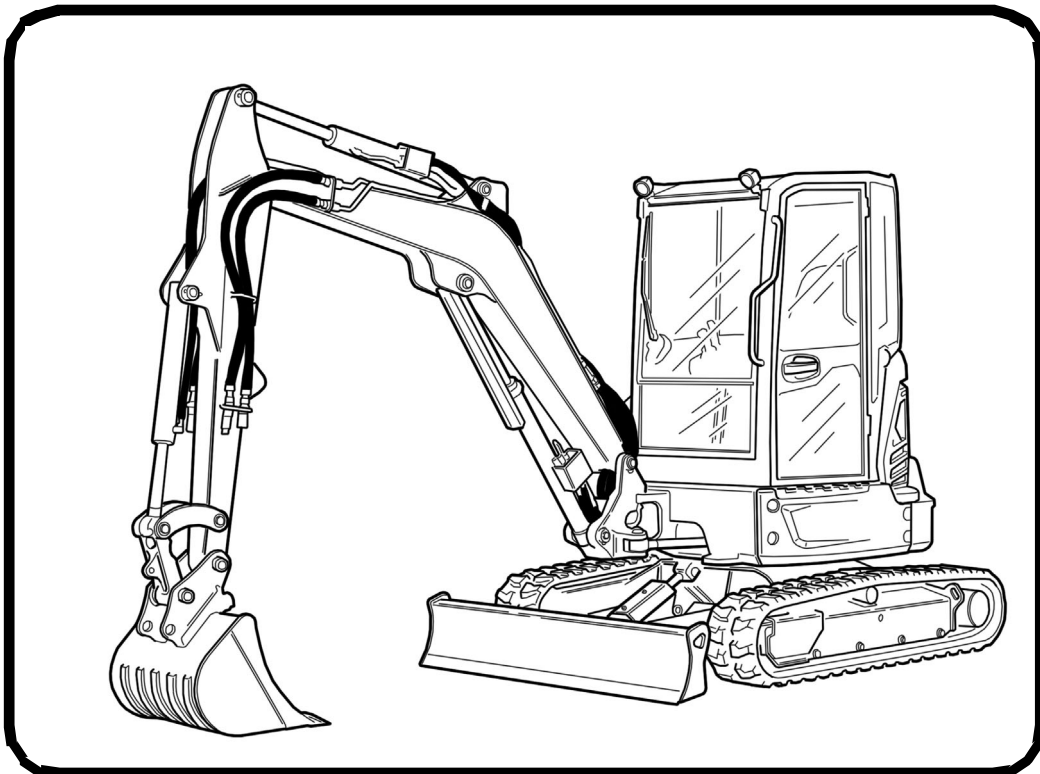


DOOSAN

Operation & Maintenance Manual DX35z Compact Excavator

Serial Number 11001 and Up



OPERATOR SAFETY WARNING



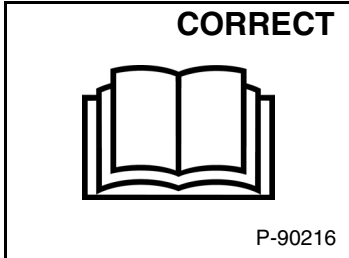
WARNING

Operator must have instructions before operating the machine. Untrained operators can cause injury or death.

W-2001-0502

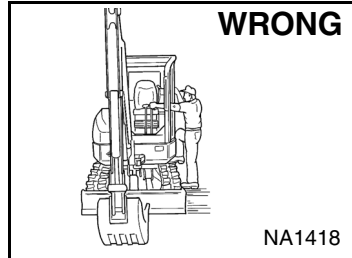


Safety Alert Symbol: This symbol with a warning statement, means: "Warning, be alert! Your safety is involved!" Carefully read the message that follows.



⚠ Never operate without instructions.

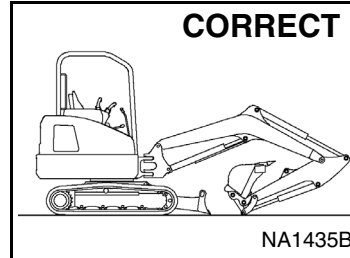
⚠ Read machine signs, and Operation & Maintenance Manual, and Operator's Handbook.



⚠ Do not grasp control handles when entering cab / canopy.

⚠ Be sure controls are in neutral before starting.

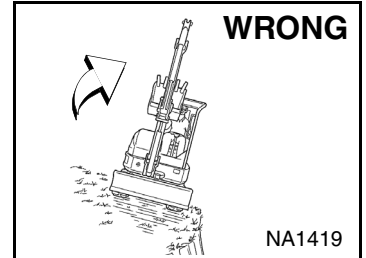
⚠ Sound horn and check behind machine before starting.



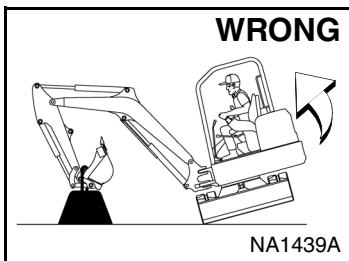
⚠ Never operate without approved cab / canopy.

⚠ Never modify equipment.

⚠ Never use attachments not approved by Doosan Company.

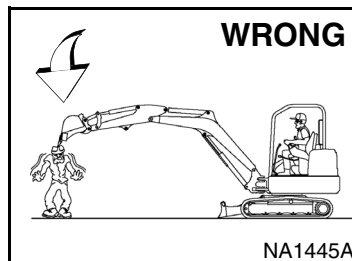


⚠ Avoid steep areas or banks that could break away.



⚠ Use caution to avoid tipping - do not swing heavy load over side of track.

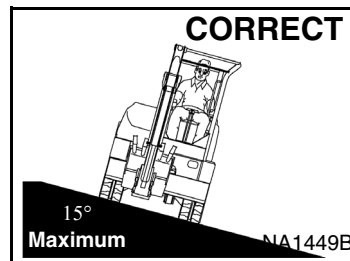
⚠ Operate on flat, level ground.



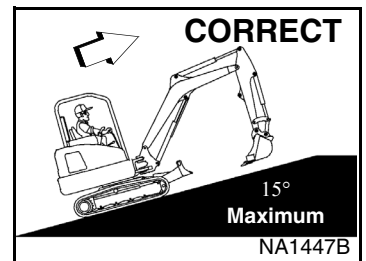
⚠ Keep bystanders out of maximum reach area.

⚠ Do not travel or turn with bucket extended.

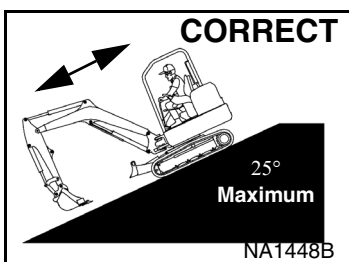
⚠ Never carry riders.



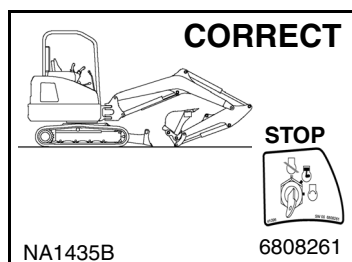
⚠ Never exceed a 15° slope to the side.



⚠ Never travel up a slope that exceeds 15°.

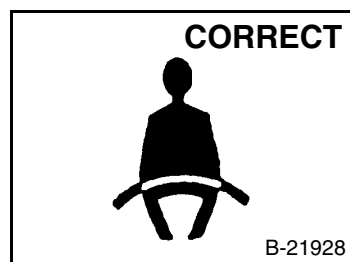


⚠ Never exceed 25° when going down or backing up a slope.



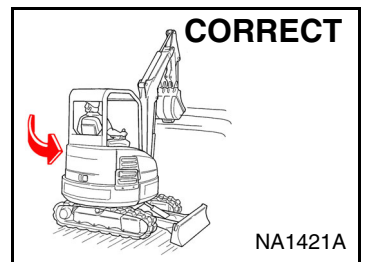
⚠ To leave excavator, lower the work equipment and the blade to the ground.

⚠ Stop the engine.



⚠ Fasten seat belt securely.

⚠ Operate controls only from operator's seat.



⚠ Look in the direction of rotation and make sure no bystanders are in the work area.

SAFETY EQUIPMENT

The excavator must be equipped with safety items necessary for each job. Ask your Doosan dealer for information on the availability and safe use of attachments and accessories.

1. SEAT BELT: Check belt fasteners and check for damaged webbing or buckle.
2. OPERATOR CAB / CANOPY (ROPS and TOPS): Check condition and mounting hardware.
3. OPERATOR'S HANDBOOK: Must be in the cab / canopy.
4. LEFT HAND CONSOLE: When raised must deactivate the travel and hydraulic functions.
5. SAFETY SIGNS (DECALS): Replace if damaged.
6. GRAB HANDLES: Replace if damaged.
7. INTEGRATED SLEW LOCK BRAKE.
8. SAFETY TREAD.: Replace if damaged.

OSW66DH-0317

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REFERENCE INFORMATION

Write the correct information for YOUR Doosan excavator in the spaces below. Always use these numbers when referring to your Doosan excavator.

Excavator Serial
Number

Engine Serial Number

NOTES:

YOUR DOOSAN DEALER:

ADDRESS:

PHONE:



Doosan Infracore Europe
s.r.o. Pobřežní 620/3
186 00 Prague
Czech Republic

FOREWORD

This Operation & Maintenance Manual was written to give the owner / operator instructions on the safe operation and maintenance of the Doosan excavator. READ AND UNDERSTAND THIS OPERATION & MAINTENANCE MANUAL BEFORE OPERATING YOUR Doosan EXCAVATOR. If you have any questions, see your Doosan dealer. This manual may illustrate options and accessories not installed on your excavator.

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DECLARATION OF CONFORMITY

For Model DX35z



EC DECLARATION OF CONFORMITY

Doosan Infracore Europe B.V., Wilgenweg 2, 2964AM, Groot-Ammers, Netherlands
certifies that the construction equipment machinery:

Type of Machine:	CRAWLER EXCAVATOR
Manufacturer:	Doosan Infracore Europe s.r.o., Pobřežní 620/3 186 00 Prague, Czech Republic
Technical File:	Doosan Infracore Europe s.r.o., Pobřežní 620/3 186 00 Prague, Czech Republic
Brand:	Doosan
Model Name:	DX35Z
Serial Number:	
Year of Manufacturing:	
Engine Manufacturer:	Kubota
Engine Type:	D1703
Rated Net Power:	18,2 kW

Pertinent EC noise emission requirement:
Has been manufactured in conformity with the provisions of the Directive 2000/14/EC,
as stated below:

Certificate No.:	1020-090-022395
Date:	16 Oct 2018
Conformity Assessment Procedure:	2000/14/EC, Annex VIII, Full Quality Assurance
Notified Body involved:	Technical and test institute for construction Prague 811/76a Prosecka, 190 00 Praha 9 - Prosek (Czech Republic) Notified body 1020 for EC Directive 2000/14/EC
Measured Sound Power Level:	93 dB(A)
Guaranteed Sound Power Level:	94 dB(A)

Has been manufactured in conformity with the provisions of:
2006/42/EC, 2014/30/EU

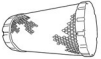
Signature

DOOSAN COMPANY IS ISO 9001 CERTIFIED

ISO 9001 is an international standard that specifies requirements for a quality management system that controls the processes and procedures which we use to design, develop, manufacture, and distribute Doosan products.

ISO 9001 means that as a company we say what we do and do what we say. In other words, we have established procedures and policies, and we provide evidence that the procedures and policies are followed.

REGULAR MAINTENANCE ITEMS

	ENGINE OIL FILTER (6 Pack) 6675517		BATTERY 7304126
	FUEL FILTER 6667352		HYDRAULIC FILL / BREATHER CAP 6692836
	FUEL PRE-FILTER 7247169		RADIATOR CAP 6646678
	AIR FILTER, Outer 6672467		PRIMARY HYDRAULIC FILTER 6661248
	AIR FILTER, Inner 6672468		CASE DRAIN HYDRAULIC FILTER 7009365

NOTE: Always verify Part Numbers with your Doosan dealer.

REGULAR MAINTENANCE ITEMS (CONT'D)

Fluids, Lubricants And Fuel

The fluids, lubricants and fuel described below are those used in the factory and apply to operating conditions in European temperate climate areas. Please see your Doosan dealer for requirements in other climate areas.

Read and understand the preventive maintenance required before adding or replacing any fluids or lubricants.

ENGINE SYSTEMS				
Machine Components	Fluids And Lubricants	T° Range	Packaging**	Part Number
Engine	Doosan Engine Power SAE 10W30 CI4	-25°C – +30°C	B	941-00900B*
	Doosan Engine Power SAE 10W30 CI4	-25°C – +30°C	C	941-00901C
	Doosan Engine Power SAE 10W30 CI4	-25°C – +30°C	D	941-00902D
	Doosan Engine Power SAE 15W40 CI4	-20°C – +40°C	B	941-00904B
	Doosan Engine Power SAE 15W40 CI4	-20°C – +40°C	C	941-00905C
	Doosan Engine Power SAE 15W40 CI4	-20°C – +40°C	D	941-00906D
Cooling Circuit	Doosan Coolant Concentrate	-36°C	B	941-00599B
	Doosan Coolant Concentrate	-36°C	C	941-00600C
Fuel Tank	High-quality diesel fuel that meets EN590	-	-	*

HYDRAULIC / HYDROSTATIC SYSTEMS				
Machine Components	Fluids And Lubricants	T° Range	Packaging**	Part Number
Hydraulic Oil Tank	Doosan Hydraulic Oil	-35°C – +50°C	B	941-00800B
	Doosan Hydraulic Oil	-35°C – +50°C	C	941-00801C
	Doosan Hydraulic Oil	-35°C – +50°C	D	941-00802D

MECHANICAL SYSTEMS				
Machine Components	Fluids And Lubricants	Drop Point	Packaging**	Part Number
All Mechanical Systems	Doosan Multi-Purpose EP-2 Grease (24 X 400 G)	From 260°C	-	941-00656
	Doosan Multi-Purpose EP-2 Grease (18 KG)	From 260°C	-	941-00655
	Doosan Multi-Purpose EP-2 Grease (50 KG)	From 260°C	-	941-00657

(*) Factory Filled Fluids And Lubricants

(**) Packaging Available:

A = 5 L Can

B = 20 L Container

C = 210 L Drum

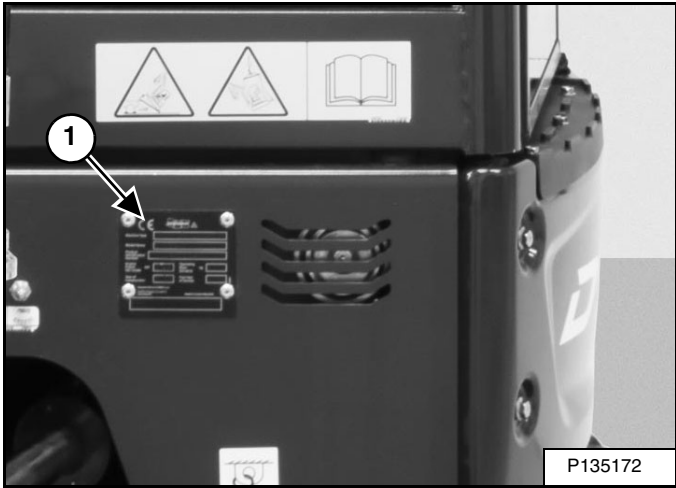
D = 1000 L Tank

SERIAL NUMBER LOCATIONS

Always use the serial number of the excavator when requesting service information or when ordering parts. Earlier or later models (identification made by serial number) may use different parts, or it may be necessary to use a different procedure in doing a specific service operation

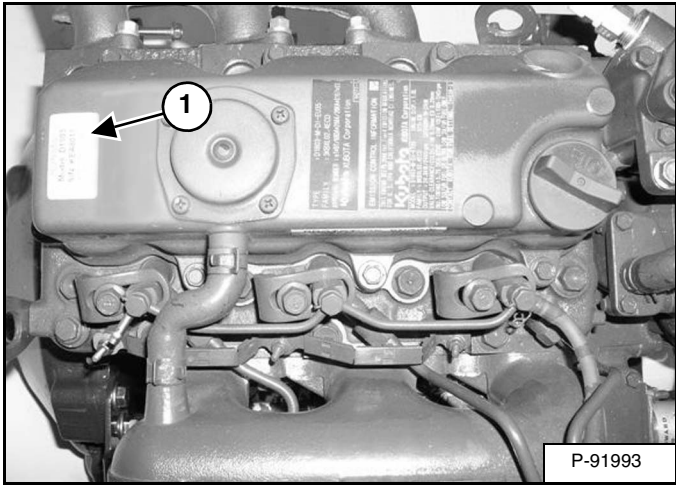
Excavator Serial Number

Figure 1



The excavator serial number plate (Item 1) [Figure 1] is located on the frame of the machine in the location shown.

Figure 2



The engine serial number (Item 1) [Figure 2] is located on the top cover.

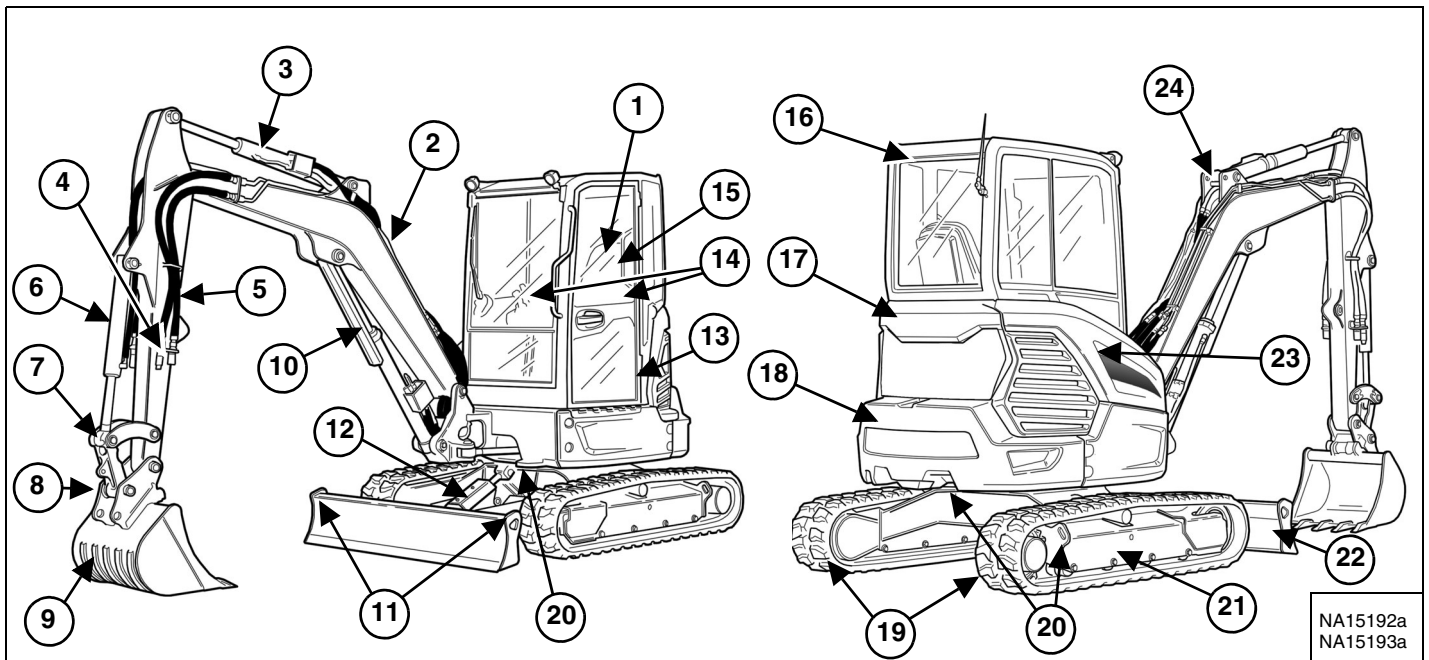
DELIVERY REPORT

Figure 3

The delivery report [Figure 3] contains a list of items that must be explained or shown to the owner or operator by the dealer when the Doosan excavator is delivered.

The delivery report must be reviewed and signed by the owner or operator and the dealer.

EXCAVATOR IDENTIFICATION



ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	Operation & Maintenance Manual and Operator's Handbook	16	Cab (ROPS / FOPS) [3]
2	Boom	17	Rear Cover
3	Arm Cylinder	18	Counterweight
4	Auxiliary Quick Couplers	19	Tracks [4]
5	Arm	20	Tie Downs (Both Sides)
6	Bucket Cylinder	21	Track Frames
7	Bucket Link	22	Blade
8	Attachment Quick Coupler (if equipped) [1]	23	Right Side Cover
9	Bucket [2]	24	Lift Point
10	Boom Cylinder		
11	Tie Downs / Lift Points		
12	Blade Cylinder		
13	Upperstructure		
14	Joysticks		
15	Operator's Seat with Seat Belt		

- [1] Attachment Coupler - Optional attachment couplers are available.
 [2] Bucket - Several different buckets and other attachments are available for the Doosan Excavator.
 [3] ROPS - (Roll-Over Protective Structure) per ISO 12117-2 and ISO 12117.
 FOPS - (Falling Object Protective Structure) per ISO 10262 - Level 1.
 [4] Tracks - Optional tracks are available.

FEATURES, ACCESSORIES AND ATTACHMENTS

Standard Items

Model DX35z Doosan excavators are equipped with the following standard items:

- 1750 mm (68.9 in) Dozer Blade
- Enclosed Cab with ROPS / FOPS Approval
- 300 mm (11.8 in) Rubber Tracks
- Two-Speed Travel
- Auto Shift Drive Motors
- Auxiliary Hydraulics (With Selectable Auxiliary Hydraulic Flow)
- Hydraulic and Travel Control Lockouts
- Engine Speed Control Dial With Auto Idle Feature
- Blade Float
- Standard Arm
- Engine And Hydraulic System Monitor With Shut Down
- Cloth Suspension Seat
- Horn
- Hydraulic Joystick Controls
- Retractable Seat Belt
- Advanced Diagnostics
- Counterweight

Options And Accessories

Below is a list of some equipment available from your Doosan excavator dealer as Dealer and/or Factory Installed Accessories and Factory Installed Options. See your Doosan dealer for other available options, accessories and attachments.

- Secondary Auxiliary Hydraulics
- Radio
- Front Guard Kit
- Load Holding Valve - Boom
- Load Holding Valve - Arm
- Lifting Device
- Overload Warning Device
- Long Arm
- Counterweight (Additional)

- Arm Mounted Auxiliary Hydraulic Couplers

Attachments

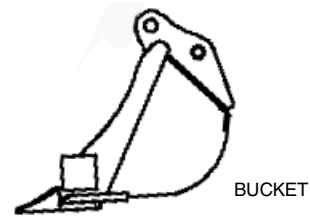
These and other attachments are approved for use on this model Doosan excavator. Do not use unapproved attachments. Attachments not manufactured by Doosan may not be approved.

The versatile Doosan excavator quickly turns into a multi-job machine with a variety of attachments.

See your Doosan dealer for information about approved attachments and attachment Operation & Maintenance Manuals.

- Auger
- Breaker
- Hydraulic Clamp
- Pro Clamp™ System
- Flail Mower
- Rotary Grinder

Buckets Available



Many bucket styles, widths and different capacities are available for a variety of different applications. They include Trenching, Digging, Grading, and Tilt, to name a few. See your Doosan dealer for the correct bucket for your Doosan excavator and application.

Specifications subject to change without notice and standard items may vary.

FEATURES, ACCESSORIES AND ATTACHMENTS (CONT'D)

Falling-Object Protective Structure (FOPS) (Cab Model)

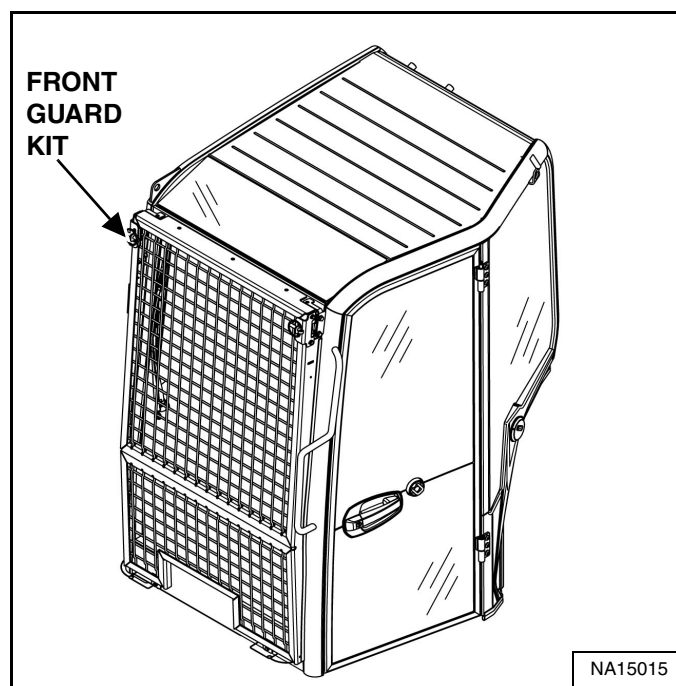
Figure 4



The excavator cab top window is qualified as a Falling-Object Protective Structure (FOPS) that meets the top guard requirements in ISO 10262 - Level 1 (Item 1) [Figure 4].

Front Guard Kit

Figure 5



Available for applications that require protection from objects entering the front of the excavator.

The excavator must have the Front Guard Kit installed to meet the front guard requirements in ISO 10262 - level 1.

Kit includes an upper and lower screen guard.

See your Doosan Dealer for more information.

Front Guard Kit Inspection And Maintenance

The Front Guard Kit must be regularly inspected and maintained. Inspect the screen for damage. Replace parts as necessary.

SAFETY AND TRAINING RESOURCES

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SAFETY INSTRUCTIONS

Before Operation

Carefully follow the operating and maintenance instructions in this manual.

The Doosan excavator is highly maneuverable and compact. It is rugged and useful under a wide variety of conditions. This presents an operator with hazards associated with off motorway, rough terrain applications, common with Doosan excavator usage.

The Doosan excavator has an internal combustion engine with resultant heat and exhaust. All exhaust gases can kill or cause illness so use the excavator with adequate ventilation.

The dealer explains the capabilities and restrictions of the Doosan excavator and attachment for each application. The dealer demonstrates the safe operation according to Doosan instructional materials, which are also available to operators. The dealer can also identify unsafe modifications or use of unapproved attachments. The attachments and buckets are designed for a Rated Lift Capacity. They are designed for secure fastening to the Doosan excavator. The user must check with the dealer, or Doosan literature, to determine safe loads of materials of specified densities for the machine - attachment combination.

The following publications and training materials provide information on the safe use and maintenance of the Doosan machine and attachments:

- The Delivery Report is used to assure that complete instructions have been given to the new owner and that the machine and attachment is in safe operating condition.
- The Operation & Maintenance Manual delivered with the machine or attachment gives operating information as well as routine maintenance and service procedures. It is a part of the machine and can be stored in a container provided on the machine. Replacement Operation & Maintenance Manuals can be ordered from your Doosan dealer.
- Machine signs (decals) instruct on the safe operation and care of your Doosan machine or attachment. The signs and their locations are shown in the Operation & Maintenance Manual. Replacement signs are available from your Doosan dealer.
- An Operator's Handbook is fastened to the operator cab of the excavator. Its brief instructions are convenient to the operator. See your Doosan dealer for more information on translated versions.

The dealer and owner / operator review the recommended uses of the product when delivered. If the owner / operator will be using the machine for a different application(s) he or she must ask the dealer for recommendations on the new use.

SAFETY INSTRUCTIONS (CONT'D)

Safe Operation Is The Operator's Responsibility



Safety Alert Symbol

This symbol with a warning statement means:
"Warning, be alert! Your safety is involved!"
Carefully read the message that follows.



WARNING

Operator must have instructions before operating the machine. Untrained operators can cause injury or death.

W-2001-0502

IMPORTANT

This notice identifies procedures which must be followed to avoid damage to the machine.

I-2019-0284



DANGER

The signal word DANGER on the machine and in the manuals indicates a hazardous situation which, if not avoided, will result in death or serious injury.

D-1002-1107



WARNING

The signal word WARNING on the machine and in the manuals indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

W-2044-1107

The Doosan excavator and attachment must be in good operating condition before use.

Check all of the items on the Doosan Service Schedule Decal under the 8-10 hour column or as shown in the Operation & Maintenance Manual.

Safe Operation Needs A Qualified Operator

For an operator to be qualified, he or she must not use drugs or alcoholic drinks which impair alertness or co-ordination while working. An operator who is taking prescription drugs must get medical advice to determine if he or she can safely operate a machine.

A Qualified Operator Must Do The Following:

Understand the Written Instructions, Rules and Regulations

- The written instructions from Doosan Company include the Delivery Report, Operation & Maintenance Manual, Operator's Handbook and machine signs (decals).
- Check the rules and regulations at your location. The rules may include an employer's work safety requirements. For driving on public roads, the machine must be equipped as stipulated by the local regulations authorising operation on public roads in your specific country. Regulations may identify a hazard such as a utility line.

Have Training with Actual Operation

- Operator training must consist of a demonstration and verbal instruction. This training is given by your Doosan dealer before the product is delivered.
- The new operator must start in an area without bystanders and use all the controls until he or she can operate the machine and attachment safely under all conditions of the work area. Always fasten seat belt before operating.

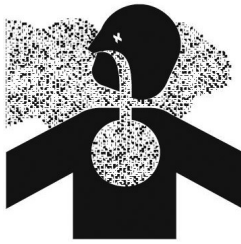
Know the Work Conditions

- Know the weight of the materials being handled. Avoid exceeding the Rated Lift Capacity of the machine. Material which is very dense will be heavier than the same volume of less dense material. Reduce the size of load if handling dense material.
- The operator must know any prohibited uses or work areas, for example, he or she needs to know about excessive slopes.
- Know the location of any underground lines.
- Wear tight fitting clothing. Always wear safety glasses when doing maintenance or service. Safety glasses, respiratory equipment, hearing protection or Special Applications Kits are required for some work. See your Doosan dealer about Doosan Safety Equipment for your model.

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SAFETY INSTRUCTIONS (CONT'D)

Avoid Silica Dust



Cutting or drilling concrete containing sand or rock containing quartz may result in exposure to silica dust. Use a respirator, water spray or other means to control dust.

FIRE PREVENTION



Maintenance

The machine and some attachments have components that are at high temperatures under normal operating conditions. The primary source of high temperatures is the engine and exhaust system. The electrical system, if damaged or incorrectly maintained, can be a source of arcs or sparks.

Flammable debris (leaves, straw, etc.) must be removed regularly. If flammable debris is allowed to accumulate, it can cause a fire hazard. Clean often to avoid this accumulation. Flammable debris in the engine compartment is a potential fire hazard.

The operator's area, engine compartment and engine cooling system must be inspected every day and cleaned if necessary to prevent fire hazards and overheating.

All fuels, most lubricants and some coolants mixtures are flammable. Flammable fluids that are leaking or spilled onto hot surfaces or onto electrical components can cause a fire.

Operation

Do not use the machine where exhaust, arcs, sparks or hot components can contact flammable material, explosive dust or gases.

Electrical



Check all electrical wiring and connections for damage. Keep the battery terminals clean and tight. Repair or replace any damaged part or wires that are loose or frayed.

Battery gas can explode and cause serious injury. Use the procedure in the Operation & Maintenance Manual for connecting the battery and for jump starting. Do not jump start or charge a frozen or damaged battery. Keep any open flames or sparks away from batteries. Do not smoke in battery charging area.

SI EXC EMEA DH-0117

FIRE PREVENTION (CONT'D)

Hydraulic System

Check hydraulic tubes, hoses and fittings for damage and leakage. Never use open flame or bare skin to check for leaks. Hydraulic tubes and hoses must be properly routed and have adequate support and secure clamps. Tighten or replace any parts that show leakage.

Always clean fluid spills. Do not use petrol or diesel fuel for cleaning parts. Use commercial non-flammable solvents.

Fueling



Stop the engine and let it cool before adding fuel. No smoking! Do not refuel a machine near open flames or sparks. Fill the fuel tank outdoors.

Ultra Low Sulfur Diesel (ULSD) poses a greater static ignition hazard than earlier diesel formulations with higher Sulfur content. Avoid death or serious injury from fire or explosion. Consult with your fuel or fuel system supplier to ensure the delivery system is in compliance with fueling standards for proper grounding and bonding practices.

Starting

Do not use ether or starting fluids on any engine that has glow plugs. These starting aids can cause explosion and injure you or bystanders.

Use the procedure in the Operation & Maintenance Manual for connecting the battery and for jump starting.

Spark Arrester Exhaust System

The spark arrester exhaust system is designed to control the emission of hot particles from the engine and exhaust system, but the muffler and the exhaust gases are still hot.

Check the spark arrester exhaust system regularly to make sure it is maintained and working properly. Use the procedure in the Operation & Maintenance Manual for cleaning the spark arrester muffler (if equipped).

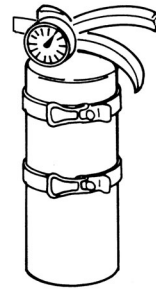
Welding And Grinding

Always clean the machine and attachment, disconnect the battery, and disconnect the wiring from the Doosan controllers before welding. Cover rubber hoses, battery and all other flammable parts. Keep a fire extinguisher near the machine when welding.

Have good ventilation when grinding or welding painted parts. Wear dust mask when grinding painted parts. Toxic dust or gas can be produced.

Dust generated from repairing non-metallic parts such as hoods, fenders or covers can be flammable or explosive. Repair such components in a well ventilated area away from open flames or sparks.

Fire Extinguishers

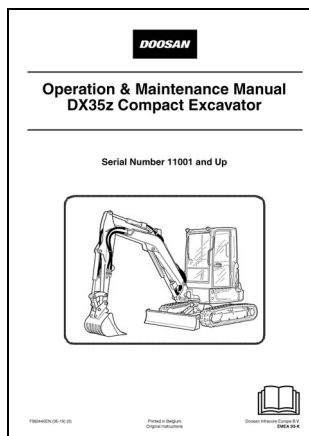


Know where fire extinguishers and first aid kits are located and how to use them. Inspect the fire extinguisher and service the fire extinguisher regularly. Obey the recommendations on the instructions plate.

PUBLICATIONS AND TRAINING RESOURCES

The following publications are also available for your Doosan excavator. You can order them from your Doosan dealer.

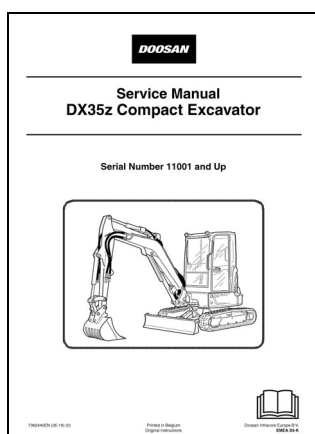
For the latest information on Doosan products and the Doosan Company, visit our Website at **doosanequipment.com** or **doosan.com**



OPERATION & MAINTENANCE MANUAL

7362440EN

- Complete instructions on the correct operation and the routine maintenance of the Doosan excavator.



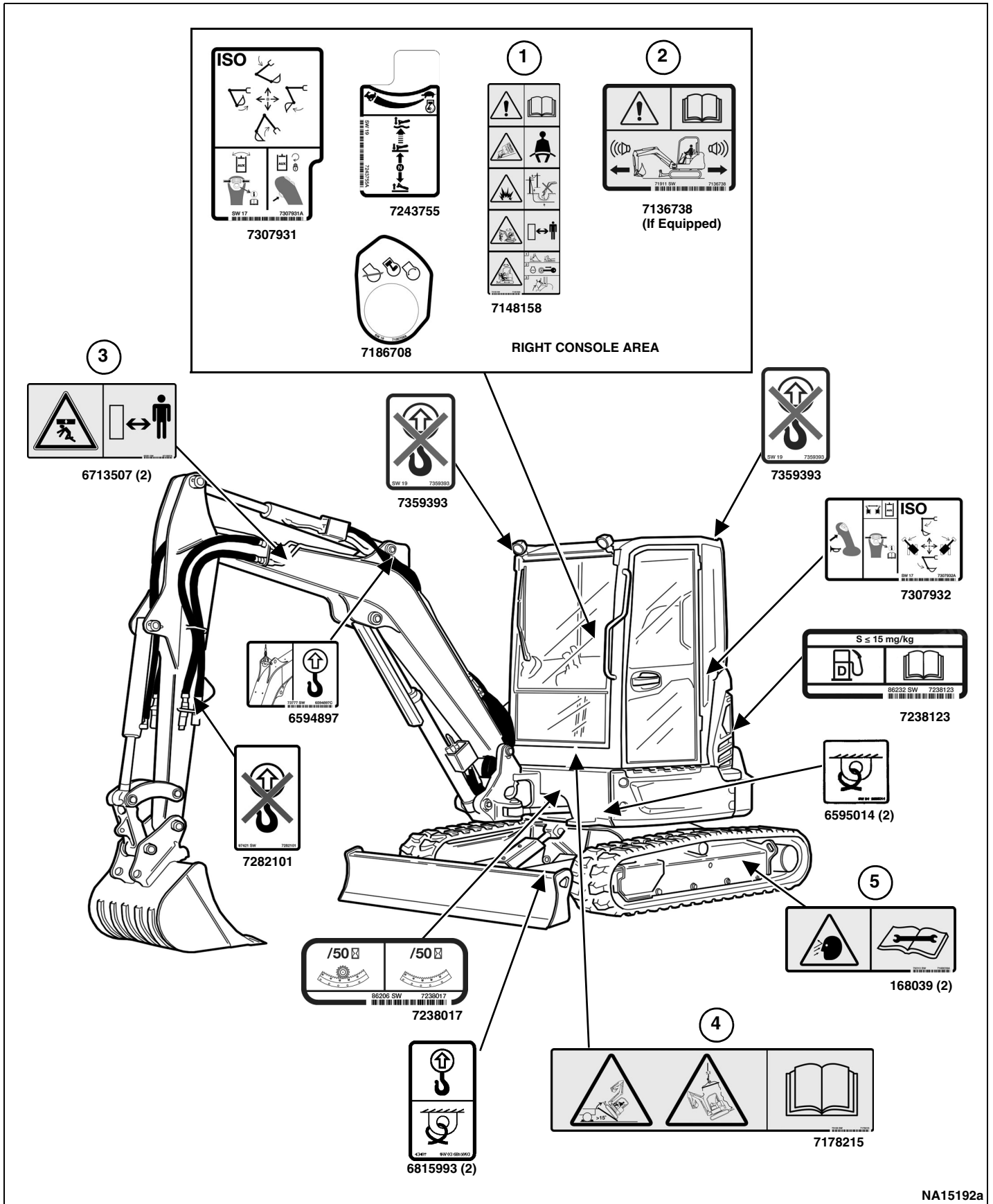
SERVICE MANUAL

7362441enUS

- Complete maintenance instructions for the Doosan excavator.

MACHINE SIGNS (DECALS)

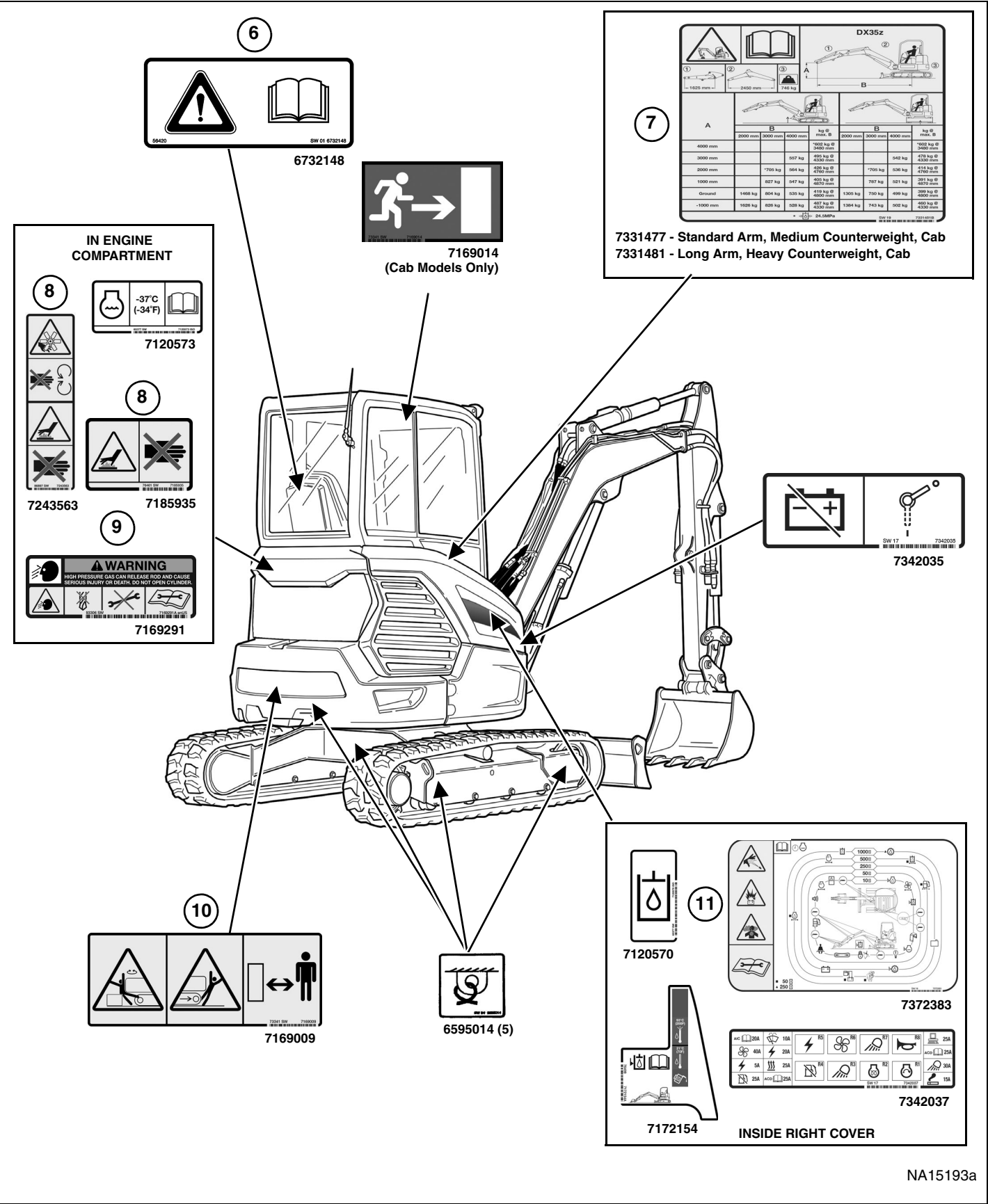
Follow the instructions on all the Machine Signs (Decals) that are on the excavator. Replace any damaged machine signs and be sure they are in the correct locations. Machine signs are available from your Doosan excavator dealer.



NA15192a

MACHINE SIGNS (DECALS) (CONT'D)

Follow the instructions on all the Machine Signs (Decals) that are on the excavator. Replace any damaged machine signs and be sure they are in the correct locations. Machine signs are available from your Doosan excavator dealer.

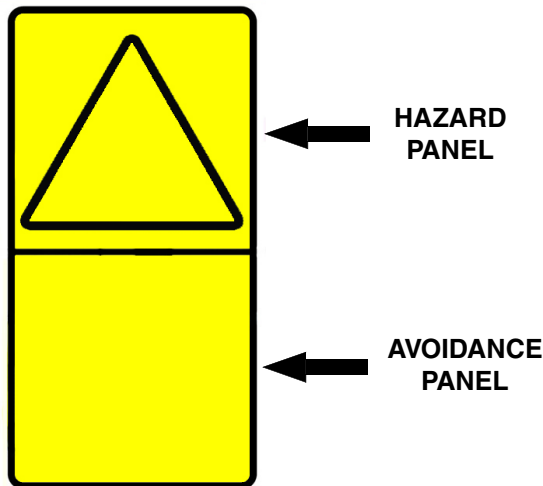


MACHINE SIGNS (DECALS) (CONT'D)

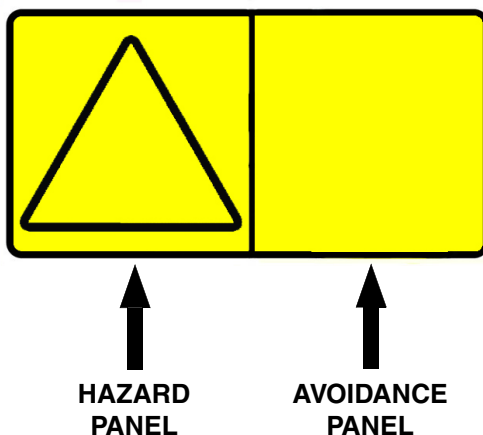
Pictorial Only Safety Signs

Safety signs are used to alert the equipment operator or maintenance person to hazards that may be encountered in the use and maintenance of the equipment. The location and description of the safety signs are detailed in this section. Please become familiarised with all safety signs installed on the excavator.

Vertical Configuration



Horizontal Configuration



The format consists of the hazard panel(s) and the avoidance panel(s):

Hazard panels depict a potential hazard enclosed in a safety alert triangle.

Avoidance panels depict actions required to avoid the hazards.

A safety sign may contain more than one hazard panel and more than one avoidance panel.

NOTE: See the numbered MACHINE SIGNS (DECALS) on Page 16 and MACHINE SIGNS (DECALS) (Cont'd) on Page 17 for the machine location of each corresponding numbered pictorial only decals as shown below.

1. General Hazard (7148158)

This safety sign is located inside the operator's area on the right side near the floor.



Failure to obey warning signs and instructions can cause serious injury or death. Never use excavator without instructions. Read and understand the Operation & Maintenance Manual and Handbook.

Keep away from dropoffs, steep areas or banks that could break away.

Explosion or electrocution can occur if machine contacts utility lines or pipes. Check for overhead or underground lines before operating.

Keep bystanders away. No riders. Check location of blade for direction of travel before moving steering controls.

Failure to operate machine from the operator's position can cause serious injury or death.

To Leave Excavator:

1. Lower attachment and blade to ground.
2. Stop engine and remove the key (if equipped).
3. Raise control console.

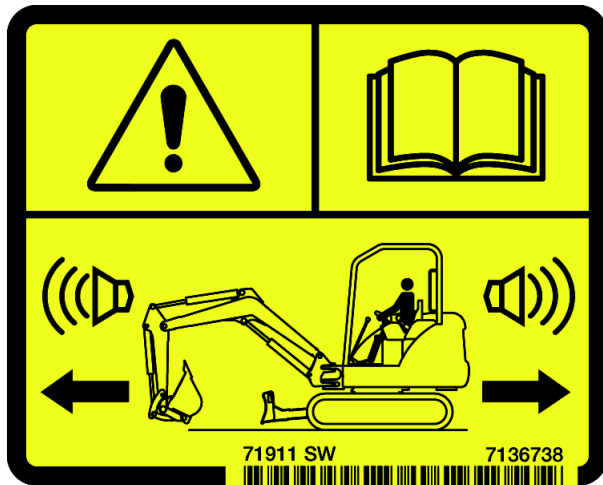
W-2518-0110

MACHINE SIGNS (DECALS) (CONT'D)

Pictorial Only Safety Signs (Cont'd)

2. Motion Alarm (7136738)

This safety sign is located on the right window of cab models.



**This machine is equipped with a motion alarm.
ALARM MUST SOUND!
when operating forward or backward.**

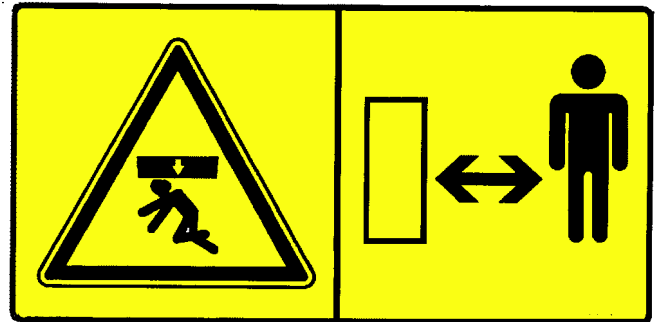
Failure to maintain a clear view in the direction of travel could result in serious injury or death.

The operator is responsible for the safe operation of this machine.

W-2786-0309

3. Crush Hazard (6713507)

This safety sign is located on both sides of the boom.



Keep away from the operating machine to avoid serious injury or death.

W-2520-0106

4. Transporting And Lifting (7178215)

This safety sign is located on the front of the cab.



Improper loading, transporting and lifting procedures can cause serious injury or death. Read and understand the Operation & Maintenance Manual prior to transporting or lifting the machine.

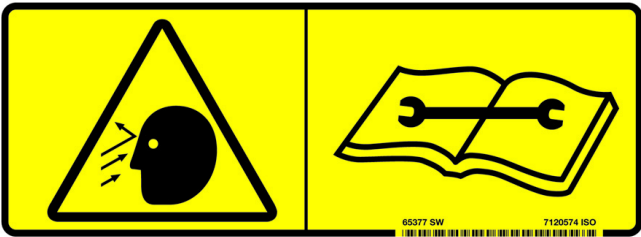
W-2517-0110

MACHINE SIGNS (DECALS) (CONT'D)

Pictorial Only Safety Signs (Cont'd)

5. Thrown or Flying Objects (7168039)

This safety sign is located on the outside of both tracks.



HIGH PRESSURE GREASE CAN
CAUSE SERIOUS INJURY

- Do not loosen the track tension fitting more than 1 - 1/2 turns.

W-2994-0515

6. Operation & Maintenance Manual (6732148)

This safety sign is located on the back of the operator's seat.



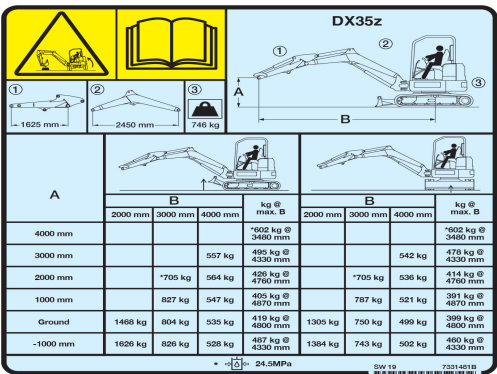
AVOID INJURY OR DEATH

Read and understand the Operation & Maintenance
Manual before operating the machine.

