missing or loose lug nuts. Shiny areas around studs indicate possible looseness of the lug nuts.

A single axle dump truck tires should be equal in size. Tires that differ more than 1/4 of an inch (6.36 mm) in diameter or 3/4 of an inch (19.05 mm) in circumference should not be mounted on the same side of a dual wheel axle. The larger or less worn tire should be mounted on the outside of dual tires that differ less than this.

If you are driving a tandem axle dump truck, never install the four largest tires on one driving axle and the four smallest on the other axle. If you do, it could lead to premature axle failure. The unevenness of the tire mounting will cause an increase in the axle lubrication that will lead to axle failure.

When you check for wear of the tires, keep the following common patterns:

Even wear

The usual sign of even wear is when the operator can run his hand across the face of the tire and feel for a constant smoothness. Even wear can also be noticed by the way that the tire grooves look even and smooth.

Erosion wear

Is also known as rolling wear, channel or river wear and can be found in both bias and radial tires. Erosion wear is an indication that the tires are used in slow operations. Erosion wear can be detected when the tire or tires begin to fray at the edges of the tire. In other words, wear will start at the edge of a tire and have little or no effect on the tread. If this occurs, rotate the tire or tires to the inside of a dual or tandem axle.

Shoulder wear

Is the normal wear of the outside portion of a tire. You can usually detect this wear by noticing that the outside groove begins to take on a shiny look. This is normal wear so do not over compensate for this wear.

Lug nuts

The operator's manual directs that the nuts be sequentially checked when operating a unit which has had a wheel removed after about 50 miles of operation and, once each week inspect and re-torque wheel lug nuts.

Wheel bearings

Wheel bearings should be inspected, lubricated and adjusted at regular intervals. This is especially important if you are operating in deep sand, mud, or water. Refer to lubrication section of the operator's manual for correct interval.

Undercarriage

Check sub-frame, steering, drive shaft, leaf springs, mounting brackets and bushings for evidence of fatigue, shifting, bending or breakage. Check U-bolts and nuts for looseness, breakage, or rust. Proper torque must be maintained on U-bolt nuts to keep axle from shifting.

Brake Slack adjusters

Check slack adjusters on the front air brake system for the correct amount of slack when applying brakes. Apply the brakes with 90 psi to force the brake chamber piston rod out of the brake chamber and measure distance traveled. This can be done manually on the front brakes but is not as accurate. Chock the rear wheels and release the parking brake to measure the rear brake chambers for proper slack. The air brake chamber piston rod travel distance should be as short as possible without brakes dragging. Brakes should be readjusted when stroke is between 1 ¼" and 2 ¼" depending on the brake chamber size and manufactures specifications.

Warning: The National Transportation Safety Board states that automatic slack adjusters should **NOT** be manually adjusted in an effort to correct excessive pushrod stroke. Manually adjusting automatic adjusters could have serious consequences.

Brake linings worn to within 1/16th of an inch of the rivets should be replaced.

Safety features

Check all your safety features that are part of your dump truck.

Check the seat belt condition for fraying, particularly at attach points, and availability.

Fire extinguisher should have current inspection tag and show a full charge (in the green), and should be stowed/attached within easy reach.

A first-aid kit should be fully stocked and handy.

A supply of flares or warning reflectors should be safely stowed in case of an accident, breakdown, or to assist other motorist in trouble.

The glove compartment should contain a valid registration card, and at least one copy of the insurance brochure titled, "In Case Of Accident". (See Appendix).

Lubrication

One of the most important steps to preventive maintenance is the lubrication of the dump truck. The single axle dump truck has about 7 to 8 primary lubrication points that must be checked and greased every day. The tandem dump truck's primary lubrication points increase to between 10 and 15 points. Do not over-grease the lubrication points. Excess pressure from too much grease can damage seals.

GENERAL LUBRICATION GUIDE

The following page contains an illustration of the tandem axle chassis, and locations of most of the important points requiring daily lubrication for the single and tandem axle dump trucks. Familiarity with lubrication points will be required for certification. Reference the numbers and match with the drawing for location. The single axle dump truck has fewer lubrication points than the tandem dump truck.

