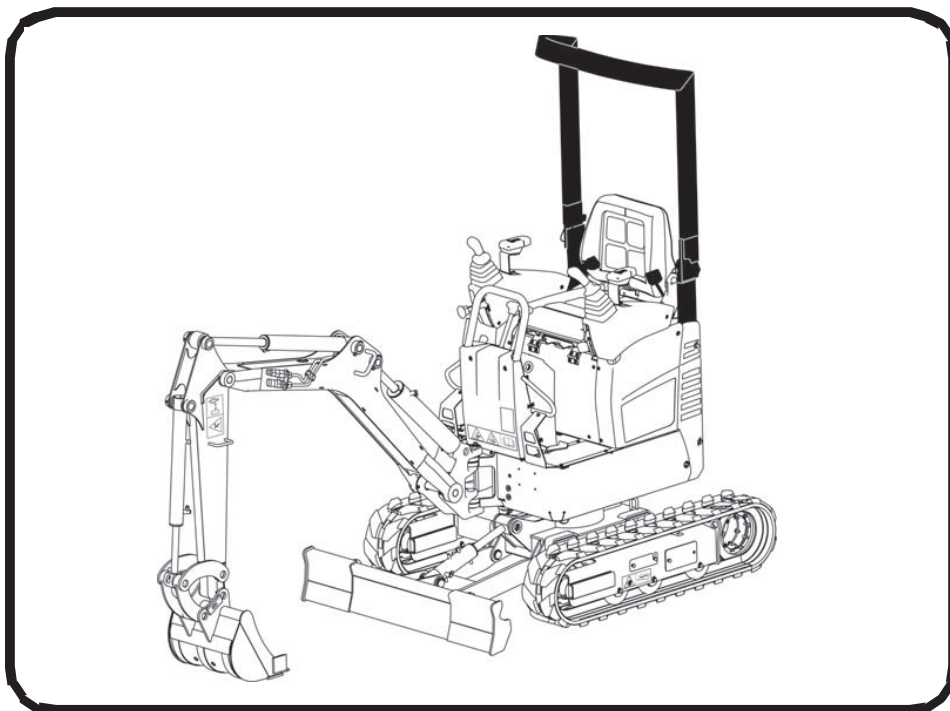


DOOSAN

EN

Operation & Maintenance Manual DX10z Compact Excavator

Serial number 11001 and Up



OPERATOR SAFETY WARNING



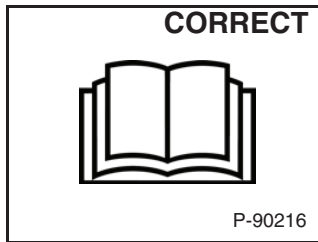
WARNING

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

W-2001-0502

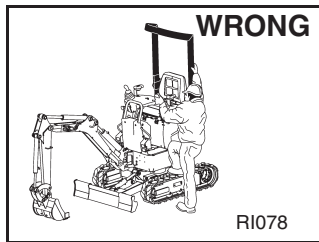


Safety Alert Symbol: This symbol with a warning statement, means: "Warning, be alert! Your safety is involved!" Carefully read the message that follows.



⚠ Never operate without instructions.

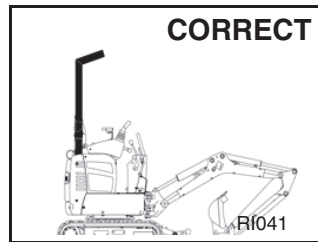
⚠ Read machine signs, Operation & Maintenance Manual, and Operator's Handbook.



⚠ Do not grasp control handles when entering machine.

⚠ Be sure controls are in neutral before starting.

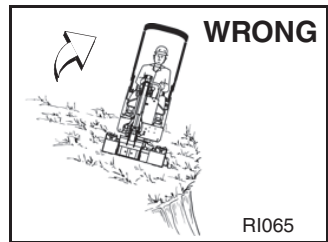
⚠ Sound horn and check behind machine before starting.



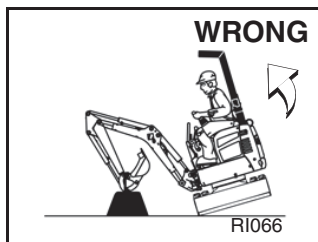
⚠ Never operate without approved TOPS.

⚠ Never modify equipment.

⚠ Never use attachments not approved by Doosan Company.

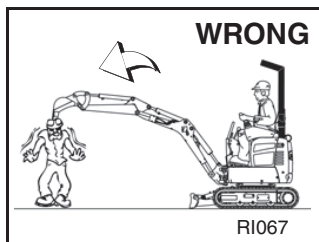


⚠ Avoid steep areas or banks that could break away.



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

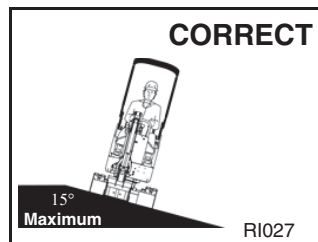
⚠ Operate on flat, level ground.



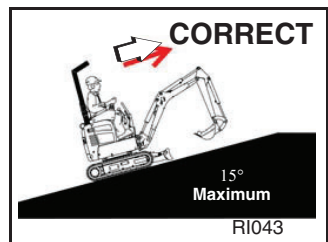
⚠ Keep bystanders out of maximum reach area.

⚠ Do not travel or turn with bucket extended.

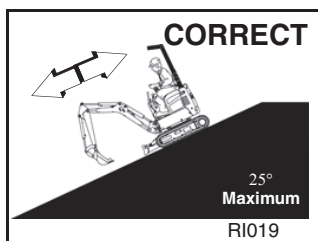
⚠ Never carry riders.



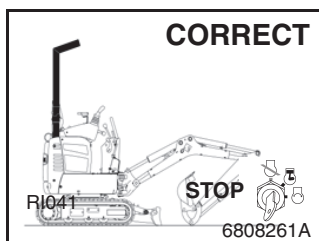
⚠ Never exceed a 15° slope to the side.



⚠ Never travel up a slope that exceeds 15°.

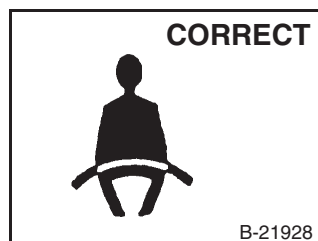


⚠ Never exceed 25° when going down or backing up a slope.



⚠ To leave excavator, lower the attachment.

⚠ Stop the engine.



⚠ Use TOPS and fasten seat belt securely.

⚠ Operate controls only from operator's seat.

⚠ Keep feet and hands on controls.

SAFETY EQUIPMENT

1. Seat Belt
2. Slew Lock
3. TOPS
4. Safety Signs (Decals)
5. Safety Tread
6. Grab Handles
7. Operator's Handbook: Must be on machine.

OSW56DH-0117

CONTENTS

CONTENTS	1
FOREWORD	2
SAFETY AND TRAINING RESOURCES	9
OPERATING INSTRUCTIONS	20
PREVENTIVE MAINTENANCE	51
SPECIFICATIONS	86
WARRANTY	94
ALPHABETICAL INDEX	96

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 B.V.,
Wilgenweg 2,
2964AM Groot-Ammers,
Netherlands

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.

DECLARATION OF CONFORMITY	3
For Model DX10z	3
DOOSAN COMPANY IS ISO 9001 CERTIFIED	4
REGULAR MAINTENANCE ITEMS	4
LUBRICANTS AND FLUIDS	5
SERIAL NUMBER LOCATIONS	6
Excavator Serial Number	6
Engine Serial Number	6
DELIVERY REPORT	6
EXCAVATOR IDENTIFICATION	7
FEATURES, ACCESSORIES AND ATTACHMENTS	8
Standard Items	8
Options And Accessories	8
Attachments	8
OPERATOR CANOPY (TOPS)	8

DECLARATION OF CONFORMITY

For Model DX10z



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 B.V., Wilgenweg 2, 2964AM Groot-Ammers, Netherlands
Technical file:	Doosan Infracore Europe B.V., Wilgenweg 2, 2964AM Groot-Ammers, Netherlands
Brand:	Doosan
Model Name:	DX10z
Serial Number:	
Engine Type:	D722-EF15
Engine Manufacturer:	Kubota
Year of Manufacturing:	
Rated Net Power:	7,4 kW (9.9 hp) @ 2000 rpm (SAE J1349 / ISO 9249)
Net Installed Power:	7,5 kW (10.0 hp) @ 2000 rpm (ISO 14396)
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:	15.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, 19000 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:	93 dB(A)

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

2964AM Groot-Ammers

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 6671057	 BATTERY 6669600
 FUEL FILTER 6667352	 RADIATOR CAP 6702797
 AIR FILTER, Outer 6673752 AIR FILTER, Inner 6673753	 HYDRAULIC RESERVOIR CAP 6727475
 PRIMARY HYDRAULIC FILTER 6653336	

NOTE: Always verify Part Numbers with your Doosan dealer.