W-3021-0217

7. Lift Capacity (7331477, 7331481)

This safety sign is located on the ceiling of canopy models and on the right window of cab models.



Overload can tip the excavator and cause serious
injury or death.

- Do not lift or hold any load that exceeds these ratings at their specific load radii and height.
- Total rated load is shown. The weight of all lifting devices must be deducted to determine the net load that can be lifted.

Read and understand the Operation & Maintenance
Manual for more information.

W-2519-0110

MACHINE SIGNS (DECALS) (CONT'D)

Pictorial Only Safety Signs (Cont'd)

8. Hot Surfaces and Rotating Fan (7185935, 7243563)

These safety signs are located inside the engine compartment.



Rotating fan blade can cause serious injury or death. Keep away from fan and moving parts. Do not operate with guard removed.

Hot surfaces can cause injury. Do not touch. Allow to cool before servicing.

W-2521-0106

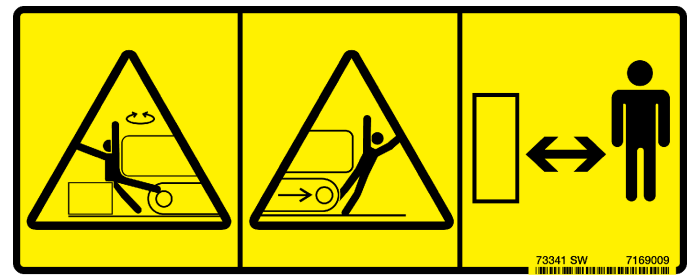
9. Thrown or Flying Objects (7169291)

This safety sign is located on the gas springs under the rear cover and inside the right cover.



10. Stay Away (7169009)

This safety sign is located on the rear of the upperstructure below the tailgate.



AVOID INJURY OR DEATH

- Keep out of swing area or travel path.
- Always look in the direction of travel.
- Make sure swing area is clear of bystanders and objects.

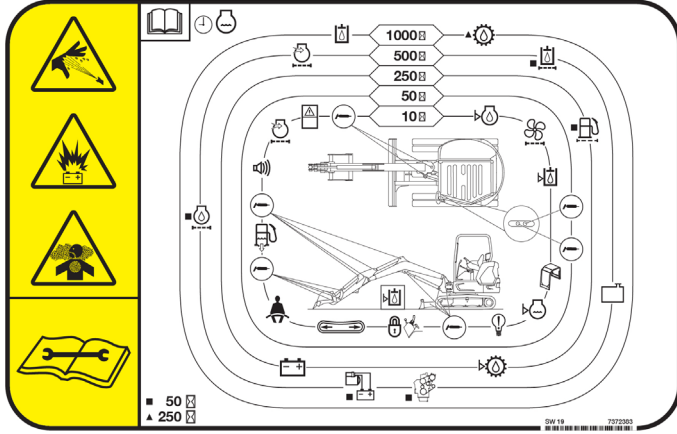
W-2775-1208

MACHINE SIGNS (DECALS) (CONT'D)

Pictorial Only Safety Signs (Cont'd)

11. High Pressure, Battery, Rotating Fan, Exhaust Gases and Service Schedule (7372383)

This safety sign is located inside the right cover. (See SERVICE SCHEDULE on Page 80.)



Leaking fluids under pressure can enter the skin and cause serious injury or death. Immediate medical attention is required. Wear goggles. Use cardboard to check for leaks.

Battery makes flammable and explosive gas. Keep arcs, sparks, flames and lighted tobacco away. Keep away from electrical contacts

Rotating fan can cause serious injury. Keep away from fan and moving parts. Do not operate with guard removed.

All exhaust gases can kill. Always ventilate.

Read and understand the Operation & Maintenance Manual for more information.

W-2522-0110

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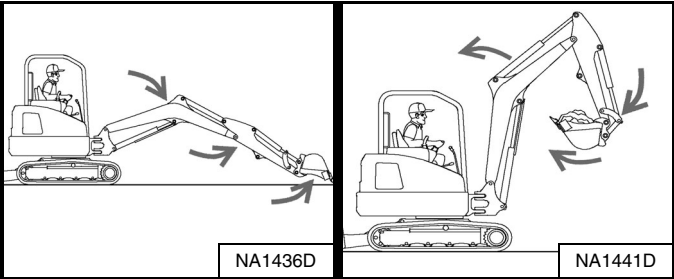
INTENDED USE

This machine is classified as a Compact Excavator as defined in ISO 6165. This machine has wheels or tracks and commonly a mounted bucket for the principle intended functions of excavating, loading and backfilling loose materials such as earth, gravel, or crushed rock.

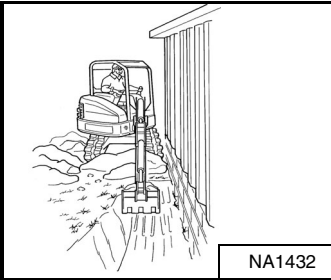
Additional Doosan approved attachments allow this machine to perform other tasks described in the attachment Operation & Maintenance Manuals.

Examples of intended use include:

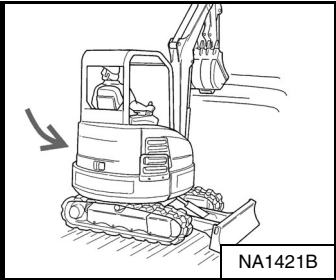
Excavating



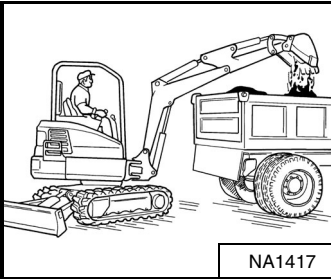
Boom Swing



Rotating the Upperstructure



Loading Material



Backfilling



! WARNING

AVOID INJURY OR DEATH

Do not exceed rated lift capacity. Excessive load can cause tipping or loss of control.

W-2374-0500

! WARNING

AVOID INJURY OR DEATH

Check area to be excavated for overhead or underground electrical power lines. Keep a safe distance from electrical power lines.

VOLTAGE	MINIMUM DISTANCE
up to 50 kV	3 m (10 ft)
beyond 50 kV	5 m (17 ft)

W-2757-EN-0513

! WARNING

Keep all bystanders 6 m (20 ft) away from equipment when operating. Contact with moving parts, a trench cave-in or flying objects can cause injury or death.

W-2119-0910

IMPORTANT

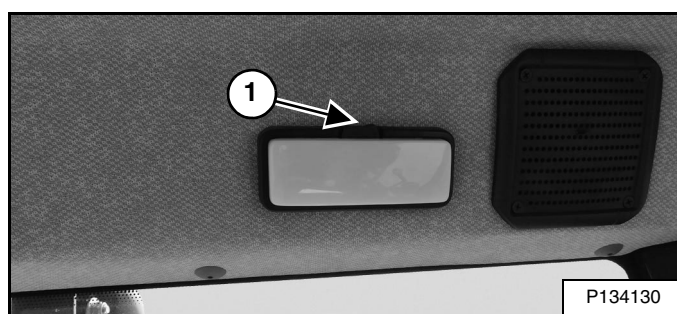
Avoid impacting objects with the blade. Damage to blade and undercarriage components may occur.

I-2256-0507

INSTRUMENTS AND CONSOLES

Cab Interior Light (If Equipped)

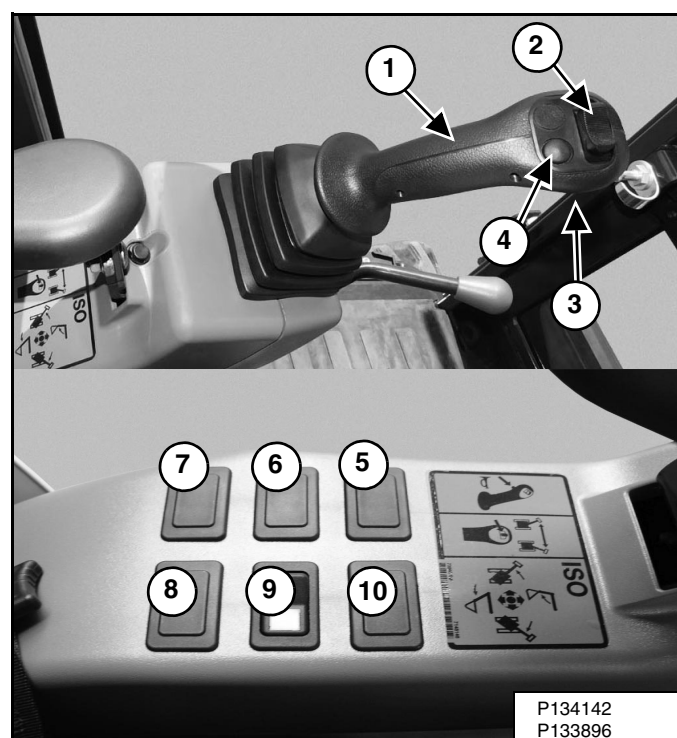
Figure 6



Press the rocker switch on top of the light (Item 1) [Figure 6] to turn the light ON and OFF.

Left Console

Figure 7



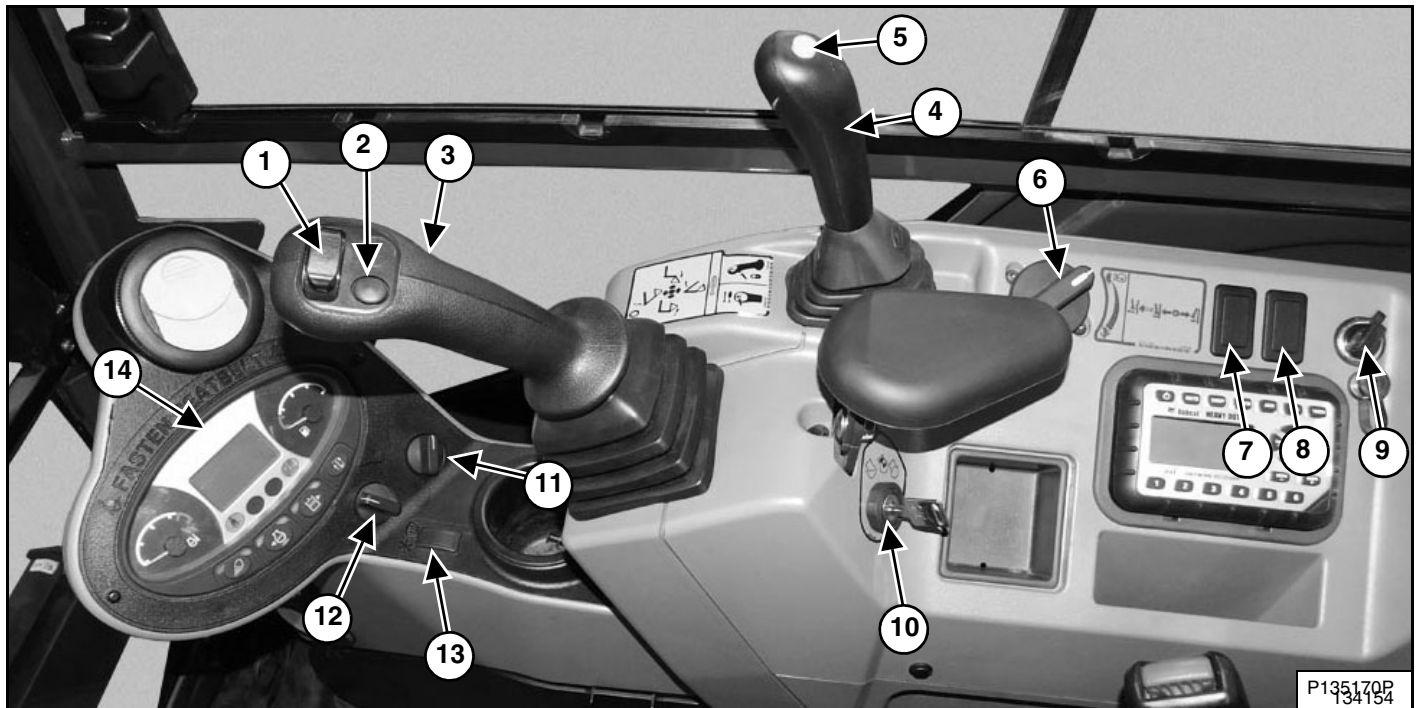
Left Console [Figure 7]

REF. NO	DESCRIPTION	FUNCTION / OPERATION
1	Left Joystick	(See HYDRAULIC CONTROLS on Page 44.)
2	Boom Swing / Secondary Auxiliary Hydraulic Switch	(See BOOM SWING on Page 51.)(See Secondary Auxiliary Hydraulics on Page 48.)
3	Horn	Press the switch on the bottom of the left joystick to sound the horn.
4	Left Joystick Button	Push the button to toggle between boom swing and secondary auxiliary hydraulics (if equipped). (See Secondary Auxiliary Hydraulics on Page 48.)
5	Wiper / Washer Switch (If Equipped)	Press the switch to the left to turn wiper ON. Press and hold switch to the left to activate window washer. Press the switch to the right to turn wiper OFF.
6	Not used for this model	
7	Beacon / Strobe Light (if equipped)	Press switch to the left to turn ON the Beacon / Strobe light. Press the switch to the right to turn OFF.
8	Not used for this model	
9	Overload Warning Device Switch (if equipped)	Press the switch to the left to activate the Overload Warning Device. Press the switch to the right to deactivate the system. (See OVERLOAD WARNING DEVICE on Page 49.)
10	Not used for this model	

INSTRUMENTS AND CONSOLES (CONT'D)

Right Console

Figure 8



REF	DESCRIPTION	FUNCTION / OPERATION
1	Primary Auxiliary Hydraulic Switch	(See Primary Auxiliary Hydraulics on Page 46.)
2	Not used for this model	
3	Right Joystick	(See HYDRAULIC CONTROLS on Page 44.)
4	Blade Control Lever	Controls raising and lowering the blade. Push all the way forward to put blade in float position. (See BLADE CONTROL LEVER on Page 50.)
5	Two-Speed Button	Engages and disengages High Range Travel Speed. (See Two-Speed Travel on Page 34.)
6	Engine Speed Control Dial	Controls rpm of the engine. (See ENGINE SPEED CONTROL on Page 50.)
7	Motion Alarm Cancel Switch	Temporarily disables the motion alarm. (See MOTION ALARM SYSTEM on Page 41.)
8	Direct to Tank Switch (if equipped)	Press switch to direct auxiliary return flow to the hydraulic oil reservoir. (See Direct To Tank Switch on Page 49.)
9	Auxiliary Power Outlet	12 volt receptacle for accessories.
10	Key Switch	Always perform the PRE-STARTING PROCEDURE (See PRE-STARTING PROCEDURE on Page 57.) before starting the engine. (See STARTING THE ENGINE on Page 59.)
11	Temperature Control (if equipped)	Turn clockwise to increase temperature; anticlockwise to decrease.
12	Fan Motor Switch (if equipped)	Turn clockwise to increase fan speed; anticlockwise to decrease.
13	Air Conditioning Switch (if equipped)	Press top of switch to turn air conditioner ON (light in switch will be ON). Press bottom of switch to turn OFF.
14	Instrument Panel	(See Instrument Panel - Standard on Page 29.)

NOTE: Always turn key switch and all accessories to OFF position when the engine is stopped, the battery will discharge if the key is left ON.

INSTRUMENTS AND CONSOLES (CONT'D)

Instrument Panel - Standard

Figure 9



P-97989

REF. NO.	DESCRIPTION	FUNCTION / OPERATION
1	Lights	Press once for work lights. (Left green LED illuminates.) Press again to turn all lights off. (Left green LED off.) Press and hold 5 seconds to display software version in display screen.
2	Auto Idle Feature	Press once to turn Auto Idle Feature ON. (Left green LED illuminates.) Press a second time to turn OFF. (Left and right green LEDs off.) (See Auto Idle Feature on Page 35.)
3	Auxiliary Hydraulic Button	Press once to enable auxiliary hydraulic function. (Left green LED illuminates.) Continue to press and release to scroll through the selectable auxiliary hydraulic setting (3-2-1-OFF). Press and hold (minimum of one second) to enable the continuous flow auxiliary hydraulic feature. (Right green LED illuminates.) Continue to press and release to scroll through the continuous flow selectable auxiliary hydraulic settings (3-2-1-OFF). (See Primary Auxiliary Hydraulics on Page 46.)
4	Information	Cycles through (after each button press) (The following information is displayed in the Data Display Screen, Item 6): <ul style="list-style-type: none"> • Hourmeter (On startup) • Job Clock (1 and 2) (Press and hold 7 seconds when displayed to reset the maintenance clock.) • Engine rpm • Battery voltage • Maintenance clock (Press and hold 7 seconds when displayed to reset the maintenance clock.) • Service codes*
5	Engine Temperature Gauge	Shows the engine coolant temperature.

INSTRUMENTS AND CONSOLES (CONT'D)

Instrument Panel - Standard (Cont'd)

REF. NO.	DESCRIPTION	FUNCTION / OPERATION
6	Data Display Screen	The data display screen shows the Hourmeter at start up and then changes to engine rpm during normal operation of the excavator. When preheat is activated, the display screen will show the remaining preheat time. Can also be used to display Job Clock, Engine rpm, Boom Offset / Second Auxiliary and Selectable Auxiliary Hydraulic Flow.
7	Fuel Gauge	Shows the amount of fuel in the tank.
8	Seat Belt	Fasten Seat Belt Reminder - Light stays on for 45 seconds to remind operator to fasten seat belt.
9		Not used for this model.
10		Not used for this model.
11	Left Console Lockout	Icon ON when left console is raised. Icon OFF when left console is lowered.
12	General Warning **	Malfunction with one or more machine functions. (See Service Codes in this manual.)
13	High Range Engaged ***	Icon is illuminated when two-speed travel is enabled.
14	Engine Coolant Temperature **	Engine coolant temperature high or sensor error.
15	Engine Malfunction **	Engine malfunction or failure.
16	Hydraulic System Malfunction **	Hydraulic system malfunction or failure.
17	Fuel	Fuel level low or sensor error. (Icon is ON when fuel level is low, Icon flashes when fuel sensor fault is activated.)
18		Not used for this model.
19		Not used for this model.
20		Not used for this model.
21		Not used for this model.

* See SYSTEM SETUP AND ANALYSIS for Service Code Description. (See DIAGNOSTIC SERVICE CODES on Page 123.)

** Icons will be ON or flashing when diagnostic system indicates a problem. (See DIAGNOSTIC SERVICE CODES on Page 123.)

*** Icons will be flashing when diagnostic system indicates a problem. (See DIAGNOSTIC SERVICE CODES on Page 123.)

INSTRUMENTS AND CONSOLES (CONT'D)

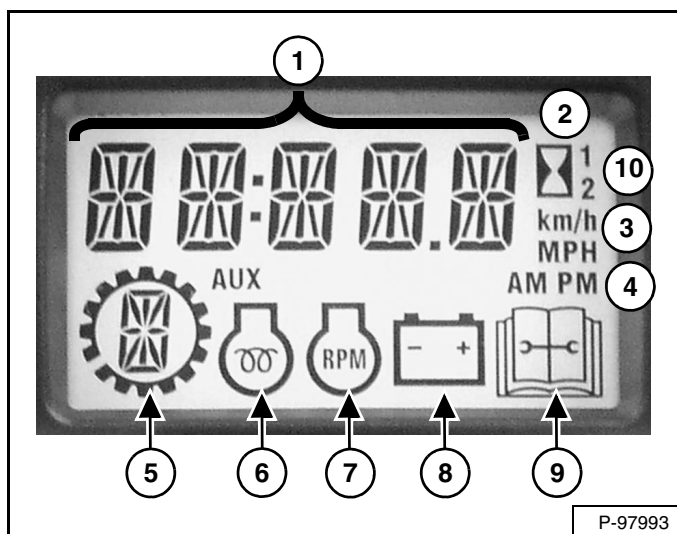
Instrument Panel - Standard (Cont'd)

Indicator Icons

The display screen can display the following information:

- Operating hours
- Job Clock (1 and 2)
- Engine rpm
- Battery voltage
- Maintenance clock countdown
- Second Auxiliaries
- Service codes

Figure 10



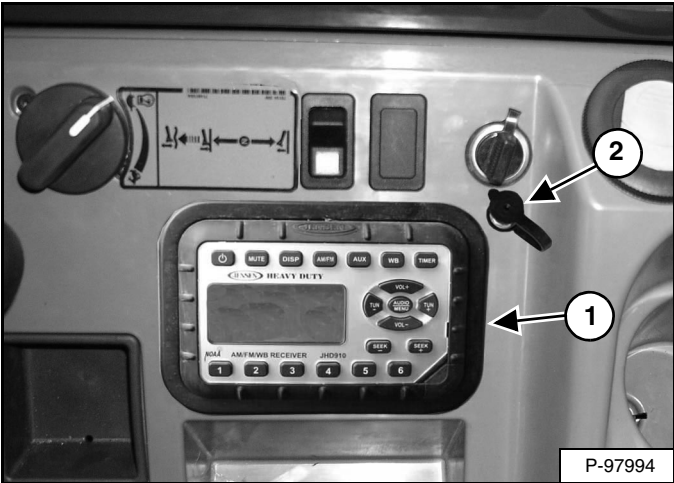
The display screen is shown in **[Figure 10]**. The data display will show operating hours upon startup.

1. **Data Display**
2. **Hourmeter**
3. **Metric / English (Not Used For This Model)**
4. **Clock (Not Used For This Model)**
5. **Selectable Auxiliary Flow (3 - 2 - 1)**
6. **Engine Preheat**
7. **Engine RPM**
8. **Battery / Charging Voltage**
9. **Service**
10. **Job Clock (1 and 2)**

INSTRUMENTS AND CONSOLES (CONT'D)

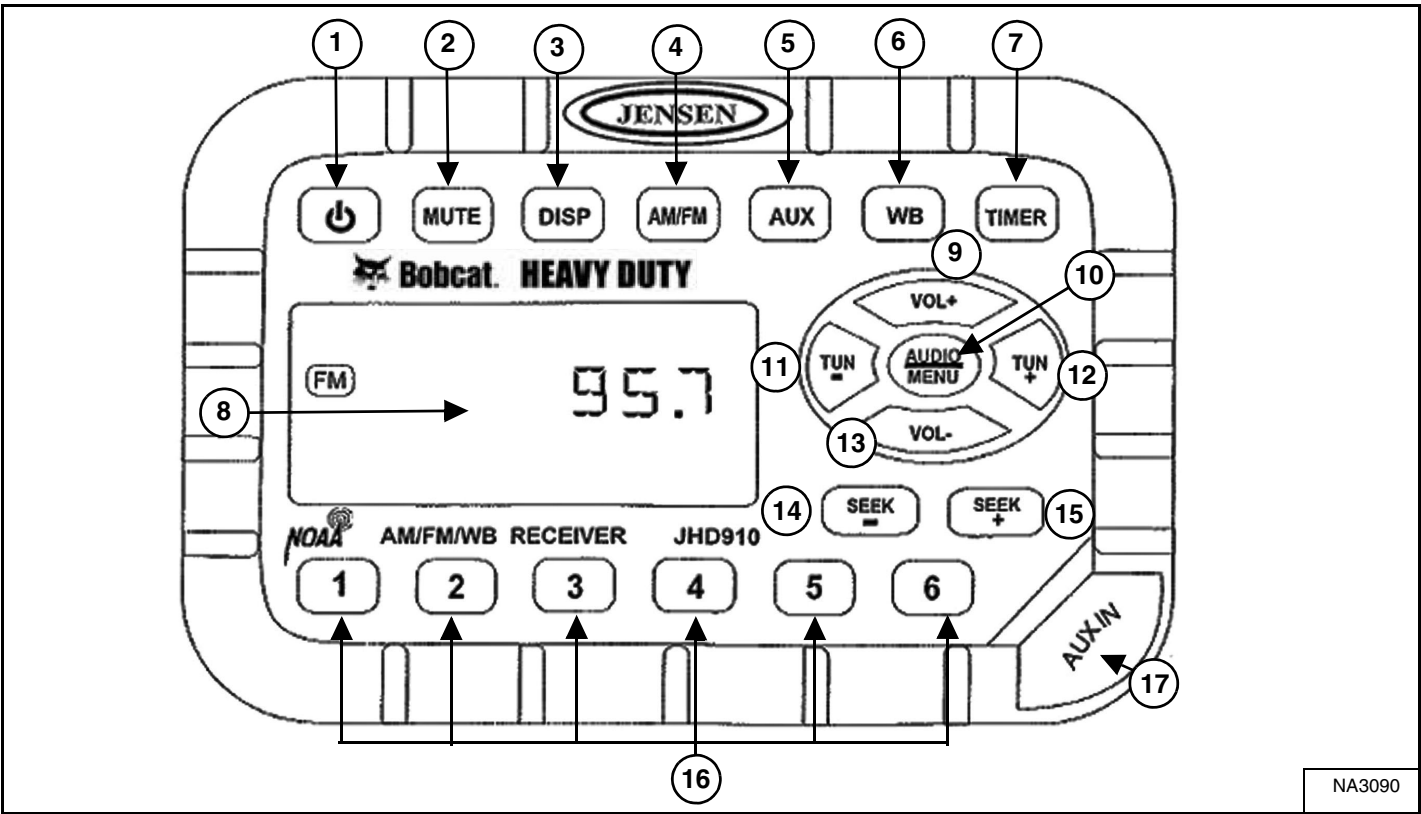
Radio Option

Figure 11



This excavator may be equipped with a radio (Item 1) and the headphone jack (Item 2) [Figure 11].

Figure 12



NOTE: See DISPLAY (Item 3) in the following table for clock setting instructions.

INSTRUMENT AND CONSOLES (CONT'D)

Radio (Cont'd)

REF. NO.	DESCRIPTION	FUNCTION / OPERATION
1	POWER	Press to turn ON; press again to turn OFF.
2	MUTE	Press to mute audio output; [MUTE] will appear in display screen; press again to turn OFF.
3	DISPLAY	Press to toggle between function mode (showing tuner frequency, auxiliary input, weather band information, or timer) and clock mode. Press and hold to enter clock setting mode; use FREQUENCY DOWN (TUN -) button to adjust hours and FREQUENCY UP (TUN +) button to adjust minutes; normal operation will resume automatically.
4	BAND	Press to select tuner mode. Press to cycle through 2 AM (MW) bands and 3 FM bands.
5	AUXILIARY	Press to select Auxiliary Input mode. Portable audio device (MP3 player) must be attached to auxiliary input jack.
6	WEATHER BAND	Press to select weather band; use FREQUENCY UP (TUN +) and FREQUENCY DOWN (TUN -) buttons to adjust to the clearest station. The weather alert feature, if activated, will automatically switch from the current function to the weather band if a weather warning is received. See AUDIO / MENU ADJUSTMENT in this table.
7	TIMER	Press to access timer mode. Press to start the timer function; press again to stop timer; press again to resume timer or press and hold to reset timer and exit from timer mode.
8	DISPLAY SCREEN	Displays the time, frequency, and activated functions.
9	VOLUME UP	Adjusts volume up; current volume (0 - 40) will appear briefly in display screen.
10	AUDIO / MENU ADJUSTMENT	AUDIO ADJUSTMENT: Press to cycle through bass, treble, and balance settings; use VOLUME UP (VOL +) and VOLUME DOWN (VOL -) buttons to adjust when desired option is displayed; normal operation will resume automatically. MENU ADJUSTMENT: Press and hold for 3 seconds to enter menu adjustment settings; press to cycle through the following settings; use VOLUME UP (VOL +) and VOLUME DOWN (VOL -) buttons to adjust when desired option is displayed; normal operation will resume automatically. <ul style="list-style-type: none"> • Beep Confirm (On or Off) - Determines if beep will sound with each button press. • Operation Region (USA or Europe) - Selects the appropriate region. • Clock Display (12 or 24) - Selects a 12-hour or 24-hour clock display. • Display Brightness (Low, Medium, or High) - Determines brightness level of display screen. • Backlight Colour (Amber or Green) - Determines backlight colour of display screen. • Power On Volume (0 - 40) - Selects default volume setting when radio is turned on. • WB Alert (On or Off) - Determines if weather band alert feature is activated.
11	FREQUENCY DOWN	Press to manually tune the radio frequency down.
12	FREQUENCY UP	Press to manually tune the radio frequency up.
13	VOLUME DOWN	Adjusts volume down; current volume (0 - 40) will appear briefly in display screen.
14	SEEK FREQUENCY DOWN	Press to automatically tune frequency down to next strong station.
15	SEEK FREQUENCY UP	Press to automatically tune frequency up to next strong station.
16	PRESET STATIONS	Used to store and recall stations for each AM and FM band. Press and hold to store current station; press button to recall station.
17	AUXILIARY INPUT JACK	Connect line output of portable audio device (MP3 player) to 3,5 mm (1/8 in) jack and press AUXILIARY button.

INSTRUMENTS AND CONSOLES (CONT'D)

Raising And Lowering The Console

Raise the console before exiting the cab.

Figure 13



Pull up on the release handle [Figure 13]. The lift spring will assist in raising the console.

Lower the console before operating the excavator.

Push down on the lever [Figure 13] until the latch is engaged.

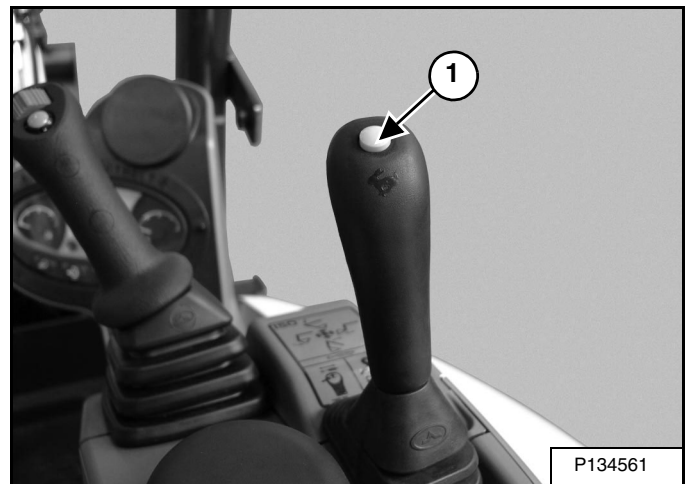
NOTE: When the console is raised, the hydraulic and traction system functions are locked and will not operate.

If the engine stops, the boom / bucket (attachments) can be lowered to the ground using hydraulic pressure in the accumulator.

The control console must be in the locked down position, and the key switch in the ON position.

Two-Speed Travel

Figure 14



Press the button (Item 1) [Figure 14] to engage the high range. Press a second time to disengage.

NOTE: When engaging high range, two audible beeps will be heard. When engaging low range, one audible beep will be heard.

Figure 15



When high range is engaged, the two-speed travel icon (Item 1) [Figure 15] will illuminate.

Press the button (Item 1) [Figure 14] again to disengage.

Auto Shift Drive Motors

The travel motors are equipped with an auto shift feature that senses hydraulic pressure. When in high range, the travel motors will automatically shift to low range when more torque is required and return to high range when hydraulic pressure decreases.

NOTE: Always set the travel speed to low range when loading or unloading the excavator onto a transport vehicle.

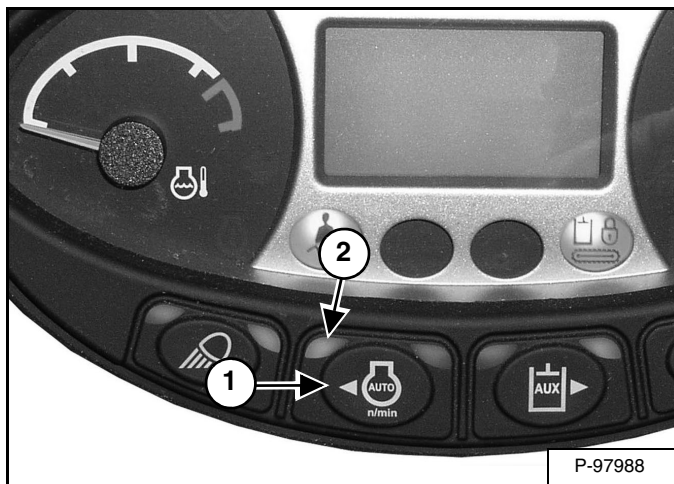
INSTRUMENTS AND CONSOLES (CONT'D)

Auto Idle Feature

The auto idle feature (when engaged) will reduce the engine speed to low idle when the control levers (joystick, blade, travel, etc.) are in neutral and not used for approximately four seconds. The engine rpm will return to the set position as soon as any control lever is activated.

NOTE: Auto idle is only available on machines equipped with a dial throttle.

Figure 16



The automatic idle switch (Item 1) [Figure 16] is used to engage or disengage the automatic idle feature.

Press the switch (Item 1) once to engage automatic idle and the LED (Item 2) will illuminate. Press the switch (Item 1) a second time to disengage automatic idle, the LED (Item 2) [Figure 16] will be OFF.

NOTE: Always disengage the auto idle feature when loading or unloading the excavator onto a transport vehicle.

OPERATOR CAB (ROPS / FOPS)

Description

The Doosan excavator has an optional operator cab (ROPS / FOPS) to protect the operator if the excavator is tipped over or from falling objects. The seat belt must be worn for ROPS / FOPS protection.

Check the ROPS / FOPS cab, mounting, and hardware for damage. Never modify the ROPS / FOPS cab. Replace the cab and hardware if damaged. See your Doosan dealer for parts.

ROPS - Roll-Over Protective Structure per ISO 12117-2.

FOPS - Falling Objects Protective structure, Top Guard per ISO 10262 - Level 1.

WARNING

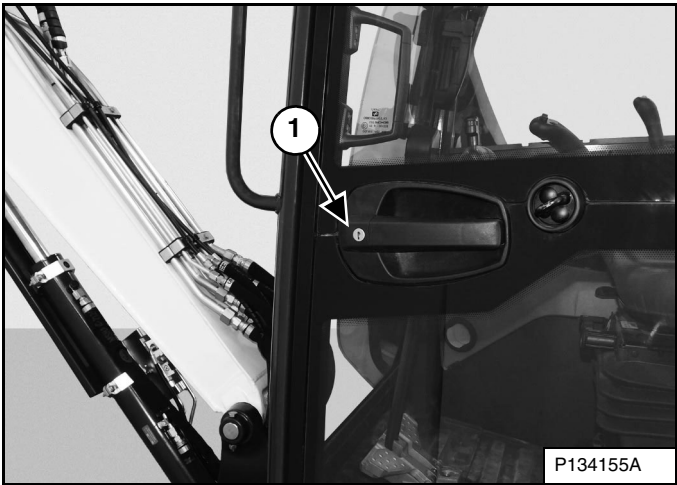
Never modify operator cab by welding, grinding, drilling holes or adding attachments unless instructed to do so by Doosan Company. Changes to the cab can cause loss of operator protection from rollover and falling objects, and result in injury or death.

W-2069DH-0117

OPERATOR CAB (ROPS / FOPS) (CONT'D)

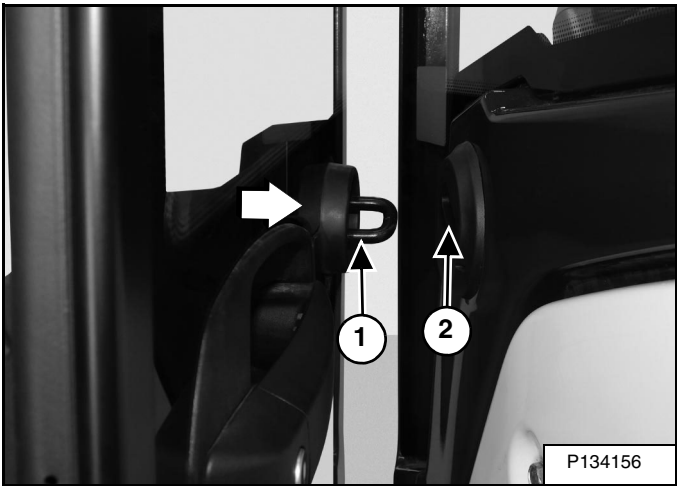
Cab Door

Figure 17



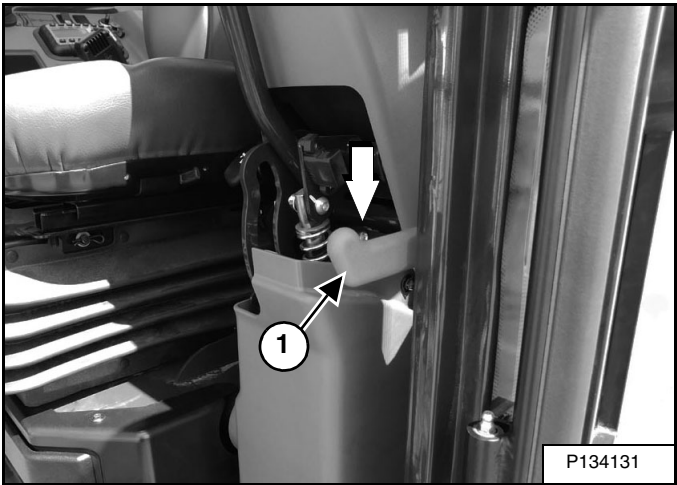
The cab door can be locked (Item 1) [Figure 17] with the same key as the starter switch.

Figure 18



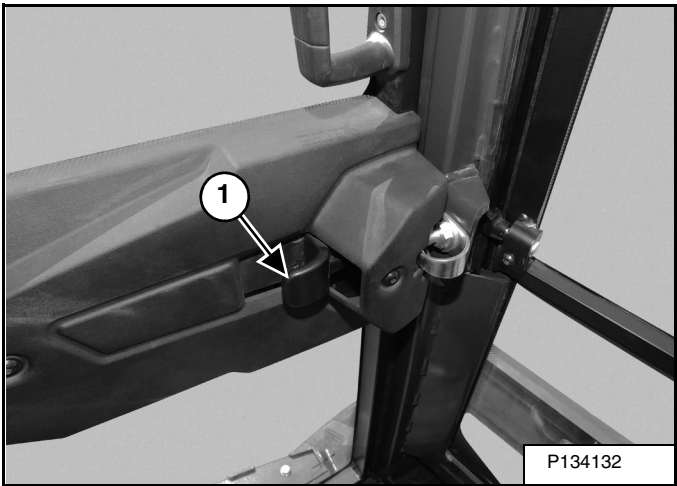
Push the door all the way open until the latch post (Item 1) engages in the latch (Item 2) [Figure 18] to hold the door in the open position.

Figure 19



When the door is in the open position, push down on the latch (Item 1) [Figure 19] to close the door.

Figure 20



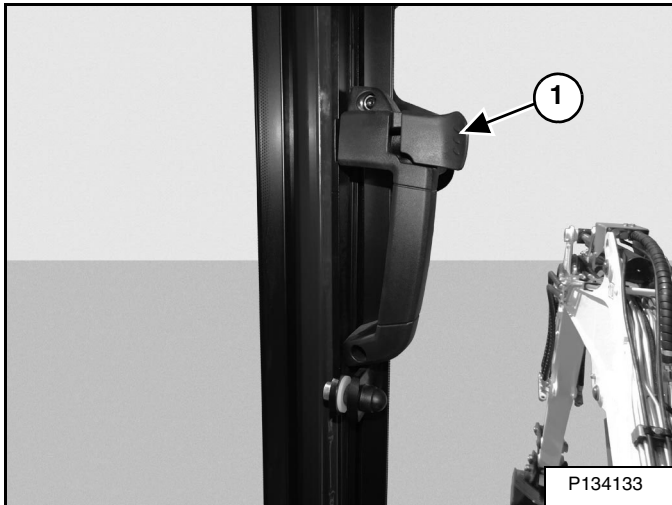
From inside the cab, open the door using the handle (Item 1) [Figure 20].

OPERATOR CAB (ROPS / FOPS) (CONT'D)

Front Window

Opening The Front Window

Figure 21



Push the window latch buttons (Item 1) **[Figure 21]** on both sides.

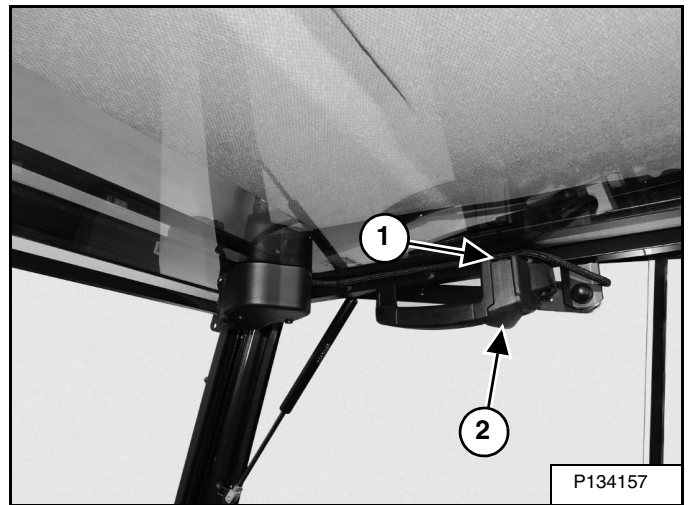
Figure 22



Use both window grab handles (Item 1) **[Figure 22]** to pull the top of the window in.

Continue moving the window in and up over the operator's head until the window is fully raised.

Figure 23



When the window is fully raised, the latch (Item 1) **[Figure 23]** (both sides) will close on the bracket in the latched position.

Pull down and forward slightly on the window to make sure it is fully latched.

Closing The Front Window

Use both window grab handles to support the window while pressing the window latch button (Item 2) **[Figure 23]** (both sides).

Use both window grab handles (Item 1) **[Figure 22]** to pull the window down fully.

Press the top of the window in until the latch locks into the latched position (both sides) **[Figure 21]**.

Pull inward and upward slightly on the window to make sure it is fully latched in the closed position.

OPERATOR CAB (ROPS / FOPS) (CONT'D)

Front Wiper

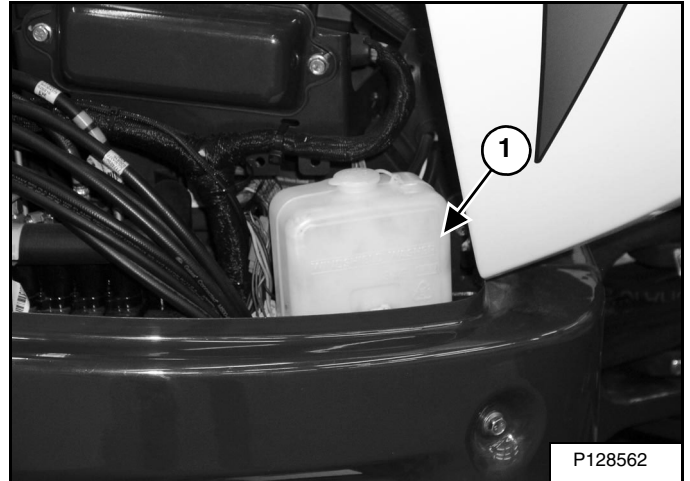
Figure 24



The front window is equipped with a wiper (Item 1) [Figure 24] and washer.

Window Washer Reservoir

Figure 25



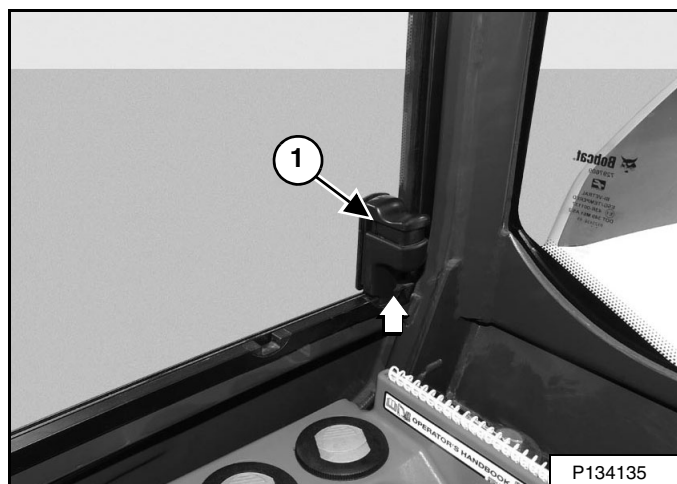
The window washer reservoir (Item 1) [Figure 25] is located under the right side cover.

OPERATOR CAB (ROPS / FOPS) (CONT'D)

Right Side Windows

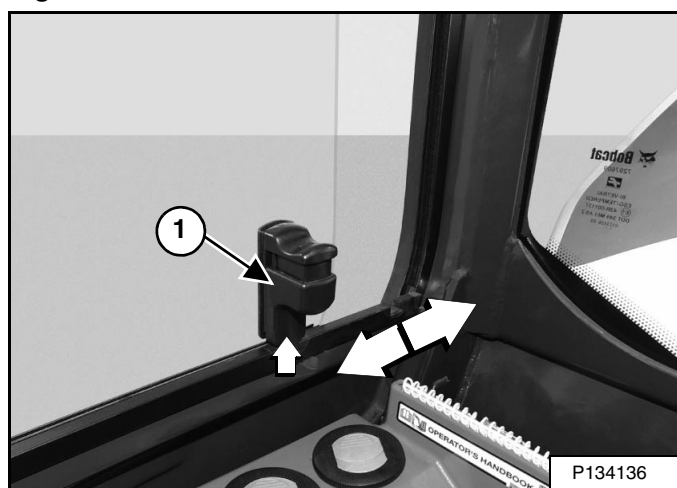
Opening The Right Rear Window

Figure 26



Pull up on the bottom latch (Item 1) [Figure 26].

Figure 27



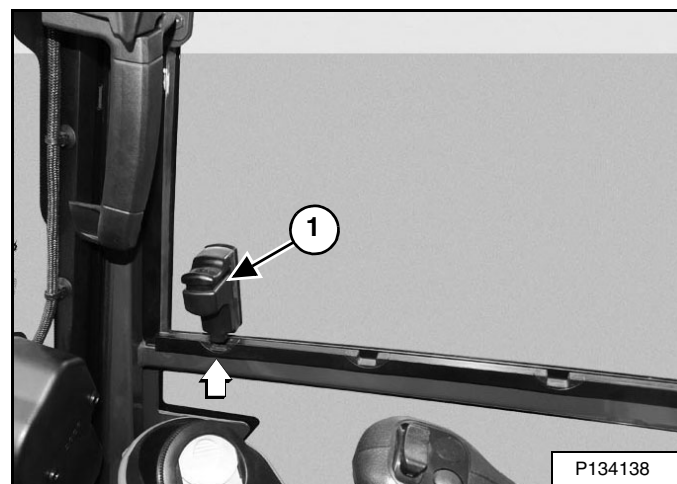
Pull the latch (Item 1) [Figure 27] forward to open the window until the desired stop. Release the bottom latch and snap the lock in place.

Closing The Right Rear Window

Pull up on the bottom latch (Item 1) [Figure 26] and push the latch back to close the window.

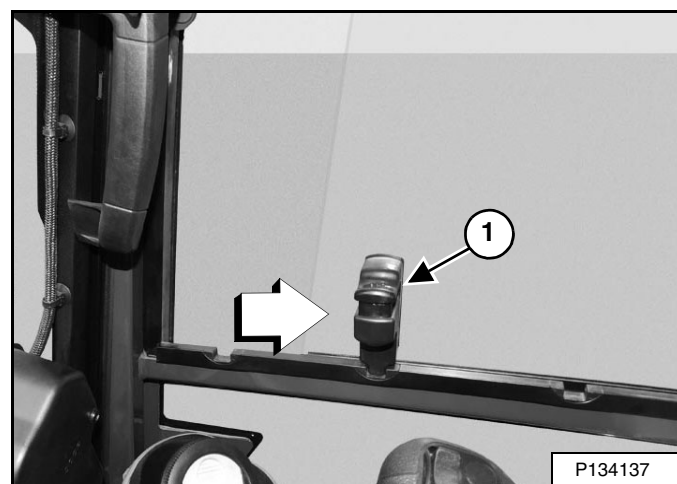
Opening The Right Front Window

Figure 28



Pull up on the bottom latch (Item 1) [Figure 28] located at the front of the front window.

Figure 29



Pull the latch (Item 1) [Figure 29] backward to open the window until the desired stop. Release the bottom latch and snap the lock in place.

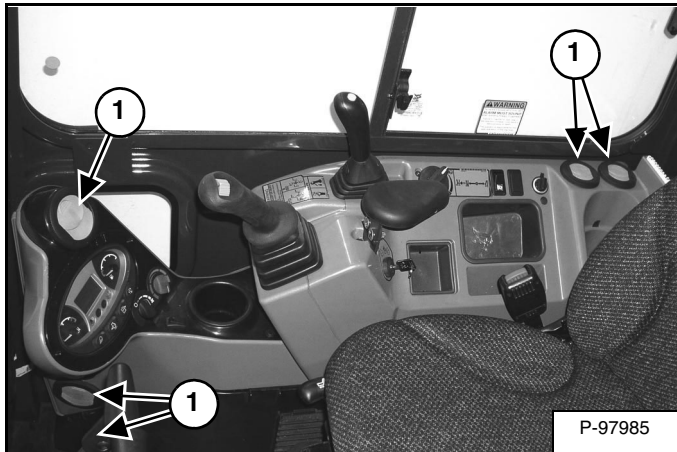
Closing The Right Front Window

Pull up on the bottom latch (Item 1) [Figure 28] and push the latch forward to close the window.

OPERATOR CAB (ROPS / FOPS) (CONT'D)

Heating And Ventilation Ducting

Figure 30



The louvers (Item 1) [Figure 30] can be positioned as needed to direct the air flow to various areas in the cab.

EMERGENCY EXIT

The door, the right side rear window and the front window provide exits.

Right Side Rear Window

Figure 31



Exit through the window [Figure 31].

Front Window

Figure 32



Open the front window and exit [Figure 32].

NOTE: If the excavator has a Special Applications Kit installed, the front window is NOT an emergency exit.