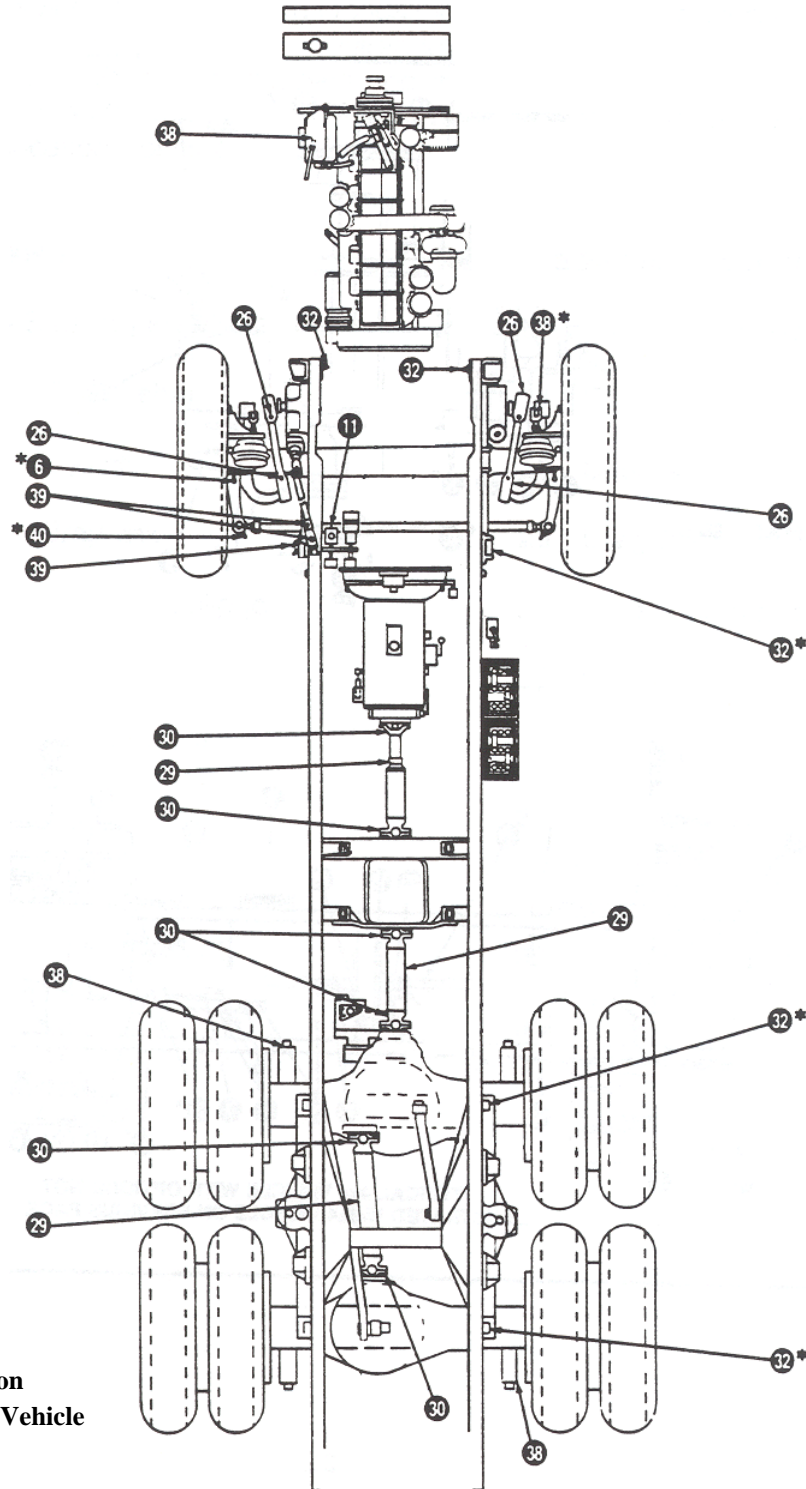
Single Axle lubrication points

- 6** - Steering knuckles
- 11** - Clutch shaft
- 15** - U-joints
- 26** - Drag link
- 29** - Prop shaft slip joint
- 30** - Prop shaft U-joint
- 40** - Tie rod ends

Tandem axle lubrication points

- 6** - Steering knuckles
- 11** - Clutch shaft
- 15** - U-joints
- 26** - Drag link
- 29** - Prop shaft slip joint
- 30** - Prop shaft U-joint
- 32** - Spring pins
- 35** - Transfer case shift link
- 38** - Brake slack adjuster
- 39** - Steering column U-joint
- 40** - Tie rod ends

Lubrication Diagram for Single & Tandem axle Dump Trucks



* These Points
Symmetrical on
Both Sides of Vehicle

Lubrication of dump body and hoist

Note: Different manufacturing designs on hoists call for different lubrication points.
Be sure to inspect the hoist carefully to locate all grease points.