LUBRICANTS AND FLUIDS

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 CJ4 / ACEA E9	-25°C – +30°C	B, C, D	941-00907*
	Doosan Engine Power SAE 15W40 CJ4 / ACEA E9	-20°C – +40°C	B, C, D	941-00910*
Cooling Circuit	Doosan Coolant Concentrate	-36°C	B, C	941-00599*
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, C, D	941-00800*

MECHANICAL SYSTEMS				
Machine Components	Fluids And Lubricants	Drop Point	Packaging**	Part Number
All Mechanical Systems	Doosan Multipurpose Grease	From 260°C	-	941-00655*

(*) Factory Filled Fluids And Lubricants

(**) Packaging Available:

A = 5 L Can

B = 20 L Container

C = 210 L Drum

D = 1000 L Tank

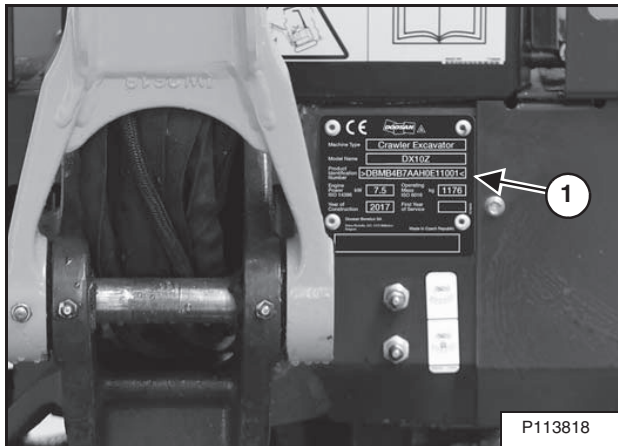
E = 400 g Tube

SERIAL NUMBER LOCATIONS

Always use the serial number of the excavator when requesting service information or when ordering parts. Early 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

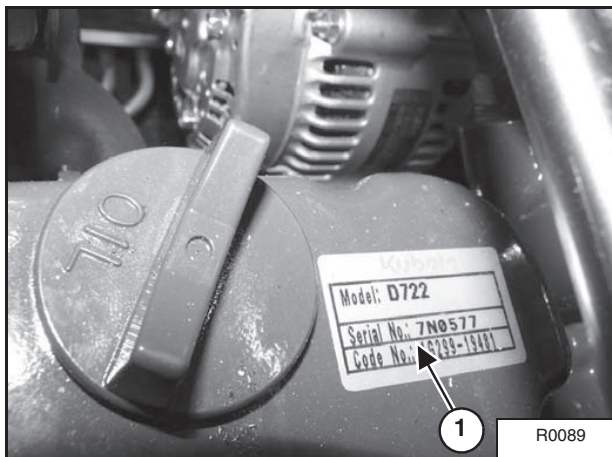
Figure 1



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

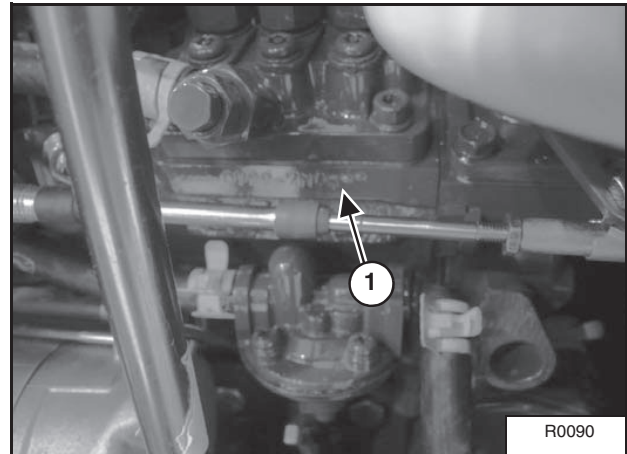
Engine Serial Number

Figure 2



The engine serial number is located as a plate (Item 1) on the top of the engine [Figure 2].

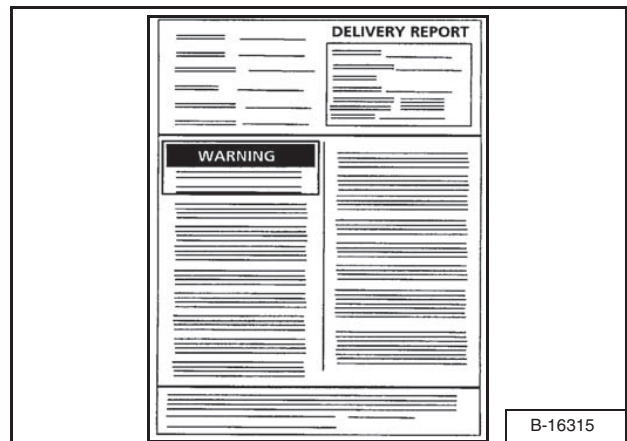
Figure 3



It also appears engraved on the side of the engine (Item 1) [Figure 3].

DELIVERY REPORT

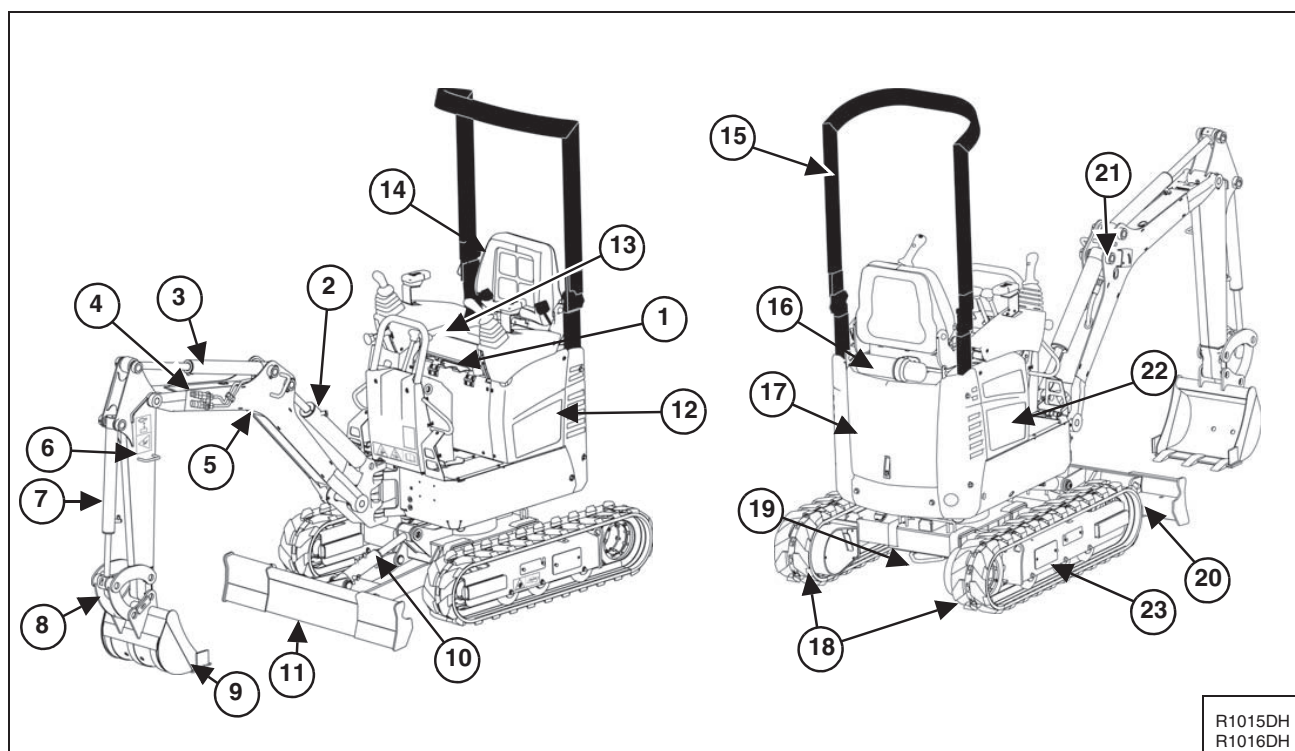
Figure 4



The delivery report [Figure 4] 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	Operator's Handbook	15	Tip-Over Protective Structure (TOPS)
2	Boom Cylinder	16	Operation & Maintenance Manual
3	Arm Cylinder	17	Tailgate
4	Auxiliary Quick Couplers	18	Tracks
5	Boom	19	Tie Downs
6	Arm	20	Tie Downs / Lift Point (Both Sides)
7	Bucket Cylinder	21	Lift Point
8	Bucket Link / Attachment Coupler (If Equipped)	22	Right Side Cover
9	Bucket [A]	23	Track Frames
10	Blade Cylinder		
11	Blade		
12	Upperstructure		
13	Control Levers (Joysticks)		
14	Operator's Seat with Seat Belt		

[A] BUCKET - Several different buckets and other attachments are available for the Doosan excavator.

FEATURES, ACCESSORIES AND ATTACHMENTS

Standard Items

Model DX10 Doosan excavators are equipped with the following standard items:

- 710 mm dozer blade / 1100 mm extended
- 180 mm rubber track
- Auxiliary hydraulics - double act
- Boom mounted light
- Control console locks
- Demolition kit
- Horn
- Hydraulically expandable undercarriage from 710 to 1100 mm
- Muffler
- Retractable seat belt
- Suspension seat
- Two speed travel
- * TOPS canopy
- Working lights

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.