MOTION ALARM SYSTEM

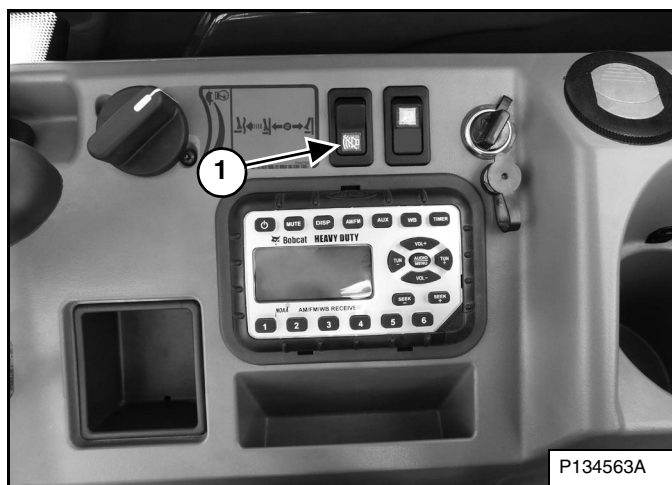
Operation

Figure 33



This excavator can be equipped with a motion alarm system. The motion alarm is located underneath the rear of the excavator.

Figure 34



The motion alarm can be temporarily disabled by pressing the Motion Alarm switch (Item 1) [Figure 34] while the machine is moving. As soon as the travel levers are returned to the NEUTRAL position, the motion alarm will be enabled.

WARNING

This machine is equipped with a motion alarm.
ALARM MUST SOUND!
when operating forward or backward.

Failure to maintain a clear view in the direction of travel could result in serious injury or death.

The operator is responsible for the safe operation of this machine.

W-2786-0309

The motion alarm will sound when the operator moves the travel control levers (Item 1) [Figure 35] in either the forward or reverse direction.

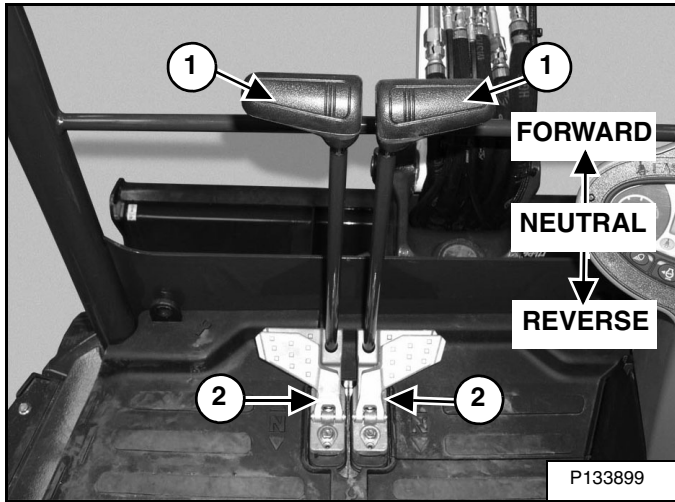
If the alarm does not sound, or for adjustment instructions, see inspection and maintenance instructions for the motion alarm system in the preventive maintenance section of this manual. (See MOTION ALARM SYSTEM on Page 84.)

TRAVEL CONTROLS

Forward And Reverse Travel

NOTE: The following procedures describe forward, reverse, left and right as seated in the operator's seat.

Figure 35



Position the blade so it is at the front of the machine (as you sit in the operator's seat). Slowly move both steering levers* (Item 1) [Figure 35] forward for forward travel; backward for reverse travel.

* Travel can also be controlled with foot pedals (Item 2) [Figure 35]. Pivot the heel of the pedals forward for additional space on the floor.

WARNING

AVOID INJURY OR DEATH

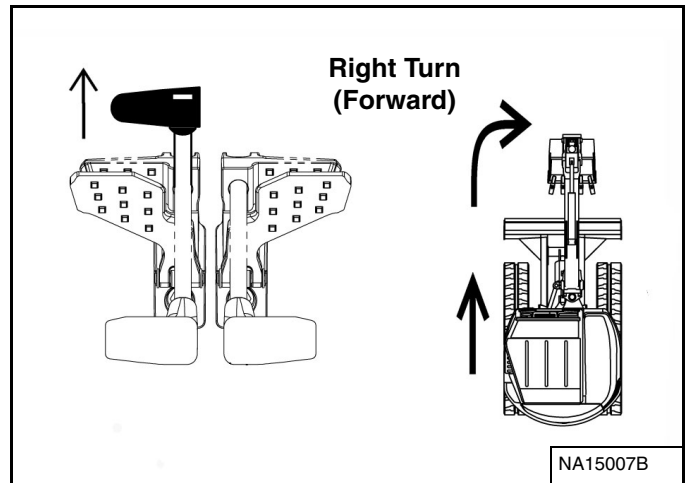
- Check the blade location before travelling. When the blade is to the rear, operate the steering levers / foot pedals in the opposite direction to when the blade is in the front.
- Move the steering levers / foot pedals slowly. Abrupt lever motion will cause the machine to jerk.

W-2235-EN-1009

Turning

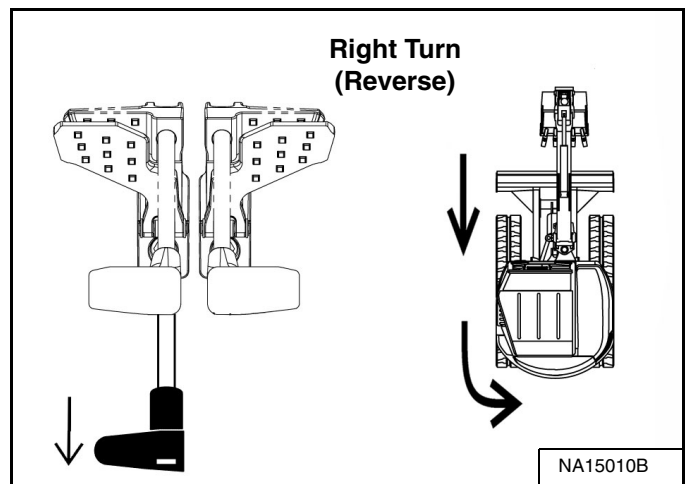
Right Turn

Figure 36



Push the left steering lever forward to turn right [Figure 36] while travelling forward.

Figure 37



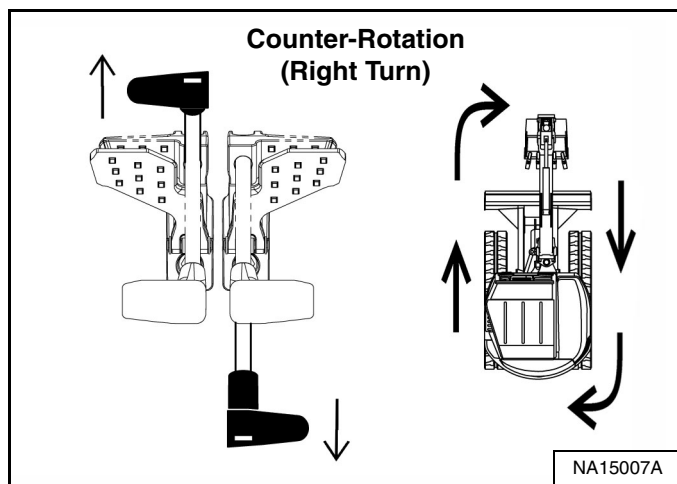
Pull the left steering lever backward to turn right while travelling backward [Figure 37]

TRAVEL CONTROLS (CONT'D)

Turning (Cont'd)

Counter-Rotation Right Turn

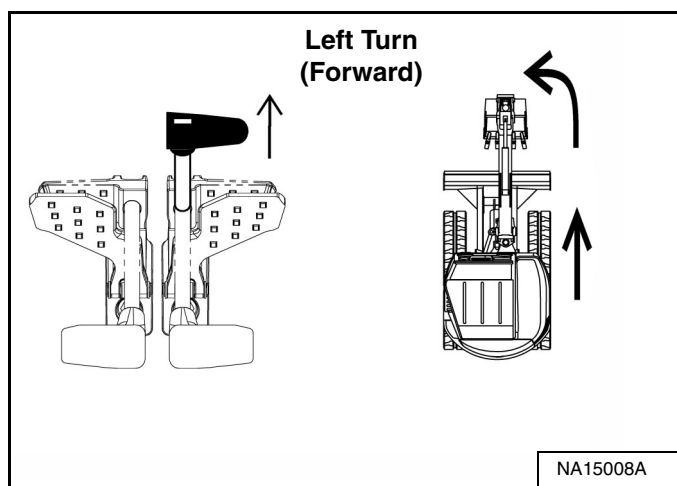
Figure 38



Push the left steering lever forward and pull the right steering lever backward [Figure 38].

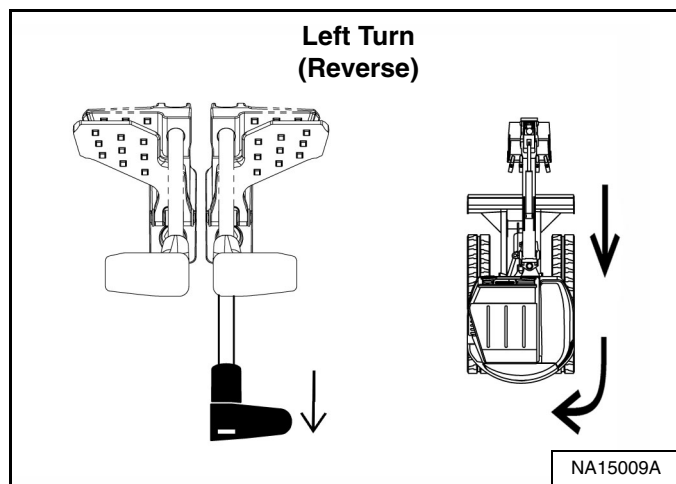
Left Turn

Figure 39



Push the right steering lever forward to turn left while travelling forward [Figure 39].

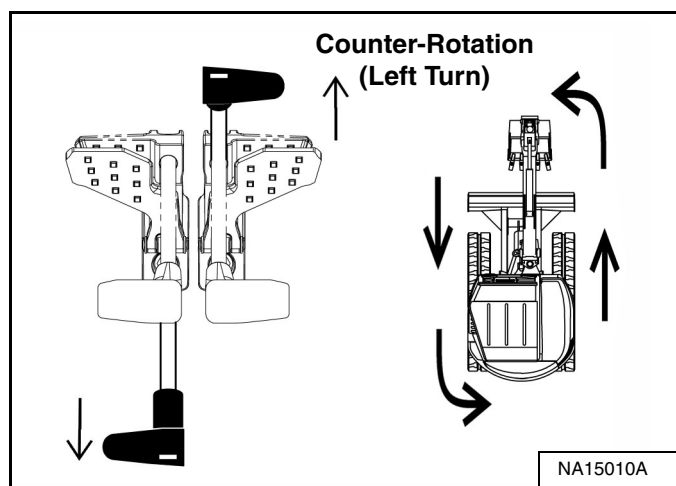
Figure 40



Pull the right steering lever backward to turn left while travelling backward [Figure 40].

Counter-Rotation Left Turn

Figure 41



Push the right steering lever forward and pull the left steering lever backward [Figure 41].

HYDRAULIC CONTROLS

Description

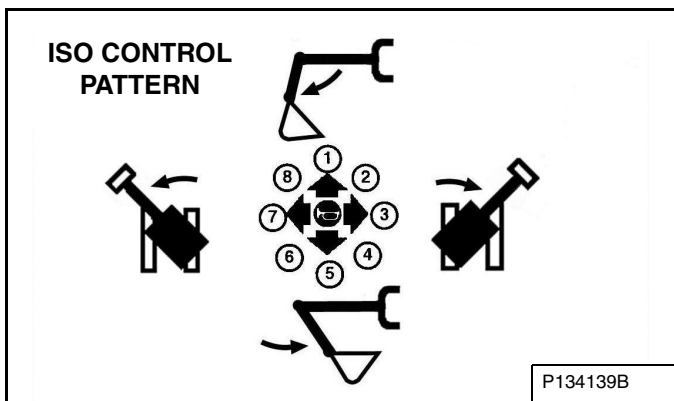
Operate the work equipment (boom, arm, bucket, and upperstructure slew) with the left and right joysticks.

Left Joystick

Figure 42



Figure 43



The left lever (joystick) is used to operate the arm and slew the upperstructure [Figure 42].

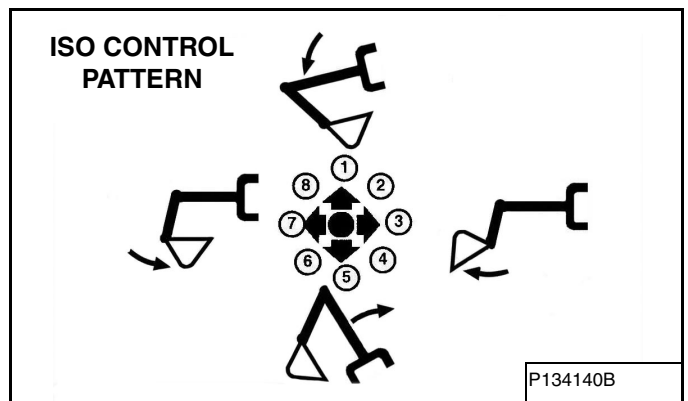
1. Arm out.
2. Arm out and slew right.
3. Slew right.
4. Arm in and slew right.
5. Arm in.
6. Arm in and slew left.
7. Slew left.
8. Arm out and slew left.

Right Joystick

Figure 44



Figure 45



The right lever (joystick) is used to operate the boom and bucket [Figure 44].

1. Boom lower.
2. Boom lower and bucket dump.
3. Bucket dump.
4. Boom raise and bucket dump.
5. Boom raise.
6. Boom raise and bucket curl.
7. Bucket curl.
8. Boom lower and bucket curl.

WARNING

AVOID INJURY OR DEATH

Before leaving the machine:

- Lower the work equipment to the ground.
- Lower the blade to the ground.
- Stop the engine and remove the key.
- Raise the control console.

W-2780-0109

Quick Couplers

WARNING

AVOID BURNS

Hydraulic fluid, tubes, fittings and quick couplers can get hot when running machine and attachments. Be careful when connecting and disconnecting quick couplers.

W-2220-0396

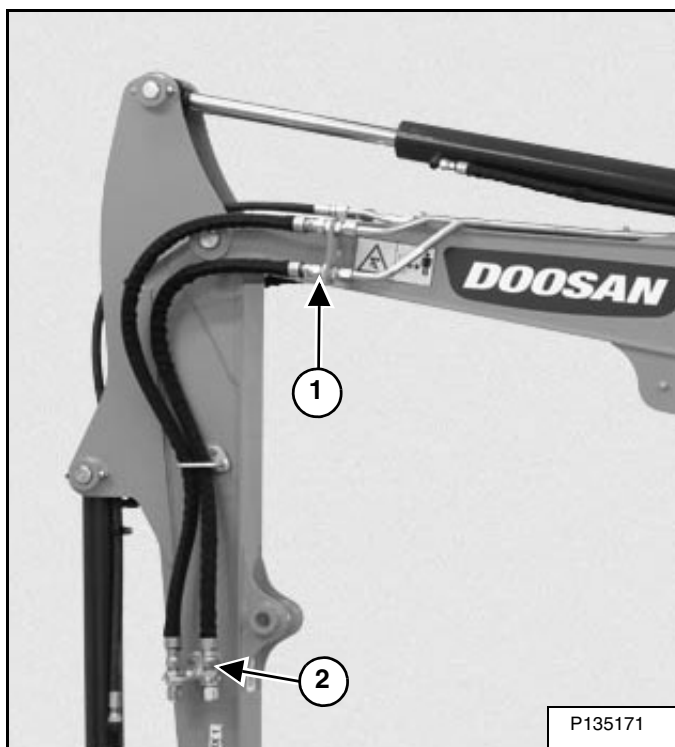
WARNING

AVOID INJURY OR DEATH

Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical attention from a physician familiar with this injury.

W-2072-0807

Figure 46



If equipped with auxiliary hydraulics, the excavator and attachments are supplied with flush faced couplers. The couplers can be mounted on the boom (Item 1) or on the arm (Item 2) [Figure 46].

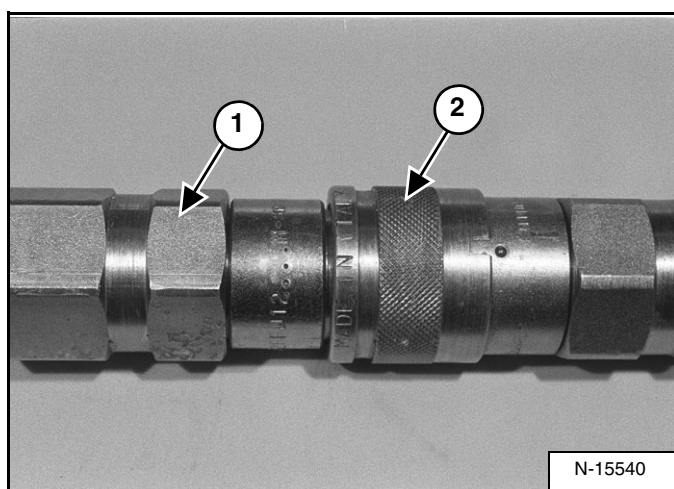
To Connect:

Remove any dirt or debris from the surface of both the male and female couplers, and from the outside diameter of the male coupler. Visually check the couplers for corroding, cracking, damage, or excessive wear, if any of these conditions exist, the coupler(s) (Item 1) [Figure 46] must be replaced.

Install the male coupler into the female coupler. Full connection is made when the ball release sleeve slides forward on the female coupler.

To Disconnect:

Figure 47



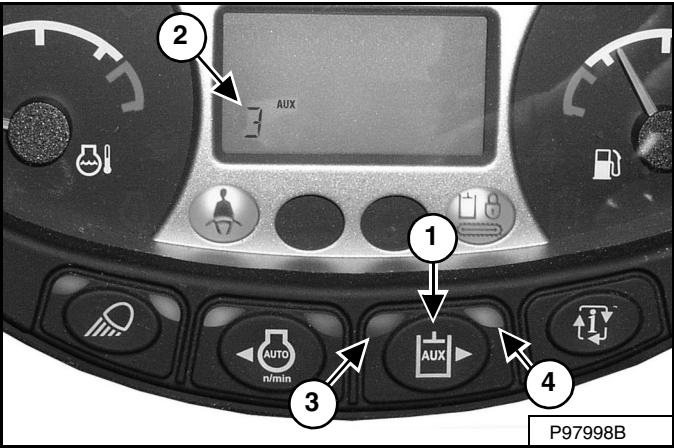
Hold the male coupler (Item 1). Retract the sleeve (Item 2) [Figure 47] on the female coupler until the couplers disconnect.

HYDRAULIC CONTROLS (CONT'D)

Primary Auxiliary Hydraulics

The primary auxiliary hydraulics has Selectable Auxiliary Hydraulic Flow or Continuous Auxiliary Hydraulic Flow. This allows the operator to select a hydraulic flow that matches the attachment hydraulic requirements. The auxiliary hydraulics can be set to Aux3, Aux2, Aux1 or OFF. Aux3 allows maximum hydraulic flow, Aux2 allows medium hydraulic flow and Aux1 allows low hydraulic flow.

Figure 48



NOTE: If the auxiliary hydraulics are enabled when the engine is turned OFF, they will stay enabled when the engine is restarted. If Continuous Flow was enabled at engine OFF, it will reset to selectable flow mode.

Selectable Auxiliary Hydraulics Flow - Press the Auxiliary Hydraulics button (Item 1) (an audible beep will sound each time the auxiliary button is pressed). The last selected auxiliary hydraulic flow (Aux3, Aux2 or Aux1) will appear in the data display (Item 2). The LED (Item 3) [Figure 48] will be illuminated.

To change the auxiliary flow, press the Auxiliary Hydraulics button (Item 1) to toggle through the settings, each time the button is pressed, the next setting will appear in the data display (Item 2) [Figure 48]. Once the desired setting is selected, it will stay at that setting until a different auxiliary flow is selected by the operator. (Example: Even if the engine was STOPPED, if Aux2 has been selected, after key OFF and engine restart, the Aux2 setting will still be the active hydraulic flow when the machine is started.)

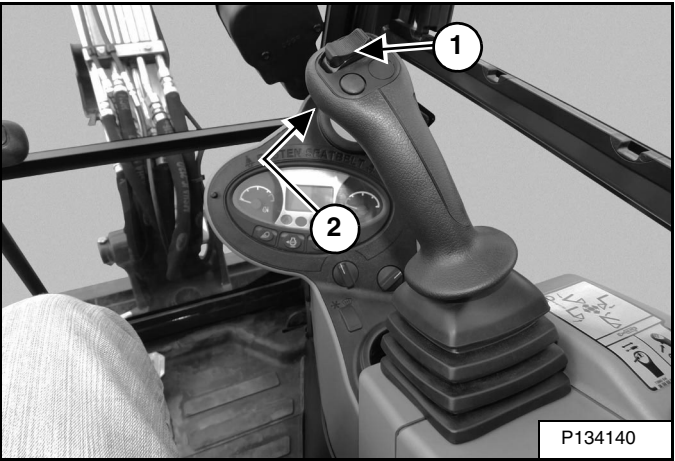
Continuous Flow Auxiliary Hydraulics - Press and hold the Auxiliary Hydraulics button (Item 1) for more than one second. The LED (Item 4) will illuminate. Press the Auxiliary Hydraulics button (Item 1) [Figure 48] again to scroll through the various continuous flow auxiliary hydraulic settings (3, 2, 1).

Examples For Setting Selectable Auxiliary Hydraulic Flow And The Attachment Used:

AUX FLOW SETTING	FLOW	FLOW PERCENTAGE	ATTACHMENT
Aux3	Maximum	100%	Breaker, Vibratory Plate Compactor, Auger
Aux2	Medium	65 – 75%	Clamp, Grapple
Aux1	Low	25 – 35%	Power Tilt, Hydra Tilt

NOTE: Use only approved attachments for your model excavator. Attachments are approved for each model of excavator based on various factors. Using unapproved attachments could cause damage to the attachment or to the excavator.

Figure 49



Move the switch (Item 1) [Figure 49] on the right control lever to the right to supply hydraulic flow to the female coupler. Move the switch to the left to supply hydraulic flow to the male coupler. If you move the switch halfway, the auxiliary functions move at approximately one-half speed.

Press the button (Item 2) [Figure 49] on the front of the handle to provide continuous flow to the female coupler.

NOTE: Pressing the switch (Item 1) to the left while pressing the button (Item 2) [Figure 49] on the front of the handle will provide continuous flow to the male coupler.

Press the button (Item 2) [Figure 49] a second time to stop auxiliary flow to the quick couplers.

NOTE: Reverse flow can cause damage to some attachments. Use reverse flow with your attachment only if approved. See your attachment Operation & Maintenance Manual for detailed information.

HYDRAULIC CONTROLS (CONT'D)

Relieve Hydraulic Pressure With Standard Instrument Panel (Excavator And Attachment)

Excavator:

Put the attachment flat on the ground.

Stop the engine and turn the key switch to ON.

NOTE: The left console must be fully lowered for relieving hydraulic pressure.

NOTE: Excavator engine must have recently been started to relieve hydraulic pressure.

Figure 50



If the auxiliary hydraulics are disabled, press Auxiliary Hydraulics button (Item 1) [Figure 50] and then move the switch (Item 1) [Figure 49] to the right and left several times.

If the auxiliary hydraulics are enabled, then move the switch (Item 1) [Figure 49] to the right and left several times.

Attachments:

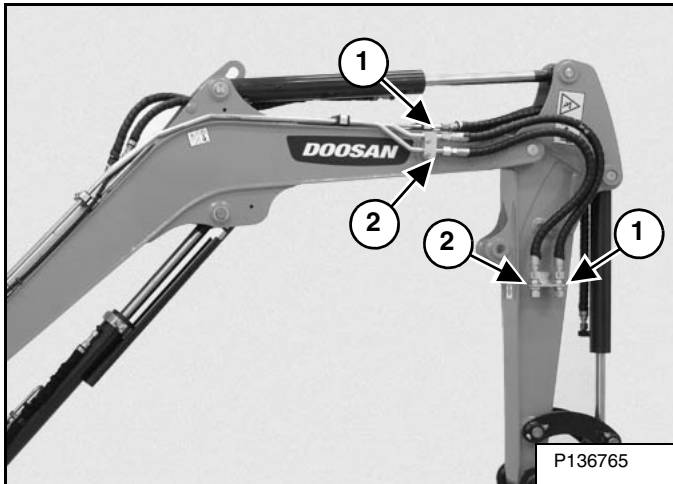
- Follow procedure above to relieve hydraulic pressure in excavator.
- Connect male coupler from attachment to female coupler of excavator then repeat procedure above. This will relieve pressure in the attachment.
- Connect the female coupler from the attachment.

Hydraulic pressure in the auxiliary hydraulic system can make it difficult to engage quick couplers to an attachment.

HYDRAULIC CONTROLS (CONT'D)

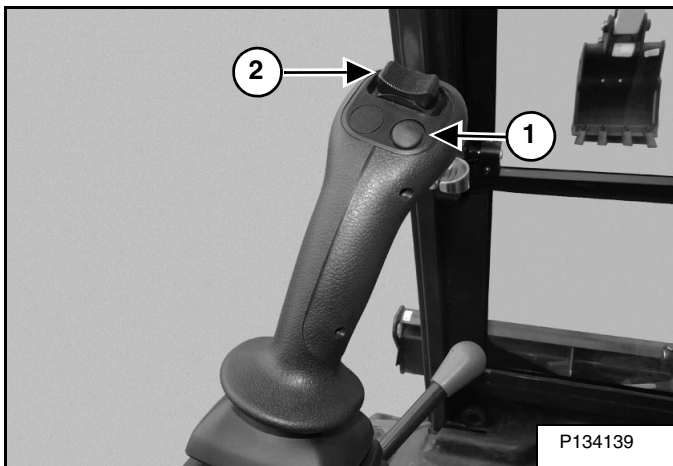
Secondary Auxiliary Hydraulics

Figure 51



When machines are equipped with secondary auxiliary hydraulics, the second set of hydraulic couplers will be mounted on the right side of the arm or boom (Items 1 or 2) [Figure 51].

Figure 52



Press and hold the button (Item 1) [Figure 52] on the left joystick until an audible beep is heard to switch between the boom swing function and the secondary auxiliary hydraulics.

Figure 53



The display (Item 2) [Figure 53] will show **2 AUX** when in the second auxiliary mode.

Move the switch (Item 2) [Figure 52] on the left joystick to the left to supply hydraulic flow to the female coupler. Move the switch to the right to supply hydraulic flow to the male coupler. If you move the switch halfway, the auxiliary functions move at approximately one-half speed.

Relieve Secondary Auxiliary Hydraulic Pressure (Excavator And Attachment)

Excavator:

Put the attachment flat on the ground.

Stop the engine and turn the key to ON.

NOTE: The left console must be fully lowered for relieving hydraulic pressure.

NOTE: Excavator engine must have recently been started to relieve hydraulic pressure.

Press and hold the button (Item 1) [Figure 52] on the left joystick until an audible beep is heard to switch to the secondary auxiliary hydraulics.

The display will show **2 AUX** (Item 2) [Figure 53] when in the second auxiliary mode.

Move the switch (Item 2) [Figure 52] to the right and left several times to relieve pressure.

Attachments:

- Follow procedure above to relieve pressure in excavator.
- Connect male coupler from attachment to female coupler of excavator then repeat procedure above. This will relieve pressure in the attachment.
- Connect the female coupler from the attachment.

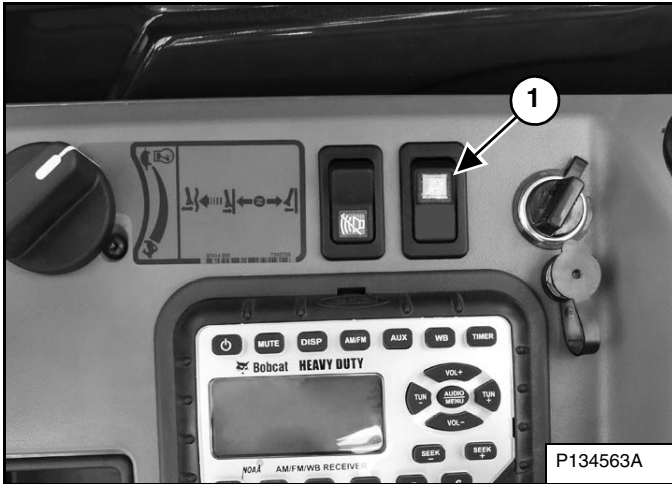
Hydraulic pressure in the auxiliary hydraulic system can make it difficult to engage quick couplers to an attachment.

HYDRAULIC CONTROLS (CONT'D)

Direct To Tank Switch

The direct to tank switch (if equipped) is located on the right console.

Figure 54



Push the top of the switch (Item 1) [Figure 54] to direct auxiliary return flow to the hydraulic oil reservoir. The button will illuminate.

Push the bottom of the switch (Item 1) [Figure 54] to select two-way hydraulic auxiliary flow operation.

OVERLOAD WARNING DEVICE

Description

NOTE: The excavator must be equipped with the optional boom load holding valve to install the overload warning device.

The overload warning device (if equipped) senses hydraulic pressure in the boom lift circuit. When the hydraulic pressure in the boom lift circuit reaches a predetermined pressure setting, a buzzer will sound that indicates an overload condition.

If the buzzer sounds, immediately move the arm closer to the excavator and lower the boom. Reduce the size of the load before attempting to re-lift the load.

Operation

Figure 55

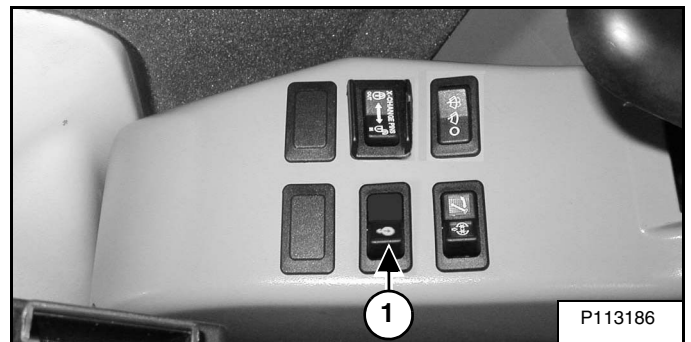
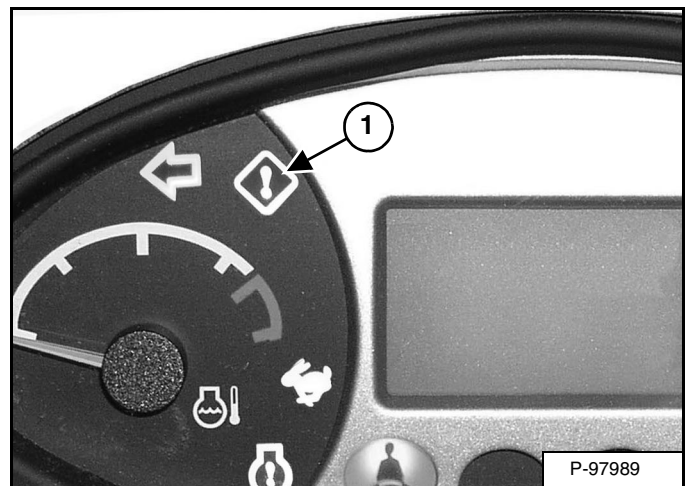


Figure 56



Press the switch (Item 1) [Figure 55] to the right to enable the Overload Warning Feature.

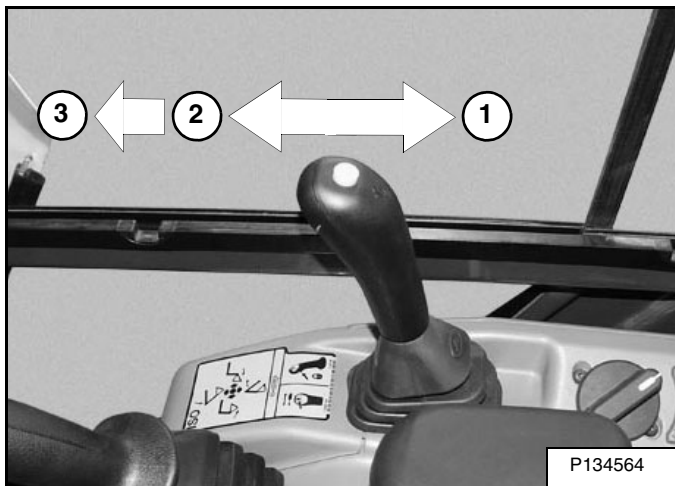
A buzzer will sound and the general warning icon (Item 1) [Figure 56] will illuminate when the boom is overloaded.

To disengage the overload warning feature, press the switch (Item 1) [Figure 55] to the left. The icon (Item 1) [Figure 56] will turn off when the overload warning feature is disabled.

BLADE CONTROL LEVER

Raising And Lowering Blade

Figure 57



Pull the lever backward to raise the blade (Item 1) [Figure 57].

Push the lever forward to lower the blade (Item 2) [Figure 57].

Push the lever (Item 3) [Figure 57] forward until the lever is in the locked position to put the blade in the *float* position.

Pull the lever backward to unlock from the *float* position.

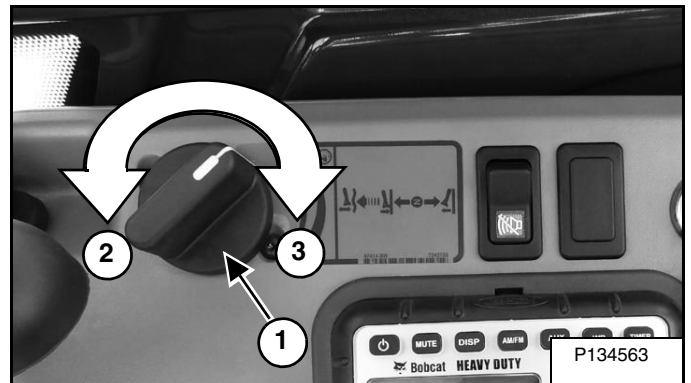
NOTE: Keep blade lowered for increased digging performance.

ENGINE SPEED CONTROL

Setting Engine Speed (RPM)

Engine Speed Control Dial

Figure 58



The engine speed control dial (Item 1) [Figure 58] controls engine rpm.

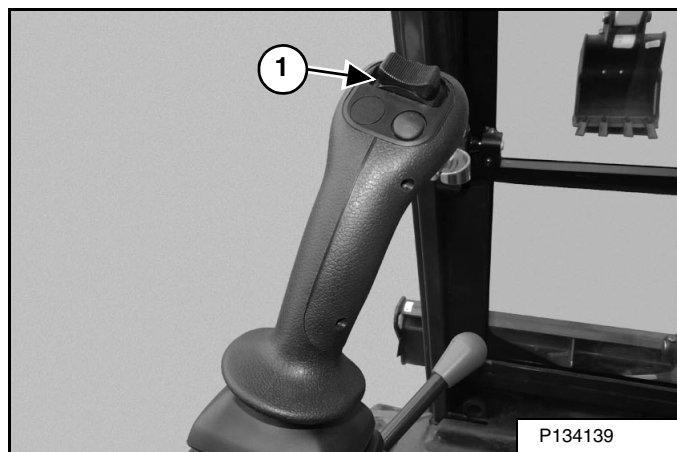
Rotate the engine speed control dial anticlockwise (Item 2) to reduce engine rpm. Rotate the engine speed control dial clockwise (Item 3) [Figure 58] to increase engine rpm.

NOTE: Auto idle feature is only available with the engine speed control dial (Item 1) [Figure 58]. (See Auto Idle Feature on Page 35.)

BOOM SWING

Operation

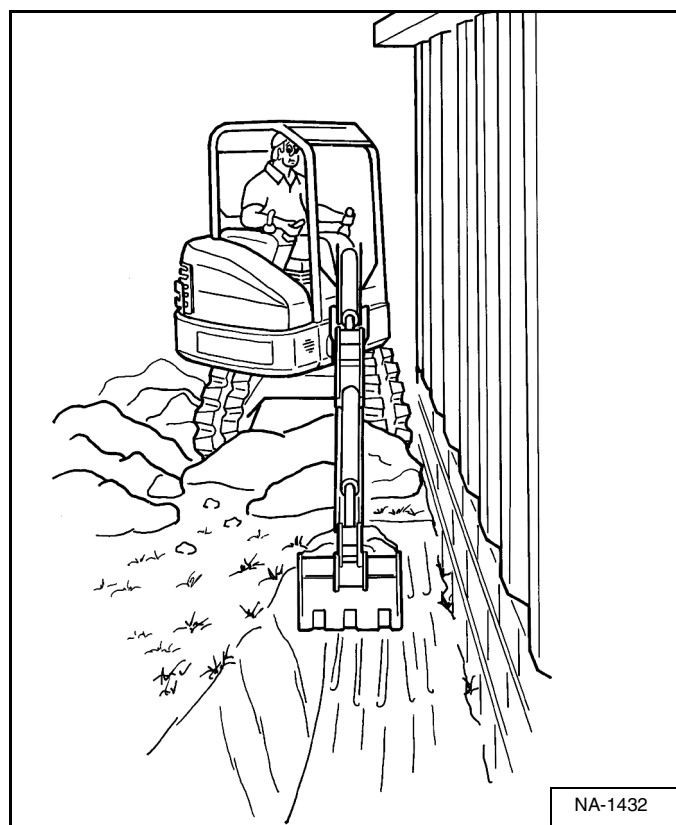
Figure 59



When no auxiliary hydraulics are enabled, control the boom swing with the left joystick switch (Item 1) [Figure 59]. Move the switch to the left to swing the boom to the left. Move the switch to the right to swing the boom to the right.

For instructions on operating the boom swing / auxiliary hydraulics (See Secondary Auxiliary Hydraulics on Page 48.).

Figure 60



NOTE: The purpose of the boom swing is to offset the boom with respect to the upperstructure for digging close to a structure [Figure 60].

BOOM LOAD HOLDING VALVE

Description

The boom load holding valve (if equipped) will hold the boom in its current position in the event of hydraulic pressure loss.



WARNING

AVOID INJURY OR DEATH

Do Not work or stand under raised work equipment or attachment.

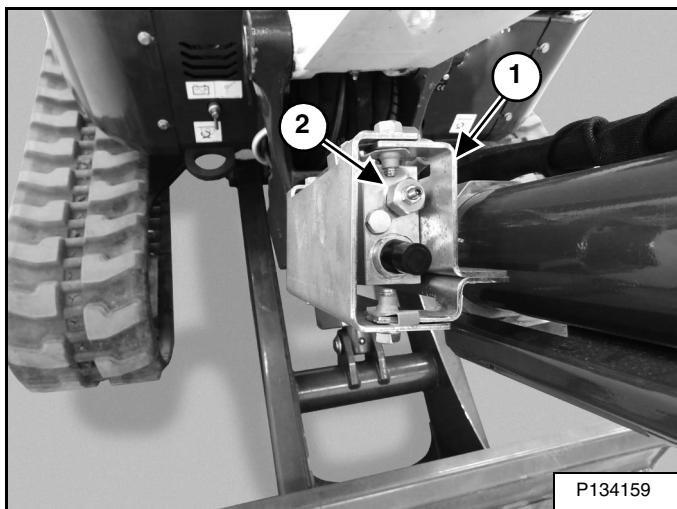
W-2793-0409

Lowering The Boom With Accumulator Pressure

Place a container under the valve and hose end to contain hydraulic fluid. Enter the excavator and turn the key switch to the ON position or press the ENTER CODE Button (Keyless Panel), but do not start the engine. Move the joystick boom retract function to slowly lower the boom.

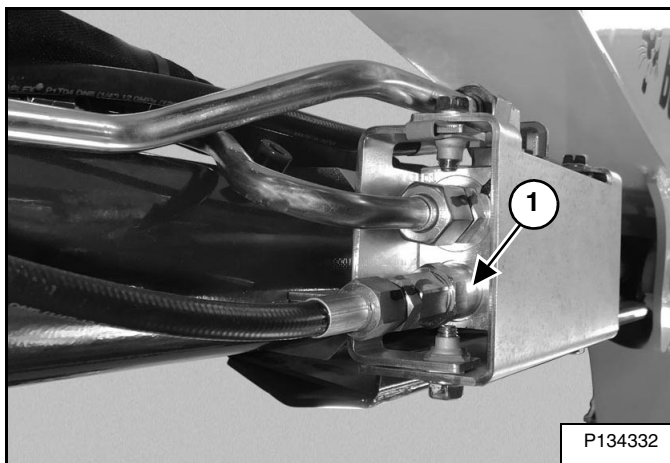
Lowering The Boom With NO Accumulator Pressure

Figure 61



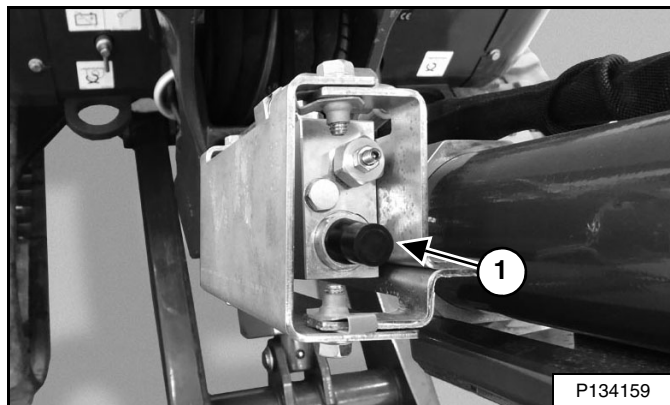
If the excavator is equipped with a boom load holding valve (Item 1) [Figure 61], it will be attached to the boom cylinder at the base end as shown.

Figure 62



NOTE: DO NOT remove or adjust the port relief valves (Item 2) [Figure 61] and (Item 1) [Figure 62]. If a port relief valve has been tampered with, see your Doosan dealer for service.

Figure 63



Remove the plastic protective cap (Item 1) [Figure 63] from the valve.



WARNING

AVOID BURNS

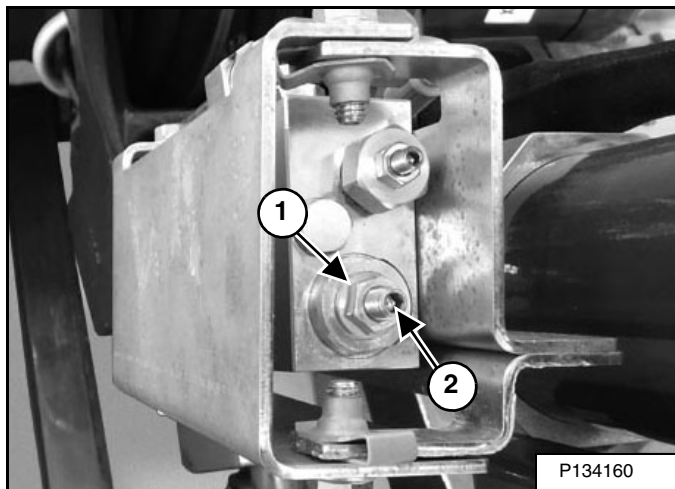
Hydraulic fluid, tubes, fittings and quick couplers can get hot when running machine and attachments. Be careful when connecting and disconnecting quick couplers.

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BOOM LOAD HOLDING VALVE (CONT'D)

Lowering The Boom With NO Accumulator Pressure (Cont'd)

Figure 64



Remove the boom base end hose from the boom load holding valve. Place a container under the valve and base end hose to contain hydraulic fluid.

Loosen the jam nut (Item 1). Install a hex wrench into the valve screw (Item 2) **[Figure 64]** and slowly rotate the screw clockwise 45° to 90° turn and allow the boom to lower to the ground.

After the boom is fully lowered, rotate the screw (Item 2) anticlockwise 45° to 90° turn and tighten the lock nut (Item 1) **[Figure 64]**. Reinstall the base end hose.

ARM LOAD HOLDING VALVE

Description

The arm load holding valve (if equipped) will hold the arm in its current position in the event of hydraulic pressure loss.

! WARNING

AVOID INJURY OR DEATH

Do Not work or stand under raised work equipment or attachment.

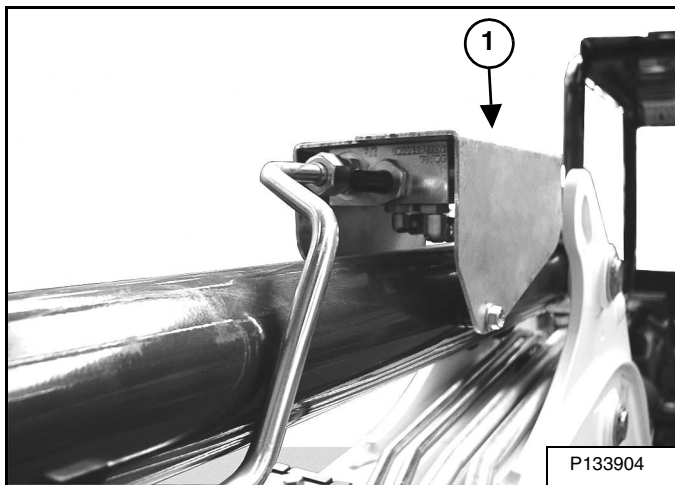
W-2793-0409

Lowering The Arm With Accumulator Pressure

Place a container under the valve and hose end to contain hydraulic fluid. Enter the excavator and turn the key switch to the ON position or press the ENTER CODE Button (Keyless Panel), but do not start the engine. Move the joystick arm retract function to slowly lower the arm.

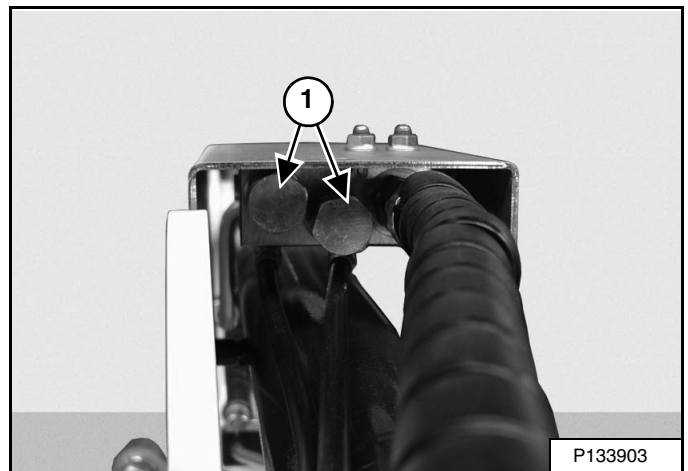
Lowering The Arm With NO Accumulator Pressure

Figure 65



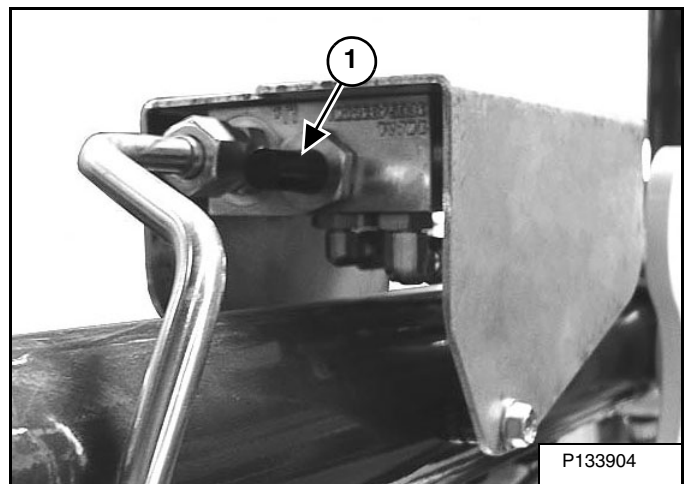
If the excavator is equipped with an arm load holding valve (Item 1) [Figure 65], it will be attached to the arm cylinder base end as shown.

Figure 66



NOTE: DO NOT remove or adjust the two port relief valves (Item 1) [Figure 66]. If the port relief valves have been tampered with, see your Doosan dealer for service.

Figure 67



Remove the plastic protective cap (Item 1) [Figure 67] from the valve.

! WARNING

AVOID BURNS

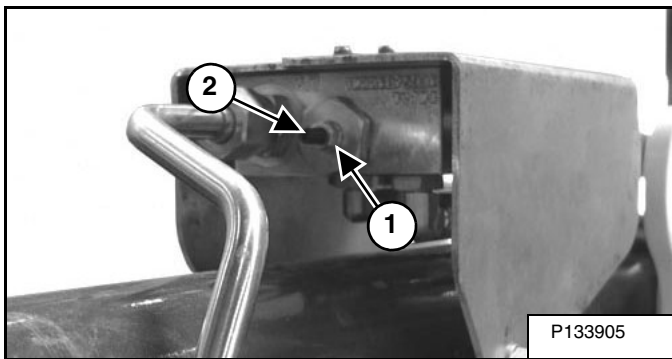
Hydraulic fluid, tubes, fittings and quick couplers can get hot when running machine and attachments. Be careful when connecting and disconnecting quick couplers.

W-2220-0396

ARM LOAD HOLDING VALVE (CONT'D)

Lowering The Arm With NO Accumulator Pressure (Cont'd)

Figure 68



Remove the arm base end hose from the arm load holding valve. Place a container under the valve and base end hose to contain hydraulic fluid.

Loosen the jam nut (Item 1). Install a hex wrench into the valve screw (Item 2) **[Figure 68]** and slowly rotate the screw clockwise 45° to 90° turn and allow the arm to lower.

After the arm is lowered, rotate the screw (Item 2) anticlockwise 45° to 90° turn and tighten the lock nut (Item 1) **[Figure 68]**. Reinstall the base end hose.

Daily Inspection And Maintenance

⚠ WARNING

W-2001-0502

WARNING

W-2003-0807

DX35z Operation & Maintenance Manual

DAILY INSPECTION (CONT'D)

Daily Inspection and Maintenance (Cont'd)

! WARNING

AVOID INJURY OR DEATH

- Keep door / cover closed except for service.
- Keep engine clean of flammable material.
- Keep body, loose objects and clothing away from electrical contacts, moving parts, hot parts and exhaust.
- Do not use the machine in space with explosive dusts or gases or with flammable material near exhaust.
- Never use ether or starting fluid on diesel engine with glow plugs or air intake heater. Use only starting aids as approved by engine manufacturer.
- Leaking fluids under pressure can enter skin and cause serious injury.
- Battery acid causes severe burns; wear goggles. If acid contacts eyes, skin, or clothing, flush with water. For contact with eyes, flush and get medical attention.
- Battery makes flammable and explosive gas. Keep arcs, sparks, flames and lighted tobacco away.
- For jump start, connect negative cable to the machine engine last (never at the battery). After jump start, remove negative connection at the engine first.
- Exhaust gases can kill. Always ventilate.