SHA's dump trucks are equipped with a constant-running hydraulic pump located in front of the engine. Check the pump, drum, and hoses for leaks.

Inspect the welds on the dump bed for breakage. Inspect the frame bolts that connect the dump bed to the truck for looseness. Oil the joints on the tailgate latch system.

Pre-operation inspection

After conducting your pre-start checks, proceed to the next sequence of steps called the pre-operations checks. The pre-operations check is the process in which the operator will start the vehicle's engine and conduct basic operation checks to be certain the vehicle will run smoothly and effectively.

Seat & Seat belt

Make certain the seat will adjust to your needs and lock in place. Check seat belt for adjustment and the ability to restrain the operator in the seat properly.

The steps described below are the fundamental steps in checking that the vehicle will run smoothly and effectively. Any problems or deficiencies found must be written down immediately on your Operator's Daily Checklist / Equipment Service Request.

Engine warm-up

Engine idle rpm should be set at 1,000 for 3 to 5 minutes, depending on outside temperature. The warm-up period provides time for the cold engine oil to warm and circulate, establishing a film between moving parts.

The warm-up period is especially important for turbo-charged engines when temperatures are at or below freezing. The cold external lines leading to the turbo-charger will tend to slow oil flow until the oil warms. Slow oil flow to the turbo-charger reduces the oil available for the bearing. Engines equipped with a turbo charger must have a minimum warm up period of 5 minutes at 1,000 rpm.

Oil pressure

The initial start-up oil pressure should be between 60 and 90 psi and should come up to a "normal" reading in about 20 to 30 seconds. The low oil pressure warning light should cut off right after the engine has started. **If it does not, shut down the engine immediately and investigate.**

Water Temperature Gauge

The normal water temperature gauge reading usually means either seeing the red needle in the green area or the red needle between 180 to 208 degrees. Make sure that the needle moves into that range as the engine warms up.

Voltmeter

Make certain the voltmeter gauge shows a charge for the battery.

Air Pressure

If air pressure has dropped below 60 psi, you should hear a buzzing sound or see a red warning light indicating low air pressure. The air pressure must reach a reading of between 90 and 120 psi in order to operate the air brake system. After air pressure reaches 120 psi, the parking brake may now be released.

Parking Brake

The purpose of the parking brake is to hold the vehicle in a stationary position and to assist in bringing the vehicle to a complete stop in an emergency. Do not use to stop the vehicle during normal driving. Test the parking brake by pushing "IN" and then pulling "OUT" the yellow triangle control knob and listen for escaping air.

Hydraulic oil reservoir

Maintain the oil level between 3/4 and full in the site glass. Keep hydraulic oil free of contaminants to avoid damage to the system. Raise dump bed and listen for any unusual noises and feel for jolts or slowness while raising the dump bed. This will speed up the warming cycle of the hydraulic oil and circulate through the system. Visually inspect the hydraulic cylinder(s) and hoses for condition and leaks.

Clutch

Check the clutch pedal for any unusual free play. A properly adjusted clutch pedal should have a free play of no less than **1&1/4"** for most model trucks. This means that when you depress the clutch, the clutch should begin to disengage the transmission after the clutch is depressed **1&1/4"**. Some model trucks may have more free play. See the chart below taken from International truck manual. If the clutch feels "spongy" or the transmission does not engage, **have the clutch serviced immediately!!**

INTERNATIONAL TRUCK

Vehicle Model	Pedal Free Travel
2000 – 4000, 7000 – 8000, Metro II, 1452, Model II, 1652	1 1/4 inch (32 mm)
5000	1 1/4 – 2 inches (34-48 mm)
9600, 9700	1 5/8 – 2 1/8 inches (43-55 mm)
9300	1 1/2 inch (38 mm)

Brakes

Check the service brake for proper operation (the air pressure must be above 60 psi before performing this task). Check the service brake by engaging the transmission in low gear and at 5 mph apply the service brake. Feel for any unusual vibrations, pulling left or right and sponginess when applying the brake. Repeat this in reverse gear.