- Beacon kit
- Strobe kit
- Object Handling (lift eye)

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

Attachments

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

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

See your Doosan dealer for more details on these and other attachments and field accessories.

- Digging bucket
- Grading bucket
- Hydraulic breaker
- Laser Receiver

OPERATOR CANOPY (TOPS)

The excavator has an operator canopy (TOPS - Tip-Over Protective Structure) as standard equipment. The TOPS meets ISO 3471 and ISO 12117.

The canopy provides operator protection if the excavator is tipped over. The seat belt must be worn for TOPS protection.



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

SAFETY AND TRAINING RESOURCES

SAFETY INSTRUCTIONS	10
Before Operation	10
Safe Operation Is The Operator's Responsibility	11
Safe Operation Needs A Qualified Operator	11
Avoid Silica Dust	12
FIRE PREVENTION	12
Maintenance	12
Operation	12
Electrical	12
Hydraulic System	13
Fuelling	13
Starting	13
Spark Arrester Exhaust System	13
Welding And Grinding	13
Fire Extinguishers	13
PUBLICATIONS AND TRAINING RESOURCES	14
MACHINE SIGNS (DECALS)	15
Pictorial-Only Safety Signs	17

SAFETY INSTRUCTIONS

Before Operation

Carefully follow the operating and maintenance instructions in this manual.

The Doosan excavator is highly manoeuvrable 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



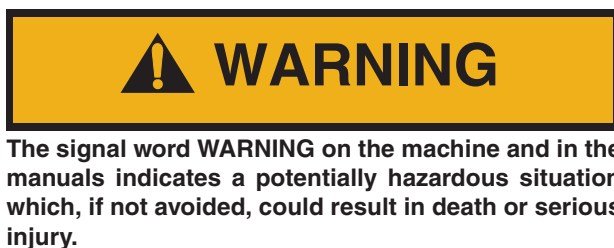
W-2001-0502



I-2019-0284



D-1002-1107



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 coordination 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.

SI EXC EMEA DH-0117

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.

Fuelling



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 fuelling 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).

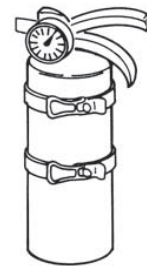
Welding And Grinding

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.

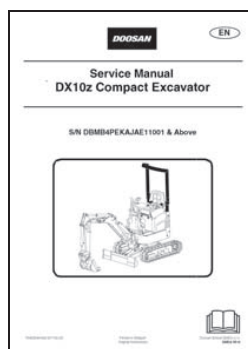
For the latest information on Doosan products and the Doosan Company, visit our Web site at <http://www.doosanequipment.com> or doosan.com



OPERATION & MAINTENANCE MANUAL

7349203enGB

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



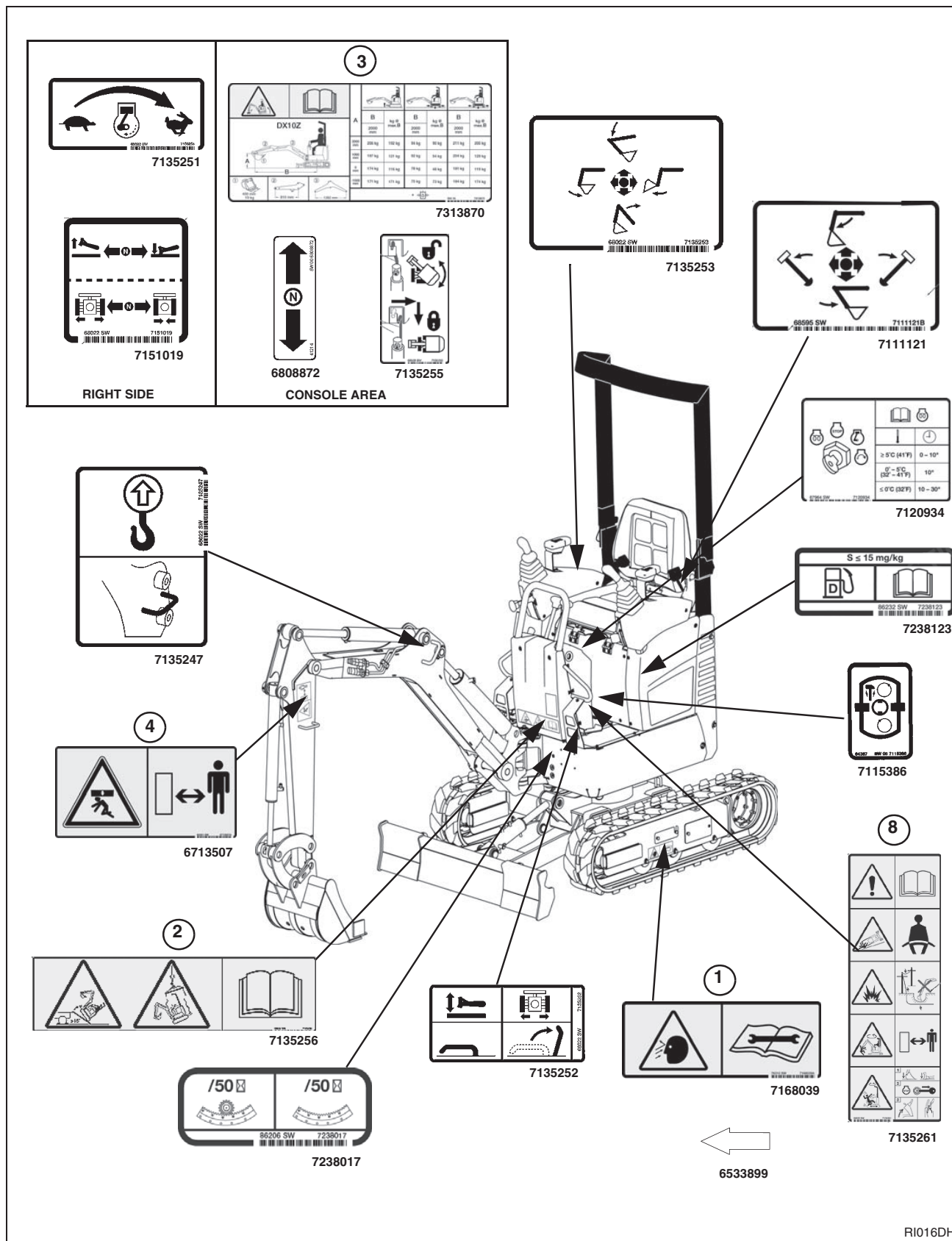
SERVICE MANUAL

7317603enUS

- Complete maintenance instructions for your Doosan excavator.

MACHINE SIGNS (DECALS)

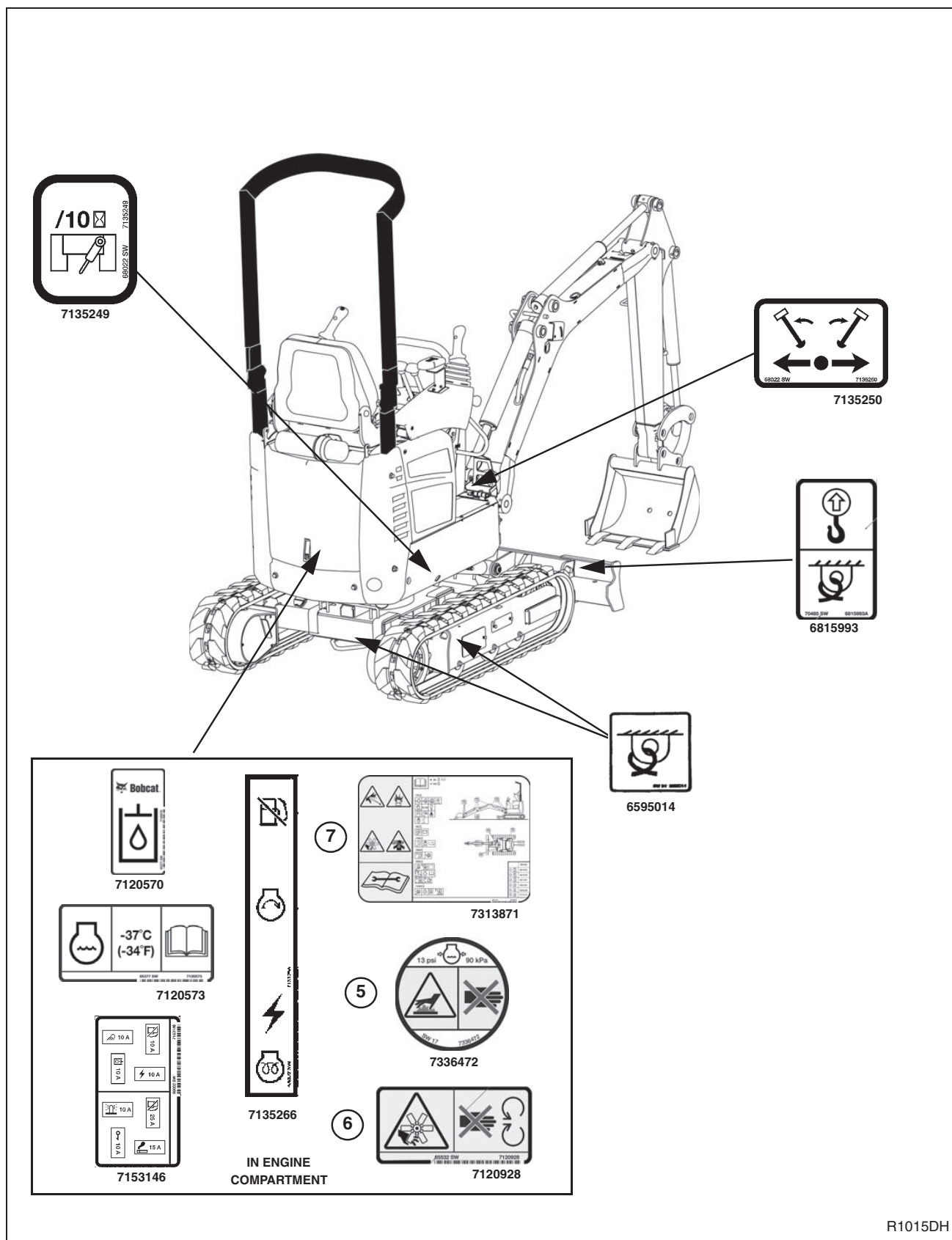
Follow the instructions on all the Machine Signs (Decals) that are on the excavator. Replace any damaged machine signs and be sure they are in the correct locations. Machine signs are available from your Doosan excavator dealer.