W-2782-0409

IMPORTANT

PRESSURE WASHING DECALS

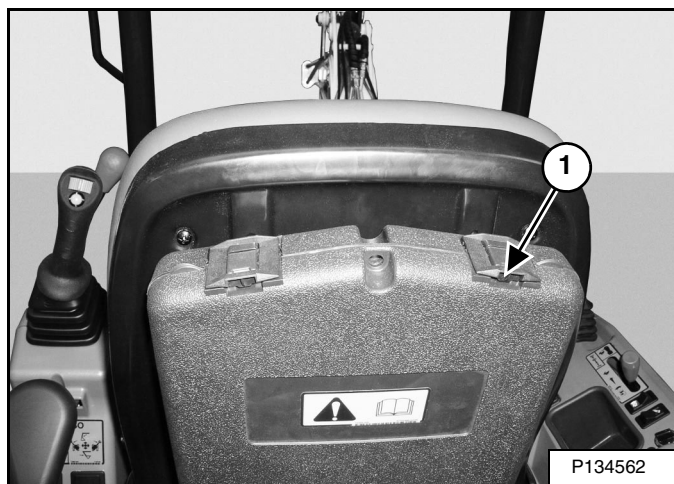
- Never direct the stream at a low angle toward the decal that could damage the decal causing it to peel from the surface.
- Direct the stream at a 90 degree angle and at least 300 mm (12 in) from the decal. Wash from the center of the decal toward the edges.

I-2226-0910

PRE-STARTING PROCEDURE

Operation & Maintenance Manual Location

Figure 70



Read and understand the Operation & Maintenance Manual (Item 1) [Figure 70] (located inside the storage box on the back of the operator's seat) before operating.

Entering The Excavator

Figure 71



Use the grab handles and tracks to enter the cab [Figure 71].

PRE-STARTING PROCEDURE (CONT'D)

Entering The Excavator (Cont'd)

! WARNING

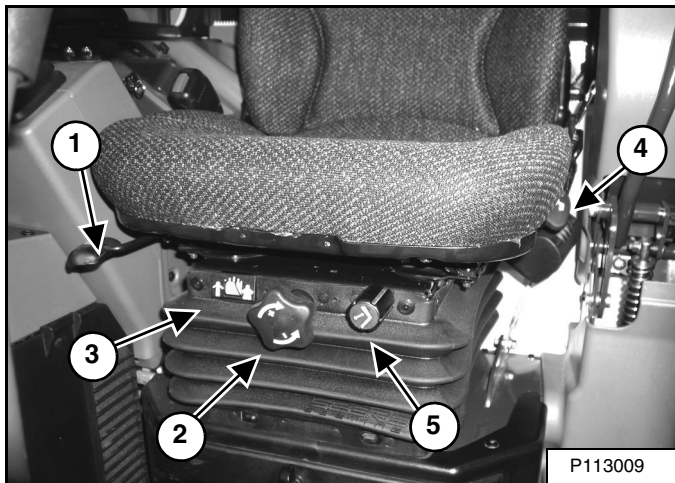
AVOID INJURY OR DEATH

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual, Operator's Handbook and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments, repairs or service. Untrained operators and failure to follow instructions can cause injury or death.

W-2003-0807

Seat Adjustment

Figure 72



Release the seat lever (Item 1) [Figure 72] to adjust the seat forward or back.

Turn the handle (Item 2) to change the adjustment for operator weight. Turn the handle until the operator's weight is shown in the window (Item 3) [Figure 72].

Release the lever (Item 4) [Figure 72] to change the incline of the seat back.

Sit in the seat and turn the knob (Item 5) [Figure 72] to adjust the height of the seat.

Seat Belt

Figure 73



Fasten the seat belt [Figure 73].

STARTING THE ENGINE

Standard Instrument Panel - Key Start

WARNING

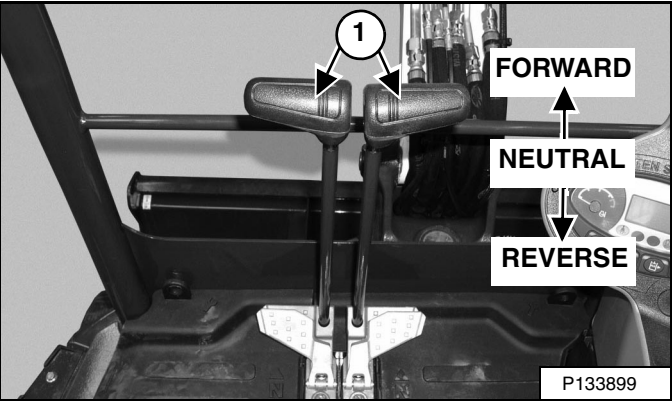
AVOID INJURY OR DEATH

- Fasten seat belt, start and operate only from the operator's seat.
- Never wear loose clothing when working near machine.

W-2135-1108

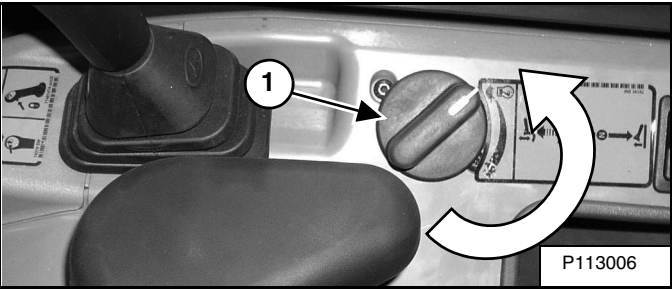
Perform the PRE-STARTING PROCEDURE. (See PRE-STARTING PROCEDURE on Page 57.)

Figure 74



Put control levers (Item 1) [Figure 74] in the NEUTRAL position.

Figure 75



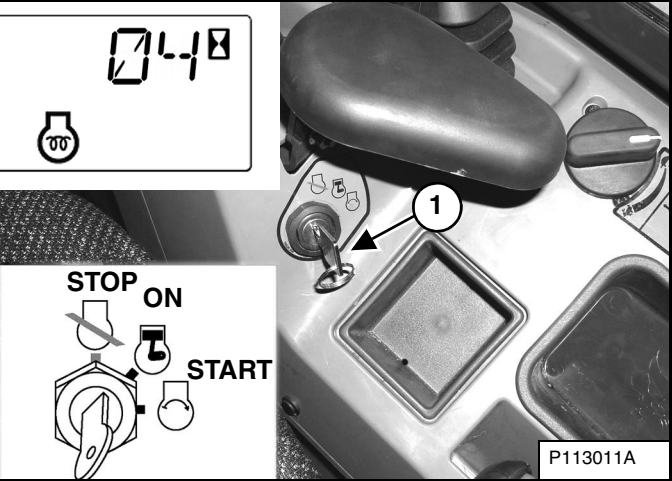
Turn the engine speed control dial (Item 1) [Figure 75] anticlockwise to low idle.

IMPORTANT

Do not engage the starter for longer than 15 seconds at a time. Longer use can damage the starter by overheating. Allow starter to cool for one minute before using starter again.

I-2034-0700

Figure 76



With the left console raised, turn the key (Item 1) [Figure 76] to the ON position. If preheating is required, the glow plugs will automatically cycle and the remaining preheat time (in seconds) will show in the data display screen (see inset). (Preheat icon will be ON).

Turn the key to START and release the key when the engine starts. It will return to the ON position [Figure 76].

Stop the engine if the warning lights and alarm do not go OFF. Check for the cause before starting the engine again.

Turn the key switch OFF to stop the engine.

WARNING

AVOID INJURY OR DEATH

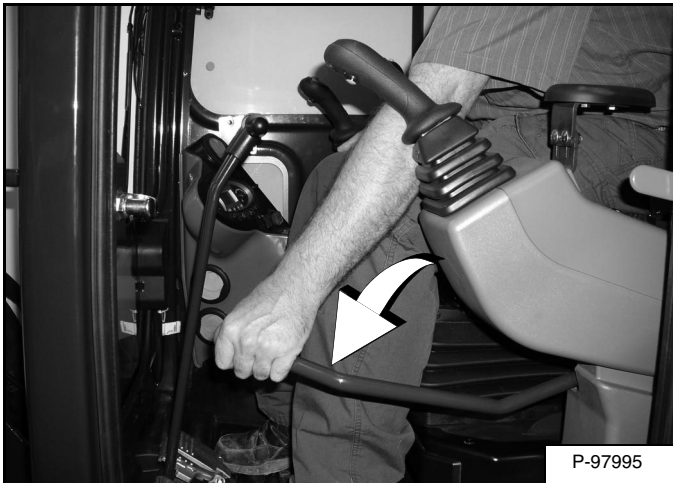
When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

W-2050-0807

STARTING THE ENGINE (CONT'D)

Lowering The Control Console

Figure 77



Lower the control console [Figure 77].

NOTE: There is a control lock sensor in the left console which deactivates the hydraulic control levers (joysticks) and the traction drive system when the control console is raised. The console must be in the locked down position for the hydraulic control levers (joysticks) and traction system to operate.

NOTE: If the control lock sensor does not deactivate the control levers and traction system when console is raised, see your Doosan dealer for service.

Warming The Hydraulic System

IMPORTANT

When the temperature is below -30°C (-20°F), hydrostatic oil must be warmed before starting. The hydrostatic system will not get enough oil at low temperatures and will be damaged. Park the machine in an area where the temperature will be above -18°C (0°F) if possible.

I-2007-0910

Let the engine run at least 5 minutes to warm the engine and hydraulic fluid before operating the excavator.

Cold Temperature Starting

! WARNING

EXPLOSION CAN CAUSE SERIOUS INJURY, DEATH OR SEVERE ENGINE DAMAGE

DO NOT use ether or starting fluid with glow plug or air intake heater systems.

W-2071-0415

If the temperature is below freezing, perform the following to make starting the engine easier:

- Replace the engine oil with the correct type and viscosity for the anticipated starting temperature. (See Engine Oil Chart on Page 96.)
- Make sure the battery is fully charged.
- Install an engine heater.

NOTE: If the battery is discharged (but not frozen) a booster battery can be used to jump start the excavator. (See Using A Booster Battery (Jump Starting) on Page 106.)

NOTE: The display screen on the instrument panel may not be at full intensity when the temperature is below -26°C (-15°F). The display screen may take 30 seconds to several minutes to warm up. All systems remain monitored even when the display screen is off.

MONITORING THE DISPLAY PANELS

Instrument Panel

Figure 78



Frequently monitor the temperature and fuel gauges [Figure 78].

After the engine is running, frequently monitor the instrument panel [Figure 78] for machine condition.

The associated icon is displayed if there is an error condition.

EXAMPLE: Engine Coolant Temperature is High.

The Engine Coolant Temperature icon (Item 1) [Figure 78] is ON.

Press the Information button (Item 2) [Figure 78] repeatedly to cycle the data display until the service code screen is displayed. One of the following SERVICE CODES is displayed.

- [M0810] Engine Coolant Temperature Too High
- [M0811] Engine Coolant Temperature Extremely High

Find the cause of the service code and correct before operating the excavator again. (See DIAGNOSTIC SERVICE CODES on Page 123.)

Warning And Shutdown

When a WARNING condition exists; the associated icon light is ON and the alarm sounds 3 beeps. If this condition is allowed to continue, there may be damage to the engine or hydraulic systems.

When a SHUTDOWN condition exists; the associated icon light is ON and the alarm sounds continuously. The monitoring system will automatically stop the engine in 15 seconds. The engine can be restarted to move or relocate the excavator.

The SHUTDOWN feature is associated with the following icons:

General Warning
Engine Malfunction
Engine Coolant Temperature
Hydraulic Fluid Temperature

STOPPING THE ENGINE AND LEAVING THE EXCAVATOR

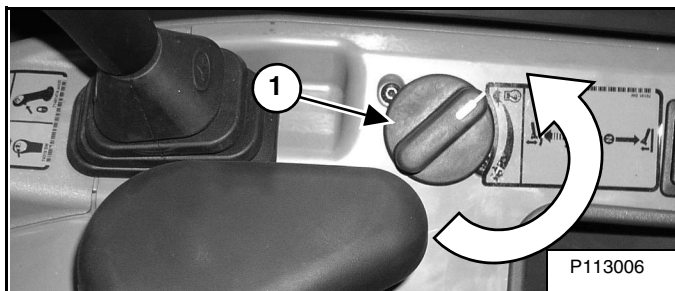
Procedure

Figure 79



Stop the machine on level ground. Lower the work equipment and the blade to the ground [Figure 79].

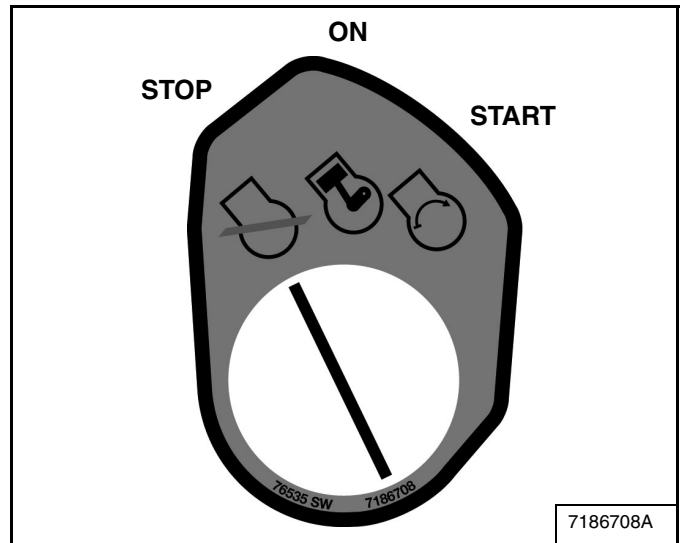
Figure 80



Turn the engine speed control dial (Item 1) [Figure 75] anticlockwise to low idle.

Run the engine at idle speed for about 5 minutes to allow it to cool.

Figure 81



Turn the key to STOP (Item 1) [Figure 81].

Disconnect the seat belt. Remove the key from the switch to prevent operation of machine by unauthorised personnel. Raise the control console and exit the machine.

ATTACHMENTS

Installing And Removing The Attachment (Pin-On Attachment)

Installation

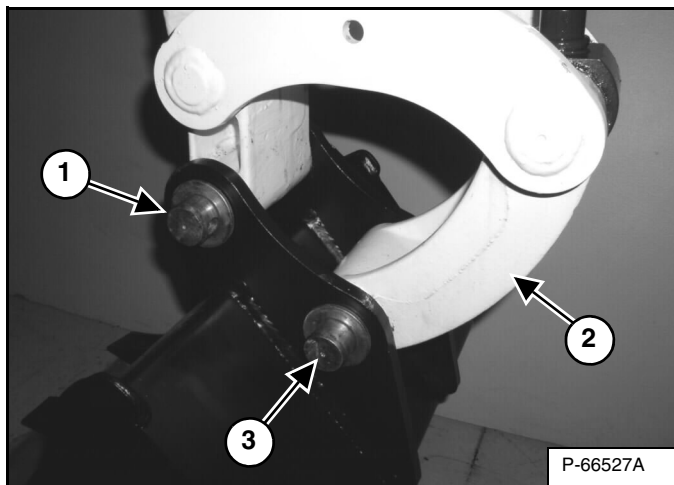
WARNING

AVOID INJURY OR DEATH

Stop the machine on a firm flat surface. When removing or installing attachments (such as a bucket), always have a second person in the operator's seat, give clear signals and work carefully.

W-2140-0189

Figure 82

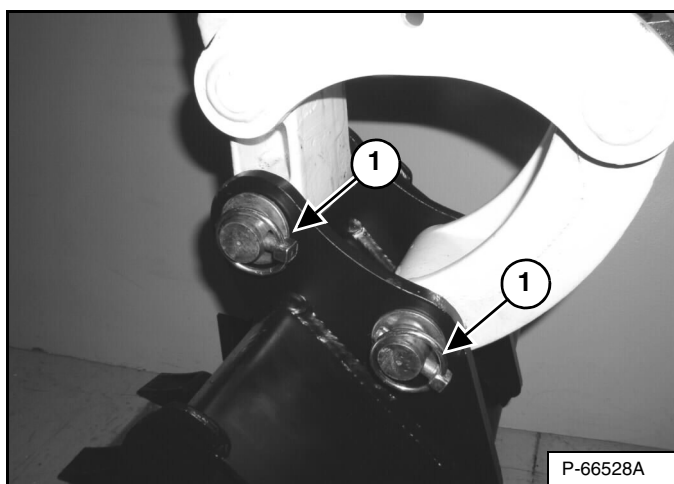


Install the arm into the bucket and align the mounting hole.

Install the pin (Item 1) [Figure 82] and washers.

Install the link (Item 2) in the bucket and align the mounting hole. Install the pin (Item 3) [Figure 82] and washers.

Figure 83



Install the two retainer pins (Item 1) [Figure 83]. Install grease in the grease fittings.

Removal

Park the excavator on a flat surface and lower the bucket fully.

Remove the two retainer pins (Item 1) [Figure 83].

Remove the washers and pins (Items 1 and 3) [Figure 82].

Do not damage the dust seals in the arm.

WARNING

AVOID INJURY OR DEATH

Never use attachments or buckets which are not approved by Doosan Company. Buckets and attachments for safe loads of specified densities are approved for each model. Unapproved attachments can cause injury or death.

W-2052-0117

OPERATING PROCEDURE

Inspect The Work Area

Before beginning operation, inspect the work area for unsafe conditions.

Look for sharp drop-offs or rough terrain. Have underground utility lines (gas, electrical, water, sewer, irrigation, etc.) located and marked. Work slowly in areas of underground utilities.

Remove objects or other construction material that could damage the excavator or cause personal injury.

Always check ground conditions before starting your work:

- Look for signs of instability such as cracks or settlement.
- Be aware of weather conditions that can affect ground stability.
- Check for adequate traction if working on a slope.

Basic Operating Instructions

When operating on a public road or motorway, always follow local regulations. For example: A slow moving vehicle (SMV) sign, or direction signals may be required.

Run the engine at low idle speed to warm the engine and hydraulic system before operating the excavator.

IMPORTANT

Machines warmed up with moderate engine speed and light load have longer life.

I-2015-0284

New operators must operate the excavator in an open area without bystanders. Operate the controls until the excavator can be handled at an efficient and safe rate for all conditions of the work area.

Operating Near An Edge Or Water

Keep the excavator as far back from the edge as possible and the excavator tracks perpendicular to the edge so that if part of the edge collapses, the excavator can be moved back.

Always move the excavator back at any indication the edge may be unstable.

Lowering The Work Equipment (Engine STOPPED)

The hydraulic control levers control the movement of the boom, arm, bucket and upperstructure slew functions.

The console must be in the locked down position, and the key switch in the ON position.

Use the control lever to lower the boom.

Figure 84



The joystick lock switch disengages the hydraulic control functions from the joysticks when the console are raised [Figure 84].

NOTE: If the engine stops, the boom / bucket (attachments) can be lowered to the ground using hydraulic pressure in the accumulator.

The control console must be in the locked down position, and the key switch in the ON position.

Use the control lever to lower the boom.

Lower the control console to engage the hydraulic control functions of the joysticks [Figure 84].

OPERATING PROCEDURE (CONT'D)

Lift Capacity

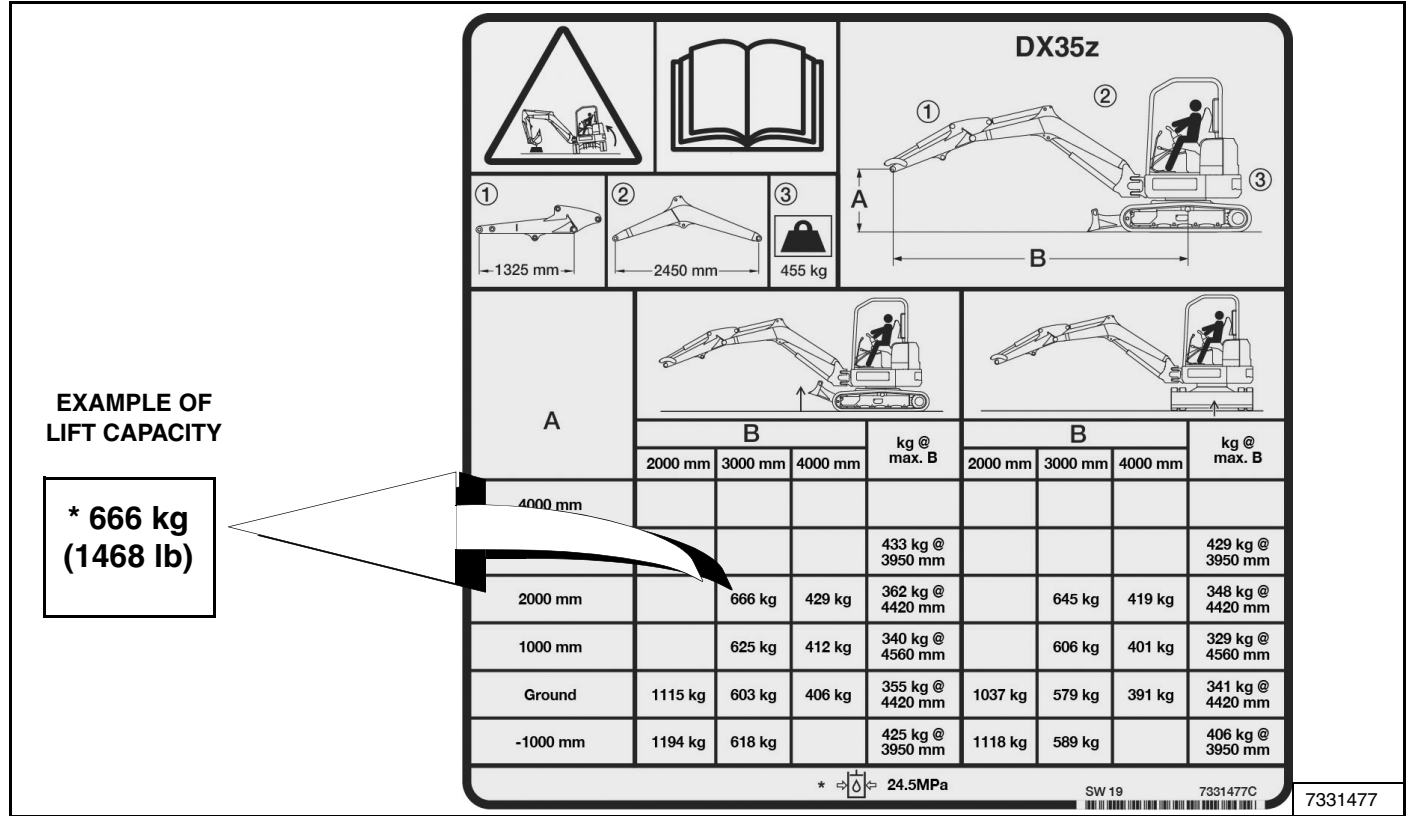
The lifting capacities were calculated with a standard configuration machine equipped with a Pin-On X-Change and no attachment. The weight of the attachment, the hydraulic clamp (if equipped), and a different interface (if equipped) must be subtracted from the lift capacity to obtain the actual lift capacity.

**WARNING**

AVOID INJURY OR DEATH
Do not exceed rated lift capacity. Excessive load can cause tipping or loss of control.

W-2374-0500

Figure 85



Detailed information about quick coupler and hydraulic clamp weights can be found in documentation including the serial number plate. The following lists examples of the optional quick coupler and hydraulic clamp weights:

- Optional Buckets and Attachments (See **NOTE** below)
- Hydraulic Clamp And Cylinder 56.2 kg (124 lbs)

NOTE: For bucket weights, see your Doosan dealer. For attachment weights, see the attachment Operation & Maintenance Manual.

The following example will show how to calculate the lift capacity differences between the lift capacity charts with standard equipment and when using optional equipment.

OPERATING PROCEDURE (CONT'D)

Lift Capacity (Cont'd)

The following is an example for determining the lift capacity using the sample chart shown above **[Figure 85]**.

- Machine Position: Over Blade, Blade Down
- Lift Radius: 3000 mm (118 in)
- Lift Point Height: 2000 mm (78 in)
- Standard Bucket

1. Obtain Lift Capacity from Chart: 666 kg (1468 lb)

2. Obtain the weights of any optional equipment that reduces the lift capacity of the machine (coupling interface, attachment)

Optional Equipment Weights: Standard Bucket (42 kg (92 lb)).

3. Calculate the actual lift capacity by subtracting the weight of any optional equipment from the lift capacity of the standard configuration:

666 kg (1468 lb) (capacity of standard configuration) - 42 kg (92 lb) (standard bucket) = 624 kg (1376 lb) (actual lift capacity)

** The lift capacity charts (decals) are based off ISO 10567: 2007. The lift capacities are defined as the lower value of 75% of the tipping load or 87% of the hydraulic lift capacity.*

OPERATING PROCEDURE (CONT'D)

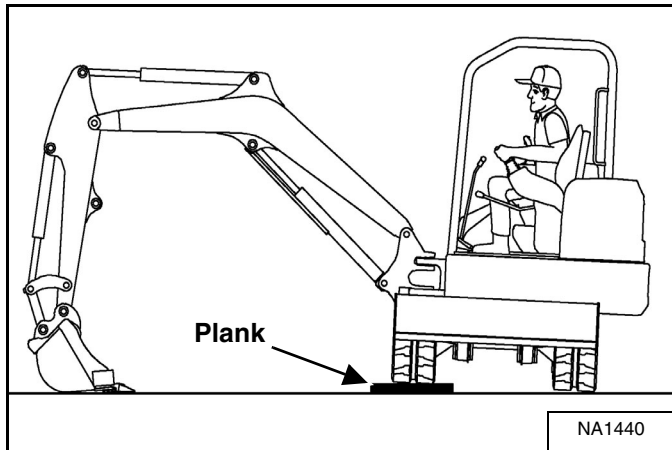
Driving The Excavator

When operating on uneven ground, operate as slow as possible and avoid sudden changes in direction.

Avoid travelling over objects such as rocks, trees, stumps, etc.

When working on wet or soft ground, put planks on the ground to provide a solid base to travel on and prevent the excavator from getting stuck.

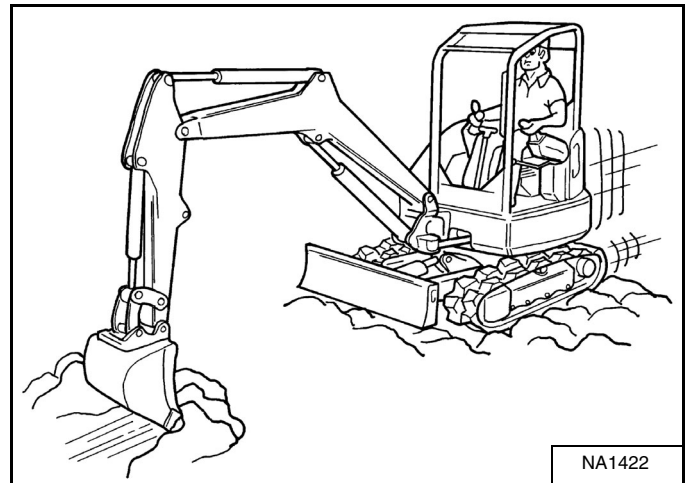
Figure 86



If one or both tracks have become stuck in soft or wet ground, raise one track at a time by turning the upperstructure and pushing the bucket against the ground [**Figure 86**].

Put planks under the tracks and drive the excavator to dry ground.

Figure 87



The bucket may also be used to pull the excavator. Raise the blade, extend the arm and lower the boom. Operate the boom and arm in a digging manner [**Figure 87**].

OPERATING PROCEDURE (CONT'D)

Operating On Slopes

WARNING

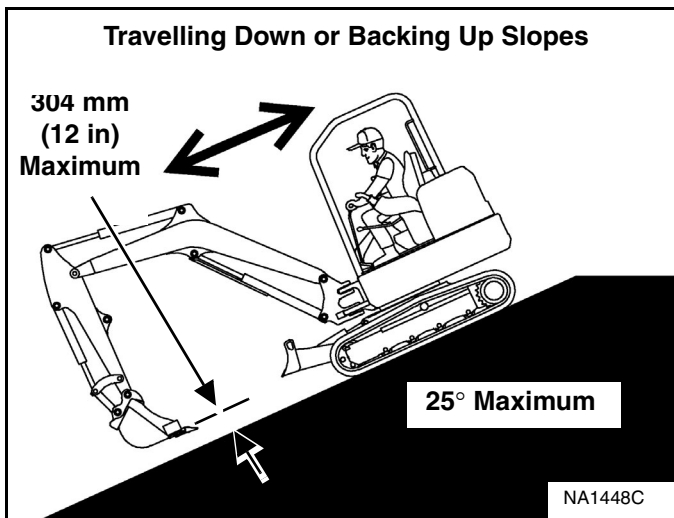
AVOID INJURY OR DEATH

- Do not travel across or up slopes that are over 15 degrees.
- Do not travel down or back up slopes that exceed 25 degrees.
- Look in the direction of travel.

W-2497-0304

When going down a slope, control the speed with the steering levers and the speed control lever.

Figure 88



When going down grades that exceed 15 degrees, put the machine in the position shown, and run the engine slowly [Figure 88].

Operate as slow as possible and avoid sudden changes in lever direction.

Avoid travelling over objects such as rocks, trees, stumps, etc.

Stop the machine before moving the upper equipment controls. Never allow the blade to strike a solid object. Damage to the blade or hydraulic cylinder can result.

WARNING

AVOID INJURY OR DEATH

- Avoid steep areas or banks that could break away.
- Keep boom centered and attachments as low as possible when traveling on slopes or in rough conditions. Look in the direction of travel.
- Always fasten seat belt.

W-2498-0304

Figure 89

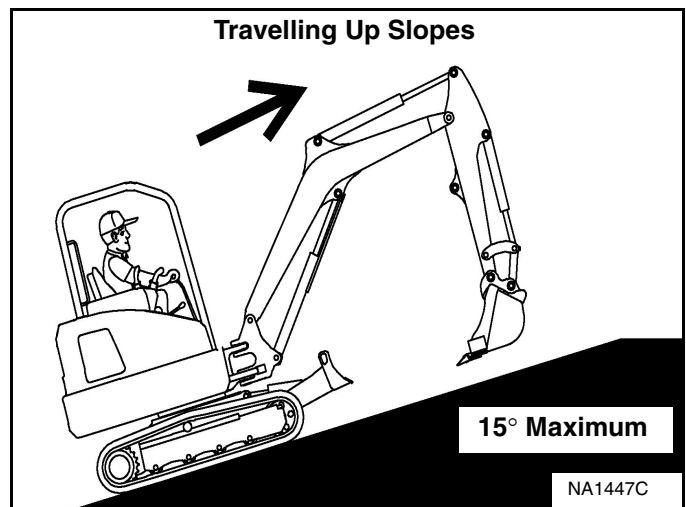
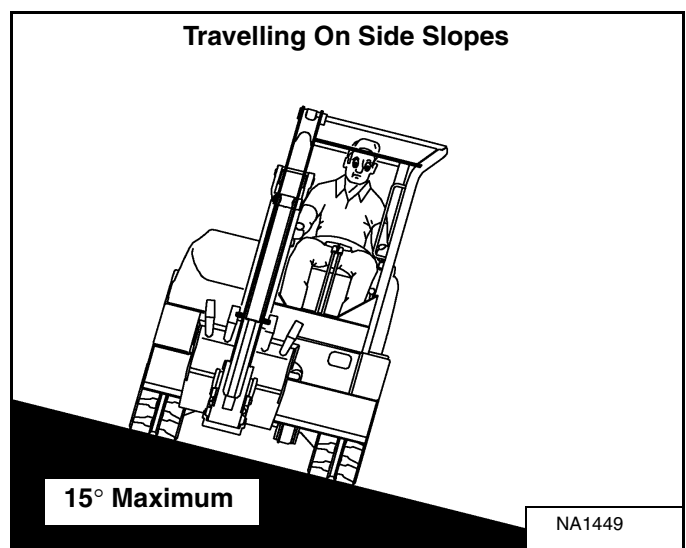


Figure 90

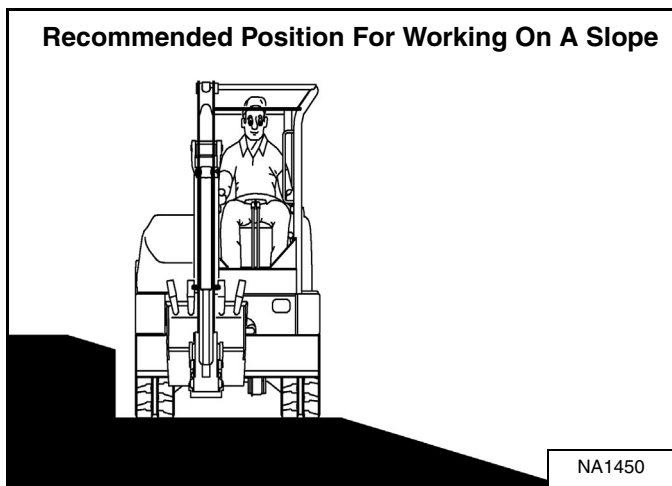


When travelling up slopes or on side slopes that are 15 degrees or less, position the machine as shown and run the engine slow [Figure 89] and [Figure 90].

OPERATING PROCEDURE (CONT'D)

Operating On Slopes (Cont'd)

Figure 91



When operating on a slope, level the work area before beginning [Figure 91].

If this is not possible, the following procedures should be used:

Do not work on slopes which are over 15 degrees.

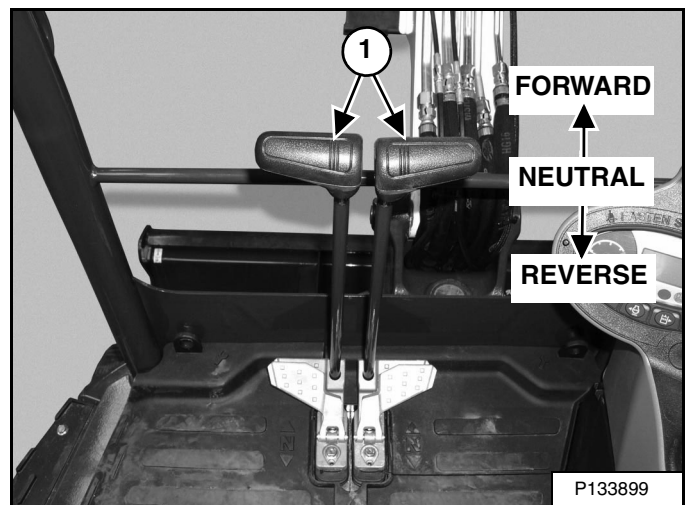
Use a slow work cycle.

Avoid working with the tracks across the slope. This will reduce stability and increase the tendency for the machine to slide. Position the excavator with the blade downhill and lowered.

Avoid swinging or extending the bucket more than necessary in a down hill direction. When you must swing the bucket downhill, keep the arm low and skid the bucket downhill.

When working with the bucket on the uphill side, keep the bucket as close to the ground as possible. Dump the spoil far enough away from the trench or hole to prevent the possibility of a cave in.

Figure 92



To brake the machine when going down a slope, move the steering levers (Item 1) [Figure 92] to the NEUTRAL position. This will engage the hydrostatic braking.

When the engine stops on a slope, move the steering levers to the NEUTRAL position. Lower the boom / bucket to the ground.

NOTE: If the engine stops, the boom / bucket (attachments) can be lowered to the ground using hydraulic pressure which is stored in the accumulator.

The console must be in the locked down position, and the key switch in the ON position.

Use the control lever to lower the boom.

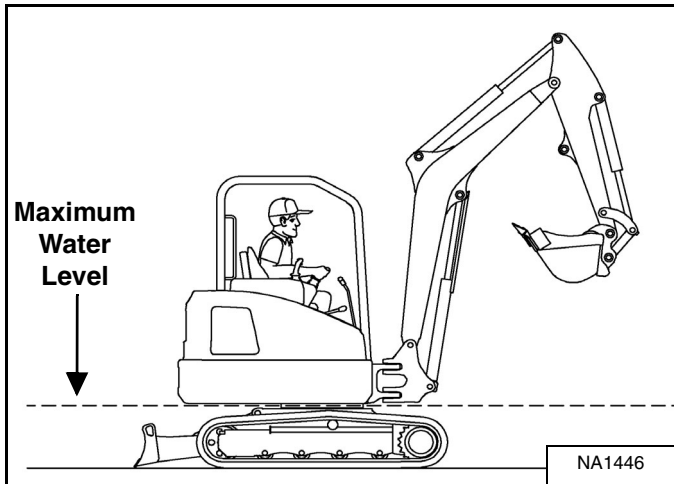
Start the engine and resume operation.

OPERATING PROCEDURE (CONT'D)

Operating In Water

Mud and water should be removed from the machine before parking. In freezing temperatures, park the machine on boards or concrete to prevent the track or undercarriage from freezing to the ground and preventing machine movement.

Figure 93



Do not operate or immerse the excavator in water higher than the bottom of the swing bearing **[Figure 93]**.

Grease the excavator when it has been operated or immersed in water for a period of time. Greasing forces the water out of the lubrication areas.

Water must be removed from the cylinder rods. If water freezes to the cylinder rod, the cylinder seals can be damaged when the rod is retracted.

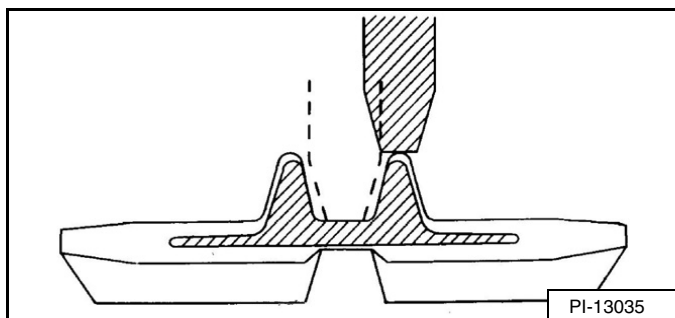
OPERATING PROCEDURE (CONT'D)

Avoiding Track Damage

Mud and water should be removed from the machine before parking. In freezing temperatures, park the machine on boards or concrete to prevent the track or undercarriage from freezing to the ground and preventing machine movement.

Some Cause Of Track Damage:

Figure 94

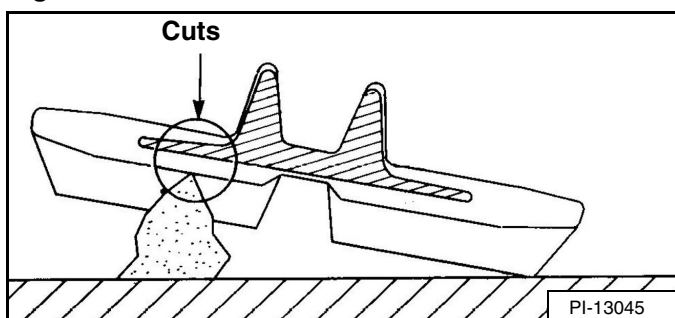


Incorrect track tension: When the rubber track is detracting, the idler or sprocket rides on the projections of the embedded metal **[Figure 94]** causing the embedded metal to be exposed to corrosion. (See TRACK TENSION on Page 111.)

If rubber track is clogged with stones or foreign objects, these can get wedged between the sprocket / rollers and cause detracting and track stress.

When moisture invades through cuts on the track, the embedded steel cords will corrode. The deterioration of the design strength may lead to the breaking of the steel cords.

Figure 95

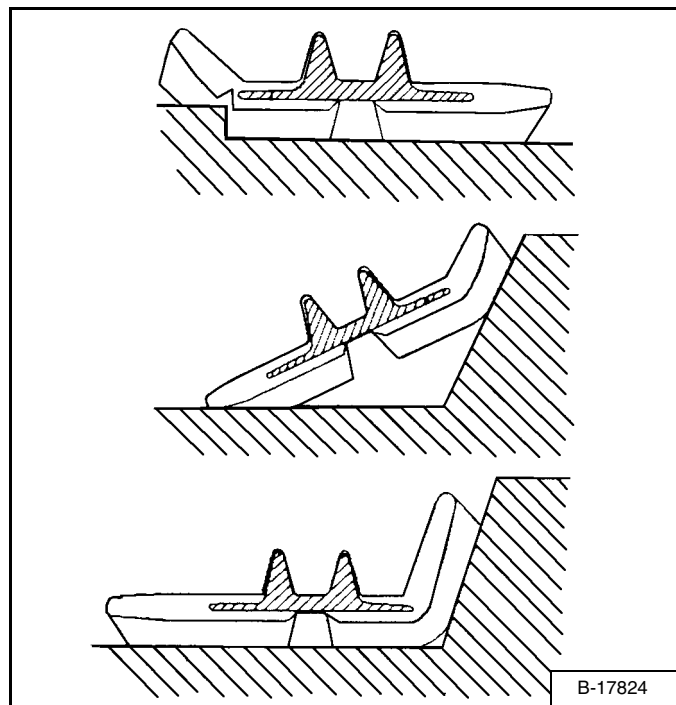


When rubber tracks drive over projections or sharp objects in the field, the concentrated forces applied cause cuts on the lug side rubber surface **[Figure 95]**. In case of making turns on projections, the lug side rubber surface will have an even higher chance to be cut. If the cuts run through the embedded steel cords, it might result in the steel cords' breakage due to their corrosion.

Avoid quick turns on bumpy and rocky fields.

Driving over sharp objects should be avoided. If this is impossible, do not make turns while driving over sharp objects.

Figure 96



When rubber tracks drive over sharp projections, intensive stress is applied to the lug side rubber surface, especially at the edges of embedded metals, causing cracks and cuts in the area around the embedded metals **[Figure 96]**.

Avoid extensive stress applied to the lug root where metals are embedded. Operators should try to avoid driving over stumps and ridges.

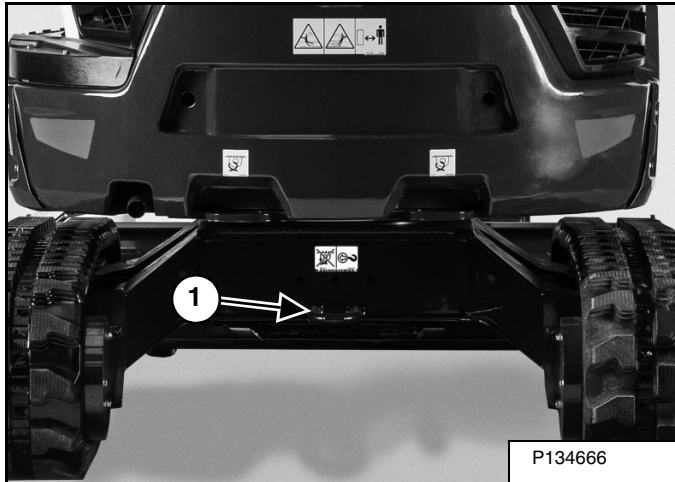
TOWING THE EXCAVATOR

Procedure

There is not a recommended towing procedure for the excavators.

The excavator can be lifted onto the transport vehicle (See LIFTING THE EXCAVATOR on Page 73.).

Figure 97



The excavator can be skidded a short distance for service (for example, moving it onto a transport vehicle) without damaging the hydraulic system. (The tracks will not turn.) There might be slight wear to the tracks when the excavator is skidded.

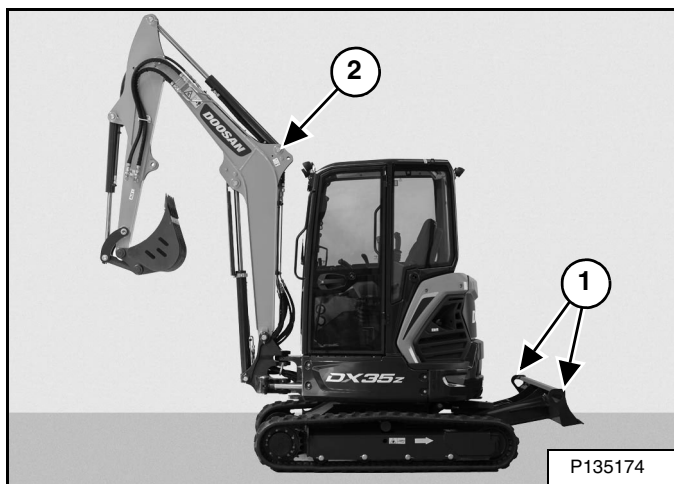
Secure the towing chain to the loop located at the rear of the excavator (Item 1) [Figure 97].

The towing chain (or cable) must be rated at 1.5 times the weight of the excavator. (See Performance on Page 134.)

LIFTING THE EXCAVATOR

Procedure

Figure 98



Before lifting, fully extend the cylinders of the bucket, arm, and boom. Raise the blade fully. Turn the upperstructure so the boom and blade are at opposite ends of the excavator as shown [Figure 98].

Put all the control levers in NEUTRAL and stop the machine.

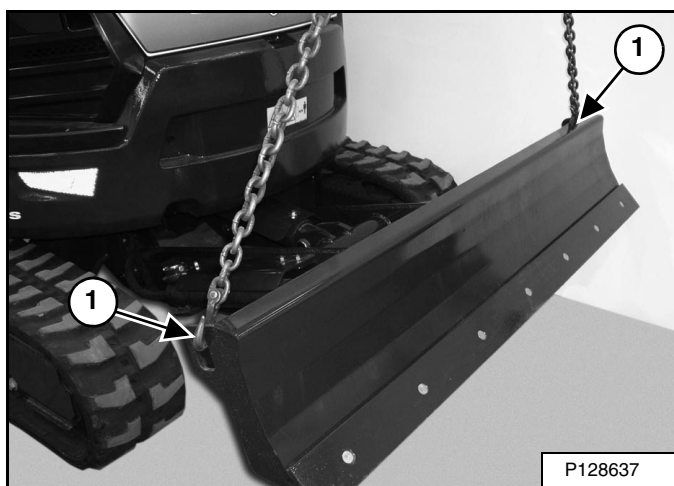
WARNING

AVOID INJURY OR DEATH

- Use chains and lifting equipment with sufficient capacity for the weight of the excavator plus any added attachments.
- Maintain centre of gravity and balance when lifting.
- Do not swing boom or upperstructure.
- Never lift with operator on machine.
- Never lift with the blade angled (if equipped).

W-2800-EN-0210

Figure 99



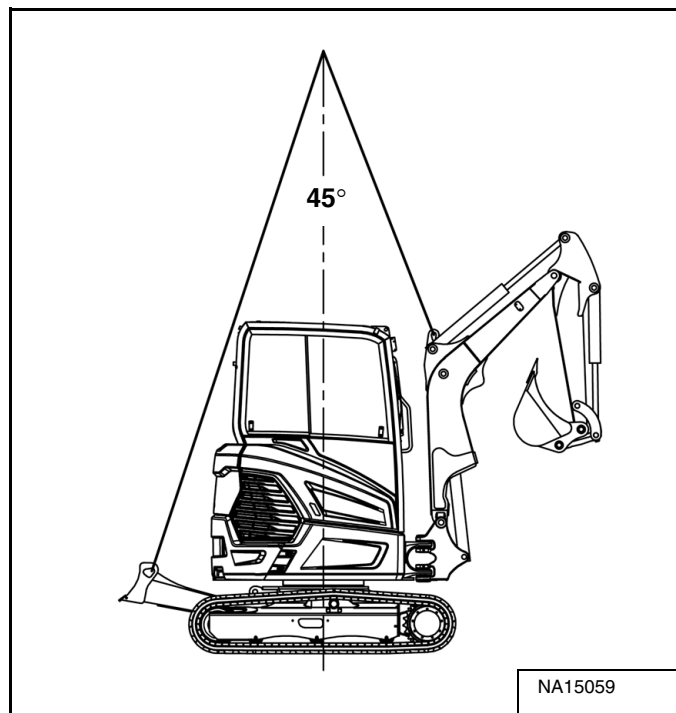
Fasten chains to the ends of the blade (Item 1) [Figure 98] and [Figure 99] and up to a lifting fixture above the canopy / cab. The lifting fixture must extend over the sides of the canopy / cab to prevent the chains from hitting the ROPS / TOPS.

Figure 100



Fasten a chain (Item 2) [Figure 98] and [Figure 100] from the rod to the lift fixture.

Figure 101



The excavator should remain as close to horizontal as possible while it is lifted. To prevent damage, the chains should not contact any part of the operator canopy / cab. The chains should be at an angle of 45 degrees [Figure 101].

TRANSPORTING THE EXCAVATOR ON A TRAILER

Loading And Unloading

When transporting the machine, observe the rules, motor vehicle laws, and vehicle limit ordinances. Use a transport and towing vehicle of adequate length and capacity.

Secure the parking brakes and block the wheels of the transport vehicle.

Align the ramps with the centre of the transport vehicle. Secure the ramps to the truck bed and be sure ramp angle does not exceed 15 degrees.

Use metal loading ramps with a slip resistant surface.

Use ramps that are the correct length and width and can support the weight of the machine.

The rear of the trailer must be blocked or supported when loading or unloading the machine to prevent the front of the transport vehicle from raising.

Determine the direction of the track movement before moving the machine (blade forward).

Disengage the auto idle feature and move the two-speed travel to the low range position.



WARNING

AVOID SERIOUS INJURY OR DEATH

Adequately designed ramps of sufficient strength are needed to support the weight of the machine when loading onto a transport vehicle. Wood ramps can break and cause personal injury.

W-2058-0807

Figure 102



Move the machine forward onto the transport vehicle [Figure 102].

Do not change direction of the machine while it is on the ramps.

Lower the boom, arm, bucket, and blade to the transport vehicle.

Stop the engine and remove the key (if equipped).

Put blocks at the front and rear of the tracks.

TRANSPORTING THE EXCAVATOR ON A TRAILER (CONT'D)

Fastening

Tie down the excavator to prevent it from moving when going up or down slopes or during sudden stops.