When backing up, listen for the Back-up alarm. The parking brake should also be checked at this time. With the parking brake on, and transmission in low gear, slowly engage the clutch and apply force against the parking brake. Automatic transmission need only to place in drive and increase engine rpm. If the parking brake does not stop the vehicle from moving, have it serviced immediately. For tandem axle trucks, please check under tandem dump truck operations.

Steering

Check the steering by moving the steering wheel from side to side to check that there is minimum play. Minimum play is less than 10 degrees of slack. This means that within 10 degrees the steering should move the wheels and tires. If steering play is greater than 10 degrees have it checked by the shop mechanic.

Electric Canopy

Tandem dump truck operators should check the electric canopy during the pre-operation to make sure that it is operating properly. The canopy arms should swing smoothly and without stopping as the motor unravels the canvas. The canopy should extend all the way to the tail end of the dump bed. Inspect the canopy canvas after it has stopped. Write down any defects on the Operator's Daily Checklist / Equipment Service Request.

Dump bed

After checking all the gauges, engage the dump bed lever and raise the bed and listen for any unusual noises. Prior to engaging the dump lever, make sure that there is nothing in the dump bed. After raising the bed all the way up, raise the red safety prop bar, then lower the dump bed until it firmly rests on the prop bar. Once this has been done, inspect the hydraulic cylinder, hoses, and connectors under the bed. After completing your inspection, raise the dump bed, lower the red safety stop bar, and lower the dump bed.

Tailgate latch or release

To test the tailgate release lever or switch, the operator must either pull the tailgate release lever down or press the electric button that activates the tailgate release. The dump bed should be raised enough to allow the tailgate to swing open, yet still reach the manual release lever, before releasing the tailgate.

Winter attachments

Check the snow plow by raising and lowering the hydraulic lever that controls the snow plow. Engage the salt spreader hydraulic lever and turn on the Dickey john control box to check for the auger and spinner activation. Make sure the salt spreader box is empty before conducting this check.

Two-way radio

Check for power (ON), correct operating channel, squelch and volume controls, and depress the microphone transmitting key for indicator light.

Walk-around inspection

The warm-up period is an opportune time to inspect those components which require the engine to be running for proper inspection.

Inspect all lights for burned-out bulbs, broken or dirty lenses, and broken or damaged wiring. Check all signal lights (turn, four-way flasher, brakes, warning beacon, back-up lights and alarm), headlights (high and low beam), tail lights, license plate lights for proper operation.

Inspect windshield, other windows, and mirrors for pits, cracks, and cleanliness.

Inspect for leaks around and under the dump truck.

Once you have completed the pre-operation checks, the truck is ready to operate.

Shut-down Procedures

The proper shut-down steps required are as follows. The sequence or steps for a shut down provided below yield the most effective means to prolonging the life and use of the vehicle.

Cooling

Idle the engine 3 to 5 minutes before shutting down to allow lubricating oil and coolant to carry heat away from the engine and turbo-charger to prevent damage from rising heat. This idling period is especially important to the turbo-charger. It gets much hotter, and its bearings depend on engine oil for lubrication, so it must be allowed to cool down.

Fuel

The operator should refuel after letting the engine cool down. Shut off the engine before filling up the vehicle's fuel tank(s). Refueling before parking minimizes the accumulation of condensation in the fuel tanks and reduces preparation time spent in the morning.

Parking

After fueling, drive to the vehicle's parking area. Place transmission in neutral and pull the parking air brake knob out. Do **NOT** use the gear shift selector in place of the parking brake. Chock the rear tires for additional parking safety. Place wheel chock on downhill side of the rear wheels when parking dump truck on a down grade.

Air reservoir(s)

Some of SHA's dump trucks both single and tandem axle may have been retro-fitted with Automatic Reservoir Drain Valves (spitters), that operate automatically to eject moisture and contaminants, and require no manual assistance. The operator's and owner's manual recommend that the reservoirs be drained and the valve examined periodically to ensure the drain passage is not obstructed. Air reservoirs with a standard drain cock should be drained daily in cold weather and once a week in warm weather to expel any moisture. Open the drain cock located either on the bottom or at the end of the tank. Be sure to close the drain cocks after all moisture has been expelled.