RI016DH

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.

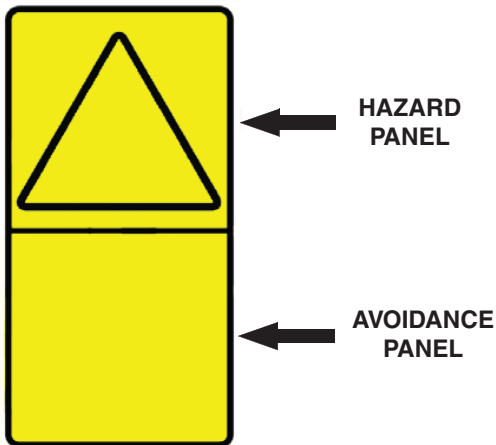


MACHINE SIGNS (DECALS) (CONT'D)

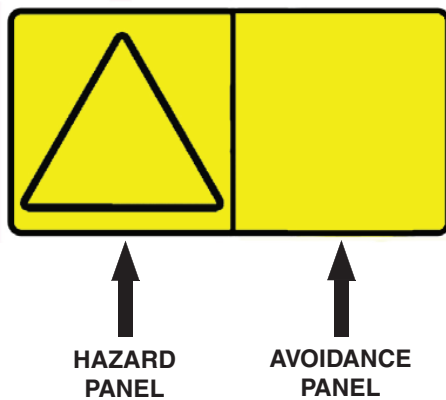
Pictorial-Only Safety Signs

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 familiarized 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.

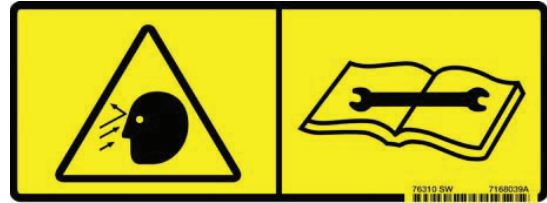
Avoidance panels depict actions required to avoid the hazards.

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 15 and Machine Signs (Decals) (Cont'd) on Page 16 for the machine location of each corresponding numbered pictorial-only decals as shown below.

1. 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 grease fitting. Do not loosen bleed fitting more than 1 - 1/2 turns.

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

W-2516-0110

2. Transporting And Lifting (7135256)

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



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.

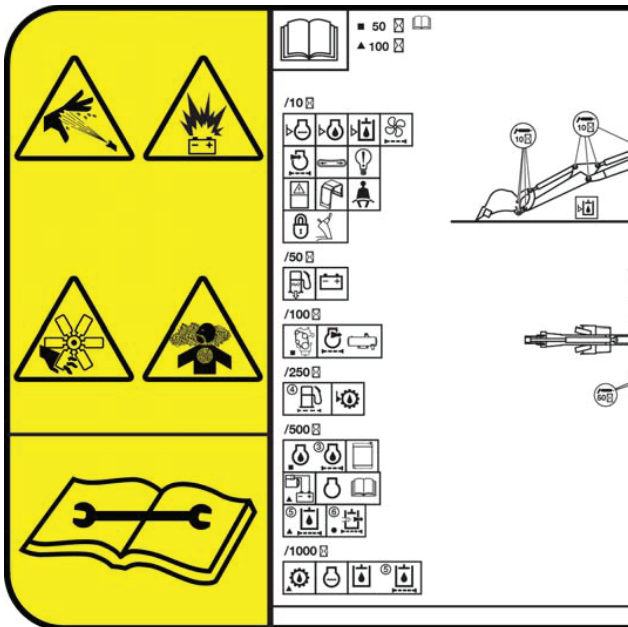
W-2517-0110

MACHINE SIGNS (DECALS) (CONT'D)

Pictorial-Only Safety Signs (Cont'd)

7. Service Schedule; High Pressure, Battery, Rotating Fan And Exhaust Gases (7313871)

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



8. General Hazard (7135261)

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



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



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

OPERATING INSTRUCTIONS

INTENDED USE	.22
INSTRUMENTS AND CONSOLES	.23
Instrumentation	.23
Operator Controls	.23
Raising And Lowering The Consoles	.24
ENGINE SPEED CONTROL	.24
Operation	.24
Two-Speed Travel	.24
TAILGATE	.25
Opening And Closing The Tailgate	.25
OPERATOR CANOPY (TOPS)	.26
Description	.26
Lowering The TOPS Canopy	.26
Raising The TOPS Canopy	.26
STEERING LEVERS	.27
Driving Forward And Reversing	.27
Turning	.27
HYDRAULIC CONTROLS	.29
Control Levers (Joysticks)	.29
Control Lockout Lever	.30
Auxiliary Hydraulic Pedal	.30
Boom Swing Pedal	.31
Quick Connectors	.31
BLADE CONTROL	.32
Blade / Track Expansion Lever	.32
Raising And Lowering The Blade	.32
TRACK FRAME EXPANSION	.33
Expanding And Retracting The Tracks	.33
UPPERSTRUCTURE SLEW LOCK	.34
DAILY INSPECTION	.35
PRE-STARTING PROCEDURE	.37
Before Starting The Engine	.37
STARTING THE ENGINE	.38
Key Switch	.38
Cold Temperature Starting Procedure	.39
Warning The Hydraulic System	.40

BUCKETS AND ATTACHMENTS	41
Installing	41
Removing	41
OPERATING PROCEDURE	42
Inspecting The Work Area	42
Basic Operating Instructions	42
Driving On Public Roads	42
Lowering The Work Equipment (Engine STOPPED)	42
Object Handling	43
Driving The Excavator	44
Operating On Slopes	45
Operating In Water	47
Avoiding Track Damage	47
STOPPING THE EXCAVATOR	48
LIFTING THE EXCAVATOR	49
TRANSPORTING THE EXCAVATOR	49
Loading Onto Transport Vehicle	49
Fastening To Transport Vehicle	50

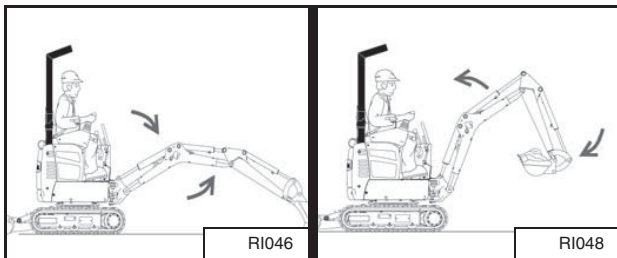
INTENDED USE

This machine is classified as an Excavator as defined in ISO 6165. This machine has 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.

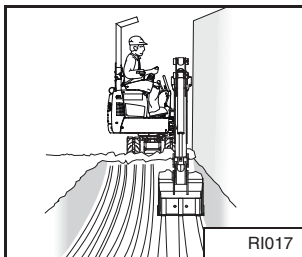
Additional Doosan approved attachments allow this machine to perform other tasks described in the attachment Operation & Maintenance Manuals.