Front Tie Down Locations

Figure 103

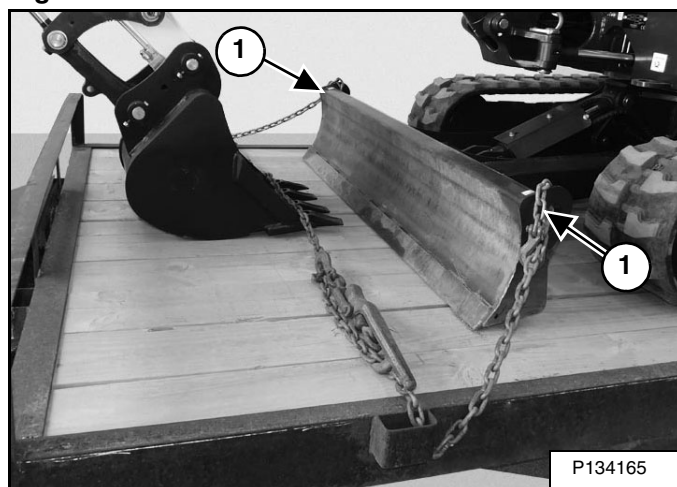
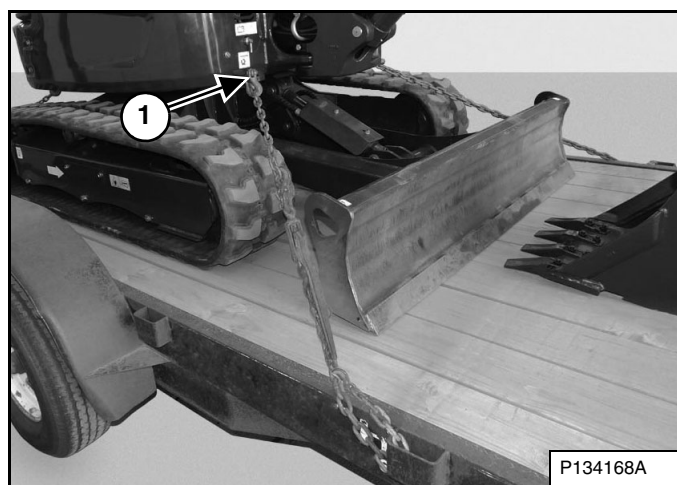


Figure 104



Fasten chains to the front corners of the blade (Item 1) [Figure 103] or to the tie down loops at the front of the upperstructure (Item 1) [Figure 104].

Rear Tie Down Locations

Figure 105

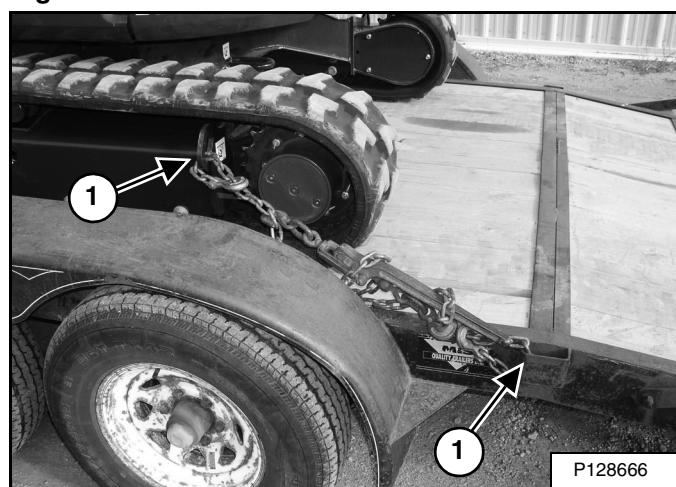
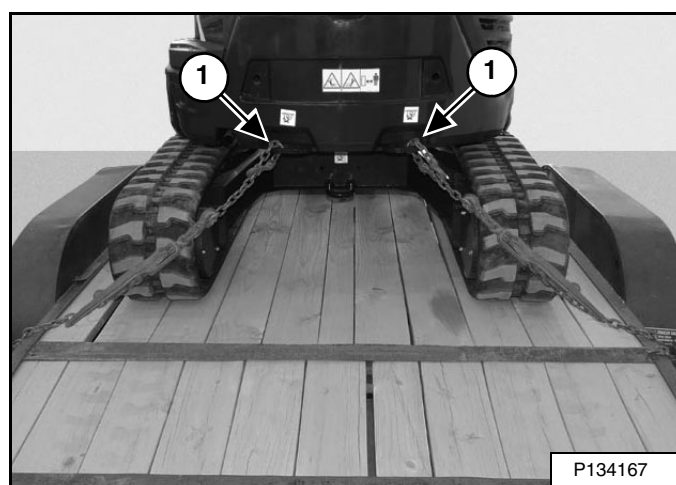


Figure 106



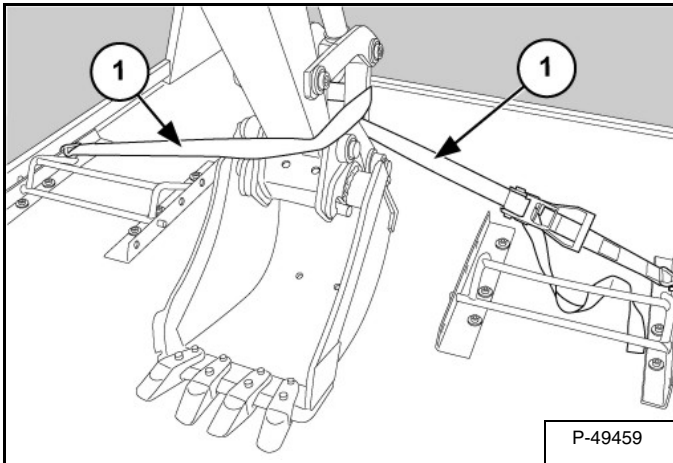
Fasten chains to the tie down loops at the rear corners of the track frame (Item 1) [Figure 105] or to the tie down loops at the rear of the upperstructure (Item 1) [Figure 106].

Use chain binders to tighten the chains and then safely tie the chain binder levers to prevent loosening.

TRANSPORTING THE EXCAVATOR ON A TRAILER (CONT'D)

Fastening (Cont'd)

Figure 107



Loop a chain (Item 1) **[Figure 107]** around the bucket link and to the trailer.

Use chain binders to tighten the chains and then safely tie the chain binder levers to prevent loosening.

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MAINTENANCE SAFETY



WARNING

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual, Operator's Handbook and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments, repairs or service. Untrained operators and failure to follow instructions can cause injury or death.

W-2003-0807



Safety Alert Symbol: This symbol with a warning statement, means: "Warning, be alert! Your safety is involved!" Carefully read the message that follows.

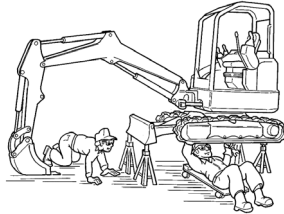
CORRECT



P-90216

- Never service the Doosan Compact Excavator without instructions.

CORRECT



NA1428

- Use the correct procedure to lift and support the excavator.

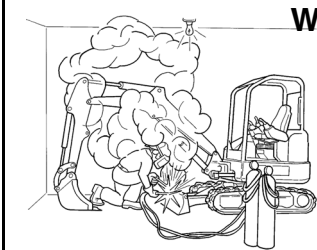
CORRECT



NA1425

- Cleaning and maintenance are required daily.

WRONG



NA1427

- Have good ventilation when welding or grinding painted parts.
- Wear dust mask when grinding painted parts. Toxic dust and gas can be produced.

WRONG



NA1426

- Vent exhaust to outside when engine must be run for service.
- Exhaust system must be tightly sealed. Exhaust fumes can kill without warning.

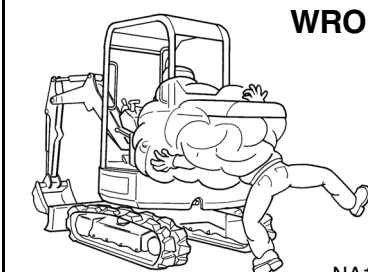
WRONG



NA1429

- Always lower the bucket and blade to the ground before doing any maintenance.
- Never modify equipment or add attachments not approved by Doosan Company.

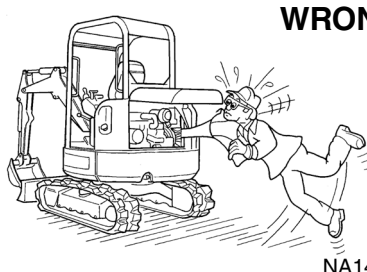
WRONG



NA1430

- Stop, cool and clean engine of flammable materials before checking fluids.
- Never service or adjust machine with the engine running unless instructed to do so in the manual.
- Avoid contact with leaking hydraulic fluid or diesel fuel under pressure. It can penetrate the skin or eyes.
- Never fill fuel tank with engine running, while smoking, or when near open flame.

WRONG



NA1431

- Keep body, jewelry and clothing away from moving parts, electrical contact, hot parts and exhaust.
- Wear eye protection to guard from battery acid, compressed springs, fluids under pressure and flying debris when engines are running or tools are used. Use eye protections approved for type of welding.
- Keep tailgate closed except for service. Close and latch tailgate before operating the excavator.

WRONG



B-19798

- Lead-acid batteries produce flammable and explosive gases.
- Keep arcs, sparks, flames and lighted tobacco away from batteries.
- Batteries contain acid which burns eyes or skin on contact.
- Wear protective clothing. If acid contacts body, flush well with water. For eye contact flush well and get immediate medical attention.

Maintenance procedures which are given in the Operation & Maintenance Manual can be performed by the owner/operator without any specific technical training. Maintenance procedures which are **not** in the Operation & Maintenance Manual must be performed **ONLY BY QUALIFIED DOOSAN SERVICE PERSONNEL**. Always use genuine Doosan replacement parts. The Service Safety Training Course is available from your Doosan dealer.

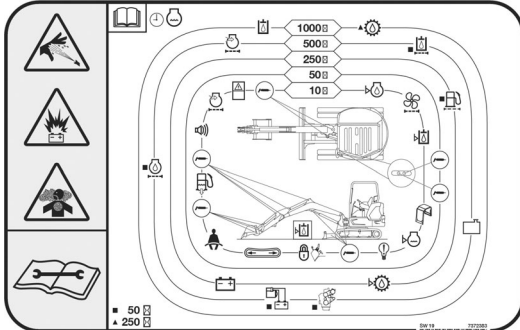
MSW38DH-0409

SERVICE SCHEDULE

Maintenance Intervals

Maintenance work must be done at regular intervals. Failure to do so will result in excessive wear and early failures.

The service schedule is a guide for correct maintenance of the Doosan excavator.



See inside page of the back cover for symbols and identification.

Every 10 Hours (Before Starting The Excavator)

- **Engine Oil** - Check level and add as needed. (See Page 96.)
- **Engine Air Filters and Air System** - Check the condition indicator. Service only when required. Check for leaks and damaged components. (See Page 89.)
- **Engine Cooling System** - Check coolant level COLD and add premixed coolant as needed. (See Page 98.) and (See Page 100.)
- **Seat Belt, Seat Belt Retractors, Seat Belt Mounting hardware** - Check the condition of seat belt and mounting hardware. Clean or replace seat belt retractors as needed. Clean dirt and debris from moving parts. (See Page 83.)
- **Control Console Lockout** - Check the control console lockout lever for proper operation. (See Page 82.)
- **Operator Cab** - Check the cab condition and mounting hardware. (See Page 35.)
- **Operator Cab and HVAC Filters** - Clean filters. (See Page 89.)
- **Indicators and Lights** - Check for correct operation of all indicators and lights. (See Page 27.)
- **Safety Signs** - Check for damaged signs (decals). Replace any signs that are damaged. (See Page 16.)
- **Hydraulic Fluid** - Check fluid level and add as needed. (See Page 108.)
- **Fuel Filter** - Drain water and sediment from filter. (See Page 94.)
- **Track Tension** - Check tension and adjust as needed. (See Page 111.)
- **Pivot Points** - Grease all machinery pivot points. Grease clamp (if equipped). (See Page 118.)

First 50 Hours

- **Fuel Filter** - Replace filter. (See Page 94.)
- **Engine Oil and Filter** - Replace oil and filter. (See Page 97.)
- **Drive Belts (Alternator)** - Check condition. Replace as needed. (See Page 114.)
- **Hydraulic Filter and Case Drain Filter** - Replace hydraulic filter and case drain filter. (See Page 109.)
- **Alternator and Starter** - Check connections.

Every 50 Hours

- **Swing Bearing** - Grease swing bearing and swing pinion. Service every 10 hours when operating in water. (See Page 118.)

WARNING

AVOID INJURY OR DEATH

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual, Operator's Handbook and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments, repairs or service. Untrained operators and failure to follow instructions can cause injury or death.

W-2003-0807

SERVICE SCHEDULE (CONT'D)

Maintenance Intervals (Cont'd)

First 250 Hours

- **Travel Motors (Final Drive)** - Replace fluid. (See Page 113.)

Every 250 Hours Or Every 12 Months

- **Battery** - Check cables, connections, and electrolyte level; add distilled water as needed. (See Page 101.)
- **Fuel Filter** - Replace filter. (See Page 94.)
- **Travel Motors (Final Drive)** - Check fluid level and add as needed. (See Page 113.)

Every 500 Hours Or Every 12 Months

- **Engine Oil and Filter** - Replace oil and filter. (See Page 97.)
- **Engine Air Filters and Air System** - Check the condition indicator. Service only when required. Check for leaks and damaged components. (See Page 90.)
- **Engine Cooling System** - Clean debris from radiator, fuel cooler, hydraulic fluid cooler, air conditioning condenser (if equipped). (See Page 99.)
- **Drive Belts (Alternator) (Air Conditioning - If Equipped)** - Check condition. Replace as needed. (See Page 114.) and (See Page 114.)
- **Hydraulic Filter, Case Drain Filter, and Hydraulic Reservoir Breather Cap** - Replace the hydraulic filter, case drain filter, and reservoir breather cap (See Page 109.)
- **Alternator and Starter** - Check connections.
- **HVAC** - Check housing and coils.

Every 1000 Hours Or Every 12 Months

- **Engine Valves** - Adjust the engine valve clearance.
- **Travel Motors (Final Drive)** - Replace fluid. (See Page 113.)
- **Hydraulic Fluid and Filters** - Replace hydraulic fluid and filters. (See Page 109.)

Every 24 Months

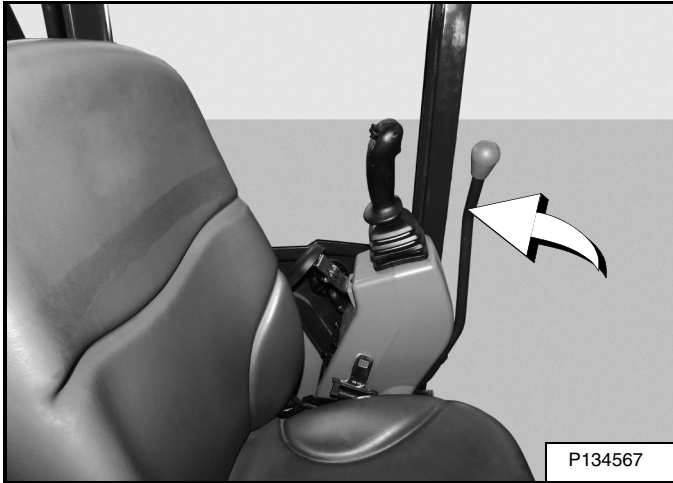
- **Coolant** - Replace the coolant. (See Page 100.)

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CONTROL CONSOLE LOCKOUTS

Inspection And Maintenance

Figure 108



When the left console is raised **[Figure 108]**, the hydraulic control levers (joysticks) and traction system must not function.

Sit in the operator's seat, fasten the seat belt and start the engine.

Keep the left console raised **[Figure 108]**.

Move the joystick control levers. There should be no movement of the boom, arm, slew or bucket.

Move the steering control levers. There should be no movement of the excavator tracks.

Service the system if these controls do not deactivate when the left control console is raised. (See your Doosan dealer for service.)

SEAT BELT

Inspection And Maintenance

! WARNING

Failure to properly inspect and maintain the seat belt can cause lack of operator restraint resulting in serious injury or death.

W-2466-0703

Check the seat belt daily for correct function.

Inspect the seat belt system thoroughly at least once each year or more often if the machine is exposed to severe environmental conditions or applications.

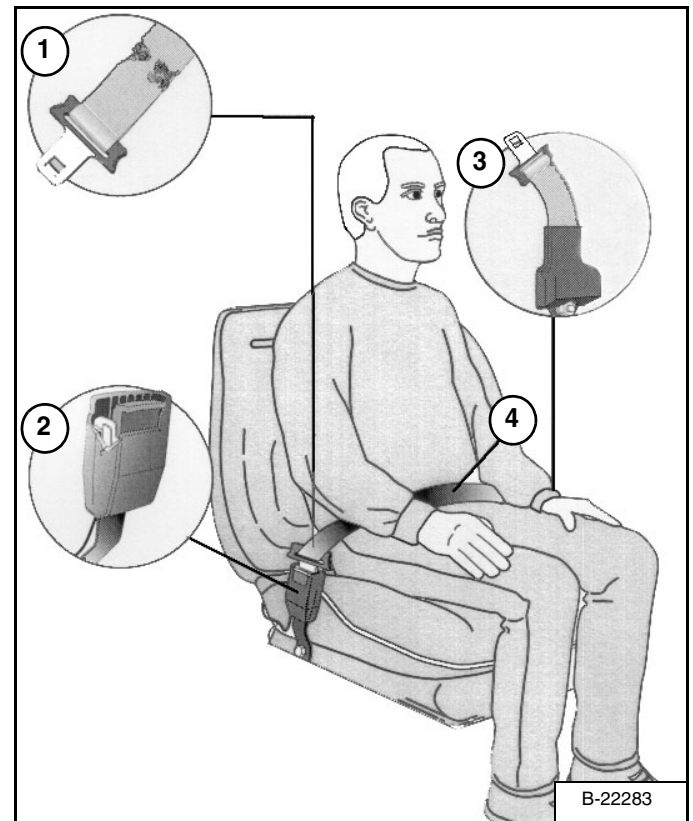
Any seat belt system that shows cuts, fraying, extreme or unusual wear, significant discolourations due to ultraviolet UV exposure, dusty / dirty conditions, abrasion to the seat belt webbing, or damage to the buckle, latch plate, retractor (if equipped), hardware or any other obvious problem should be replaced immediately.

The items below are referenced in **[Figure 109]**.

1. Check the webbing. If the system is equipped with a retractor, pull the webbing completely out and inspect the full length of the webbing. Look for cuts, wear, fraying, dirt and stiffness.
2. Check the buckle and latch for correct operation. Make sure latch plate is not excessively worn, deformed or buckle is not damaged or casing broken.
3. Check the retractor web storage device (if equipped) by extending webbing to determine if it looks correct and that it spools out and retracts webbing correctly.
4. Check webbing in areas exposed to ultraviolet (UV) rays from the sun or extreme dust or dirt. If the original colour of the webbing in these areas is extremely faded and / or the webbing is packed with dirt, the webbing strength may have deteriorated.

See your Doosan dealer for seat belt system replacement parts for your machine.

Figure 109



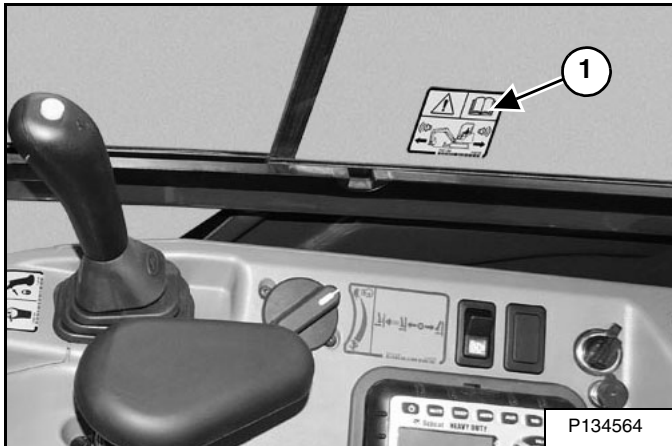
MOTION ALARM SYSTEM

Description

This excavator may be equipped with a motion alarm system. The motion alarm will sound when the operator moves the travel control levers in either the forward or reverse direction. Slight movement of the steering levers in either the forward or reverse direction is required with hydraulic components before the motion alarm will sound.

Inspecting

Figure 110



Inspect for damaged or missing motion alarm decal (Item 1) [Figure 110]. Replace if required.

NOTE: The excavator will need to be moved slightly in both the forward and reverse direction to test the motion alarm. Keep all bystanders away from machine during test.

WARNING

AVOID INJURY OR DEATH

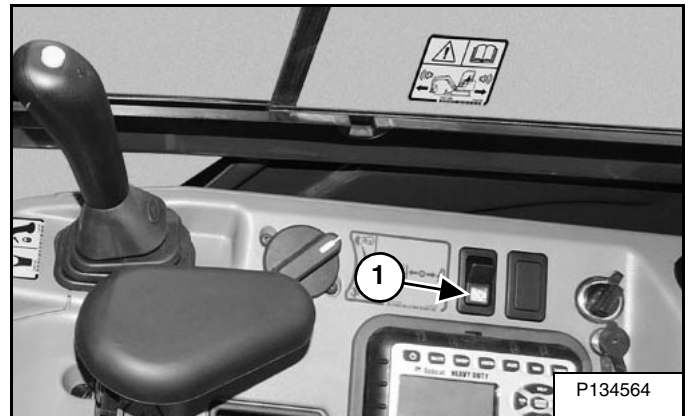
When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

W-2050-0807

Sit in the operator's seat and fasten the seat belt. Start the engine. (See PRE-STARTING PROCEDURE on Page 57.)

Move the travel control levers (one lever at a time) in the forward direction. The motion alarm must sound. Move the travel control levers (one lever at a time) in the reverse direction. The motion alarm must sound.

Figure 111



Slightly move both travel control levers in the forward direction (until the machine is slowly moving forward) and then press the motion alarm cancel switch (Item 1) [Figure 111]. The motion alarm will shut off. With the machine still moving forward, move both of the levers to the NEUTRAL position, the motion alarm must sound.

Slightly move both travel control levers in the reverse direction (until the machine is slowly moving backward) and then press the motion alarm cancel switch (Item 1) [Figure 111] (the switch icon will be illuminated when the motion alarm is deactivated). The motion alarm will shut off. With the machine still moving backward, move one of the levers to the NEUTRAL position, the motion alarm must sound.

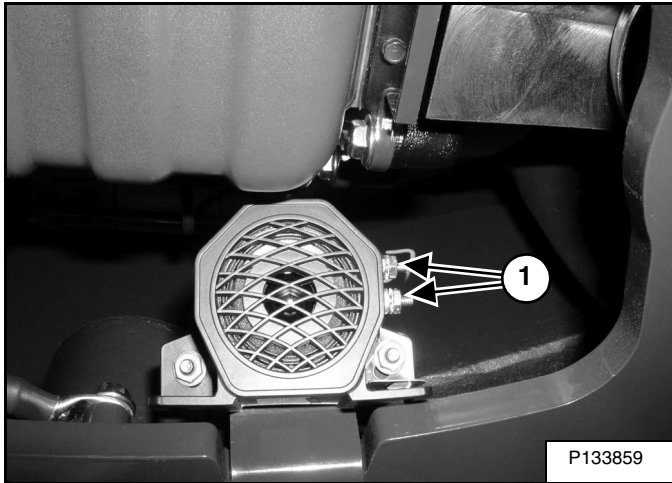
Return both levers to NEUTRAL and turn excavator key to OFF position. Exit the excavator. (See STOPPING THE ENGINE AND LEAVING THE EXCAVATOR on Page 62.)

MOTION ALARM SYSTEM (CONT'D)

Inspecting (Cont'd)

The motion alarm is mounted to the bottom rear of the excavator. (To the front of the engine oil pan.)

Figure 112



Inspect the motion alarm electrical connections (Item 1) [Figure 112], wire harness, and motion alarm switch (Item 1) [Figure 113] for tightness and damage. Repair or replace any damaged components.

If the motion alarm switch requires adjustment, see the following information.

WARNING

**This machine is equipped with a motion alarm.
ALARM MUST SOUND!
when operating forward or backward.**

Failure to maintain a clear view in the direction of travel could result in serious injury or death.

The operator is responsible for the safe operation of this machine.

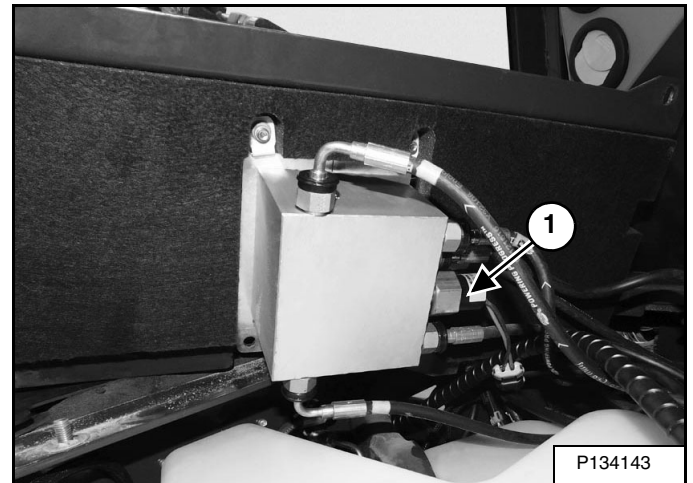
W-2786-0309

Adjusting Switch Position

The motion alarm switch (Item 1) [Figure 113] is located in the travel control valve located under the floorplate. Remove the floor mat and the floorplate. (See the Service Manual for the correct procedure.)

Remove the travel levers.

Figure 113



The switch (Item 1) [Figure 113] is non-adjustable. It must be fully installed into the travel control valve housing and tightened. Tighten the switch to 18 – 20 N•m (13 – 15 ft-lb).

Inspect the motion alarm system for proper function after switch replacement.

TAILGATE

Opening And Closing

! WARNING

AVOID INJURY OR DEATH

Never service or adjust the machine when the engine is running unless instructed to do so in the manual.

W-2012-0497

! WARNING

Keep the rear door closed when operating the machine. Failure to do so could seriously injure a bystander.

W-2020-1285

Figure 114



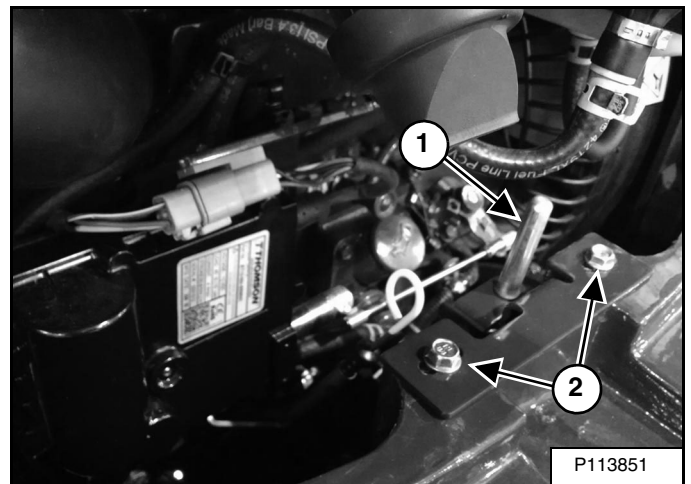
Push the button (Item 1) [Figure 114] to open the tailgate.

Push firmly to close the tailgate.

NOTE: The tailgate (Item 1) [Figure 114] can be locked using the start key.

Adjusting The Latch

Figure 115



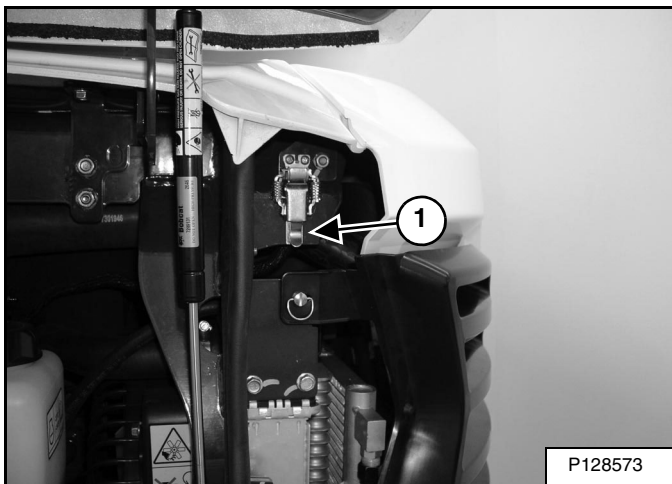
The tailgate latch (Item 1) can be adjusted by loosening the two bolts (Item 2) [Figure 115], moving the latch, and tightening the two bolts.

Close the tailgate before operating the excavator.

RIGHT SIDE COVER

Opening And Closing

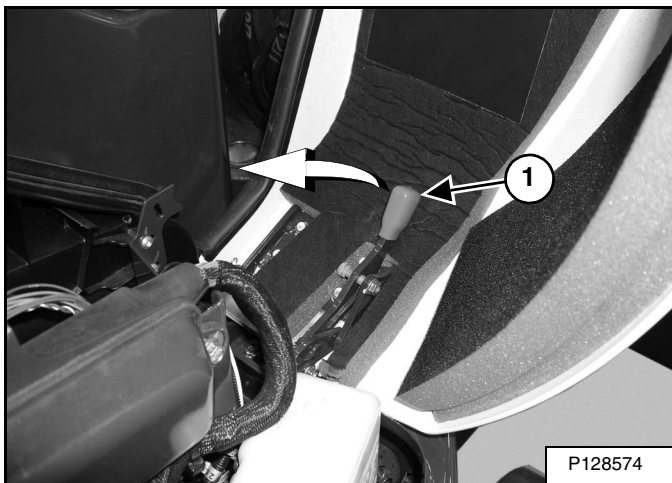
Figure 116



Open the tailgate to access the right side cover latch (Item 1) [Figure 116].

Pull up on the latch (Item 1) [Figure 116] to release cover.

Figure 117



Raise the right side cover and rotate forward until it is held fully open.

To close the right side cover, pull back on the lever (Item 1) [Figure 117] while raising the right side cover. Rotate the cover back until it is in the fully closed position.

Close the cover fully and secure by lowering the latch (Item 1) [Figure 116] to lock the cover in the closed position.

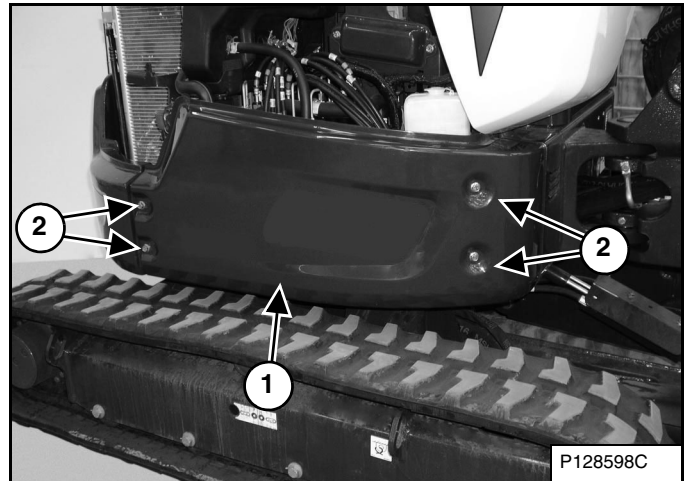
RIGHT SIDE PANEL

Removal And Installation

Open the right side cover. (See RIGHT SIDE COVER on Page 87.)

Removal

Figure 118



To remove the right side upperstructure cover (Item 1), remove the four bolts (Item 2) [Figure 118].

Remove the cover (Item 1) [Figure 118].

Installation

Position the cover (Item 1) [Figure 118] to the upperstructure.

Install the four bolts (Item 2) [Figure 118] and tighten.

CAB FILTERS

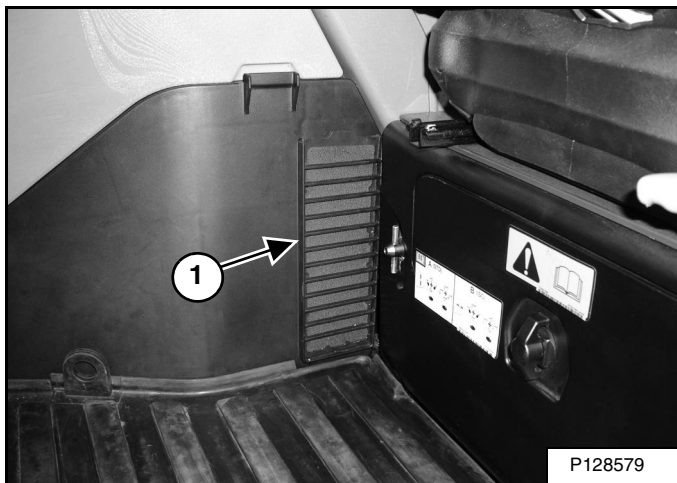
Cleaning And Maintenance

The recirculation filter and the fresh air filter must be cleaned regularly. (See SERVICE SCHEDULE on Page 80.)

The recirculation filter is located to the right of the operator seat and the fresh air filter is located under the right side cover.

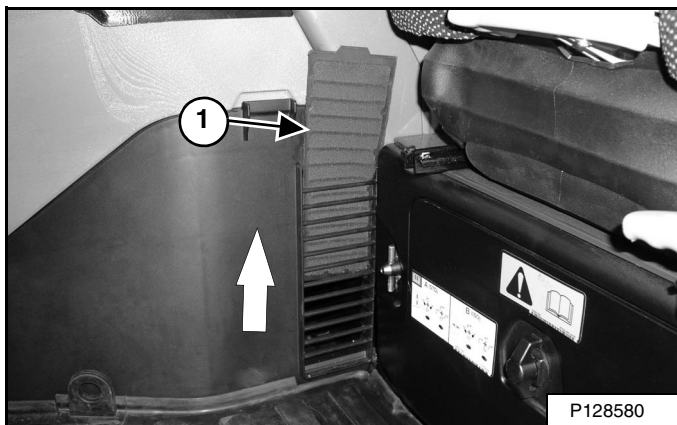
Recirculation Filter

Figure 119



The recirculation filter (Item 1) [Figure 119] is located to the right of the operator's seat.

Figure 120



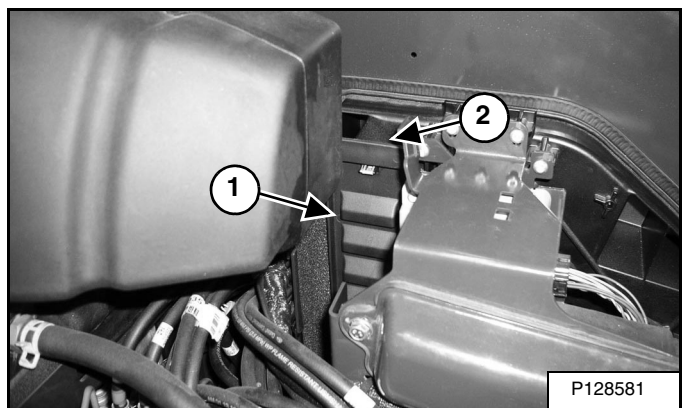
Pull up on the filter (Item 1) [Figure 120] until removed from the housing.

Shake the filter or use low pressure air to clean the filter. Replace the filter when very dirty or if damaged.

Installation: Position the bottom of the filter (Item 1) [Figure 120] into the housing and slowly push the filter down fully.

Fresh Air Filter

Figure 121

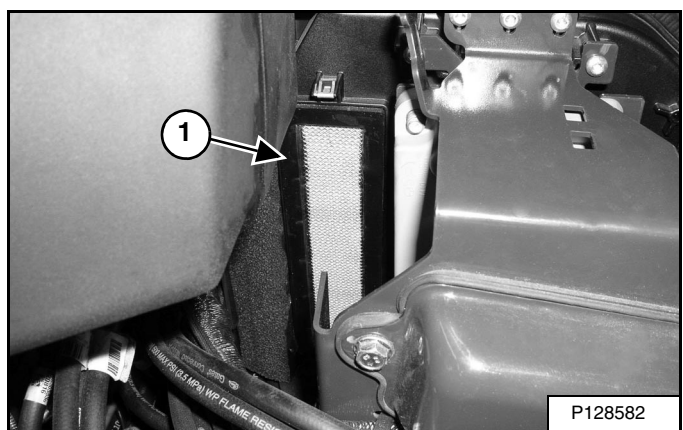


The fresh air filter is located under the right side cover.

Open the right side cover. (See RIGHT SIDE COVER on Page 87.)

Pull out on the tab (Item 1) and remove the cover (Item 2) [Figure 121].

Figure 122



Pull the filter (Item 1) [Figure 122] out of the housing.

Shake the filter or use low pressure air to clean the filter. Do not use solvents. Replace the filter when very dirty or damaged.

Installation: Position the filter (Item 1) [Figure 120] into the housing and slowly push the filter in fully.

Place the bottom tabs of the filter cover (Item 2) into the frame and push the top in until the tab (Item 1) [Figure 121] locks to the frame.

NOTE: Do not use a brush on the filter as it can push debris into the filter. Gently tap the sides of the filter and / or use low pressure compressed air from the back side of the filter to remove debris. If the filter is damaged, replace the filter.

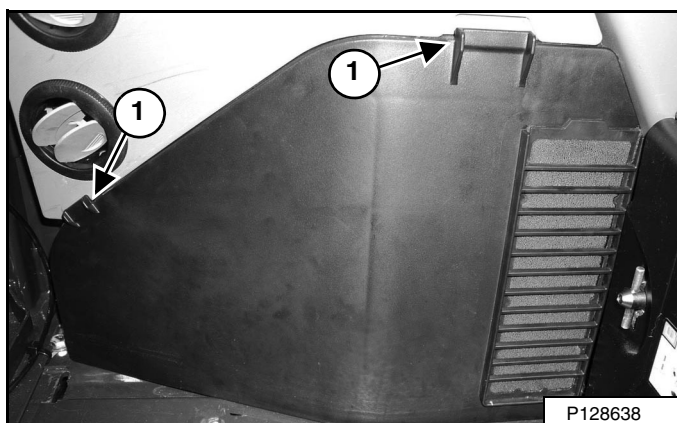
HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

Cleaning And Maintenance

The inside of the HVAC housing needs to be cleaned regularly. Dust will accumulate over time inside the housing. A dusty heater and evaporator coil will reduce heating and cooling efficiency. (See SERVICE SCHEDULE on Page 80.)

The HVAC housing is located to the right of the operator seat.

Figure 123

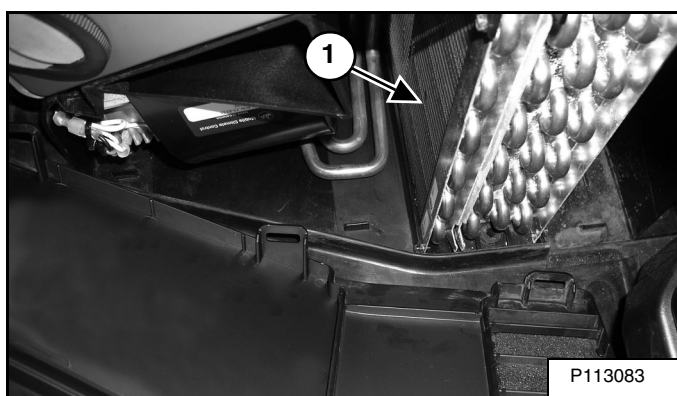


Remove the floor mat.

Pull back on the two latches (Item 1) **[Figure 123]** and remove the HVAC side cover.

To allow water to drain from the HVAC housing during the cleaning process, it is recommended to rotate the upperstructure 90° to the right. Then using the blade, raise the front of the excavator to allow water to run out of the housing. Use jackstands to support the front of the undercarriage.

Figure 124



Use a lower pressure air or a low pressure water stream to remove debris and to clean the coils (Item 1) **[Figure 124]**.

After the housing has been cleaned and flushed, remove the jackstands and raise the blade so the front of the excavator is flat on the ground. Stop the engine.

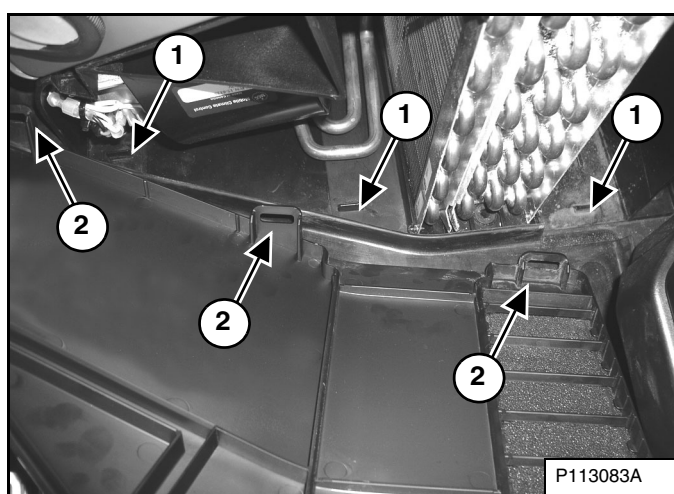
There are three rubber drain valves that allow condensation to drain from the housing during normal air conditioning usage. These drain valve can get clogged with dirt and should be cleaned at the same time the housing is cleaned.

Two of the drain valve can be accessed from the right side cover (the drain valves are located below the HVAC housing on the right side) and one of the valves is located below the left rear corner of the HVAC housing and will be accessed by removing the centre floorplate.

Pinch the three rubber drain valves on the flat sides to open the valves and allow dirt and moisture to exit from the end of the valves.

Reinstall the centre floorplate and close the right side cover.

Figure 125



NOTE: The floor mat needs to be removed to allow easier access for installing the HVAC side cover.

Three tabs (Item 1) are on the bottom of the HVAC housing that the side cover retainers (Item 2) **[Figure 125]** fit into.

Position the side cover on the tabs and starting with the front edge of the side cover, position it into the front of the HVAC housing. Press on the front of the cover to secure the front latch (Item 1) **[Figure 123]**. Then press in on the top edge of the side cover and work back to the rear of the cover and secure the rear latch.

Reinstall the floor mat.

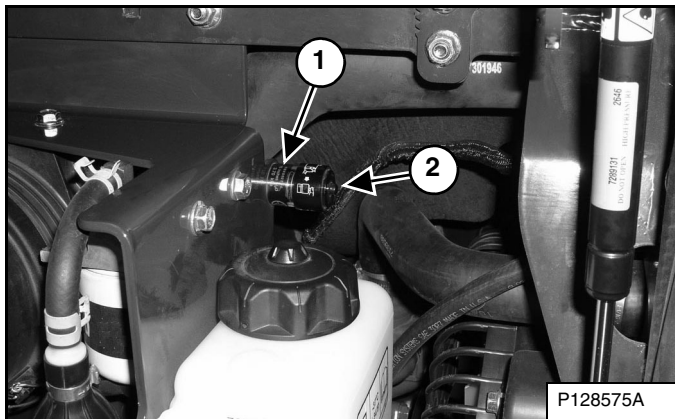
AIR CLEANER SERVICE

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 80.)

Daily Check

The air cleaner is located in the engine compartment. Open the tailgate to access the air cleaner for service. (See TAILGATE on Page 86.)

Figure 126



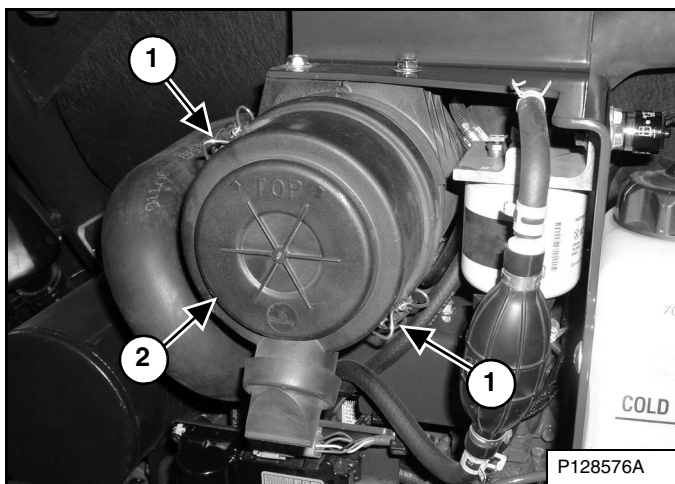
Check the condition indicator (Item 1) [Figure 126]. If the red ring shows in the condition indicator, the filter needs to be replaced.

Replace the inner filter every third time the outer filter is replaced or as indicated.

Replacing The Filter Elements

Outer Filter

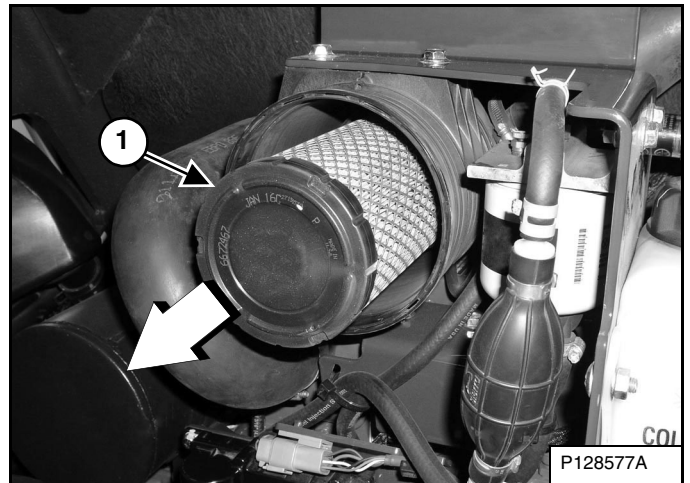
Figure 127



Release the two fasteners (Item 1) [Figure 127].

Remove and clean the dust cup (Item 2) [Figure 127].

Figure 128



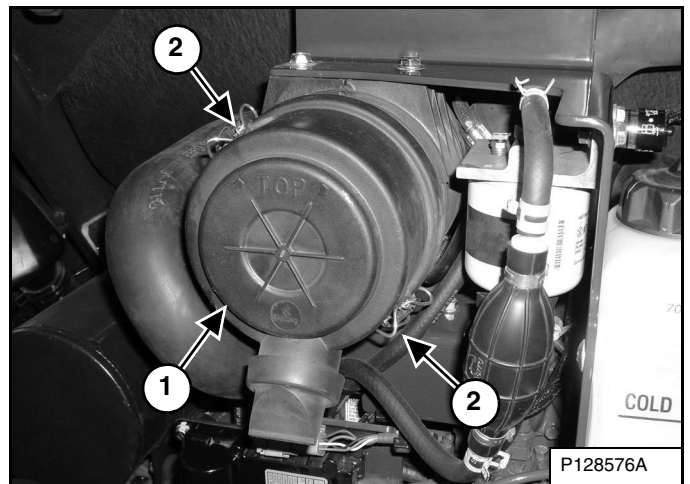
Pull the outer filter (Item 1) [Figure 128] from the air cleaner housing.

Check the housing for damage.

Clean the housing and the seal surface. DO NOT use compressed air.

Install a new filter.

Figure 129



Install the dust cup (Item 1) and engage the fasteners (Item 2) [Figure 129].

Check the air intake hose and the air cleaner housing for damage. Make sure all connections are tight.

After the outer filter has been replaced, press the button (Item 2) [Figure 126] on the end of the condition indicator and start the engine. Run at full rpm, then reduce engine speed and stop the engine. If the red ring (Item 1) [Figure 126] shows in the condition indicator, replace the inner filter.

AIR CLEANER SERVICE (CONT'D)

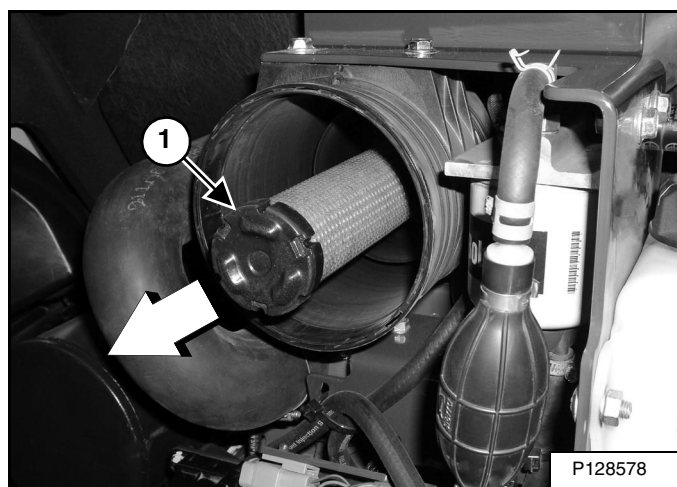
Replacing The Filter Elements (Cont'd)

Inner Filter

Only replace the inner filter under the following conditions:

- Replace the inner filter every *third* time the outer filter is replaced.
- After the outer filter has been replaced, press the button (Item 2) **[Figure 126]** on the end of the condition indicator. Start the engine. Run the engine at full rpm, then reduce engine speed. Stop the engine. If the red ring shows in the condition indicator, replace the inner filter.

Figure 130



Remove the dust cup, outer filter and inner filter (Item 1) **[Figure 130]**.

NOTE: Make sure all sealing surfaces are free of dirt and debris.

Install the new inner filter.

Install the outer filter and the dust cup.

Press the button on the condition indicator to remove the red ring.

FUEL SYSTEM

Fuel Specifications

NOTE: Contact your local fuel supplier to receive recommendations for your region.

U.S. Standard (ASTM D975)

Use only clean, high quality diesel fuel, Grade Number 2-D or Grade Number 1-D.

Ultra low sulfur diesel fuel must be used in this machine. Ultra low sulfur is defined as 15 mg/kg (15 ppm) sulfur maximum.

The following is one suggested blending guideline that should prevent fuel gelling during cold temperatures:

TEMPERATURE	GRADE 2-D	GRADE 1-D
Above -9°C (+15°F)	100%	0%
Down to -21°C (-5°F)	50%	50%
Below -21°C (-5°F)	0%	100%

NOTE: Biodiesel blend fuel may also be used in this machine. Biodiesel blend fuel must contain no more than five percent biodiesel mixed with ultra low sulfur petroleum based diesel. This biodiesel blend fuel is commonly marketed as B5 blended diesel fuel. B5 blended diesel fuel must meet ASTM specifications.

E.U. Standard (EN590)

Use only clean, high quality diesel fuel that meets the EN590 specifications listed below:

- Ultra low sulfur diesel fuel defined as 10 mg/kg (10 ppm) sulfur maximum
- Diesel fuel with cetane number of 51.0 and above.