Shut-down

Once you have completed the preliminary steps of a shut-down and the engine has cooled the required 3 to 5 minutes, proceed to shut down the engine. In some models of dump truck this simply means that you turn the ignition key to the off position. In other models, it may require turning the key to the off position and then pulling the "shut-off" or "cut-off" knob.

Housekeeping

Upon leaving the vehicle for the night make sure that you conduct a "clean sweep" inspection. That means take the time to keep the vehicle clean, remove tools, personal belongings and trash from the cab, and wash the vehicle after every use.

Final Walk-around

Inspect tires and wheels for abnormal wear and damage. Check lug nuts for looseness, and damage to glass, mirrors, lights, etc. Look for fluid leaks, and generally give the vehicle a good once-over.

Review

Items to check on a daily inspection. All deficiencies should be marked on the Operator's Daily Checklist / Equipment Service Request (ODC/ESR) and then given to your supervisor or shop foreman: The operator should be checking for possible problems, such as:

- Broken, worn, or missing parts.
- Leaks (oils or fuel under or on the Dump Truck).
- Hydraulic oil levels (sight gauges).
- Engine oil level and condition of oil.
- Radiator coolant level.
- Battery cables and connections.
- Fuel level.
- Air cleaner and filter indicator.
- Condition and adjustment of fan belts.
- Exhaust system.
- Safety devices.
- Tires, wheels, rims, and lug bolts.
- Windshield, glass in doors and cab wipers and washers.
- Starting circuit.
- Gauges for normal operation.

PERFORMING START-UP, WARM-UP AND SHUT-DOWN

Daily pre-start checks are to be performed every day prior to starting the engine; this is commonly called preventive maintenance (P.M.).

I. Before starting the engine, first do a walk around inspection.

- Open engine compartment side panel, raise hood or open top of engine hood and check engine oil level. Check for contaminants or water.
- Check engine coolant: The level should be at least 3/4 inch from the top of the radiator. Check fan belts and hoses.
- Hydraulic oil level: Check through the site glass.
- Air cleaner: Check air filter indicator. Make sure that the filter is clean.
- Fuel tank: Keep fuel tank full to reduce chance of condensation and corrosion.
- Transmission oil level: Some transmissions have a check plug, others have a dip stick. Check for proper oil level.

II. Starting the engine.

- Enter cab and once seated **Fasten seat belt**.
- Check to see that all the instruments are in good condition, and check that the parking brake is on.
- With clutch depressed, turn the ignition switch to the "on" position and press starter button. Release the starter button or switch key the instant the engine starts.
- As soon as the engine starts, **watch the oil pressure gauge** to be sure it immediately climbs to the correct pressure. If no oil pressure registers, immediately shut the engine off.

CAUTION: Do not engage the starter for more than a few seconds at a time.

If the engine does not start within 10 to 20 seconds, release the starter switch and wait 60 seconds before trying again. This will allow for the starter motor to cool off.

III. After starting the engine, check all the following gauges below for their proper readings:

- Fuel gauge
- Oil pressure
- Coolant temperature
- Voltmeter
- Transmission oil pressure and temperature (if applicable)
- Tachometer

IV. Check steering for excess play. Turn the steering wheel left and right and observe front wheel movement.

V. Check auxiliary systems:

- Horn
- Heater/defroster/fan
- Windshield wipers
- Mirrors, doors, windows

VI. Check all floor pedals for looseness and workability.

- Throttle
- Brake
- Clutch pedal for free-play.

VII. While engine is warming up, do a second walk around.

- Lights and back-up alarm.
- Listen for any unusual sounds or noises. If you here any, locate where they are coming from and inform your supervisor or shop foreman.
- Work all the attachments to verify their good working order and that hydraulic oil is flowing through the controls.

VIII. Shutting down

- Let engine idle and cool down for 3 to 5 minutes.
- Refuel dump truck.
- Park on level ground or across a slope.
- Transmission in neutral.
- Set parking brake.
- Chock tires when necessary.
- Do a final walk around inspection. checking for leaks and missing or loose parts.
- Shut off engine and remove the key.
- Remove personal belongings from the vehicle, and clean out cab and lock it.

Remember that any time that you conduct a preventive maintenance check on any piece of State heavy equipment; you must always accurately and completely fill out the Operator's Daily Checklist / Equipment Service Request. If you feel that you need to review how to complete this form, please review the [SHA Equipment Forms Workbook](#).