Examples of intended use include:

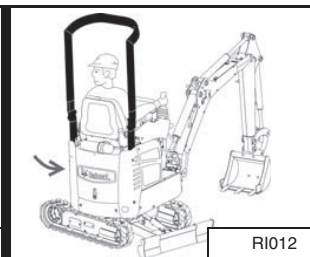
Excavating



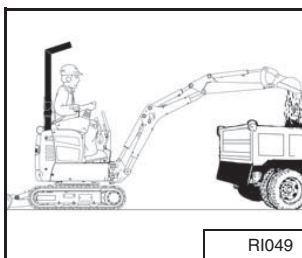
Boom Swing



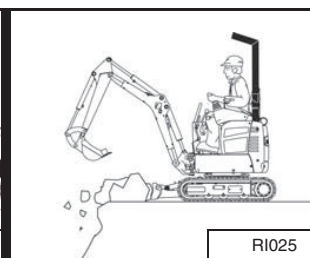
Rotating the Upperstructure



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

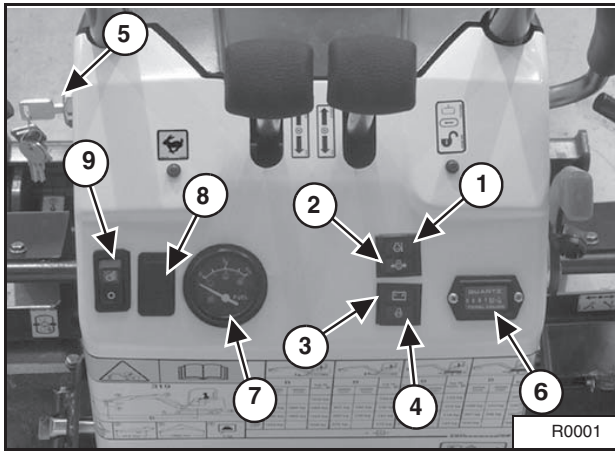
Avoid impacting objects with the blade. Damage to blade and undercarriage components may occur.

I-2256-0507

INSTRUMENTS AND CONSOLES

Instrumentation

Figure 5

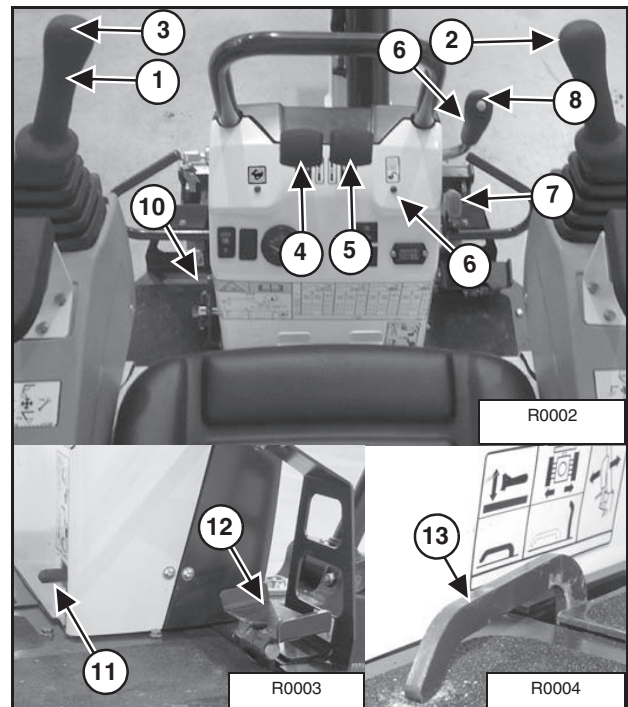


All the instruments are located on the control console [Figure 5].

REF. NO	DESCRIPTION	FUNCTION / OPERATION
1	Engine Coolant Temperature Warning Lamp	Light comes ON when coolant temperature is above allowable range. Alarm also sounds. STOP the engine if light comes ON.
2	Engine Oil Pressure Warning Lamp	Light comes ON when pressure is below allowable range. Alarm also sounds. STOP the engine if light comes ON.
3	Charging System Lamp	Light comes ON when the alternator is NOT charging the battery.
4	Glow Plug Indicator Lamp	Light comes ON when key is turned in PREHEAT position
5	Key Start Switch	Used to activate glow plugs, start and stop engine.
6	Hourmeter	Records the total operating hours of the machine.
7	Fuel Gauge	Shows the amount of fuel in the tank.
8	Not used	
9	Boom Light	Lightens the working area.
10	Hydraulic Lockout Indicator Lamp	Light comes ON when hydraulic lockout is ON.

Operator Controls

Figure 6

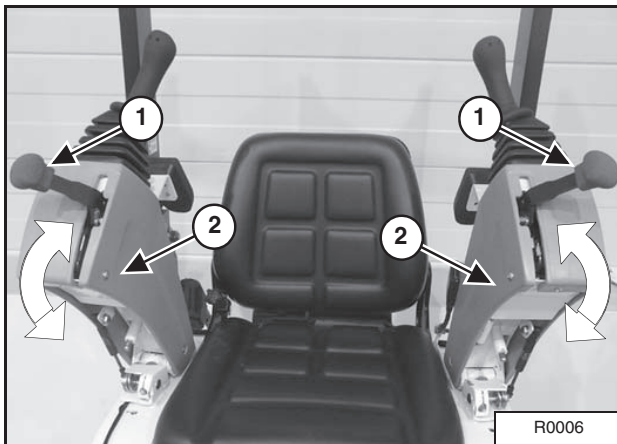


REF. NO	DESCRIPTION	FUNCTION / OPERATION
1	Left Hand Control Joystick	(See Control Levers (Joysticks) on Page 29.)
2	Right Hand Control Joystick	(See Control Levers (Joysticks) on Page 29.)
3	Horn	
5	Left Steering Lever	(See Left Turn on Page 28.)
6	Right Steering Lever	(See Right Turn on Page 27.)
7	Engine Speed Control Lever	(See ENGINE SPEED CONTROL on page 24.)
8	Two-Speed Button	(See Two-Speed Travel on page 24.)
9	High Range Indicator	
10	Auxiliary Hydraulic Pedal	(See HYDRAULIC CONTROLS on Page 29.)
11	Upperstructure Slew Lock	(See UPPERSTRUCTURE SLEW LOCK on Page 34.)
12	Boom Swing Pedal	(See Boom Swing Pedal on Page 31.)
13	Blade / Track Expansion Selector Lever	(See Blade / Track Expansion Lever on Page 32.)

INSTRUMENTS AND CONSOLES (CONT'D)

Raising And Lowering The Consoles

Figure 7



Pull up on the release lever(s) (Item 1) [Figure 7] to raise the console(s) (Item 2) to provide entry and exit from the machine.

NOTE: When either console is raised, the hydraulic control joysticks and the traction system are locked and will not function.

Before operating the machine, lower the consoles (Item 2) [Figure 7] by pushing down on the lever(s) (Item 1) until latched in the down position.

Figure 8

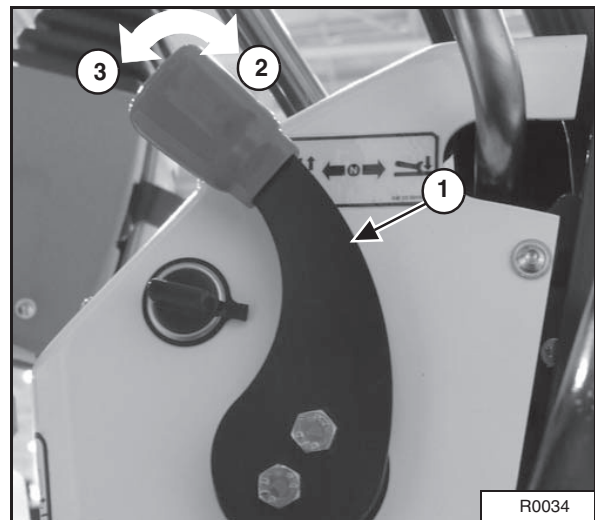


The control consoles can be repositioned [Figure 8] for operator comfort. Raise the console lever(s) (Item 1) [Figure 7] and move the consoles in or out from the operator's seat.

ENGINE SPEED CONTROL

Operation

Figure 9

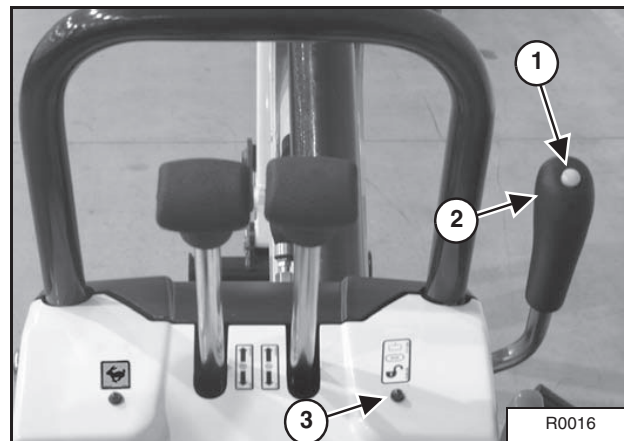


The engine speed control lever (Item 1) [Figure 9] controls the rpm of the engine.

Push (Item 2) the lever to increase engine rpm; pull (Item 3) to decrease rpm [Figure 9].

Two-Speed Travel

Figure 10



Press the button (Item 1) on the blade / track expansion control lever (Item 2) [Figure 10] to engage the high-range.

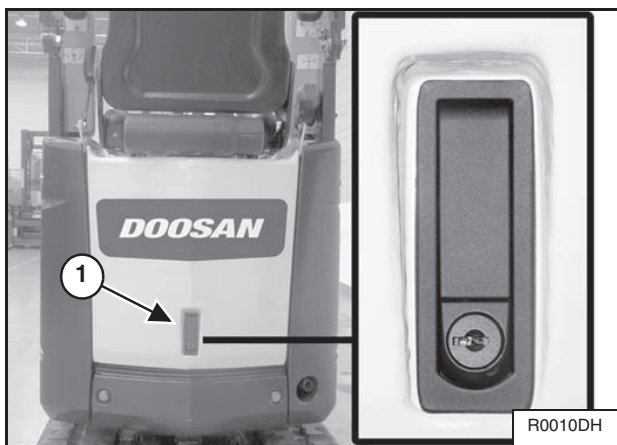
The green light (Item 3) [Figure 10] will be ON when high-range is engaged.