NOTE: Biodiesel blend fuel may also be used in this machine. Biodiesel blend fuel must contain no more than seven percent biodiesel mixed with ultra low sulfur petroleum based diesel. This biodiesel blend fuel is commonly marketed as B7 blended diesel fuel. B7 blended diesel fuel must meet EN590 specifications.

Biodiesel Blend Fuel

Biodiesel blend fuel has unique qualities that should be considered before using in this machine:

- Cold weather conditions can lead to plugged fuel system components and hard starting.
- Biodiesel blend fuel is an excellent medium for microbial growth and contamination which can cause corrosion and plugging of fuel system components.
- Use of biodiesel blend fuel may result in premature failure of fuel system components, such as plugged fuel filters and deteriorated fuel lines.
- Shorter maintenance intervals may be required, such as cleaning the fuel system and replacing fuel filters and fuel lines.
- Using biodiesel blended fuels containing more than five percent biodiesel can affect engine life and cause deterioration of hoses, tubelines, injectors, injector pump and seals.

Apply the following guidelines if biodiesel blend fuel is used:

- Ensure the fuel tank is as full as possible at all times to prevent moisture from collecting in the fuel tank.
- Ensure that the fuel tank cap is securely tightened.
- Biodiesel blend fuel can damage painted surfaces, remove all spilled fuel from painted surfaces immediately.
- Drain all water from the fuel filter daily before operating the machine.
- Do not exceed engine oil change interval. Extended oil change intervals can cause engine damage.
- Before vehicle storage; drain the fuel tank, refill with 100% petroleum diesel fuel, add fuel stabiliser and run the engine for at least 30 minutes.

NOTE: Biodiesel blend fuel does not have long term stability and should not be stored for more than three months.

FUEL SYSTEM (CONT'D)

Filling The Fuel Tank

WARNING

AVOID INJURY OR DEATH

Stop and cool the engine before adding fuel. **NO SMOKING!** Failure to obey warnings can cause an explosion or fire.

W-2063-0807

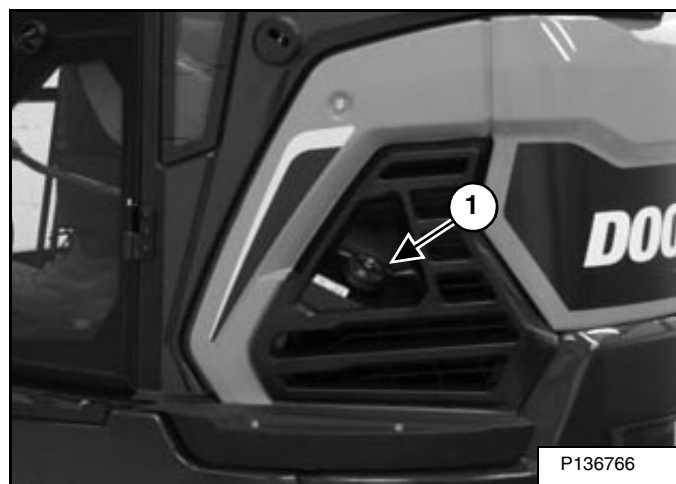
WARNING

AVOID INJURY OR DEATH

Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

Figure 131



Use the start key to unlock the fuel cap.

Remove the fuel fill cap (Item 1) [Figure 131].

Use a clean, approved safety container to add fuel. Add fuel only in an area that has a free movement of air and no flames or sparks. **NO SMOKING!**

Install and tighten the fuel fill cap.

Clean up any spilled fuel.

See the SERVICE SCHEDULE for the service interval when to remove water from or replace the fuel filter. (See SERVICE SCHEDULE on Page 80.)

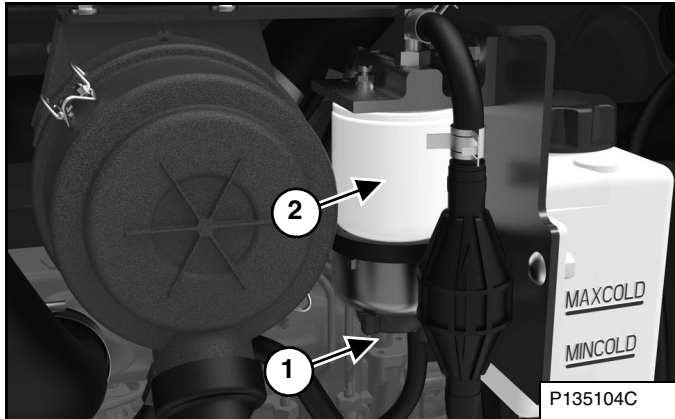
FUEL SYSTEM (CONT'D)

Fuel Filters

Removing Water

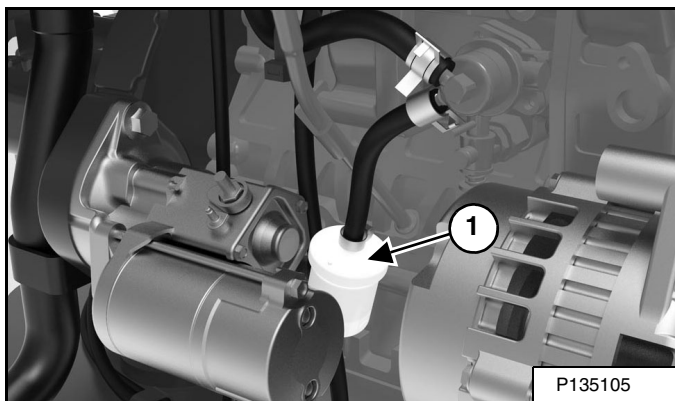
Open the tailgate. (See TAILGATE on Page 86.)

Figure 132



Loosen the drain (Item 1) [Figure 132] at the bottom of the fuel filter (Item 2) [Figure 132] to drain water from the filter into a container.

Figure 133



Inspect the fuel pre-filter (Item 1) [Figure 133] daily for moisture and contamination. Replace as necessary.

Clean up any spilled fuel.

Replacing Elements

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 80.)

Remove and replace the fuel pre-filter (Item 3) [Figure 133].

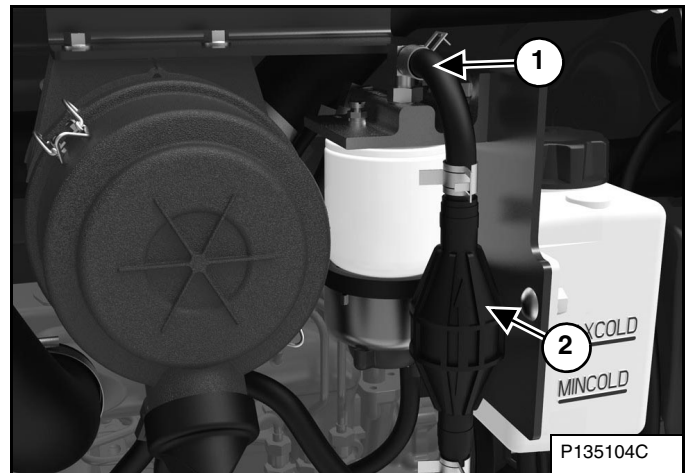
Remove the fuel filter (Item 2) [Figure 132]. Clean the area around the filter housing. Put clean oil on the seal of the new filter. Install the fuel filter and hand tighten.

Remove the air from the fuel system. (See Removing Air From The Fuel System on Page 95.)

Draining The Fuel Tank

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 80.)

Figure 134



Remove the hose (Item 1) [Figure 134] from the fuel filter. Route the hose to a container.

Squeeze the hand pump (priming bulb) (Item 2) [Figure 134] to start the fuel siphoning from the fuel tank.

Drain the fuel into the container.

Reuse, recycle or dispose of fuel in an environmentally safe manner.

Reinstall the hose (Item 1) [Figure 134] after the fuel is removed from fuel tank.

WARNING

AVOID INJURY OR DEATH

Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical attention from a physician familiar with this injury.

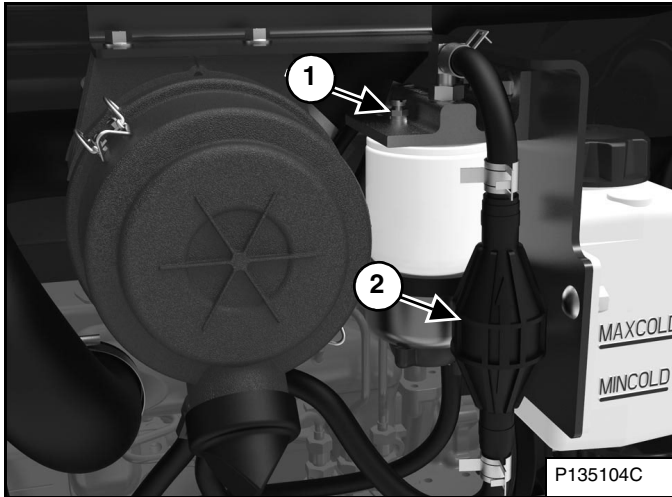
W-2072-0807

FUEL SYSTEM (CONT'D)

Removing Air From The Fuel System

After replacing the fuel filter or when the fuel tank has run out of fuel, air must be removed from the fuel system before starting the engine.

Figure 135

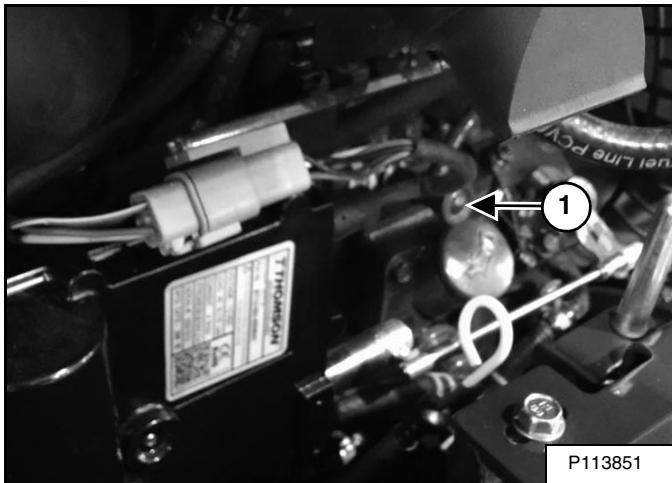


Open the tailgate. (See TAILGATE on Page 86.)

Open the fuel filter vent (Item 1) and operate the hand pump (priming bulb) (Item 2) **[Figure 135]** until the fuel flows from the vent with no air bubbles.

Close the vent (Item 1) **[Figure 135]**.

Figure 136



Start the engine. It may be necessary to open the vent (Item 1) **[Figure 136]** at the fuel injection pump briefly until the engine runs smoothly.

WARNING

AVOID INJURY OR DEATH

Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical attention from a doctor familiar with this injury.

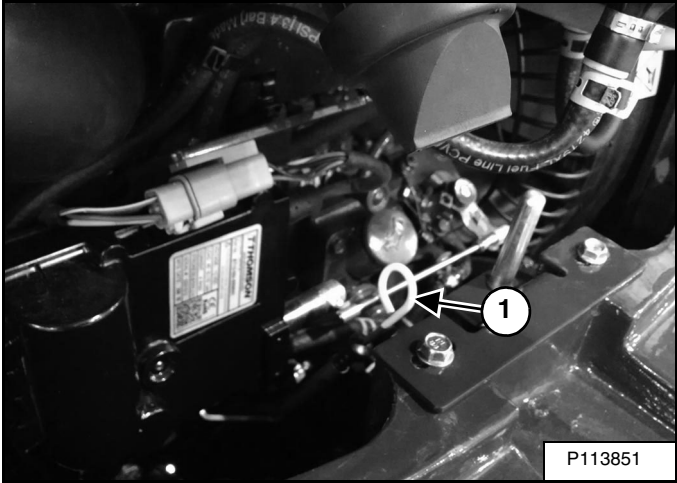
W-2072-EN-0909

ENGINE LUBRICATION SYSTEM

Checking And Adding Engine Oil

Check the engine oil after every 8 – 10 hours of operation and before starting the engine. (See SERVICE SCHEDULE on Page 80.)

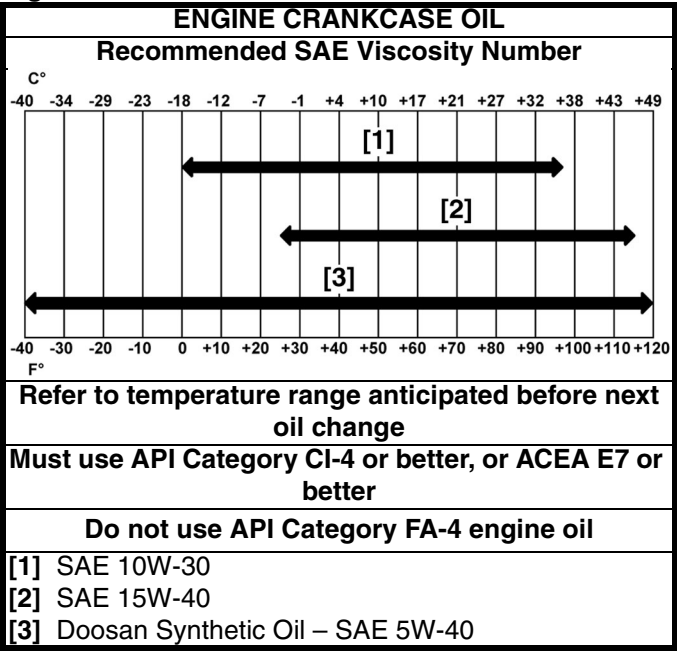
Figure 137



- Open the tailgate. (See TAILGATE on Page 86.)
- Remove the dipstick (Item 1) [Figure 137].
- Keep the oil level between the marks on the dipstick.
- Use a good quality motor oil that meets the correct API Service Classification.

Engine Oil Chart

Figure 138



Doosan engine oils are recommended for use in this machine. If Doosan engine oil is not available, use a good quality engine oil that meets API Service Category of CI-4 or better, or ACEA E7 or better [Figure 138].

WARNING

AVOID INJURY OR DEATH

Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

ENGINE LUBRICATION SYSTEM (CONT'D)

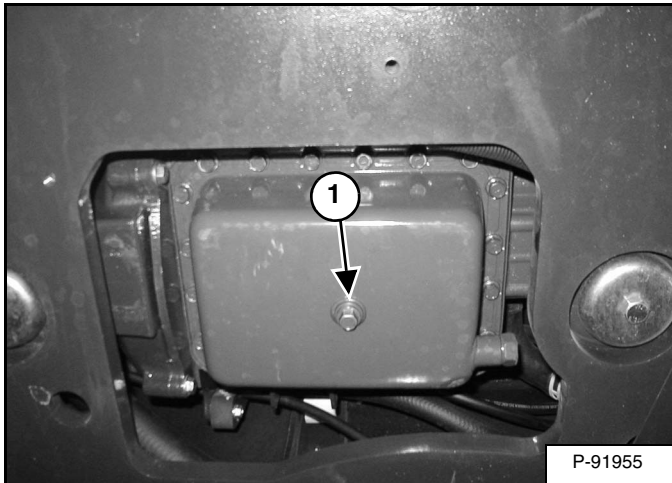
Removing And Replacing Oil And Filter

See the SERVICE SCHEDULE for the service interval for replacing the engine oil and filter. (See SERVICE SCHEDULE on Page 80.)

Run the engine until it is at operating temperature. Stop the engine.

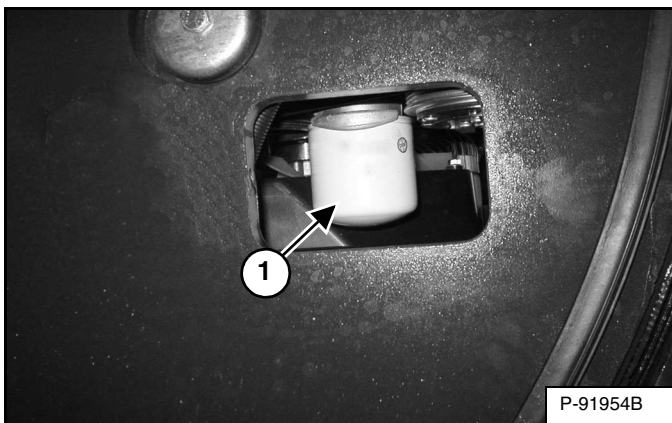
Open the tailgate. (See TAILGATE on Page 86.)

Figure 139



Place a container under the oil pan. Remove the drain plug (Item 1) [Figure 139] from the bottom of the engine oil pan.

Figure 140



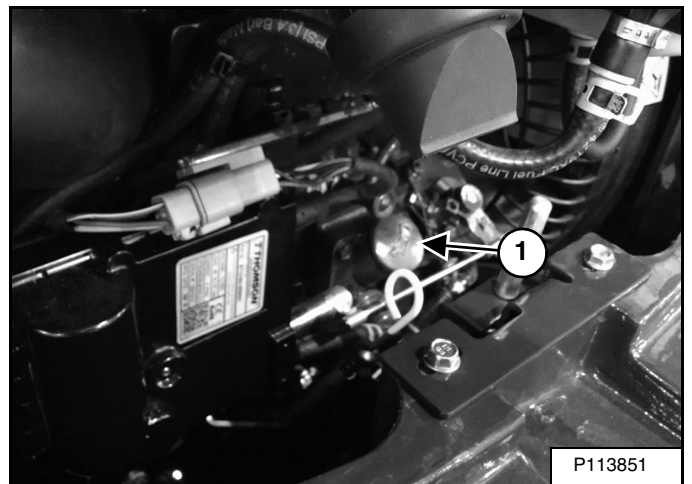
Remove the oil filter (Item 1) [Figure 140] and clean the filter housing surface.

Use a genuine Doosan replacement filter. Put clean oil on the filter gasket. Install the filter and hand tighten.

Install and tighten the drain plug (Item 1) [Figure 139].

Recycle or dispose of used oil in an environmentally safe manner.

Figure 141



Remove the fill cap (Item 1) [Figure 141].

Put oil in the engine. (See ENGINE LUBRICATION SYSTEM on Page 96.)

Install the fill cap (Item 1) [Figure 141].

Start the engine and let it run for several minutes.

Stop the engine. Check for leaks at the oil filter. Check the oil level.

Add oil as needed if it is not at the top mark on the dipstick.

ENGINE COOLING SYSTEM

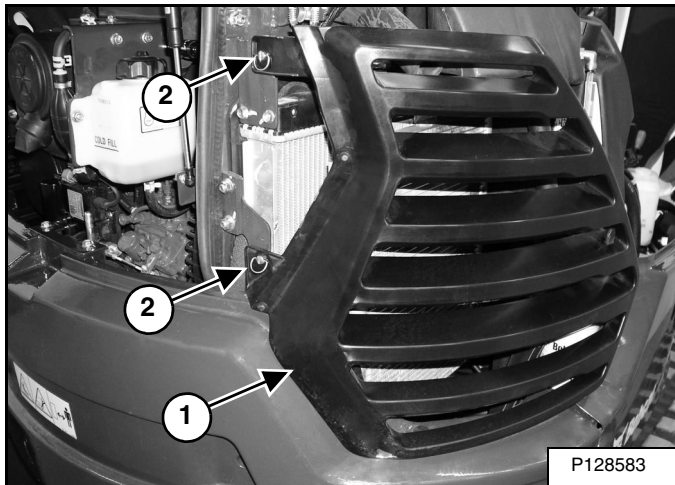
Check the cooling system every day to prevent over-heating, loss of performance or engine damage. (See SERVICE SCHEDULE on Page 80.)

Cleaning

Open the right side cover. (See RIGHT SIDE COVER on Page 87.)

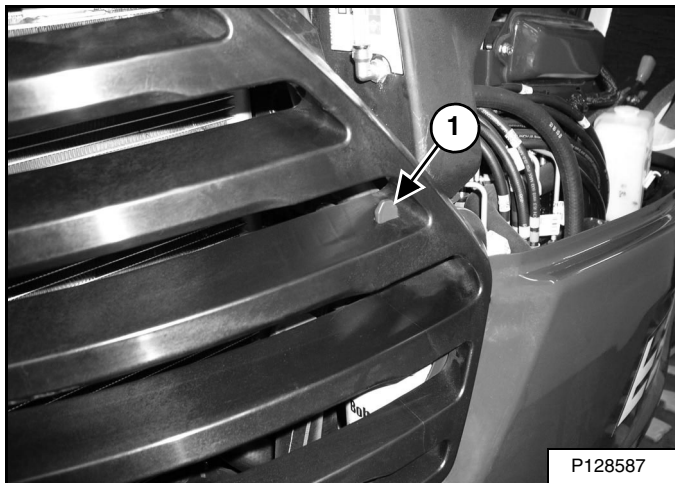
NOTE: Allow the cooling system and engine to cool before servicing or cleaning the cooling system.

Figure 142



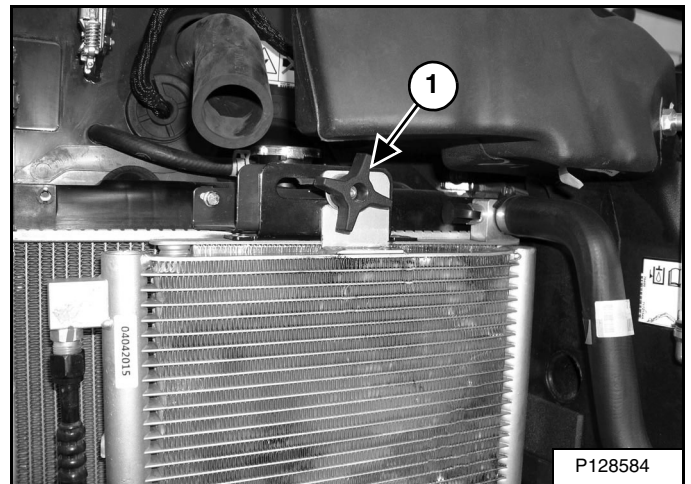
To remove the side grille (Item 1), turn the two fasteners (Item 2) [Figure 144] a quarter turn.

Figure 143



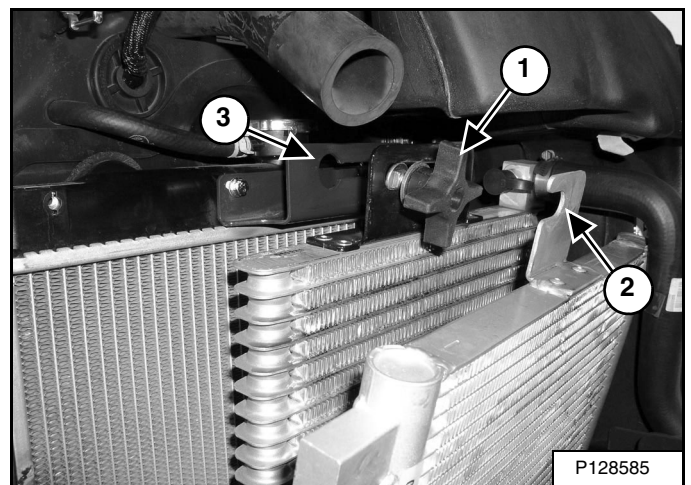
Pull out slightly on the rear of the grill and then lift up on the grille to remove from the post (Item 1) [Figure 144]. Remove the grille.

Figure 144



Loosen the knob (Item 1) [Figure 144]. Slide the knob toward the rear of the machine.

Figure 145

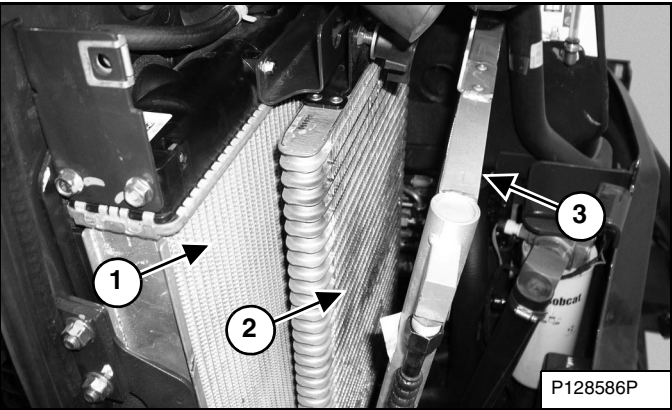


Slide the knob (Item 1) out of the condenser mount (Item 2) (if equipped) and the radiator mounting bracket (Item 3) [Figure 145]. Be careful not to damage fins.

ENGINE COOLING SYSTEM (CONT'D)

Cleaning (Cont'd)

Figure 146



Use low air pressure or low water pressure to clean the radiator (Item 1), oil cooler (Item 2) and condenser (Item 3) [Figure 146] (if equipped). Be careful not to damage fins when cleaning.

Position the knob (Item 1) so it fits into the radiator mount (Item 3) and the condenser mount (Item 2) [Figure 145] (if equipped).

Slide the knob (Item 1) toward the front of the machine until it is fully seated in the slots of the mounting brackets. Tighten the knob (Item 1) [Figure 144]. Be careful not to damage fins.

Checking Level

**WARNING**

AVOID BURNS

Do not remove radiator cap when the engine is hot. You can be seriously burned.

W-2070-1203

**WARNING**

AVOID INJURY OR DEATH

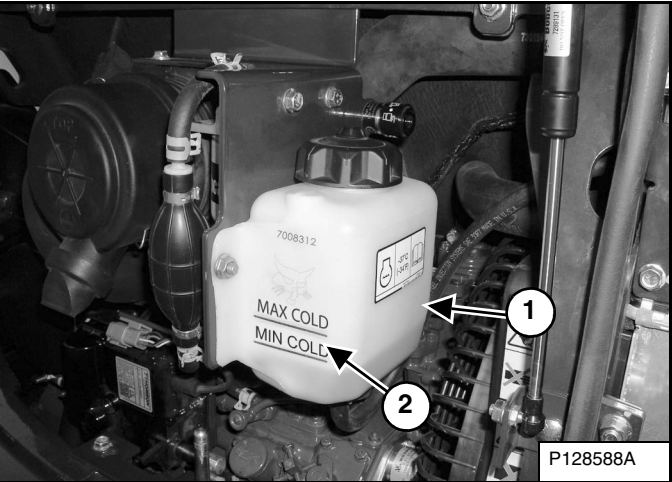
Wear safety glasses to prevent eye injury when any of the following conditions exist:

- When fluids are under pressure.
- Flying debris or loose material is present.
- Engine is running.
- Tools are being used.

W-2019-0907

Open the tailgate. (See TAILGATE on Page 86.)

Figure 147



Check the coolant level when the coolant is cold. Check the coolant level in the coolant recovery tank (Item 1). It must be between the “MAX COLD” and the “MIN COLD” level marks (Item 2) [Figure 147]. Add fluid as needed.

NOTE: The cooling system is factory filled with propylene glycol (purple colour). **DO NOT** mix propylene glycol with ethylene glycol.

IMPORTANT

AVOID ENGINE DAMAGE

Always use the correct ratio of water to antifreeze.

Too much antifreeze reduces cooling system efficiency and may cause serious premature engine damage.

Too little antifreeze reduces the additives which protect the internal engine components; reduces the boiling point and freeze protection of the system.

Always add a premixed solution. Adding full strength concentrated coolant can cause serious premature engine damage.

I-2124-0497

ENGINE COOLING SYSTEM (CONT'D)

Removing And Replacing Coolant

See the SERVICE SCHEDULE for correct service intervals. (See SERVICE SCHEDULE on Page 80.)

Stop the engine. Open the tailgate. (See TAILGATE on Page 86.)

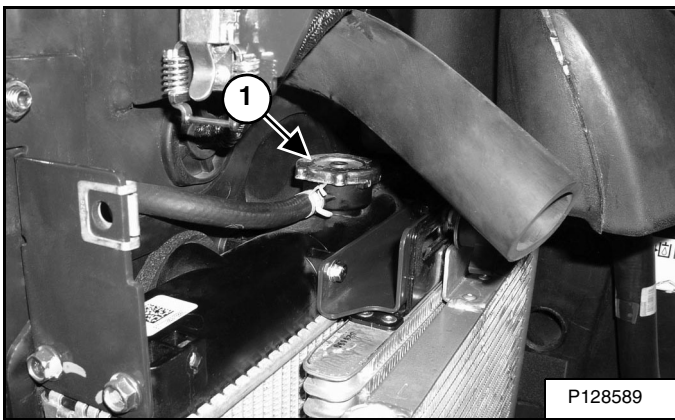
WARNING

AVOID BURNS

Do not remove radiator cap when the engine is hot. You can be seriously burned.

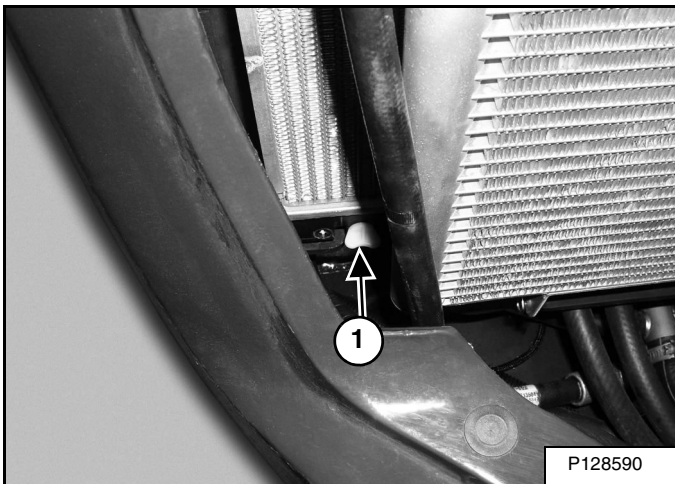
W-2070-1203

Figure 148



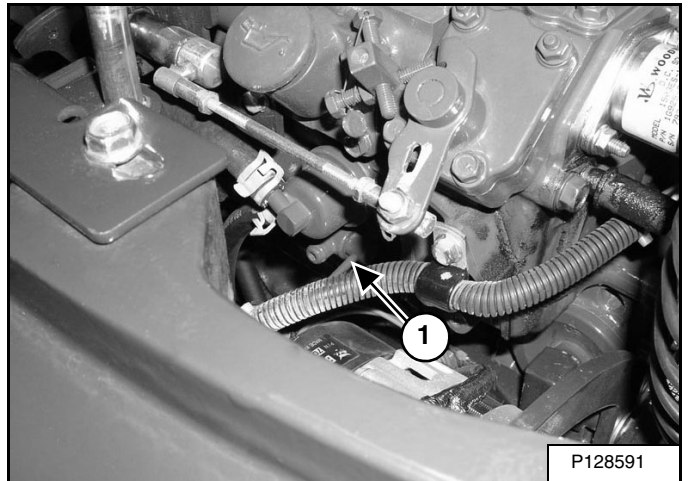
When the engine is cool, loosen and remove the radiator cap (Item 1) [Figure 148].

Figure 149



Put a hose on the drain valve at the bottom of the radiator. Open the drain valve (Item 1) [Figure 149] and drain the coolant into a container.

Figure 150



Put a hose on the drain valve on the engine block. Open the drain valve (Item 1) [Figure 150] and drain the coolant into a container.

After all the coolant is removed, close both drain valves.

Recycle or dispose of the used coolant in an environmentally safe manner.

Mix the coolant in a separate container. (See Capacities on Page 137.)

NOTE: The cooling system is factory filled with propylene glycol (purple colour). DO NOT mix propylene glycol with ethylene glycol.

The correct mixture of coolant to provide a -34°F (-37°C) freeze protection is 5 L propylene glycol mixed with 4,4 L of water **OR** 1 U.S. gal propylene glycol mixed with 3.5 qt of water.

Add premixed coolant; 47% water and 53% propylene glycol to the recovery tank if the coolant level is low.

Use a refractometer to check the condition of propylene glycol in your cooling system.

Add premixed coolant until the level is correct.

Run the engine until it is at operating temperature. Stop the engine. Check the coolant level and add as needed. Be sure the radiator cap is tight.

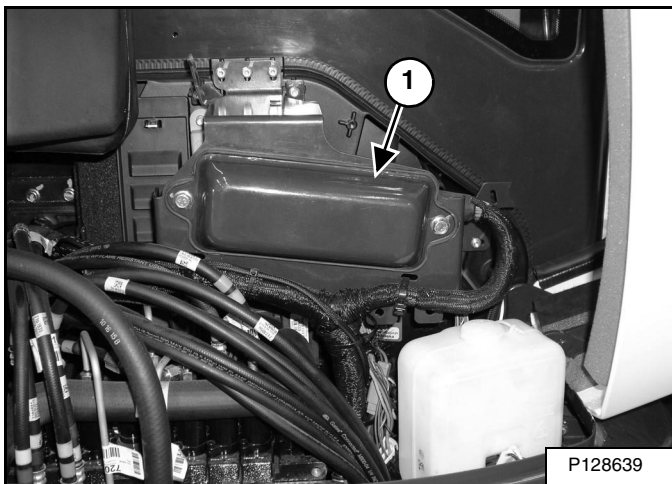
Add coolant to the recovery tank as needed.

Close the tailgate.

ELECTRICAL SYSTEM

Description

Figure 151



The excavator has a 12 volt, negative earth electrical system. The electrical system is protected by fuses located under the right side cover of the excavator (Item 1) **[Figure 151]**. The fuses will protect the electrical system when there is an electrical overload. The reason for the overload must be found and corrected before starting the engine again.

The battery cables must be clean and tight. Check the electrolyte level in the battery. Add distilled water as needed. Remove acid or corrosion from the battery and cables with a sodium bicarbonate and water solution.

Put Battery Saver P/N 6664458 or grease on the battery terminals and cable ends to prevent corrosion.

WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

Fuse And Relay Location / Identification

A decal is inside the fuse cover to show location and amp ratings.

Remove the cover to check or replace the fuses and relays.

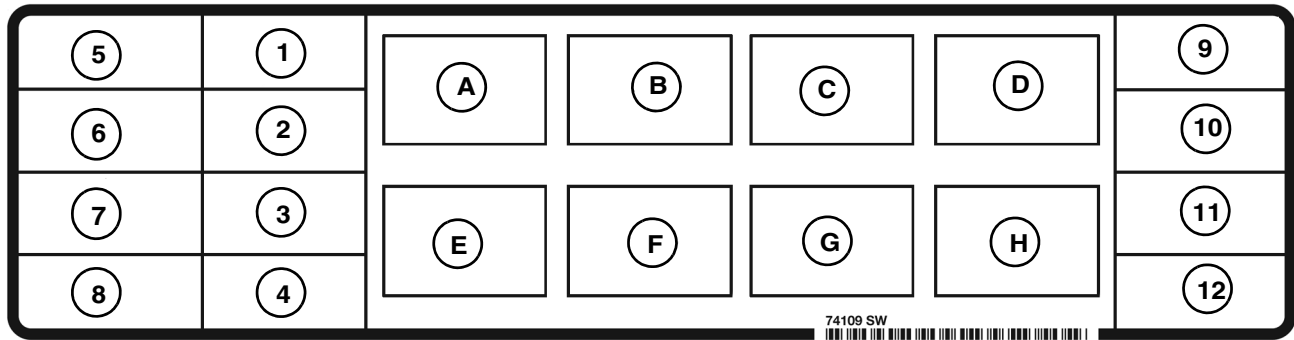
The location and sizes are shown in **[Figure 152]**.

Always replace fuses using the same type and capacity.

ELECTRICAL SYSTEM (CONT'D)

Fuse And Relay Location / Identification (Cont'd)

Figure 152



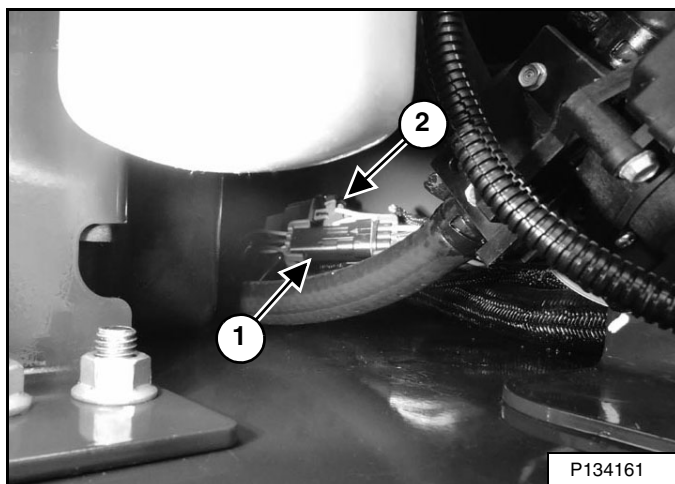
The location and sizes are shown in the table below and on the decal [Figure 152]. Relays are identified by the letter “R” in the AMP column.

REF	ICON	DESCRIPTION	AMP	REF	ICON	DESCRIPTION	AMP	REF	ICON	DESCRIPTION	AMP
1		Wiper / Washer	10	9		Panel / Display Controller	25	E		Fuel Shutoff	R
2		Switched Power	20	10		ACD Unswitched Power	25	F		Lights	R
3		Alternator Excite / Heater	25	11		Lights	30	G		Glow Plug	R
4		ACD Switched Power	25	12		Power Port	15	H		Starter	R
5		Auto Idle Controller (AIC) (if equipped)	20	A		Switched Power	R				
6		HVAC / Heater	40	B		Heater / HVAC	R				
7		Ignition	5	C		Lights	R				
8		Fuel Shutoff	25	D		Horn	R				

ELECTRICAL SYSTEM (CONT'D)

Fuse And Relay Location / Identification (Cont'd)

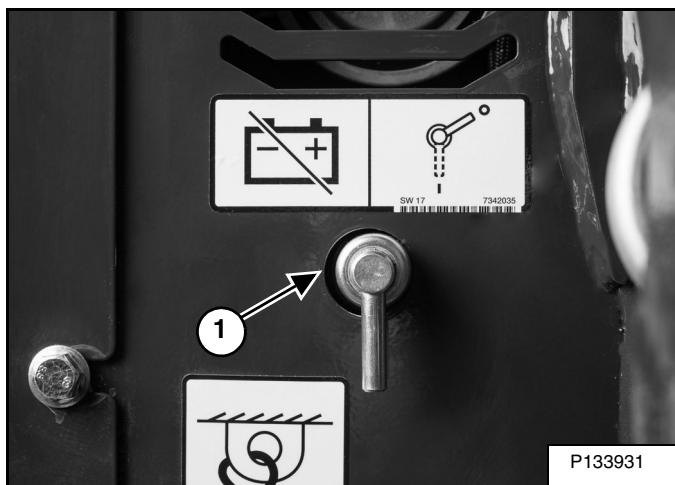
Figure 153



If the excavator is equipped with a motion alarm, there will be two relays located behind the case drain filter. The first (Item 1) is a backup alarm relay for the motion alarm. The second (Item 2) is a motion alarm relay [Figure 153].

Shut-Off Switch

Figure 154



The shut-off switch (Item 1) [Figure 154] is located on the right front of the excavator.

Rotate the switch (Item 1) anticlockwise to turn the switch to the OFF position, clockwise to turn to the ON position (shown here in the ON position) [Figure 154].

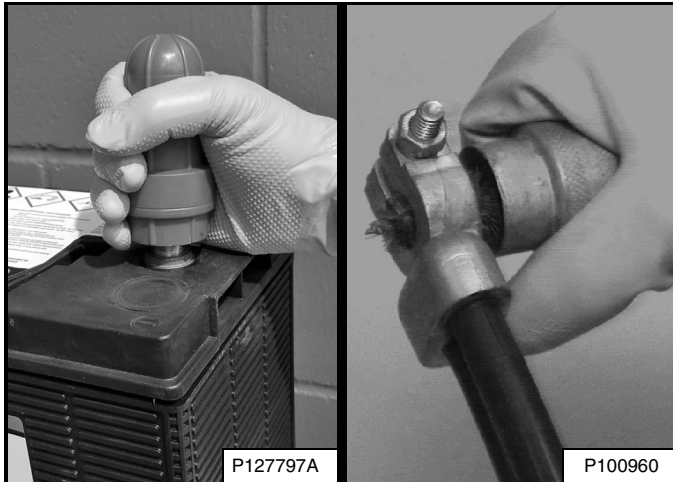
ELECTRICAL SYSTEM (CONT'D)

Battery Maintenance

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 80.)

The Doosan brand battery supplied with your machine is sealed and does not require watering. Proper charging and storage are important to maximize the life of all batteries.

Figure 155



Simple steps for reliability and long battery life:

- Keep battery posts and terminals clean **[Figure 155]**.
- Keep terminals tight.
- Remove corrosion from battery and terminals with sodium bicarbonate (baking soda) and water solution.
- Put Doosan Battery Saver or grease on the battery terminals and cable ends to prevent corrosion.
- Operate the machine for at least 15 minutes to recover from the battery drain caused by engine start up whenever practical.
- Maintain the battery charge level. This is a key factor for long battery life.
- Charge a severely discharged battery with a battery charger instead of relying on the machine charging system. (See Battery Charging on Page 105.)
- Check the battery state of charge every 30 days on machines that are not frequently used. (See Battery Testing on Page 105.)

WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

Maintaining Battery Charge Level

All batteries will self-discharge over time. This machine has features that require battery power even when the machine is not being used. Use of a quality battery maintainer is highly recommended to ensure that your machine is ready to start when you need it and avoid costly battery replacement.

Battery Maintainers

Use a good quality battery maintainer to keep the battery above 12.4 volts for machines that are not frequently used. Batteries below 12.4 volts must first be charged using a battery charger. Solar maintainers should have a minimum capacity of 10 watts to be effective.

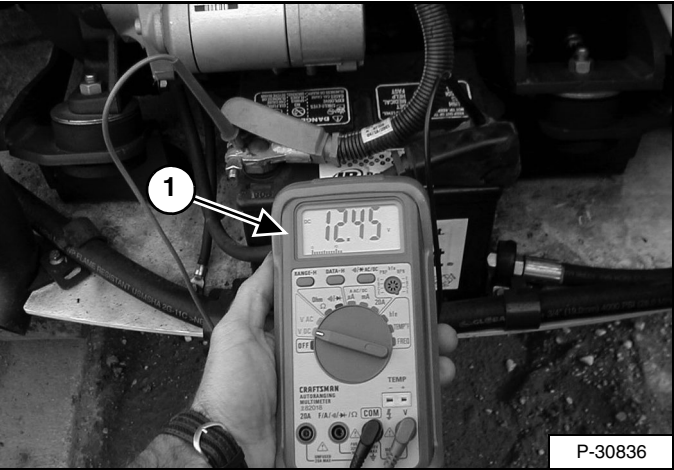
Battery Service During Machine Storage

Remove the battery if storing the machine for an extended period of time. Fully charge the battery. Store the battery in a cool dry place above freezing and boost charge periodically. If battery removal is not desired, a good quality battery maintainer must be used to compensate for battery self-discharge and parasitic loads from machine controllers, accessories, and features such as connected machine intelligence.

ELECTRICAL SYSTEM (CONT'D)

Battery Testing

Figure 156



The simplest and most common check to determine battery state of charge is to use a digital multimeter or voltmeter (Item 1) [Figure 156].

A battery found below 12.4 volts must be charged to 100% charge per the battery charger's recommendation. **Allow at least 60 minutes after operating the machine or charging the battery to get an accurate reading.**

If the reading is less than 12.4 volts after the battery has been charged for several hours, see your Doosan dealer to have a more thorough battery test performed.

The freezing point of battery electrolyte is dependent on the battery state of charge. Keeping the battery voltage above 12.4 volts will help prevent batteries from freezing, even at extremely low temperatures.

If the battery freezes, the internal grid may be damaged and the case will be distorted or cracked. If this happens, dispose of the battery according to local regulations.

Battery Charging

A battery charger designed for 12 volt charging systems is recommended. Follow the battery charger manufacturer's instructions to charge the battery to 12.6 volts (100% charge). Batteries should be charged at room temperature to avoid an undercharge or overcharge condition. Never attempt to charge a frozen battery.

The following table can be used to identify the approximate amount of time required to charge a discharged battery. Allow at least 60 minutes after operating the machine or charging the battery to get an accurate reading.

BATTERY VOLTAGE	STATE OF CHARGE	CHARGER MAXIMUM RATE		
		30 Amps	20 Amps	10 Amps
12.6 V	100%	READY TO USE		
12.4 V	75%	0.9 hr.	1.3 hr.	2.5 hr.
12.2 V	50%	1.9 hr.	2.7 hr.	5.1hr.
12.0 V	25%	2.9 hr.	4.3 hr.	7.8 hr.
11.8 V	0%	4.0 hr.	5.7 hr.	10.7 hr.

NOTE: Use a good quality automatic charger to avoid battery damage from overcharging.

WARNING

BATTERY GAS CAN EXPLODE AND CAUSE SERIOUS INJURY OR DEATH

Keep arcs, sparks, flames and lighted tobacco away from batteries. When *jumping* from booster battery make final connection (negative) at machine frame.

Do not jump start or charge a frozen or damaged battery. Warm battery to 16°C (60°F) before connecting to a charger. Unplug charger before connecting or disconnecting cables to battery. Never lean over battery while boosting, testing or charging.

W-2066-0910

ELECTRICAL SYSTEM (CONT'D)

Using A Booster Battery (Jump Starting)

IMPORTANT

If jump starting the excavator from a second machine:

When jump starting the excavator from a battery installed in a second machine, make sure the engine is **NOT** running while using the glow plugs. High voltage spikes from a running machine can burn out the glow plugs.

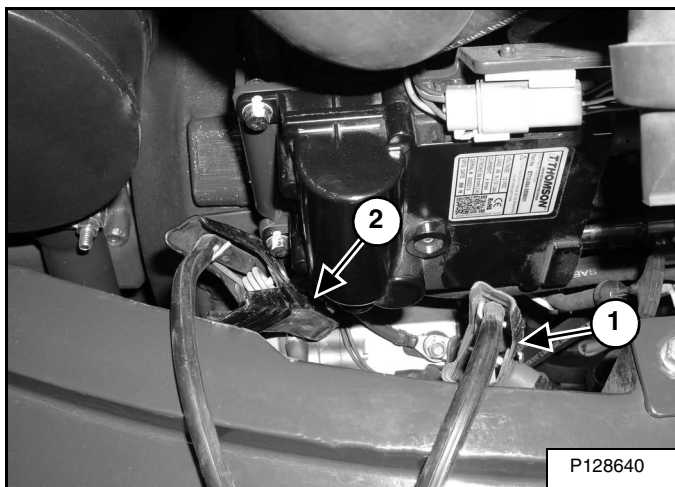
I-2060-0906

If it is necessary to use a booster battery to start the engine, **BE CAREFUL!** There must be one person in the operator's seat and one person to connect and disconnect the battery cables.

Be sure the key switch is OFF. The booster battery must be 12 volt.

Open the tailgate. (See TAILGATE on Page 86.)

Figure 157



Connect one end of the first cable to the positive (+) terminal of the booster battery. Connect the other end of the same cable to the positive (+) terminal (Item 1) [Figure 157] of the excavator starter.

Connect one end of the second cable to the negative (-) terminal of the booster battery. Connect the other end of the same cable to the starter mounting bolt (Item 2) [Figure 157].

Start the engine. After the engine has started, remove the earth (-) cable first (Item 2) [Figure 157].

Disconnect the cable from the excavator starter (Item 1) [Figure 157].

NOTE: (See Cold Temperature Starting on Page 60.)

IMPORTANT

Damage to the alternator can occur if:

- Engine is operated with battery cables disconnected.
- Battery cables are connected when using a fast charger or when welding on the excavator. (Remove both cables from the battery.)
- Extra battery cables (booster cables) are connected wrong.

I-2223-0903

! WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! **DO NOT** induce vomiting. Get prompt medical attention.

W-2065-0807

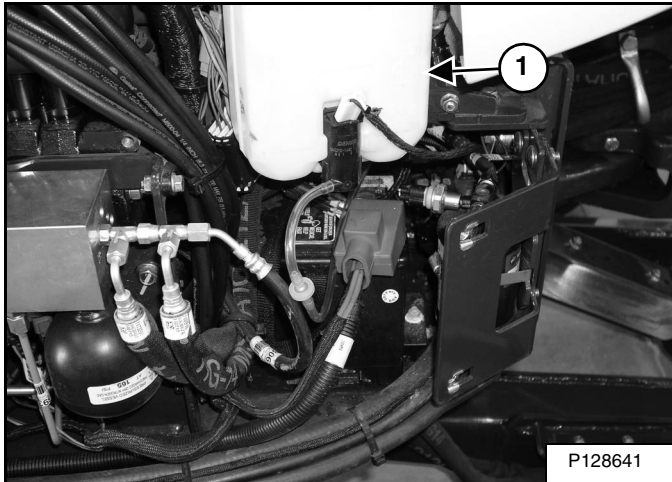
ELECTRICAL SYSTEM (CONT'D)

Removing And Installing The Battery

Open the right side cover. (See RIGHT SIDE COVER on Page 87.)

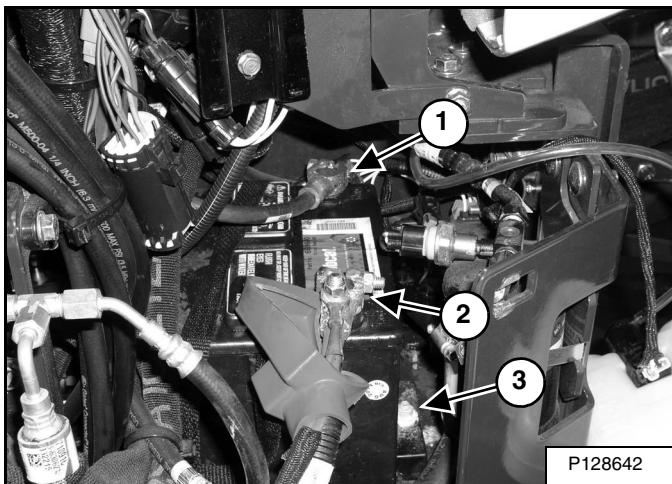
Remove the right side upperstructure cover. (See RIGHT SIDE PANEL on Page 87.)

Figure 158



Remove the washer bottle (item 1) [Figure 158] (if equipped) by lifting up on the bottle to remove from the retainer bracket. Set the bottle aside.

Figure 159



Disconnect the negative (-) cable (Item 1) [Figure 159] first.

Disconnect the positive (+) cable (Item 2) [Figure 159].

Remove the bolt (Item 3) [Figure 159] and remove the hold-down clamp.

Remove the battery.

Always clean the terminals and the cable ends, even when installing a new battery.

Install the battery. Install the hold-down clamp and tighten the bolts.

Connect the battery cables. Connect the negative (-) cable (Item 1) [Figure 159] last to prevent sparks.



WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

HYDRAULIC SYSTEM

Checking And Adding Hydraulic Oil

Figure 160

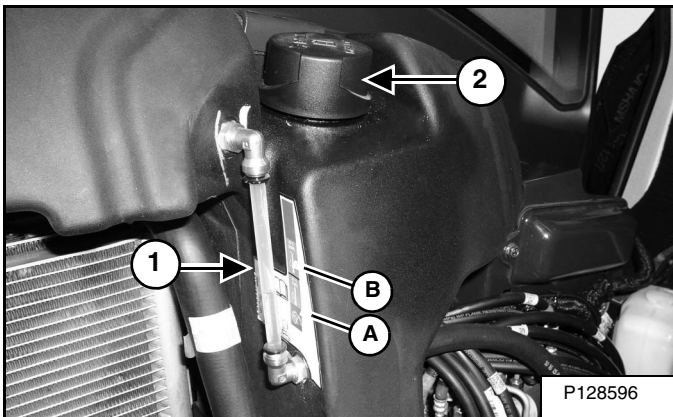


Park the machine on a flat level surface in the position shown **[Figure 160]**. (The preferred method is to check the hydraulic oil when it is cold.)

Retract the arm and bucket cylinders, put the bucket on the ground and lower the blade. Stop the engine.

Open the right side cover. (See RIGHT SIDE COVER on Page 87.)

Figure 161



Check the hydraulic oil level, it must be visible in the sight gauge (Item 1) **[Figure 161]**. The decal on the hydraulic tank shows the correct fill level.

A - Correct Oil Level COLD (Preferred)

B - Correct Oil Level HOT (Optional)

Clean the surface around the reservoir cap and remove the cap from the reservoir (Item 2) **[Figure 161]**.

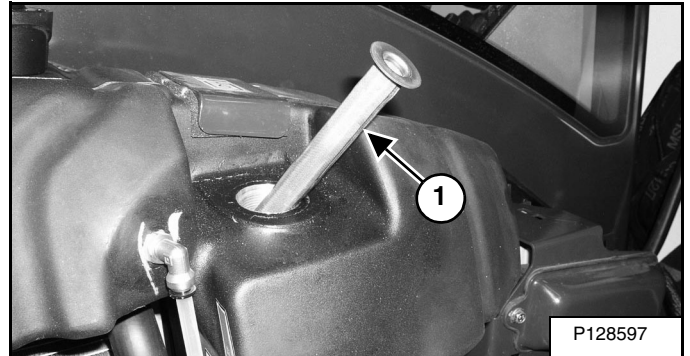
WARNING

AVOID INJURY OR DEATH

Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

Figure 162



Check the condition of the fill strainer screen (Item 1) **[Figure 162]**. Clean or replace as necessary.

Be sure the screen is installed before adding fluid.

Add the correct fluid to the reservoir until it is visible in the sight gauge. (See Hydraulic / Hydrostatic Fluid Chart on Page 109.)

Check the cap and clean as necessary. Replace the cap if damaged.

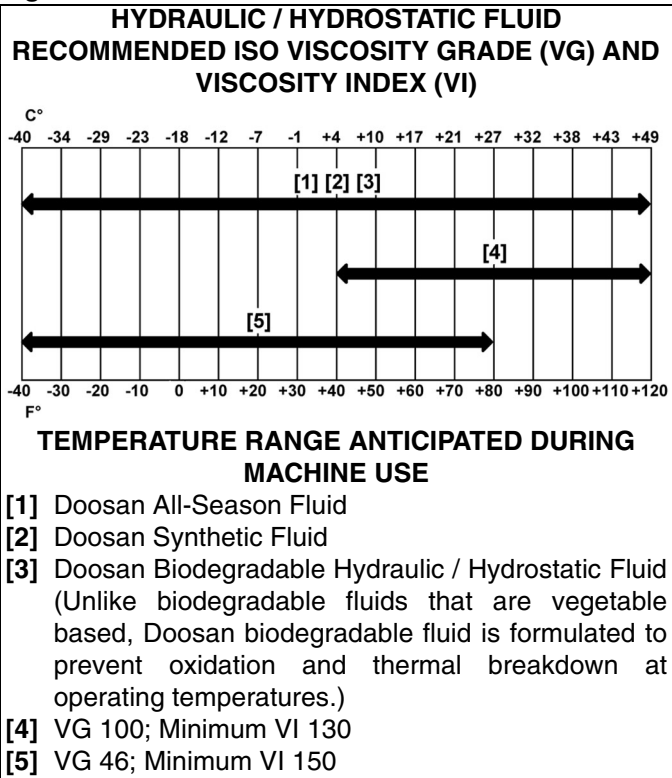
Install the cap.

Close the right side cover and tailgate.

HYDRAULIC SYSTEM (CONT'D)

Hydraulic / Hydrostatic Fluid Chart

Figure 163



Doosan hydraulic fluids are recommended for use in this machine. If Doosan hydraulic fluid is not available, use a good quality hydraulic fluid meeting the viscosity grade and viscosity index shown in the chart [Figure 163].

Removing And Replacing The Hydraulic Filters

**WARNING**

AVOID INJURY OR DEATH
Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

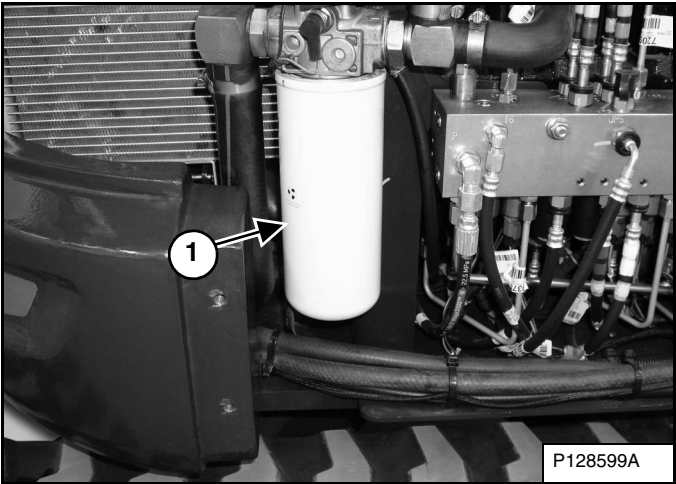
Hydraulic Filter

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 80.)

Remove the right side cover. (See RIGHT SIDE COVER on Page 87.)

For easier access to change the hydraulic filter, remove the lower right side panel. (See RIGHT SIDE PANEL on Page 87.)

Figure 164



Remove the hydraulic filter (Item 1) [Figure 164].

Clean the housing where the filter gasket makes contact.

Put clean hydraulic fluid on the gasket. Install the new filter and hand tighten only. Use a genuine Doosan replacement filter.

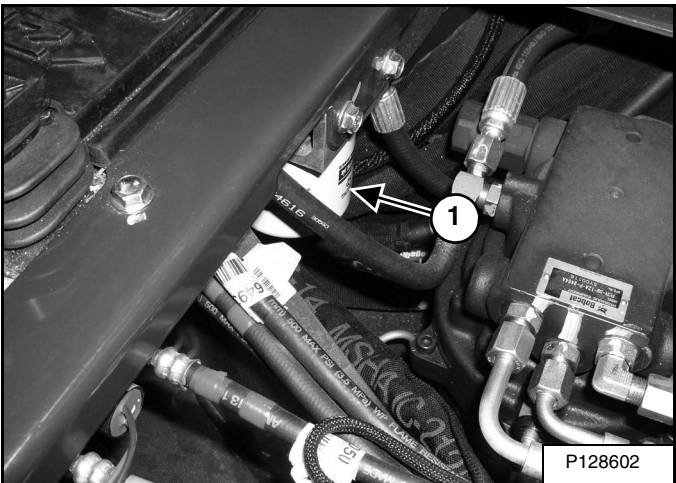
Recycle or dispose of the used hydraulic fluid in an environmentally safe manner.

Case Drain Filter

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 80.)

The case drain filter is located below the floorplate. Remove the floor mat. Remove the floorplate.

Figure 165



Remove the case drain filter (Item 1) [Figure 165].

Clean the housing where the filter gasket makes contact.

Put clean hydraulic fluid on the gasket. Install the new filter and hand tighten only.

Recycle or dispose of the used hydraulic fluid in an environmentally safe manner.

HYDRAULIC SYSTEM (CONT'D)

Removing And Replacing The Hydraulic Fluid

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 80.)

WARNING

AVOID INJURY OR DEATH

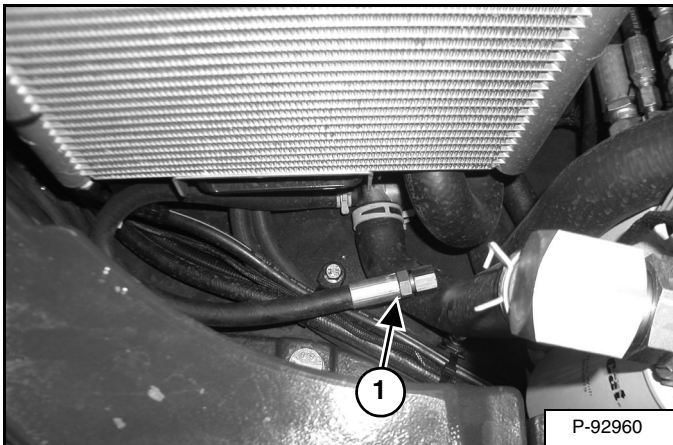
Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical attention from a doctor familiar with this injury.

W-2072-EN-0909

Retract the arm and bucket cylinders, lower the bucket to the ground. Stop the engine.

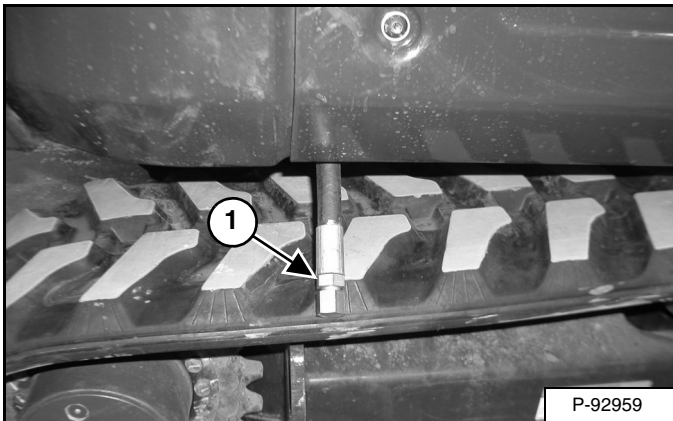
Open the tailgate. (See TAILGATE on Page 86.)

Figure 166



The hydraulic oil drain hose (Item 1) [Figure 166] is located below the oil cooler in the right rear corner of the upperstructure.

Figure 167



Reposition the drain hose out the bottom of the upperstructure and remove the cap (Item 1) [Figure 167].

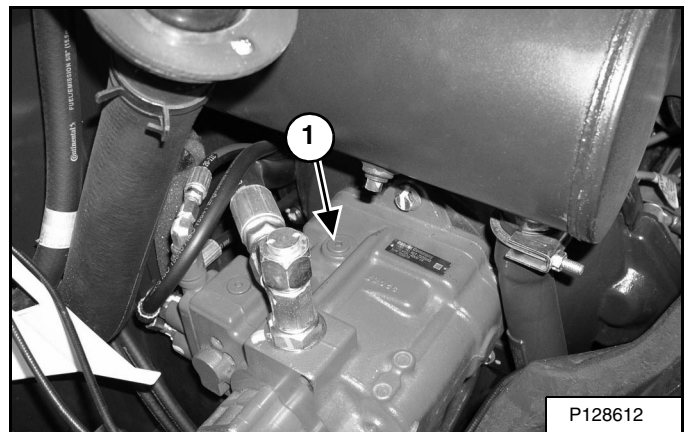
Drain the fluid into a container.

Recycle or dispose of the hydraulic fluid in an environmentally safe manner.

Install the cap (Item 1) [Figure 167] and position the drain hose back to the storage position (Item 1) [Figure 166].

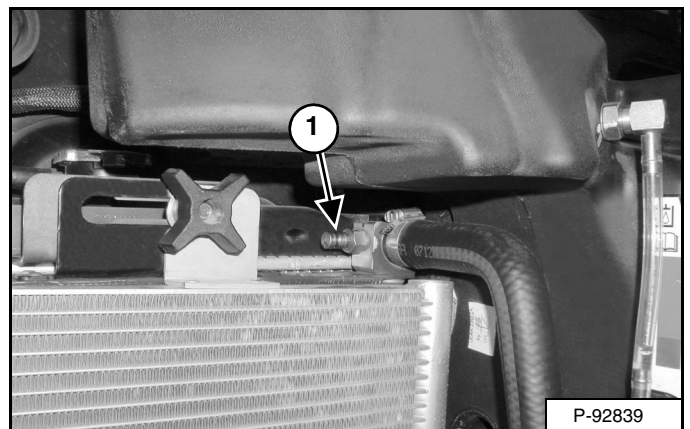
Add fluid to the reservoir. (See HYDRAULIC SYSTEM on Page 108.)

Figure 168



With the engine OFF, loosen the plug (Item 1) [Figure 168] on the hydraulic pump. Tighten the plug after a steady stream of hydraulic fluid, free of any air bubbles, drains from the plug. **DO NOT RUN THE MACHINE WITH THE PLUG OPEN.**

Figure 169



There is also a port (Item 1) [Figure 169] on the hydraulic cooler for bleeding air. Install a diagnostic coupler and hose on this fitting and to allow air to be bled from the hydraulic system after the hydraulic fluid has been replaced.

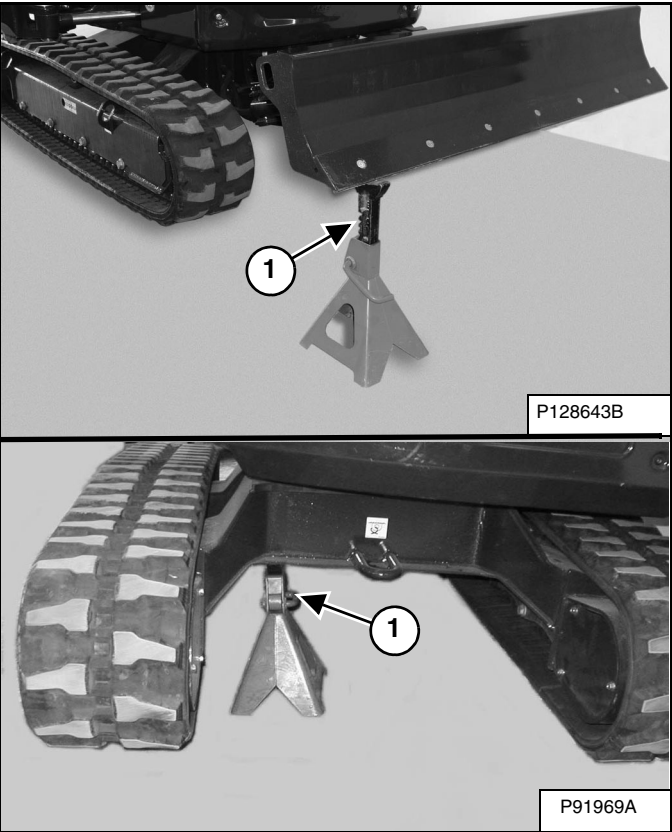
Start the engine and operate the machine through the hydraulic functions. Stop the engine. Check the fluid level and add as needed.

TRACK TENSION

NOTE: The wear of the pins and bushings on the undercarriage vary with the working conditions and the different types of soil conditions. It is necessary to inspect track tension and maintain the correct tension. See **SERVICE SCHEDULE** for the correct service interval. (See **SERVICE SCHEDULE** on Page 80.)

Adjusting

Figure 170



Raise one side of the machine (Approximately four inches) using the boom and arm.

Raise the blade fully and install jackstands under the blade and track frame (Item 1) [Figure 170]. Lower the boom until all machine weight is on the jackstands.

Stop the engine.

WARNING

AVOID INJURY

Keep fingers and hands out of pinch points when checking the track tension.

W-2142-0903

Rubber Track Clearance

Figure 171

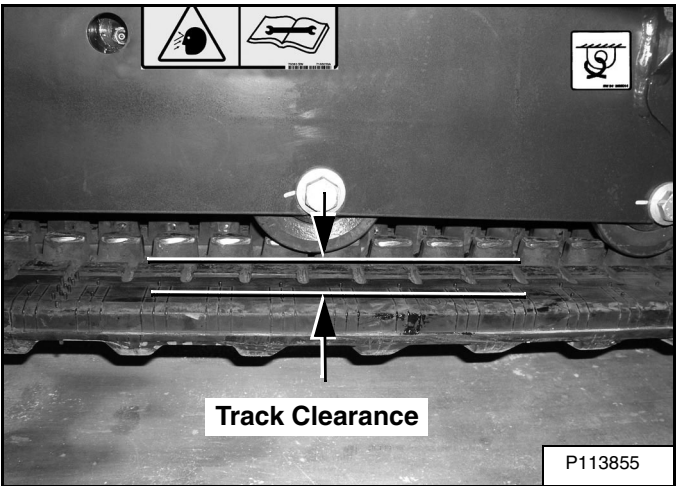
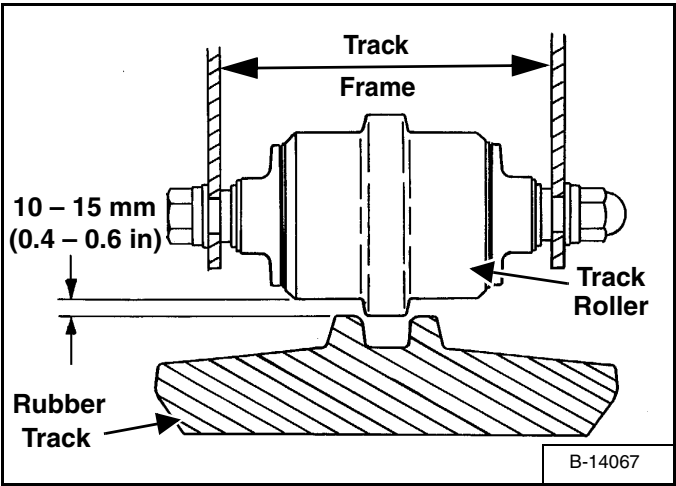


Figure 172



Measure the track clearance at the middle track roller. Do not get fingers into pinch points between the track and the track roller. Use a bolt or dowel of the appropriate size to check the gap between the contact edge of the roller and the top edge of the track guide [Figure 171] and [Figure 172].

Rubber Track Clearance	10 – 15 mm (0.4 – 0.6 in)
------------------------	------------------------------

TRACK TENSION (CONT'D)

Adjusting (Cont'd)

! WARNING

HIGH PRESSURE GREASE CAN CAUSE SERIOUS INJURY

- Do not loosen the track tension fitting more than 1 - 1/2 turns.

W-2994-0515

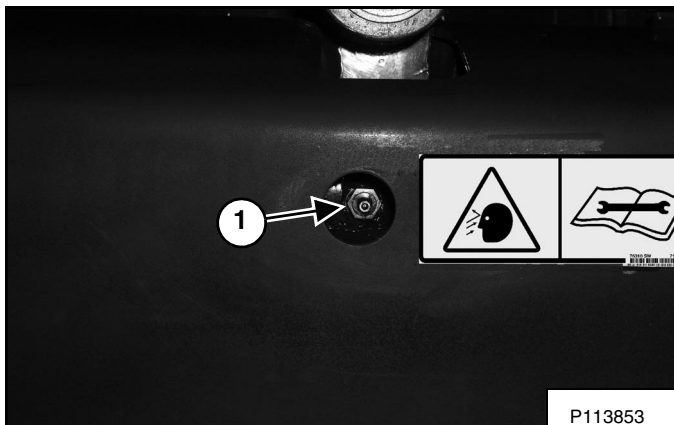
Use tool (P/N 7277225) (Item 1) [Figure 174] to loosen the tension fitting (Item 2) [Figure 173] to release tension from the track.

NOTE: Do not loosen the track tension fitting (Item 1) [Figure 173] more than 1-1/2 turns.

Installation: Tighten the track tension fitting to 23 N•m (17 ft-lb) torque.

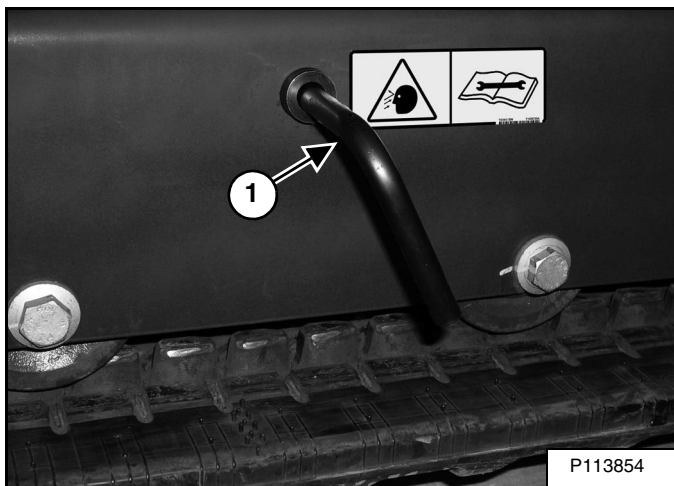
Repeat the procedure for the other side.

Figure 173



Add grease to the fitting (Item 1) [Figure 173] until the track tension is correct.

Figure 174



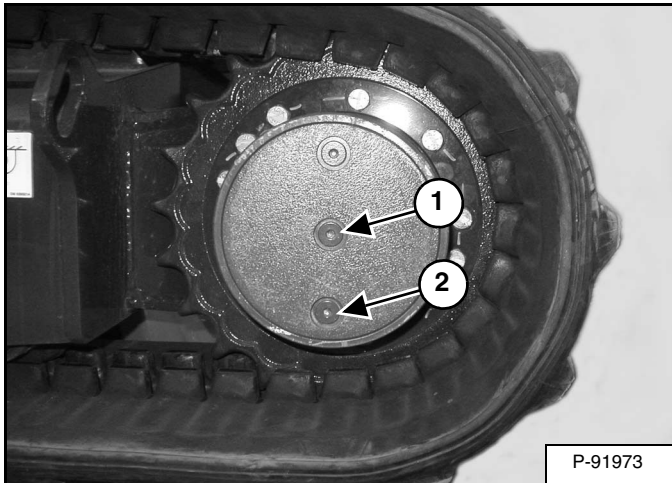
The tension removal tool (P/N 7277225) is available and recommended to direct the flow of grease to aid in cleanup. Always dispose of the grease in an environmentally friendly manner.

The tool is sized to fit the one piece track tension fitting (Item 1) [Figure 173].

TRAVEL MOTOR

Checking And Adding Oil

Figure 175



Park the excavator on a level surface with the plugs (Items 1 and 2) **[Figure 175]** in the vertical position as shown.

Remove the plug (Item 1) **[Figure 175]**. The lube level must be at the bottom edge of the hole.

Add lubricant (SAE 80W-90 API GL-5) through the hole if the lube level is low.

Removing And Replacing Oil

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 80.)

Park the excavator on a level surface with plugs (Items 1 and 2) **[Figure 175]** in the vertical position shown. Remove both plugs and drain the lubricant into a container.



WARNING

AVOID INJURY OR DEATH

Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

Install the bottom plug (Item 2) **[Figure 175]**. Add lubricant through the centre plug hole until the lube level is at the bottom edge of the hole.

Add lubricant (SAE 80W-90 API GL-5) through the hole if the lube level is low.

Install the plug (Item 1) **[Figure 175]**.

ALTERNATOR BELT

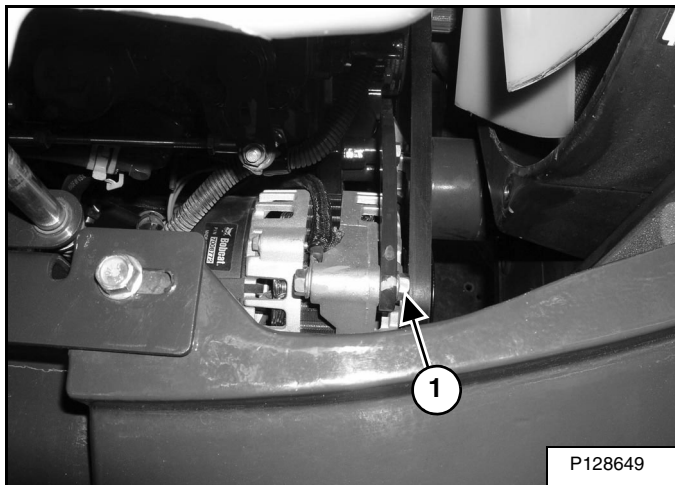
Belt Adjustment

The alternator belt is a special maintenance-free type that is pretensioned over the pulleys. This belt eliminates the need for a tensioning device and does not require periodic adjustment. Contact your Doosan dealer for replacement parts.

Belt Replacement

Stop the engine and open the tailgate. (See TAILGATE on Page 86.)

Figure 176



Loosen the bolt (Item 1) [Figure 176] and the lower alternator mounting bolt and nut (not shown).

Use a pry bar to take the pressure off of the bolt (Item 1) [Figure 176] and remove the top bolt.

Remove and replace the alternator belt.

Use the pry bar to position the alternator and install the bolt (Item 1) [Figure 176].

Tighten the top and bottom alternator mounting bolts.

Close the tailgate.

FAN BELT

Belt Adjustment

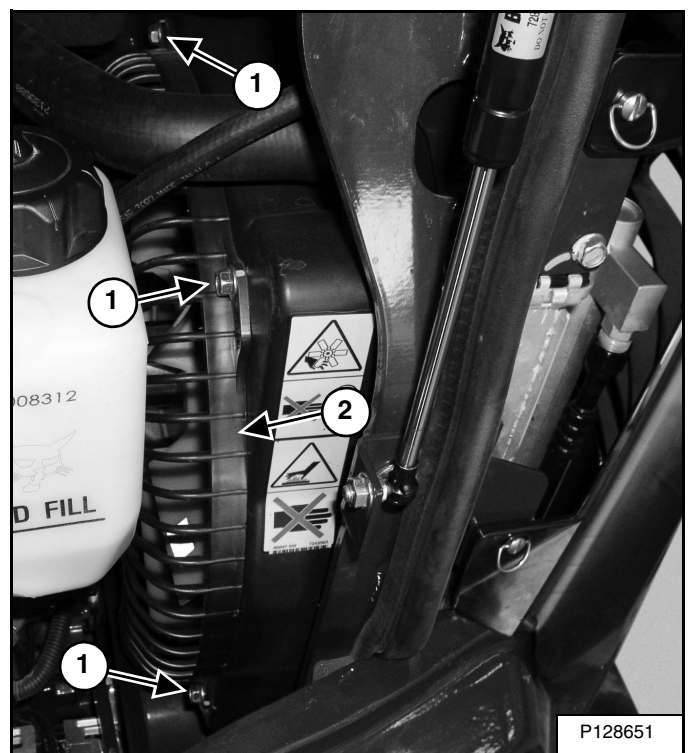
The fan belt is a special maintenance free type that is pretensioned over the pulleys. This belt eliminates the need for a tensioning device and does not require periodic adjustment. Contact your Doosan dealer for replacement parts.

Belt Replacement

Stop the engine and open the tailgate. (See TAILGATE on Page 86.)

Remove the alternator belt. (See ALTERNATOR BELT on Page 114.)

Figure 177

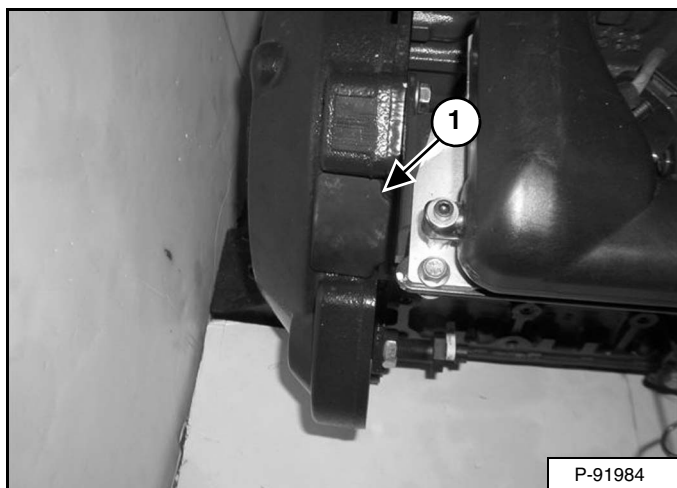


Remove the three bolts (Item 1) and the fan guard (Item 2) [Figure 177] for clearance for belt removal.

FAN BELT (CONT'D)

Belt Replacement (Cont'd)

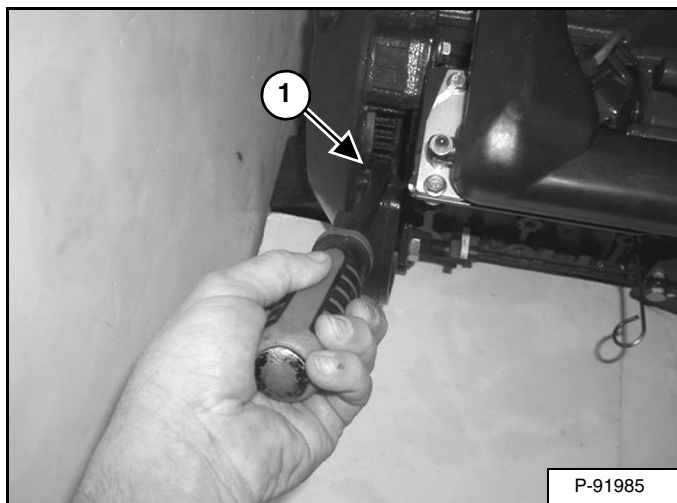
Figure 178



NOTE: The engine is removed from the machine for photo clarity only. This procedure can be performed with engine installed in machine.

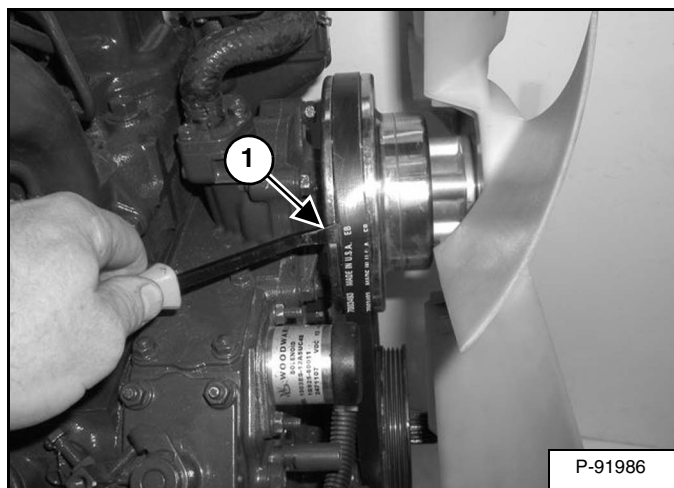
The engine will need to be rotated by hand to remove the fan belt. To access the flywheel, remove the plug (Item 1) [Figure 178] from the flywheel housing.

Figure 179



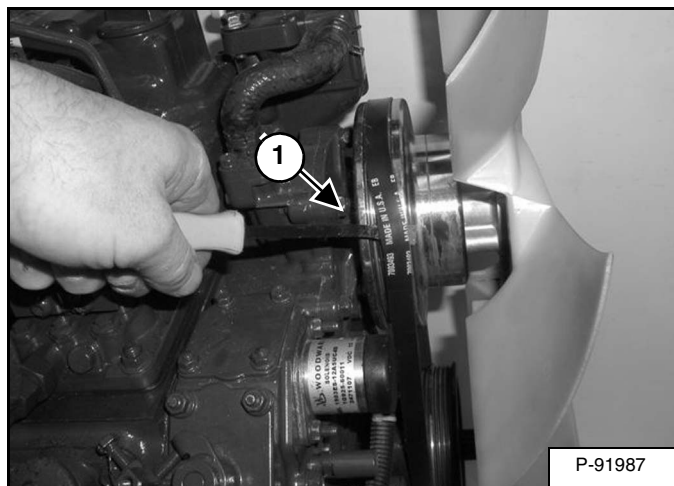
Install a pry bar (Item 1) [Figure 179] to the flywheel teeth.

Figure 180



Install a second pry bar (Item 1) [Figure 180] or flat blade screw driver between the belt and the water pump pulley.

Figure 181



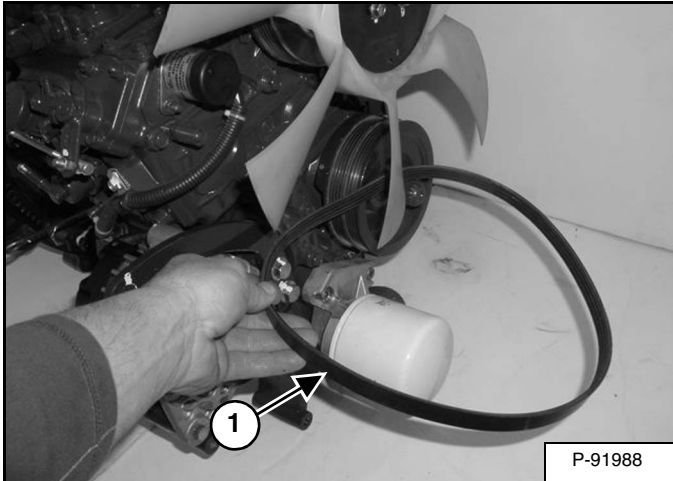
Using the pry bar (Item 1) [Figure 179] to rotate the engine, start to push the belt off of the pulley using the second pry bar (Item 1) [Figure 181].

Continue to manually rotate the engine until the belt is off the pulley.

FAN BELT (CONT'D)

Belt Replacement (Cont'd)

Figure 182

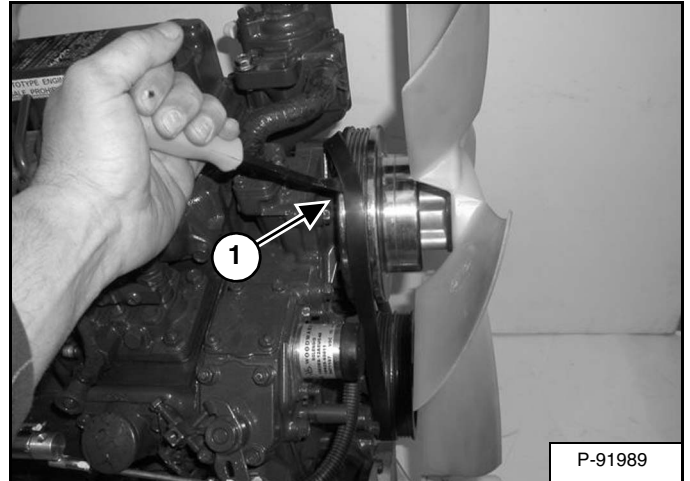


NOTE: Fan blades may be sharp, use care when removing the belt over the fan blades.

The belt (Item 1) [Figure 182] will need to be worked over the fan blades until it can be removed.

Install the new fan belt.

Figure 183



Position the belt over the water pump pulley and next to the engine block and align the lower part of the belt to the crankshaft pulley.

Using the pry bar (Item 1) [Figure 179] to rotate the engine and push the belt on the pulley using the second pry bar (Item 1) [Figure 183].

Continue rotating the engine until the belt is fully installed.

Install the flywheel plug (Item 1) [Figure 178].

Install the alternator belt. (See ALTERNATOR BELT on Page 114.)

Install the fan guard (Item 1) [Figure 177].

Close the tailgate.

BUCKET

Bucket Teeth Removal And Installation

WARNING

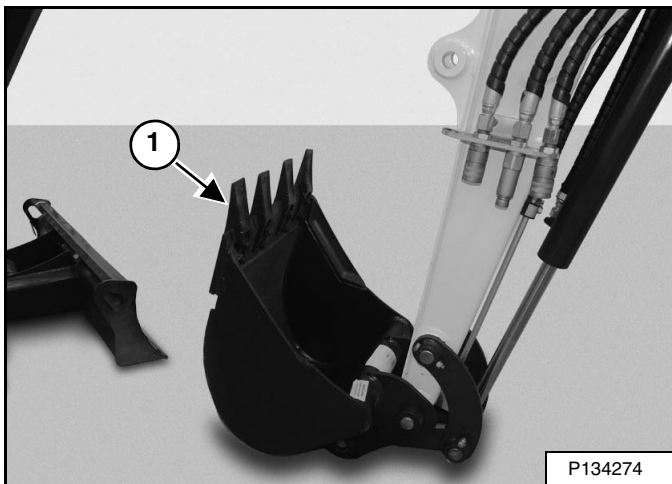
Wear safety glasses to prevent eye injury when any of the following conditions exist:

- Pressurised fluids and springs or other stored energy components.
- Flying debris or loose material is present.
- Engine is running.
- Tools are being used.

W-2505-EN-1009

Lower the boom until the bucket is fully on the ground.

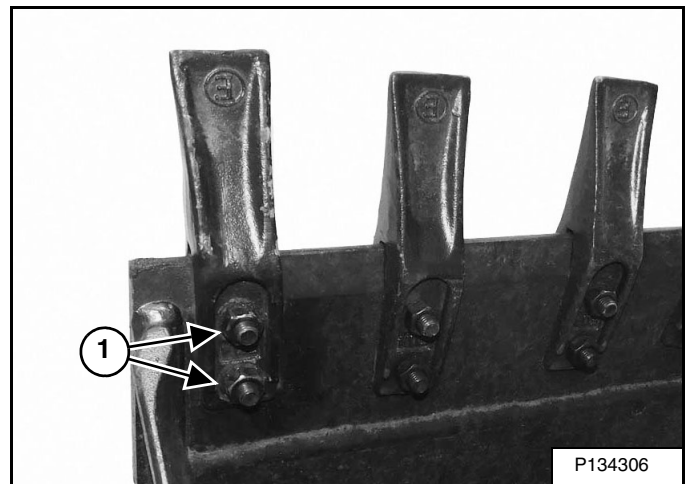
Figure 184



Position the bucket so the bucket teeth are pointed upwards at an angle convenient for accessing the teeth (Item 1) [Figure 184].

Stop the engine and exit the excavator.

Figure 185



Removal: Remove a tooth point by removing the two bolts and nuts (Item 1) [Figure 185].

Installation: Position the new tooth point on the bucket. Secure it with two bolts and nuts and tighten to 75 – 85 N•m (55 – 60 ft-lb).

TRACK ROLLER AND IDLER LUBRICATION

Procedure

The track rollers and idlers require no maintenance. The bearings are a sealed design.

LUBRICATION OF THE HYDRAULIC EXCAVATOR

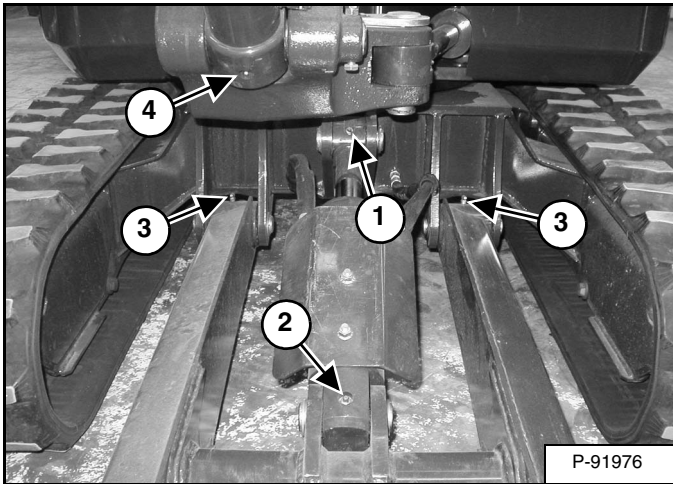
Lubrication Locations

Lubricate the excavator as specified in the SERVICE SCHEDULE for the best performance of the machine. (See SERVICE SCHEDULE on Page 80.)

Always use a good quality lithium based multipurpose grease when lubricating the machine. Apply the lubricant until extra grease shows.

Lubricate the following locations on the excavator EVERY 8 – 10 HOURS:

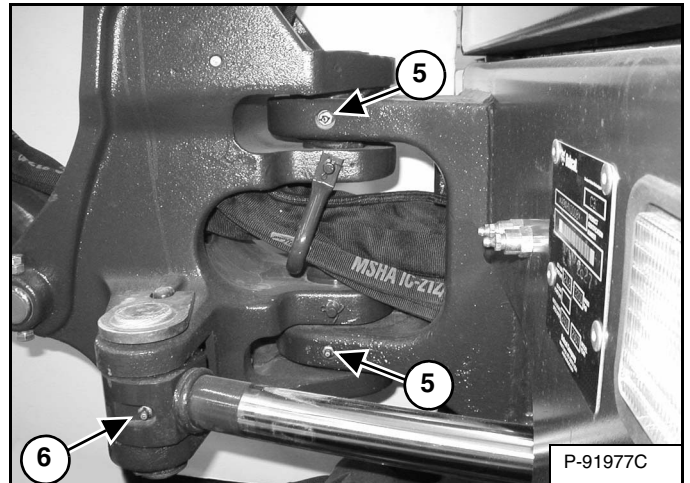
Figure 186



Ref Description (# of Fittings)

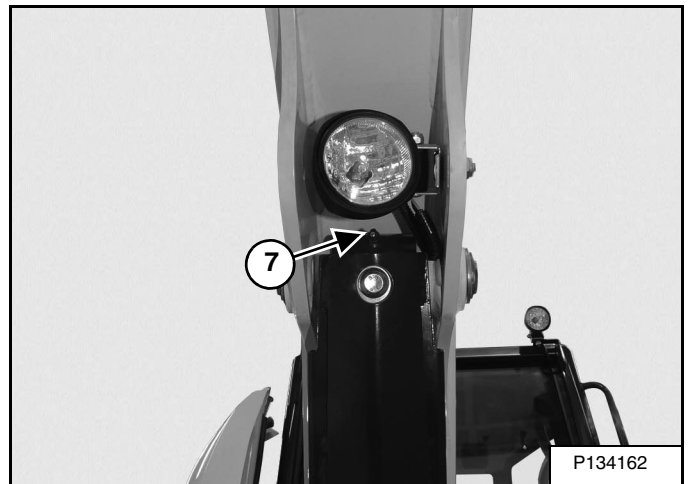
1. Blade Cylinder Rod End (1) [Figure 186]
2. Blade Cylinder Base End (1) [Figure 186]
3. Blade Pivots (2) [Figure 186]
4. Boom Cylinder Base End (1) [Figure 186]

Figure 187



5. Boom Swing Pivot (3) [Figure 187]
6. Boom Swing Cylinder Rod End (1) [Figure 187]

Figure 188

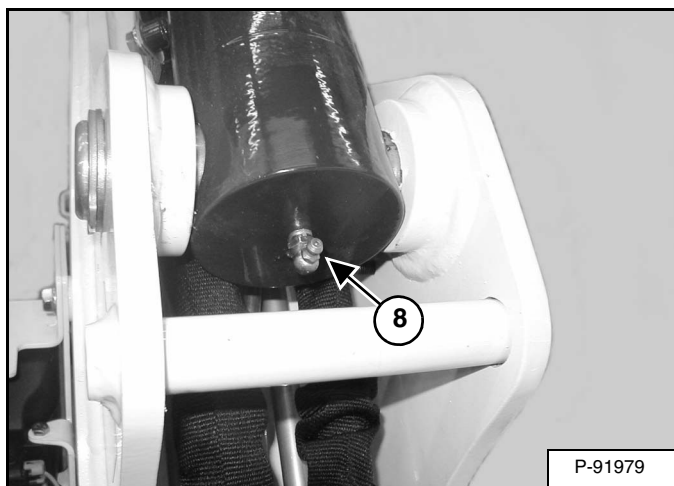


7. Boom Cylinder Rod End (1) [Figure 188]

LUBRICATION OF THE HYDRAULIC EXCAVATOR (CONT'D)

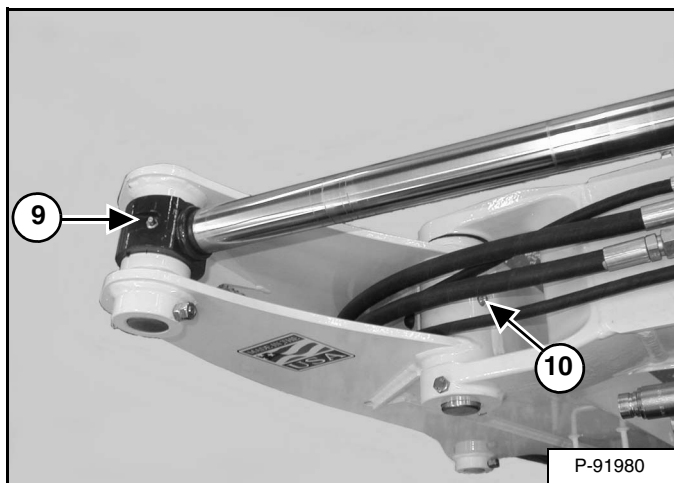
Lubrication Locations (Cont'd)

Figure 189



8. Arm Cylinder Base End (1) [Figure 189]

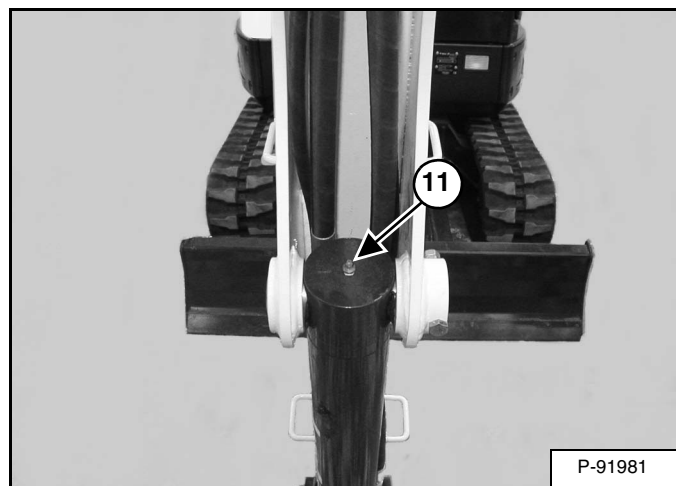
Figure 190



9. Arm Cylinder Rod End (1) [Figure 190]

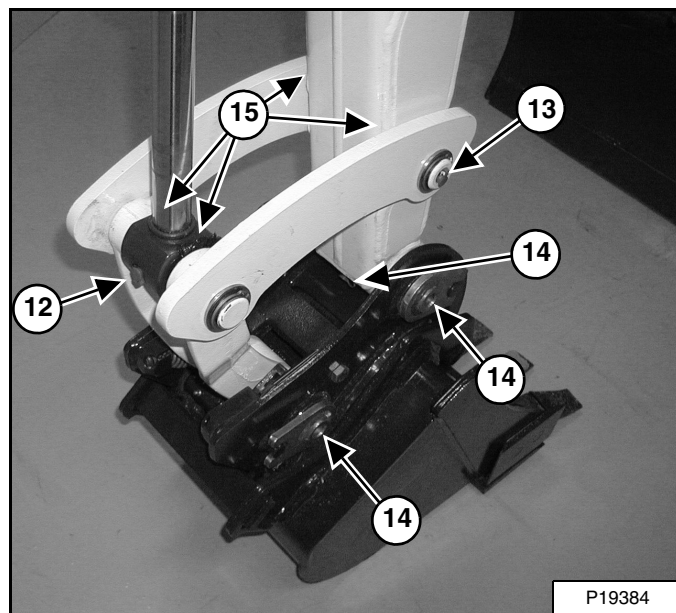
10. Arm Pivot (1) [Figure 190]

Figure 191



11. Bucket Cylinder Base End (1) [Figure 191]

Figure 192



12. Bucket Cylinder Rod End (1) [Figure 192]

13. Bucket Link Pin (1) [Figure 192]

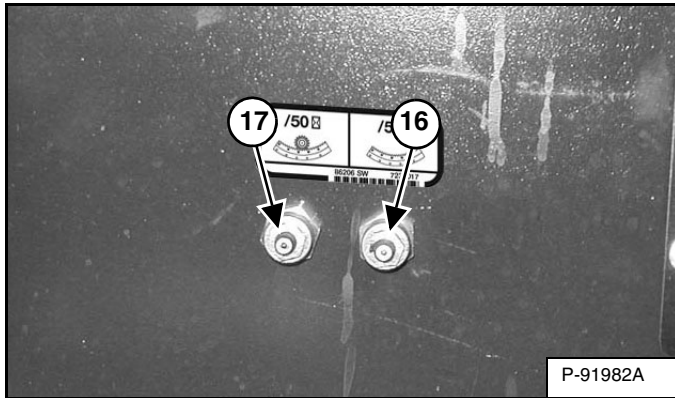
14. Bucket Pivot (3) [Figure 192]

15. Bucket Link - without extendable arm (2), with extendable arm (4) [Figure 192]

LUBRICATION OF THE HYDRAULIC EXCAVATOR (CONT'D)

Lubrication Locations (Cont'd)

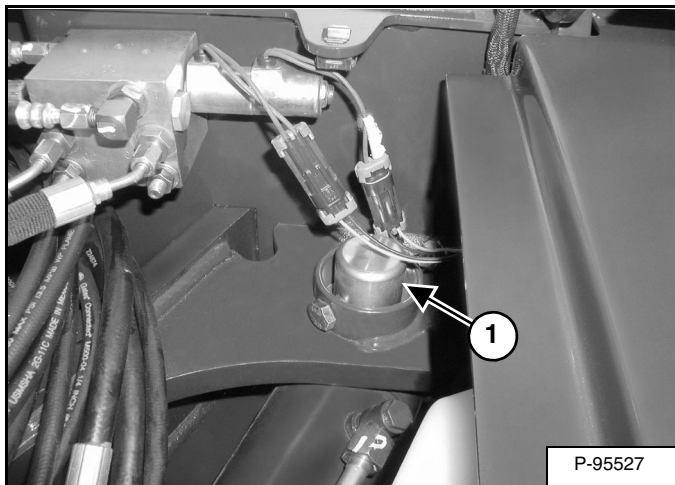
Figure 193



Lubricate the following locations on the hydraulic excavator **EVERY 50 HOURS**:

16. Swing Circle (1) [Figure 193]
17. Swing Pinion (1) [Figure 193]. (Install 3 to 4 pumps of grease then rotate the upperstructure 90°. Install 3 to 4 pumps of grease and again rotate the upperstructure 90°. Repeat this until the slew pinion has been greased at four positions.)