Press the button (Item 1) [Figure 10] again to disengage.

TAILGATE

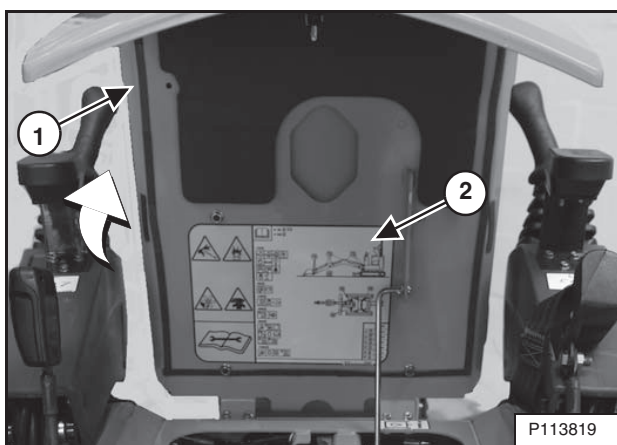
Opening And Closing The Tailgate

Figure 11



Release the latch (Item 1) and pull the tailgate open [Figure 11].

Figure 12



Raise the tailgate (Item 1) until the retaining rod (Item 2) [Figure 12] locks the tailgate in the open position.

To close the tailgate, slightly raise the tailgate (Item 1), move the retaining rod (Item 2) [Figure 12] out of the locked position, and then slowly lower the tailgate until it is fully closed.

NOTE: The tailgate can be locked using the start key.

OPERATOR CANOPY (TOPS)

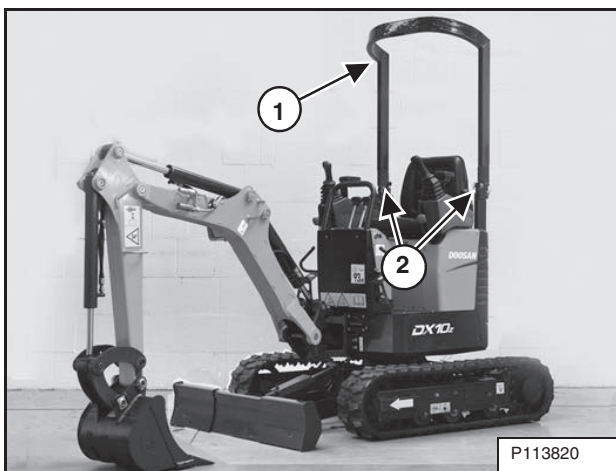
Description

The Doosan excavator has an operator canopy (TOPS) as standard equipment to protect the operator if the excavator is tipped over. The seat belt must be worn for TOPS protection.

Check the TOPS canopy, mounting, and hardware for damage. Never modify the TOPS canopy. Replace the canopy and hardware if damaged. See your Doosan dealer for parts.

TOPS - Tip-Over Protective Structure per ISO 12117.

Figure 13



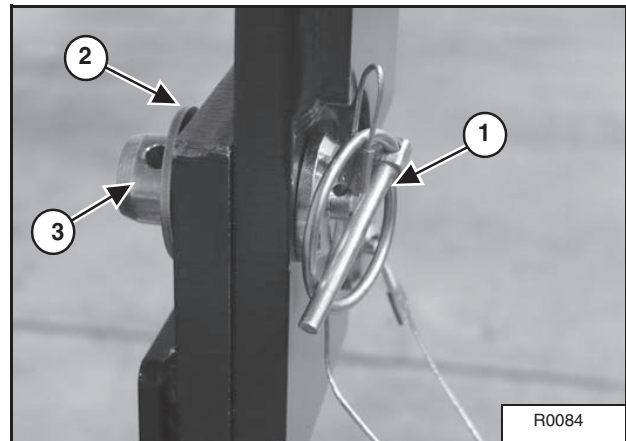
The excavator has an operator canopy (TOPS) (Item 1) [Figure 13] as standard equipment.

The canopy provides operator protection if the excavator tips over. The seat belt must be worn for TOPS protection.

Lowering The TOPS Canopy

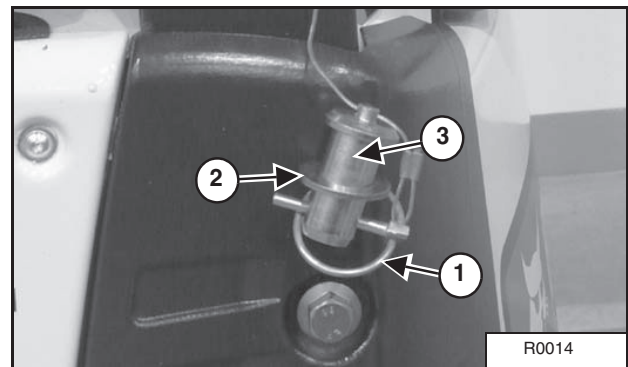
Lowering the TOPS canopy allows to reduce the machine height in order to pass through small doors.

Figure 14



Remove the retainer (Item 1) [Figure 14], the washer (Item 2) [Figure 14] and the retainer pin (Item 3) [Figure 14] on both sides of the canopy (Item 2) [Figure 13].

Figure 15



Keep the retainer (Item 1) and the washer (Item 2) installed on the retainer pin (Item 3) [Figure 15].

Figure 16



Lower the canopy (Item 1) [Figure 16].

Raising The TOPS Canopy

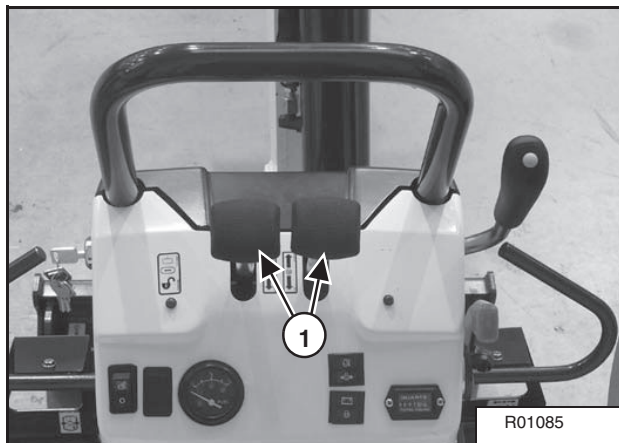
To raise the TOPS canopy, follow the same procedure in reverse.

STEERING LEVERS

Driving Forward And Reversing

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

Figure 17

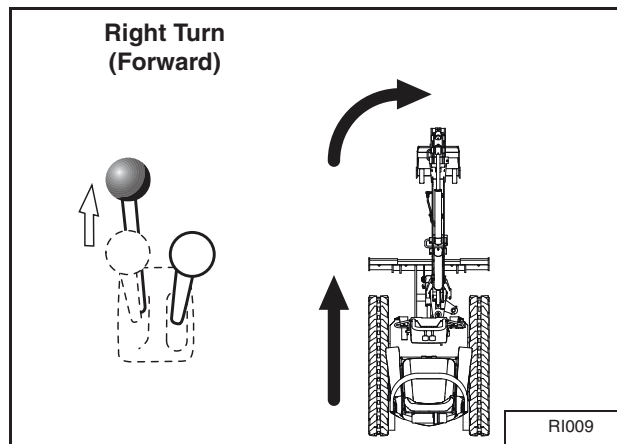


Position the blade at the front of the machine (as you sit in the operator's seat). Slowly move both steering levers (Item 1) **[Figure 17]** forward for forward travel; backward for reverse travel.

Turning

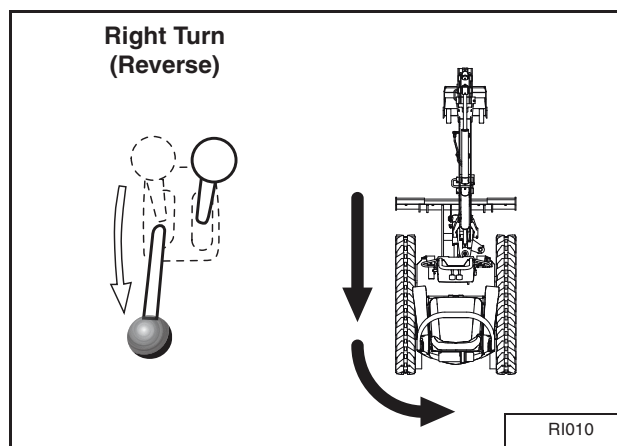
Right Turn

Figure 18



Push the left steering lever forward to turn right **[Figure 18]** while driving forward.

Figure 19



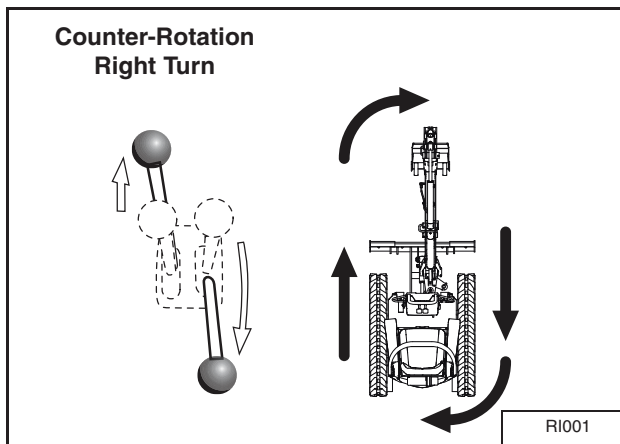
Pull the left steering lever backward to turn right **[Figure 19]** while reversing.

STEERING LEVERS (CONT'D)

Turning (Cont'd)

Counter-Rotation Right Turn

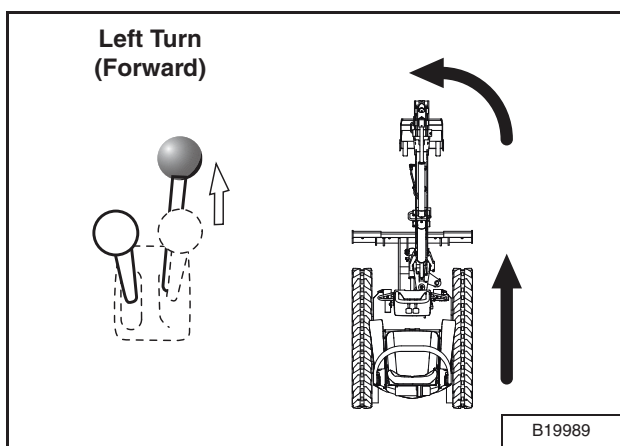
Figure 20



Pull the left steering lever forward and pull the right steering lever backward **[Figure 20]**.

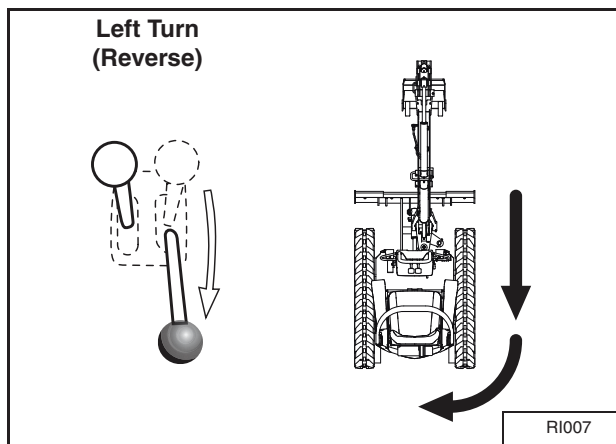
Left Turn

Figure 21



Push the right steering lever forward to turn left **[Figure 21]** while driving forward.

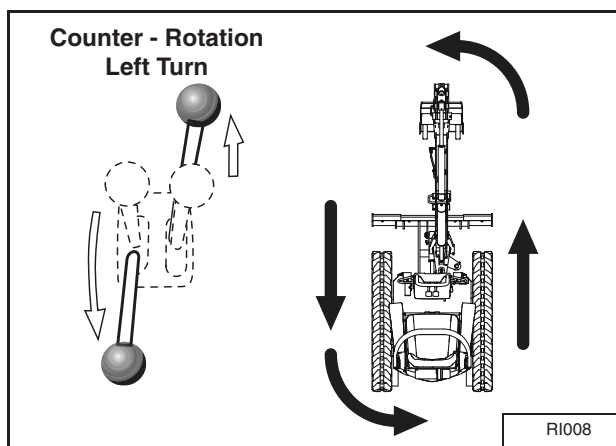
Figure 22



Pull the right steering lever backward to turn left while reversing **[Figure 22]**.

Counter-Rotation Left Turn

Figure 23



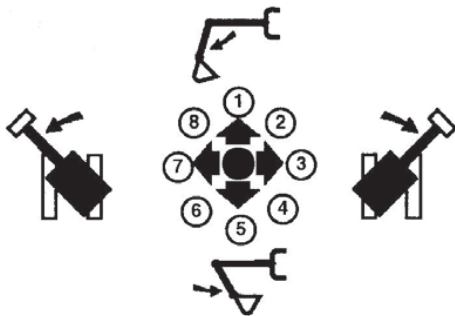
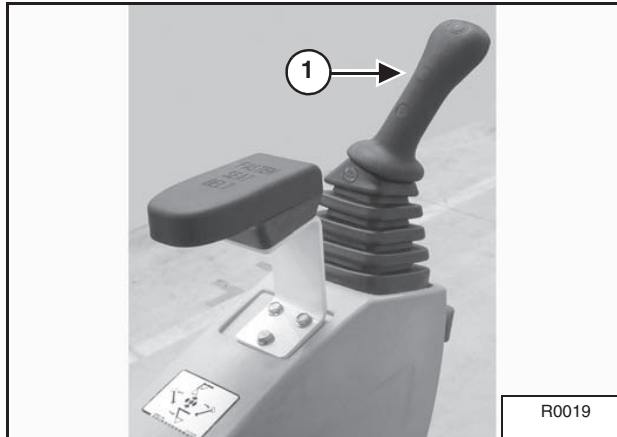
Push the right steering lever forward and pull the left steering lever backward **[Figure 23]**.

HYDRAULIC CONTROLS

Control Levers (Joysticks)

Left Joystick

Figure 24



The work equipment (boom, arm, bucket, and upperstructure slew) is operated by using the left and right control joysticks [Figure 24] and [Figure 25].

The left control joystick (Item 1) is used to operate the arm and slew the upperstructure [Figure 24].

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.

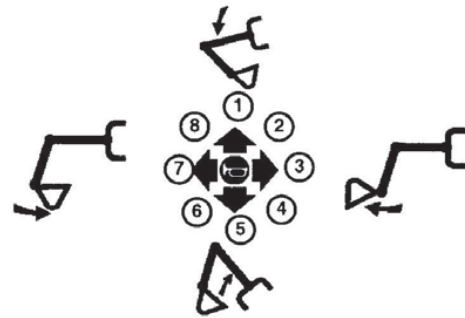
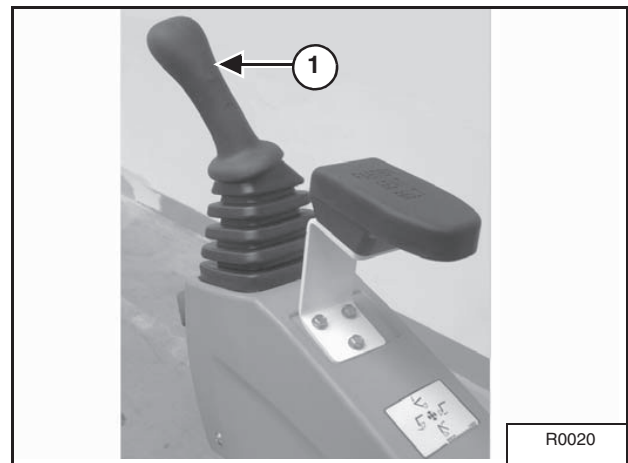
IMPORTANT

Before slewing the upperstructure, make sure the slew lock is disengaged.

I-2051-0905

Right Joystick

Figure 25



The right control joystick (Item 1) is used to operate the boom and bucket [Figure 26].

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:

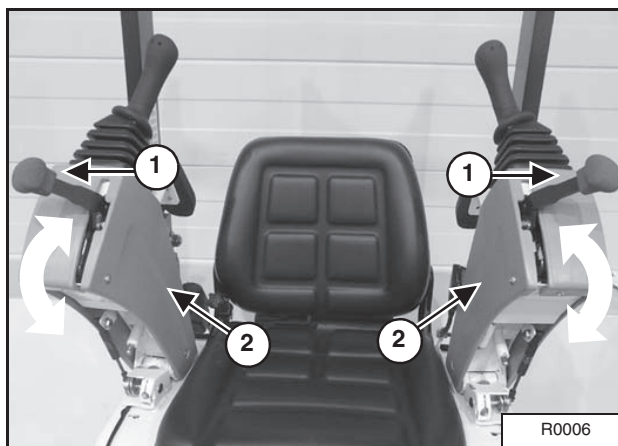
- Lower the work equipment to the ground.
- Lower the blade to the ground.
- Stop the engine and remove the key.
- Raise the control console.

W-2780-0109

HYDRAULIC CONTROLS (CONT'D)

Control Lockout Lever

Figure 26



The control lock levers (Item 1) [Figure 26] disengage the hydraulic control functions from the control joysticks when either console is raised.

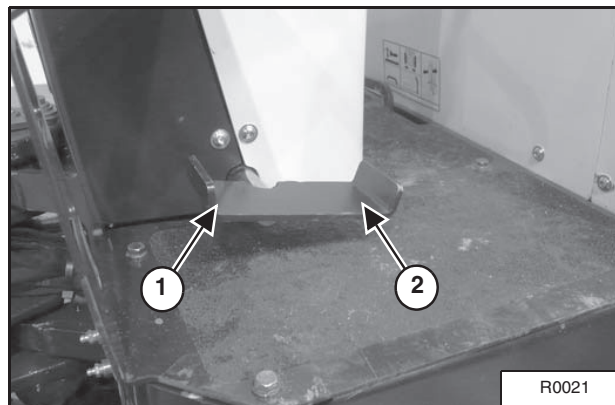
NOTE: If the engine stops, the boom / bucket (attachments) can be lowered to the ground using hydraulic pressure in the accumulator. The control console(s) must be in the locked down position, and the key switch in the ON position. Use the joystick to lower the boom.