Figure 194



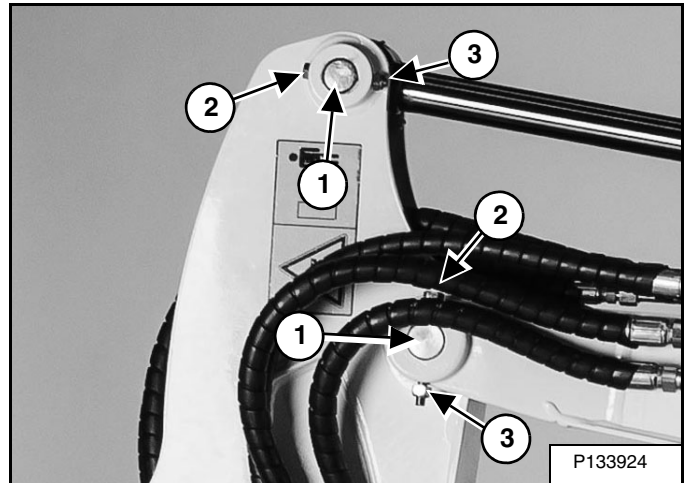
18. Boom Swing Cylinder Base End Pin (Item 1) [Figure 194]

NOTE: The boom swing cylinder base end does not have a grease fitting and uses a maintenance free bushing. No lubrication is required.

PIVOT PINS

Inspection And Maintenance

Figure 195



The pivots and cylinders (Item 1) have a large pin held in position with a bolt (Item 2) and a nut (Item 3) [Figure 195] securing the pin.

Installation: After the nut (Item 3) and bolt (Item 2) [Figure 195] are tightened together, the bolt should be free to spin.

EXCAVATOR STORAGE AND RETURN TO SERVICE

Storage

Sometimes it may be necessary to store your Doosan excavator for an extend period of time. Below is a list of items to perform before storage.

- Thoroughly clean the excavator including the engine compartment.
- Lubricate the excavator.
- Replace worn or damaged parts.
- Drive the excavator onto planks in a dry protected shelter.
- Lower the boom fully with the bucket flat on the ground.
- Put grease on any exposed cylinder rods.
- Put fuel stabiliser in the fuel tank and run the engine a few minutes to circulate the stabiliser to the pump and fuel injectors.
- Drain and flush the cooling system. Refill with premixed coolant.
- Replace all fluids and filters (engine, hydraulic).
- Replace all filters (i.e.: air cleaner, heater, etc.).
- Put all controls in neutral position.
- Remove the battery. Be sure the electrolyte level is correct then charge the battery. Store it in a cool dry place above freezing temperatures and charge it periodically during storage.
- Cover the exhaust pipe opening.
- Tag the machine to indicate that it is in storage condition.

Return To Service

After the Doosan excavator has been in storage, it is necessary to follow a list of items to return the excavator to service.

- Check the engine and hydraulic oil levels; check coolant level.
- Install a fully charged battery.
- Remove grease from exposed cylinder rods.
- Check all belt tensions.
- Be sure all shields and guards are in place.
- Lubricate the excavator.
- Remove cover from exhaust pipe opening.
- Start the engine and let run for a few minutes while observing the instrument panels and systems for correct operation.
- Drive the excavator off of the planks.
- Operate machine, check for correct function.
- Stop the engine and check for leaks. Repair as needed.

SYSTEM SETUP AND ANALYSIS

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 Reset127

DIAGNOSTIC SERVICE CODES

Viewing Service Codes

The Service Codes will aid your dealer in diagnosing conditions that can damage your machine.

Standard Instrument Panel

Figure 196



Press the Information button (Item 2) to cycle the data display (Item 1) [Figure 196] until the service code screen is displayed. If more than one service code is present, the codes will scroll on the data display.

When no service code is present, [NONE] is displayed [Figure 196].

NOTE: Corroded or loose earths can cause multiple service codes and / or abnormal symptoms. All instrument panel lights flashing, alarm sounding, headlights and taillights flashing, can indicate a bad earth. The same symptoms can apply if the voltage is low, such as loose or corroded battery cables. If you observe these symptoms, check earths and positive leads first.

DIAGNOSTIC SERVICE CODES (CONT'D)

Number Codes List

CODE		CODE	
E0105	Throttle actuator short to battery	M0116	Air Filter Not Connected
E0106	Throttle actuator short to earth	M0117	Air Filter Not Connected
E0107	Throttle actuator open circuit		
		M0216	Hydraulic Filter Not Connected
E0123	Throttle actuator not calibrated	M0217	Hydraulic Filter Plugged
E0321	5 volt supply out of range high	M0309	Battery Voltage Low
E0322	5 volt supply out of range low	M0310	Battery Voltage High
		M0311	Battery Voltage Extremely High
E0421	Throttle sensor out of range high	M0314	Battery Voltage Extremely Low
E0422	Throttle sensor out of range low	M0322	Battery Voltage Out of Range Low
E0521	Throttle actuator feedback out of range high	M0414	Engine Oil Pressure Extremely Low
E0522	Throttle actuator feedback out of range low	M0415	Engine Oil Pressure Shutdown
E3128	Interrupted power failure log only	M0610	Engine Speed High
		M0611	Engine Speed Extremely High
E3297	Controller programmed log only	M0613	Engine Speed No Signal
		M0615	Engine Speed Shutdown
H0104	Boom Angle Sensor, No Communication	M0618	Engine Speed Out of Range
H0204	Arm Angle Sensor, No Communication		
H0304	Bucket Angle Sensor, No Communication	M0710	Hydraulic Oil Temperature High
H0405	Arm Sensor Supply, Short to Battery	M0711	Hydraulic Oil Temperature Extremely High
H0406	Arm Sensor Supply, Short to Earth	M0715	Hydraulic Oil Temperature Shutdown
		M0721	Hydraulic Oil Temperature Out of Range High
H3128	Interrupted Power Failure	M0722	Hydraulic Oil Temperature Out of Range Low
H4423	Secondary Controller Not Programmed	M0810	Engine Coolant Temperature High
H4497	Secondary Controller Programmed	M0811	Engine Coolant Temperature Extremely High
		M0815	Engine Coolant Temperature Shutdown
H4621	5V Sensor Supply Out of Range High	M0821	Engine Coolant Temperature Out of Range High
H4622	5V Sensor Supply Out of Range Low	M0822	Engine Coolant Temperature Out of Range Low
		M0826	Engine Coolant Temperature Pre-Shutdown
H7404	Main Controller No Communication		
H7604	Display No Communication	M0909	Fuel Level Low
		M0921	Fuel Level Out of Range High
L0102	Lights Button Error On	M0922	Fuel Level Out of Range Low
L0202	High Flow Button Error On		
L0302	Auxiliary Button Error On	M1121	Console Sensor Out of Range High
L0402	Information Button Error On	M1122	Console Sensor Out of Range Low
		M1128	Console Sensor Failure
L7404	Gateway Controller No Communication		
		M1305	Fuel Hold Solenoid Short to Battery
L7672	Left Hand Panel Programming Error	M1306	Fuel Hold Solenoid Short to Earth
		M1307	Fuel Hold Solenoid Open Circuit

DIAGNOSTIC SERVICE CODES (CONT'D)

Number Codes List (Cont'd)

CODE		CODE	
M1402	Fuel Pull Output Error On	M2721	Throttle Sensor Out of Range High
M1403	Fuel Pull Output Error Off	M2722	Throttle Sensor Out of Range Low
M1407	Fuel Pull Output Open Circuit		
M1428	Fuel Pull Output Failure	M3128	Interrupted Power Failure
M1605	Hyd Bypass Short to Battery	M3204	Throttle Controller No Communication
M1606	Hyd Bypass Short to Ground	M3223	Throttle Controller Not Calibrated
M1607	Hyd Bypass Open Circuit	M3228	Throttle Controller Failure
		M3299	Throttle Controller Calibration In Process
M1705	Hydraulics Enable Solenoid Short to Battery		
M1706	Hydraulics Enable Solenoid Short to Earth	M3304	Deluxe Panel No Communication
M1707	Hydraulics Enable Solenoid Open Circuit		
M1732	Hydraulics Enable Solenoid Overcurrent	M3404	RFID Key Controller No Communication
M1802	PB Valve Output Error On	M3702	Hyd Exchange Output Error On
M1803	PB Valve Output Error Off	M3703	Hyd Exchange Output Error Off
M1807	PB Valve Output Open Circuit	M3904	Jog Shuttle No Communication
M1902	PB Valve Relay Error On	M4028	Wrong ECU Detected
M1903	PB Valve Relay Error Off	M4109	Alternator Low
		M4110	Alternator High
M2005	Two-Speed Solenoid Short to Battery		
M2006	Two-Speed Solenoid Short to Earth	M4304	Keyless Start Panel No Communication
M2007	Two-Speed Solenoid Open Circuit		
		M4404	Secondary Controller No Communication
M2102	Glow Plug Output Error On		
M2103	Glow Plug Output Error Off	M4621	5V Sensor Supply Out of Range High
M2107	Glow Plug Output Open Circuit	M4622	5V Sensor Supply Out of Range Low
M2128	Glow Plug Output Failure		
		M4721	8V Sensor Supply Out of Range High
M2202	Starter Output Error On	M4722	8V Sensor Supply Out of Range Low
M2203	Starter Output Error Off		
M2207	Starter Output Open Circuit	M4802	Light Relay Error On
M2228	Starter Output Failure	M4803	Light Relay Error Off
M2302	Starter Relay Error On	M5002	Light Output Error On
M2303	Starter Relay Error Off	M5003	Light Output Error Off
M2402	Fuel Pull Relay Error On	M5205	Offset Base Solenoid Short to Battery
M2403	Fuel Pull Relay Error Off	M5206	Offset Base Solenoid Short to Earth
		M5207	Offset Base Solenoid Open Circuit
M2521	Load Sense Sensor Out of Range High	M5232	Offset Base Solenoid Overcurrent
M2522	Load Sense Sensor Out of Range Low		
		M5305	Offset Rod Solenoid Error On
M2602	Glow Plug Relay Error On	M5306	Offset Rod Solenoid Short to Earth
M2603	Glow Plug Relay Error Off	M5307	Offset Rod Solenoid Open Circuit
		M5332	Offset Rod Solenoid Overcurrent

DIAGNOSTIC SERVICE CODES (CONT'D)**Number Codes List (Cont'd)**

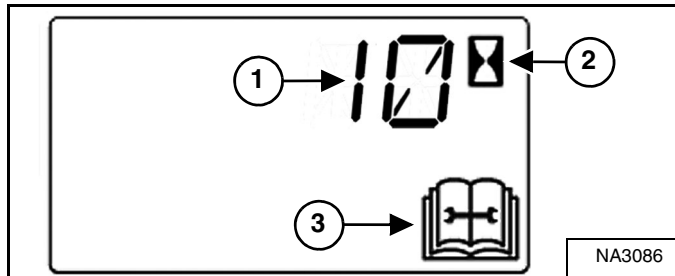
CODE		CODE	
M5505	Auxiliary Base Solenoid Short to Battery	M6505	ECU Power Short to Battery
M5506	Auxiliary Base Solenoid Short to Earth	M6506	ECU Power Short to Ground
M5507	Auxiliary Base Solenoid Open Circuit	M6507	ECU Power Open Circuit
M5532	Auxiliary Base Solenoid Overcurrent	M6604	ECU No Communication
M5605	Auxiliary Rod Solenoid Short to Battery	M6702	HVAC Output Error On
M5606	Auxiliary Rod Solenoid Short to Earth	M6703	HVAC Output Error Off
M5607	Auxiliary Rod Solenoid Open Circuit		
M5632	Auxiliary Rod Solenoid Overcurrent	M7002	Switched Power Output Error On
		M7003	Switched Power Output Error Off
M5810	Fuel Temperature High	M7007	Switched Power Output Open Circuit
M5811	Fuel Temperature Extremely High	M7028	Switched Power Output Failure
M5815	Fuel Temperature Shutdown		
M5826	Fuel Temperature Pre-Shutdown	M7423	Main Controller Not Programmed
		M7497	Main Controller Software Updated
M6021	Left Control Switch Out of Range High		
M6022	Left Control Switch Out of Range Low	M7604	Standard Display Panel No Communication
M6024	Left Control Switch Out of Neutral		
		M7748	Key Switch Multiple
M6121	Right Control Switch Out of Range High		
M6122	Right Control Switch Out of Range Low	M7839	Hourmeter Changed
M6124	Right Control Switch Out of Neutral		
		M8615	Engine Speed Derate Shutdown
M6204	Load Moment Sensor In Error	M8625	Engine Speed Derate Unresponsive
M6221	Load Moment Sensor Out of Range High		
M6222	Load Moment Sensor Out of Range Low	M8804	Telematics Not Connected
M6402	Switched Power Relay Error On	M9701	Turbo Prime Sequence Active
M6403	Switched Power Relay Error Off		
M6407	Switched Power Relay Open Circuit	R7404	No Communication To Main Controller

MAINTENANCE CLOCK

Description

The Maintenance Clock alerts the operator when the next service interval is due. *EXAMPLE:* The maintenance clock can be set to a 500 hour interval as a reminder for the next 500 hour planned maintenance.

Figure 197



During machine operation, a 2 beep alarm will sound when there are less than 10 hours until the next planned maintenance.

The remaining hours before maintenance is required (Item 1) will appear in the data display for 5 seconds while the service icon (Item 3) and the hourmeter icon (Item 2) [Figure 197] flash.

NOTE: The display will show negative numbers after counting down to zero.

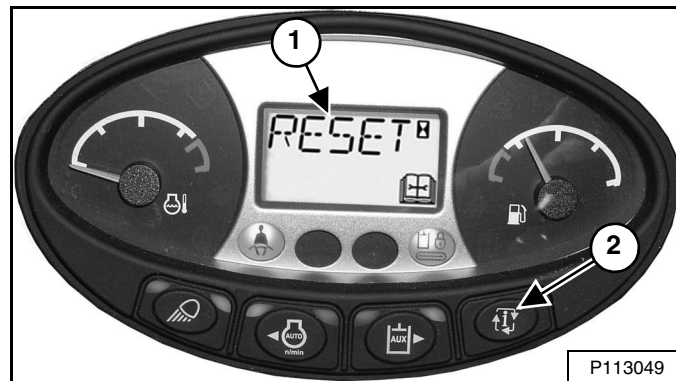
The display will revert to the previous display and will appear for 5 seconds every time the machine is started until the maintenance clock is reset.

Setup

See your Doosan dealer about installation of this feature.

Reset

Figure 198



Press the Information button (Item 2) [Figure 198] until the display screen shows the maintenance clock.

Press and hold the Information button (Item 2) for 7 seconds until [RESET] (Item 1) [Figure 198] appears in the display screen.

SPECIFICATIONS

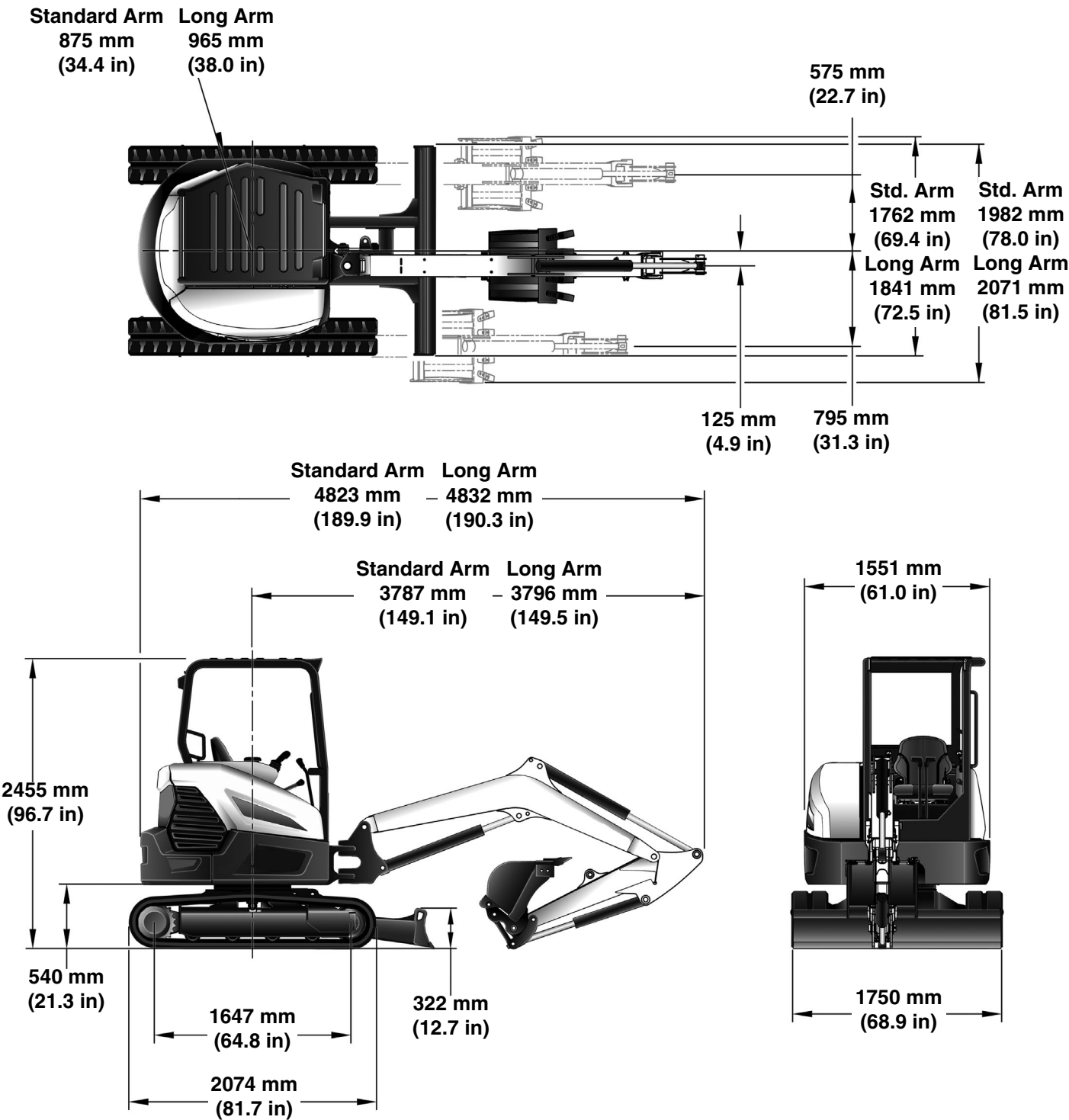
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Machine Dimensions - Standard Arm	130
Machine Dimensions - Long Arm	131
Rated Lift Capacity For Standard Arm, Medium Counterweight, and Cab	132
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Certain specification(s) are based on engineering calculations and are not actual measurements. Specification(s) are provided for comparison purposes only and are subject to change without notice. Specification(s) for your individual Doosan equipment will vary based on normal variations in design, manufacturing, operating conditions, and other factors.

EXCAVATOR SPECIFICATIONS

Machine Dimensions

- Where applicable, specifications conform to SAE or ISO standards and are subject to change without notice.

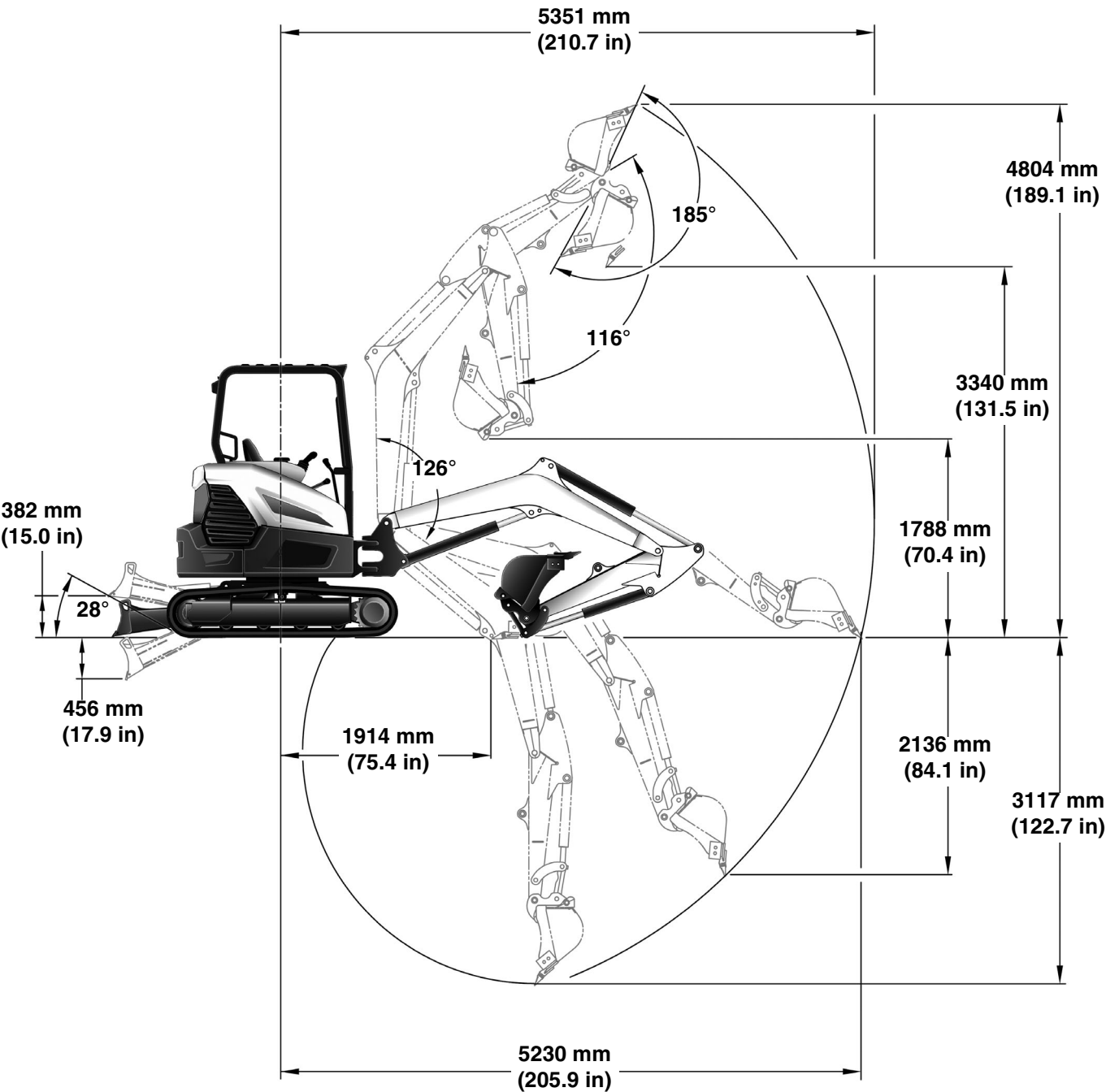


NA15186a

EXCAVATOR SPECIFICATIONS (CONT'D)

Machine Dimensions - Standard Arm

- Where applicable, specifications conform to SAE or ISO standards and are subject to change without notice.

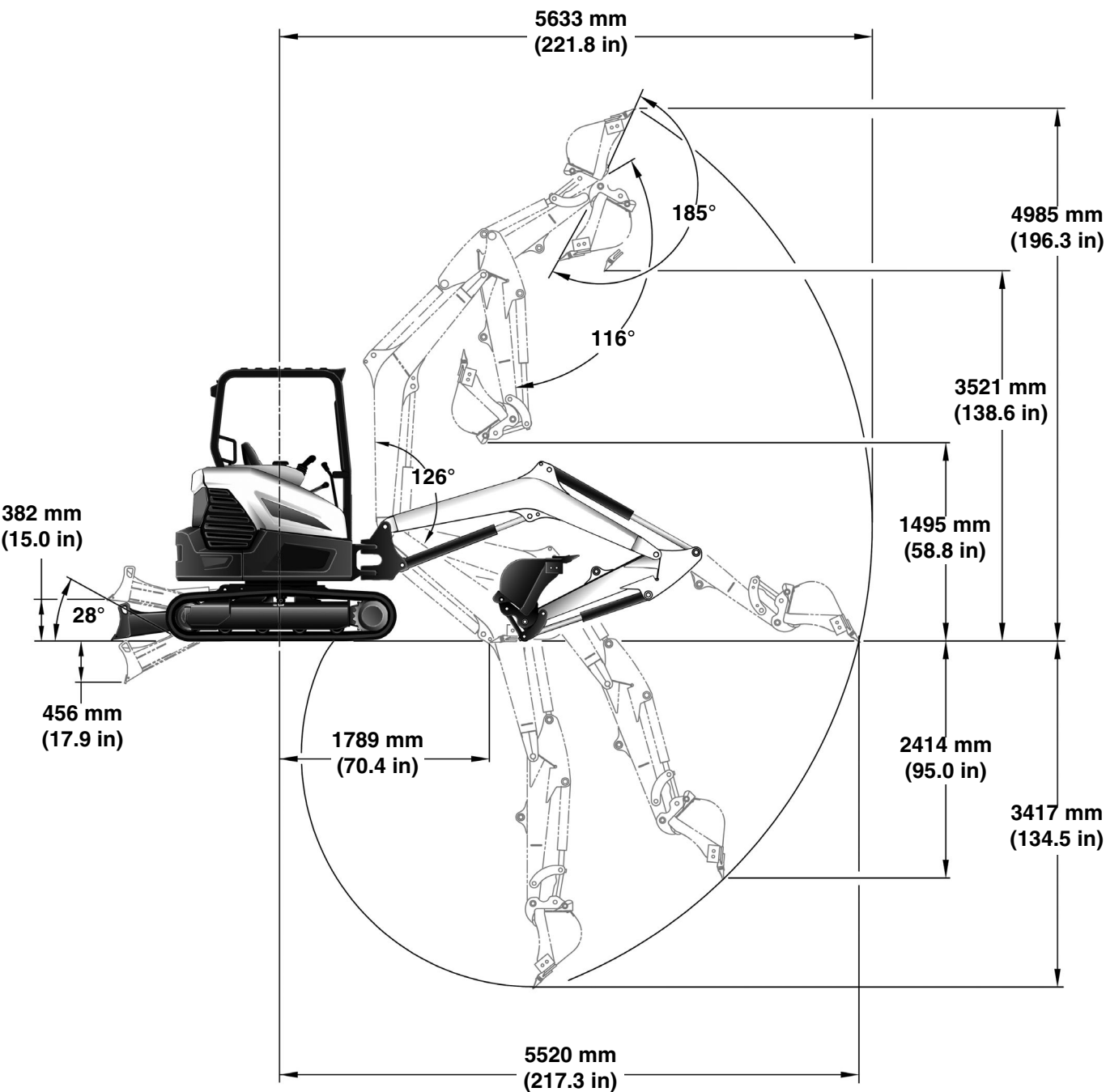


NA15189a

EXCAVATOR SPECIFICATIONS (CONT'D)

Machine Dimensions - Long Arm

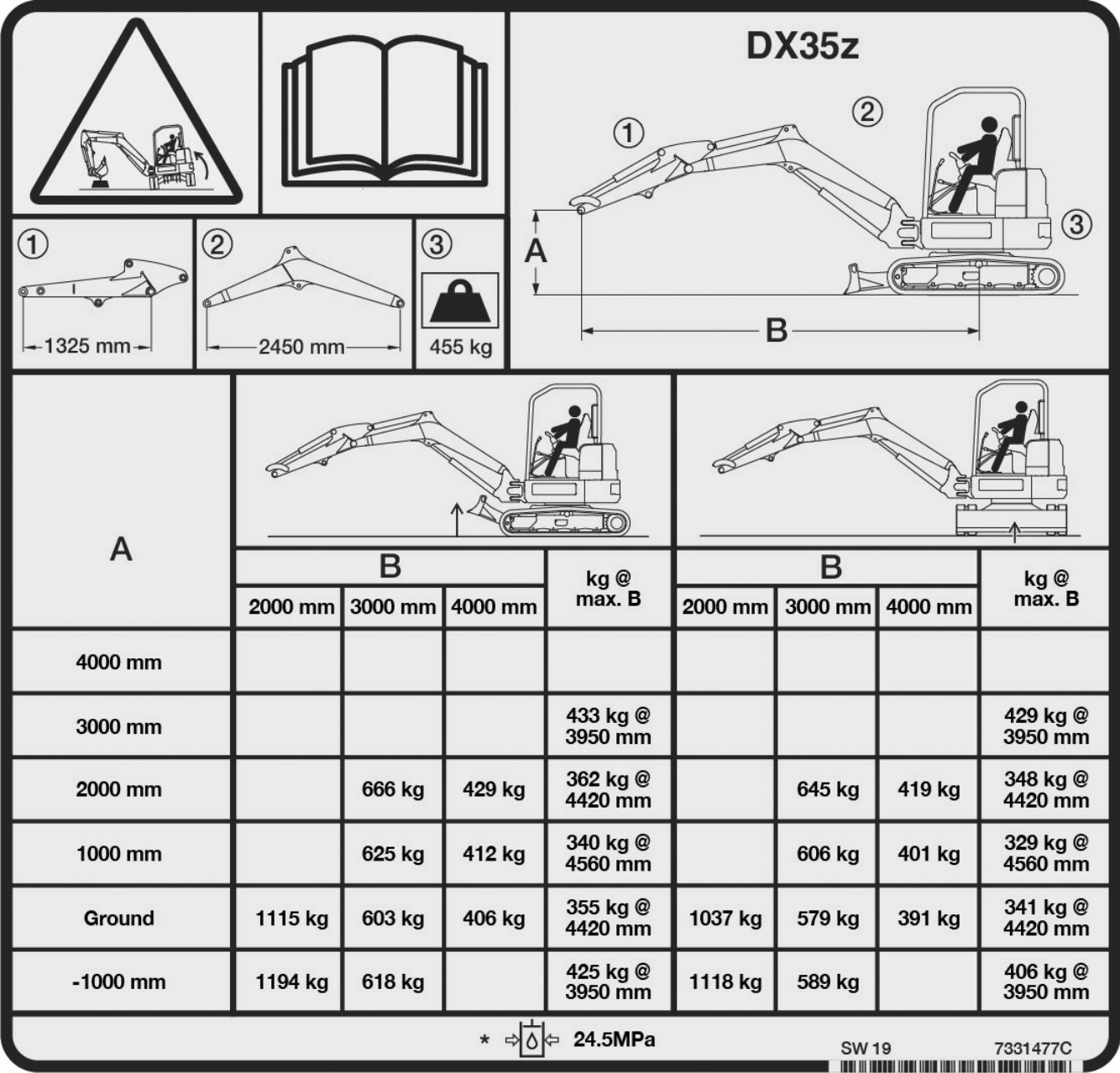
- Where applicable, specifications conform to SAE or ISO standards and are subject to change without notice.



NA15189a

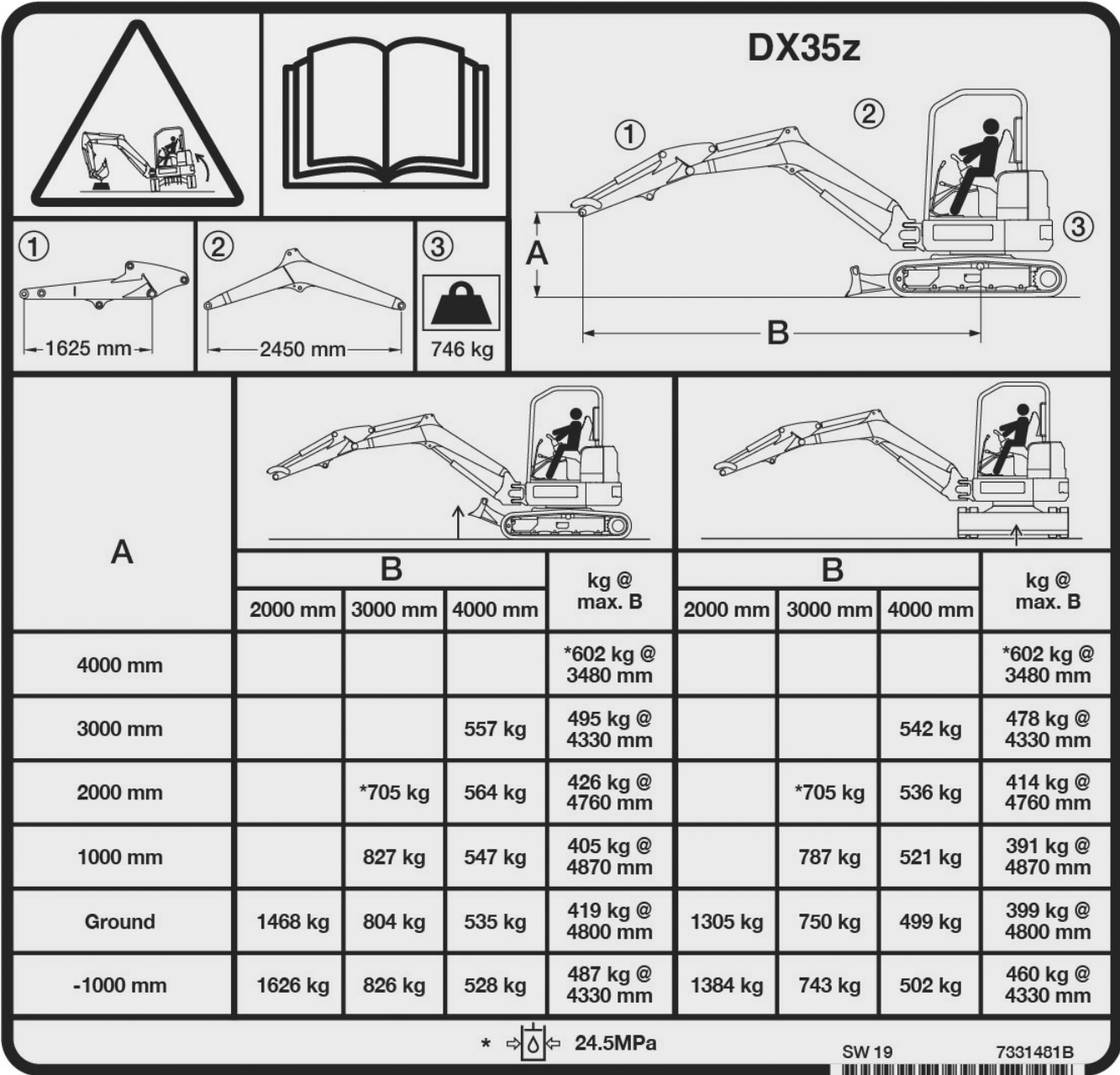
EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity For Standard Arm, Medium Counterweight, and Cab



EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity For Long Arm, Heavy Counterweight, and Cab



EXCAVATOR SPECIFICATIONS (CONT'D)

Performance

DX35z	
Operating weight (cab, standard arm, rubber tracks, medium counterweight, heating, standard bucket, and 75 kg operator)	3480 kg (7672 lb)
If equipped with the following:	Long Arm (with additional counterweight), add 303 kg (668 lb); Additional Counterweight, add 291 kg (642 lb)
Travel Speed (Low / High)	2,6 km/h / 4,7 km/h (1.6 mph / 2.9 mph)
Digging Force (per ISO 6015)	
With Standard Arm	Arm - 20790 N (4674 lbf) Bucket - 33430 N (7515 lbf)
With Long Arm	Arm - 18010 N (4049 lbf) Bucket - 33430 N (7515 lbf)

Controls

Steering	Two hand levers (optional foot pedals)
Hydraulics	Two hand operated levers (joysticks) control boom, bucket, arm and upperstructure slew
Blade	Hand lever
Two-Speed	Switch on blade lever
Boom Switch	Electric switch in left joystick
Auxiliary Hydraulics	Electric switch in right joystick
Auxiliary Pressure Release	Electric switch in right joystick
Engine	Engine speed control dial with auto idle feature, key type start switch
Starting Aid	Glow Plugs - activated by key switch
Brakes Travel Service & Parking Swing Service Holding	Hydraulic lock in motor circuit Hydraulic lock on motor Spring applied - hydraulic release

EXCAVATOR SPECIFICATIONS (CONT'D)

Engine

Make / Model	Kubota D1703-M-D1-E4B-BC-2 Stage 5
Fuel / Cooling	Diesel / Liquid
Horsepower: – Gross power (ISO 14396) – Gross power (SAE J1995) – Net power (SAE J1349)	18,2 kW (24.4 hp) @ 2200 rpm 18,5 kW (24.8 hp) @ 2200 rpm 17,9 kW (24.1 hp) @ 2200 rpm
Torque: – Gross torque (SAE J1995) – Net torque (SAE J1349)	97,4 N•m (71.8 lb-ft) @ 1500 rpm 94,6 N•m (69.7 lb-ft) @ 1600 rpm
Number Of Cylinders	3
Displacement	1,642 L (100.2 in ³)
Bore / Stroke	87,0 x 92,4 mm (3.43 x 3.64 in)
Lubrication	Pressure System with Filter
Crankcase Ventilation	Closed Breathing
Air Cleaner	Dry replaceable paper dual cartridge
Ignition	Diesel-Compression
Low Idle Speed	1200 – 1350 rpm
High Idle Speed	2350 – 2450 rpm
Engine Coolant	Propylene Glycol / water mixture (53% PG / 47% water)

Hydraulic System

Pump Type	Engine driven, single outlet, variable displacement, load sensing, torque limited, piston pump
Pump Capacity Piston Pump Gear Pump - Pilot	92,4 L/min (24.4 U.S. gpm) 8,8 L/min (2.3 U.S. gpm)
Auxiliary Flow (Aux3)	63,9 L/min (16.9 U.S. gpm)
Auxiliary Flow - 2nd Aux (Female coupler) (Male Coupler)	20,3 L/min (5.4 U.S. gpm) 15,0 L/min (4.0 U.S. gpm)
Hydraulic Filter	Full flow replaceable, 3 micron synthetic media element
Control Valve	9 spool closed centre individually compensated
System Relief Pressure Slew Circuit Boom, Boom Swing Bucket, Arm, Auxiliary Blade Joystick Control Pressure	24100 kPa (241 bar) (3495 psi) 24500 kPa (245 bar) (3550 psi) 24500 kPa (245 bar) (3550 psi) 24500 kPa (245 bar) (3550 psi) 3000 kPa (30 bar) (428 psi)
Auxiliary Relief	20600 kPa (206 bar) (2987 psi)
Arm Port Relief, Base End And Rod End	27000 kPa (270 bar) (3916 psi)
Boom Port Relief, Base End	29000 kPa (290 bar) (4206 psi)
Boom Port Relief, Rod End	27000 kPa (270 bar) (3916 psi)
Bucket Port Relief Base End And Rod End	27000 kPa (270 bar) (3916 psi)
Blade Port Relief Base End	27000 kPa (270 bar) (3916 psi)
Main Hydraulic Filter Bypass	340 kPa (3,4 bar) (50 psi)
Case Drain Filter Bypass	120 – 160 kPa (1,2 – 1,6 bar) (18 – 23 psi)

EXCAVATOR SPECIFICATIONS (CONT'D)

Hydraulic Cycle Times

Bucket Curl	2,7 Seconds
Bucket Dump	1,9 Seconds
Arm Retract	2,9 Seconds
Arm Extend	2,4 Seconds
Boom Raise	4,4 Seconds
Boom Lower	5,1 Seconds
Boom Swing Left	7,0 Seconds
Boom Swing Right	7,2 Seconds
Blade Raise	3,6 Seconds
Blade Lower	4,0 Seconds

Hydraulic Cylinders

Cylinder	Bore	Rod	Stroke
Boom (cushion up)	76,2 mm (3.00 in)	44,5 mm (1.75 in)	670 mm (26.38 in)
Arm (cushion retract / extend)	76,2 mm (3.00 in)	44,5 mm (1.75 in)	607 mm (23.90 in)
Bucket	69,9 mm (2.75 in)	44,5 mm (1.75 in)	466,3 mm (18.36 in)
Boom Swing	82,6 mm (3.25 in)	44,5 mm (1.75 in)	459,9 mm (18.11 in)
Blade	88,9 mm (3.50 in)	44,5 mm (1.75 in)	184 mm (7.25 in)

Drive System

Final Drive	Each track is driven by hydrostatic axial piston motor
Type of Reduction	48.6:1 two stage planetary

Slew System

Slew Motor	Axle piston connected to a planetary drive
Slew Circle	Single row shear type ball bearing with internal gear
Slew Speed	8,6 rpm

Undercarriage

Crawler Track Design	Sealed track rollers with boxed section track roller frame, grease type track adjuster with shock absorbing recoil spring
Width of crawler	1550 mm (61.0 in)

EXCAVATOR SPECIFICATIONS (CONT'D)

Electrical

Starting Aid	Glow Plugs
Alternator	12 volt, 90 Amp open frame w / internal regulator
Battery	12 volt - 500 CCA @ -18°C (0°F)
Starter	2,0 kW (12 volt; gear reduction 2.7 hp)
Lights	37,5 watt (2)
Instrumentation	<p>Gauges: Engine Coolant Temperature, Fuel Level.</p> <p>Warning lights: Fuel Level, Seat Belt, Engine Coolant Temperature, Engine Malfunction, Hydraulic System Malfunction, General Warning.</p> <p>Indicators: Two-Speed, Engine Preheat.</p> <p>Data Display: Operating Hours, Engine rpm, Maintenance Clock Countdown, Battery Voltage, Service Codes, Engine Preheat.</p> <p>Other: Audible Alarm, Lights.</p> <p>Optional Deluxe Instrumentation Panel: *Additional displays for: Engine rpm, Coolant Temperature and Oil Pressure; System Voltage and Hydraulic Oil Temperature. *Additional Features Included: Keyless Start, Digital Clock, Job Clock, Password Lockout, Multi-language Display, Help Screens, Diagnostic Capability and Engine / Hydraulic Systems Shutdown Function.</p>

Capacities

Fuel Tank	52,0 L (13.7 U.S. gal)
Hydraulic Reservoir Only (Centre of Sight Glass)	Tank Cap. 8,3 L (2.2 U.S. gal)
Hydraulic System (with Reservoir)	39,7 L (10.5 U.S. gal)
Cooling System	8,0 L (2.1 U.S. gal)
Engine Oil and Filter	5,2 L (5.5 qt)
Final Drive (each)	0,5 L (0.55 qt)

Tracks

Type	Rubber
Width	300 mm (11.8 in)
Number Of Shoes	Single Assembly
Number of Track Rollers (per side)	3

Ground Pressure

Rubber Tracks - Standard Arm	31,66 kPa (0,3166 bar) (4.59 psi)
Long Arm, Heavy Counterweight	34,41 kPa (0,3441 bar) (4.99 psi)

EXCAVATOR SPECIFICATIONS (CONT'D)

Environmental

DECLARED SINGLE-NUMBER NOISE EMISSION VALUES In accordance with ISO 4871	
Noise level per Directive 2000/14/EC - L_{wA}	94 dB(A)
Operator noise level per Directive 2006/42/EC - L_{pA} (Cab)	78 dB(A)

DECLARED VIBRATION EMISSION VALUES In accordance with EN 12096		
		Uncertainty
Whole-body vibration per ISO 2631-1	0,11 m/s ² (0.36 ft/s ²)	–
Hand-arm vibration per ISO 5349-1	0,34 m/s ² (1.12 ft/s ²)	–

Machines equipped with optional HVAC (air conditioning) contain fluorinated greenhouse gas (F-gas)	
F-gas type	HFC-134a
F-gas mass (kg)	0,77
CO ₂ equivalent (t)	1,10
GWP	1430

ENGINE CO ₂ EMISSION VALUES	
CO ₂ emission	938,3 g/kWh
This CO ₂ measurement results from testing over a fixed test cycle under laboratory conditions a(n) (parent) engine representative of the engine type (engine family) and shall not imply or express any guarantee of the performance of a particular engine.	

Temperature Range

Operation and storage	-17° – +43°C (-1.3° – +109.4°F)
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WARRANTY

WARRANTY	140
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WARRANTY

DOOSAN CRAWLER MINI EXCAVATORS

Doosan Infracore Europe B.V. ("Doosan") warrants to its authorized dealers who in turn warrants to the customer that each new Doosan Crawler Mini Excavator will be free from defects in material and workmanship for 24 months from the date of delivery to the customer or 2,000 hours of machine usage, whichever occurs first. During the warranty period, the authorised Doosan dealer shall repair or replace, at Doosan's option, without charge for parts, labour and travel of technicians, any part of the Doosan product which fails because of defects in material or workmanship. The customer shall provide the authorised Doosan dealer with prompt written notice of the defect and allow reasonable time for replacement or repair. Doosan may, at its option, request failed parts to be returned to the factory or to any other designated location. Transport of the Doosan product to the authorised Doosan dealer for warranty work is not the responsibility of Doosan. Service schedules must adhere to prescribed intervals and Doosan genuine parts / lubricants must be used. For coverage on engines, consult your Doosan Dealer. For non-covered items, the customer shall refer solely to the warranty, if any, of the respective manufacturers thereof, in accordance with the respective manufacturers warranty statement. Some Doosan parts are covered pro-rata depending on the expected lifetime of the part. Coverage for batteries, air-conditioning refill, couplers and ignition system parts (glow plugs, fuel injection pumps, injectors) is limited as failures generally originate from factors not under Doosan's control, such as, but not limited to, prolonged storage, abuse or fuel quality. The warranty does not cover: (i) Oils and lubricants, coolant fluids, filter elements, brake linings, tune-up parts, bulbs, fuses, alternator fan belts, drive belts, pins, bushings and other high-wear items. (ii) Damages resulting from abuse, accidents, alterations, use of the product with any bucket or attachment not approved by Doosan, air flow obstructions, or failure to maintain or use the Doosan product according to the instructions applicable to it. (iii) Ground engaging parts such as bucket teeth and cutting edges. (iv) Fuel or hydraulic system cleaning, engine tune-up, brake inspection or adjustment. (v) Adjustments or slight defects which generally do not affect the stability or reliability of the machine. Without prejudice to the rights of the customer in the products, customer agrees that Doosan and the retailing dealer, without further notice to customer, have the right to: (a) Access, use, collect and disclose any data generated by, collected by, or stored in, products or any hardware or devices interfacing with products; (b) access machine data directly through data management systems integrated within, or attached to, products, including Telematics; (c) update the data management system software from time to time; and (d) transfer data out of the country where is generated.

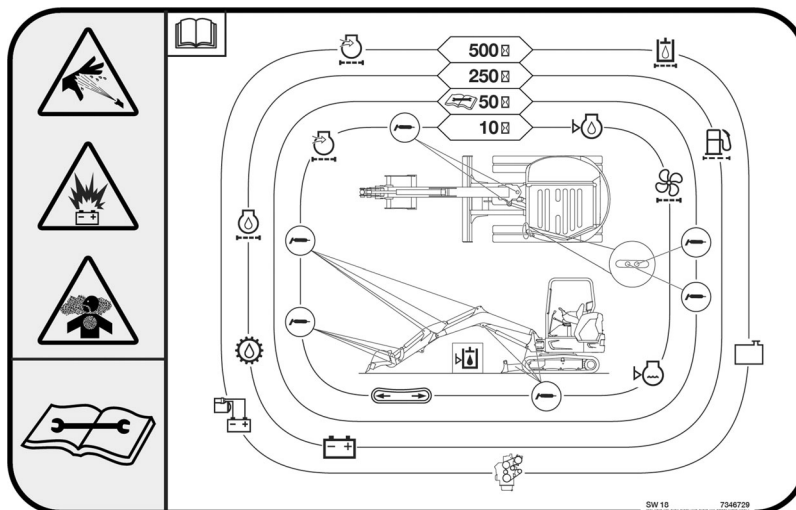
Doosan excludes other conditions, warranties or representations of all kinds, expressed or implied, statutory or otherwise (except that of title), including all implied warranties and conditions relating to merchantability, satisfactory quality and fitness for a particular purpose. Corrections by Doosan of non-conformities whether patent or latent, in the manner and for the time period provided above, shall constitute fulfillment of all liabilities of Doosan for such non-conformities, whether based on contract, warranty, tort, negligence, indemnity, strict liability or otherwise, with respect to or arising out of such product. The remedies of the end-user / owner set forth under the provisions of the warranty outlined above are exclusive and the total liability of Doosan including any holding, subsidiary, associated or affiliated company or distributor with respect to this sale or the product and service furnished hereunder in connection with the performance or breach thereof, or from delivery, installation, repair or technical direction covered by or furnished under this sale, whether based on contract, warranty, tort, negligence, indemnity, strict liability or otherwise, shall not exceed the purchase price of the product on which such liability is based. Doosan, including any holding, subsidiary, associated or affiliated company and distributor, shall in no event be liable to the end-user / owner, any successors in interest or any beneficiary or assignee relating to this sale for any consequential, incidental, indirect, special or punitive damages arising out of this sale or from any breach thereof, or any defect in, or failure of, or malfunction of the product under this sale, whether based on loss of use, lost profits or revenue, interest, lost goodwill, work stoppage, impairment of other goods, loss by reason of shut-down or non-operation, increased expenses of operation or claims of user or customers of the user for service interruption whether or not such loss or damage is based on contract, warranty, tort, negligence, indemnity, strict liability or otherwise.

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SERVICE SCHEDULE SYMBOLS



 Check Engine Oil	 Check Gear Box and / or Travel Motor Fluid
 Change Engine Oil and Filter	 Change Gear Box and / or Travel Motor Fluid
 Check Engine Coolant	 Check Track Tension, Adjust As Needed
 Change Engine Coolant	 Check Belt Tension, Adjust Or Replace As Needed
 Check Engine Air Filter, Change As Necessary	 Lubricate Grease Fittings
 Drain Contaminants From Fuel Filter	 Check Seat Belt
 Drain Contaminants From Fuel Tank	 Check Cab / Canopy
 Change Fuel Filter	 Empty Spark Arrestor Muffler
 Check Hydraulic Fluid	 Check Motion Alarm
 Change Hydraulic Fluid and Filter(s)	 Check Cab and Heater Filters
 Check Battery Cables and Connections	 Check Indicators and Lights