Lower the control console(s) (Item 2) [Figure 26] to engage the hydraulic control functions of the control joysticks.

Auxiliary Hydraulic Pedal

The left pedal controls attachments (such as a hydraulic breaker) when mounted on the arm.

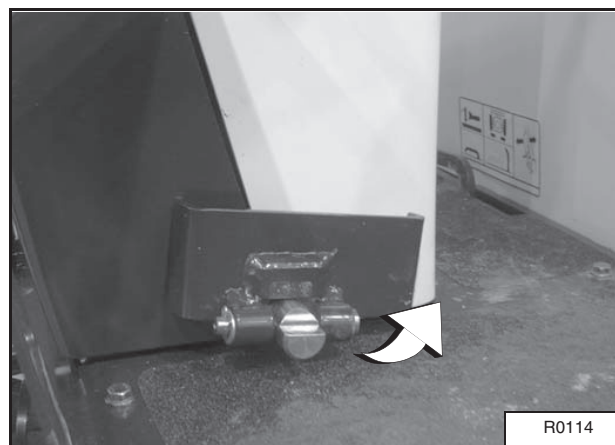
Figure 27



Press the toe of auxiliary hydraulic pedal (Item 1) [Figure 27] to provide hydraulic pressure to the top hydraulic line. Release the pedal to stop hydraulic flow.

Press the heel of auxiliary hydraulic pedal (Item 2) [Figure 27] to provide hydraulic pressure to the bottom hydraulic line. Release the pedal to stop hydraulic flow.

Figure 28

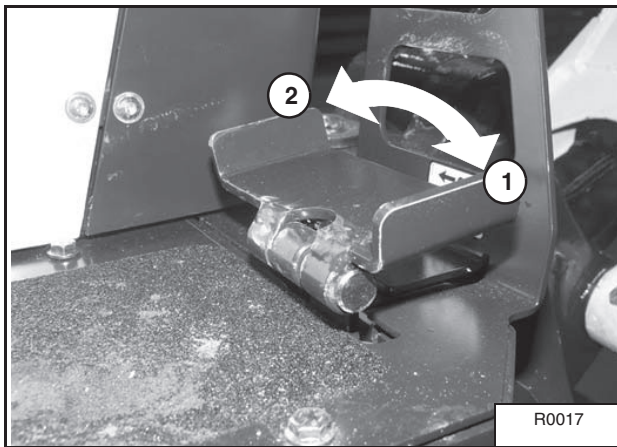


When you are not using the auxiliary flow, the pedal can be folded to prevent operation of the hydraulic functions [Figure 28].

HYDRAULIC CONTROLS (CONT'D)

Boom Swing Pedal

Figure 29

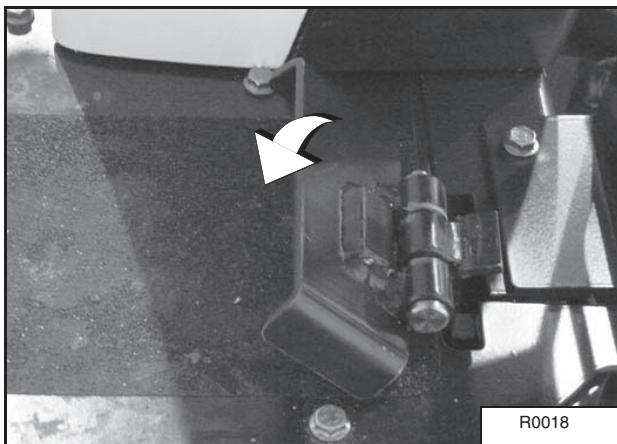


The boom swing pedal is located at the right side of the control console [Figure 29].

Press the right side (Item 1) [Figure 29] of the pedal to swing the boom to the right.

Press the left side (Item 2) [Figure 29] of the pedal to swing the boom to the left.

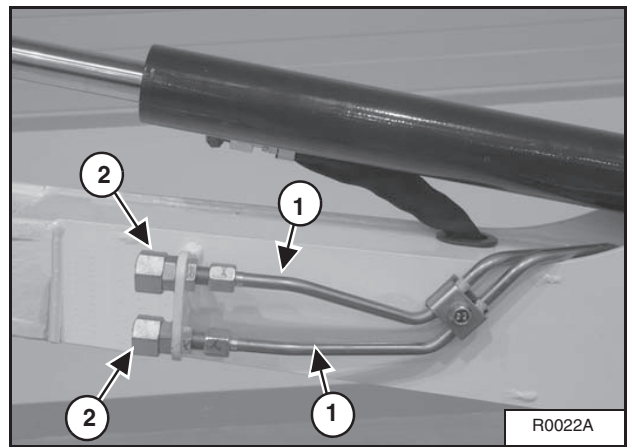
Figure 30



When not in use, the boom swing pedal can be folded inward to prevent operation of the boom swing function. In this position it can be used as a footrest [Figure 30].

Quick Connectors

Figure 31



Excavators have auxiliary hydraulic lines (Item 1) [Figure 31] located on the boom.

Hydraulic caps (Item 2) [Figure 31] cover the hydraulic fittings.

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.

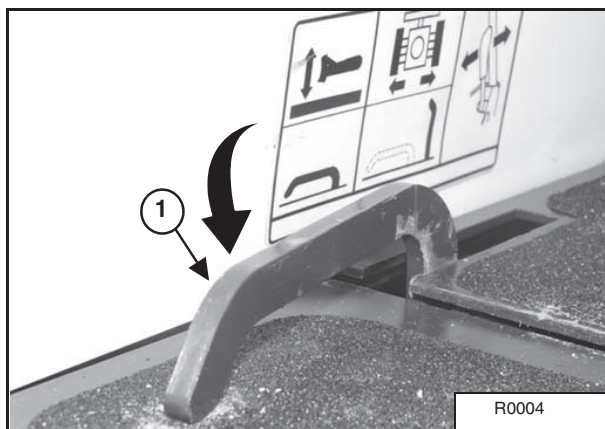
W-2220-0396

NOTE: With the engine stopped and the attachment flat on the ground, move the left pedal back and forth several times. This relieves pressure that can be trapped in the auxiliary circuit.

BLADE CONTROL

Blade / Track Expansion Lever

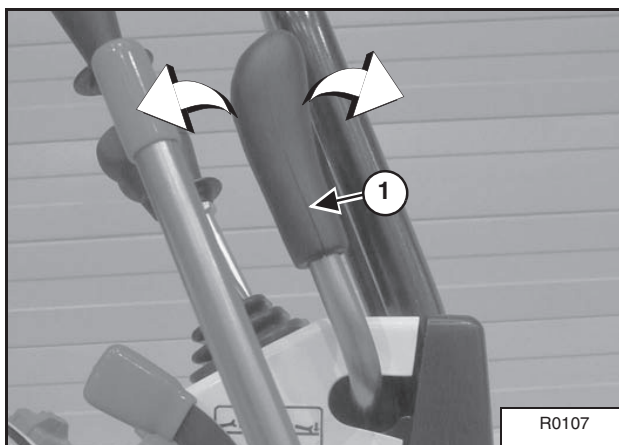
Figure 32



Lower the blade / track expansion selector lever (Item 1) [Figure 32] into the BLADE position.

Raising And Lowering The Blade

Figure 33



With the Blade / Track Expansion Lever (Item 1) [Figure 32] in the BLADE position, move the Blade / Track Expansion Lever (Item 1) [Figure 33] forward to lower the blade.

Move the Blade / Track Expansion Lever (Item 2) [Figure 33] backward to raise the blade.

NOTE: Keep the blade lowered when digging to improve digging performance.

TRACK FRAME EXPANSION

Expanding And Retracting The Tracks

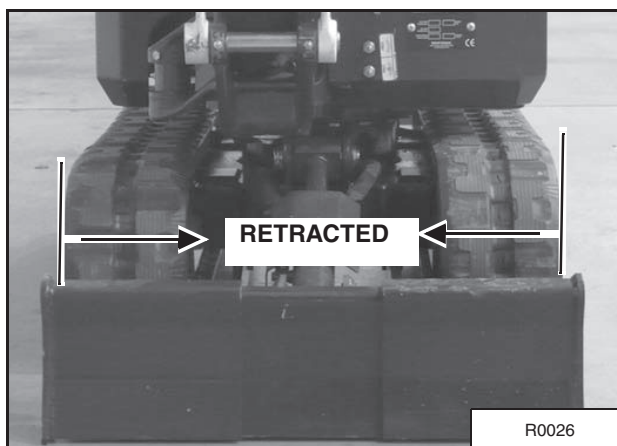
NOTE: Always expand tracks when working on slopes or in rough conditions.

IMPORTANT

To prevent wear and damage to the track, always lift the excavator before expanding or retracting the track frame.

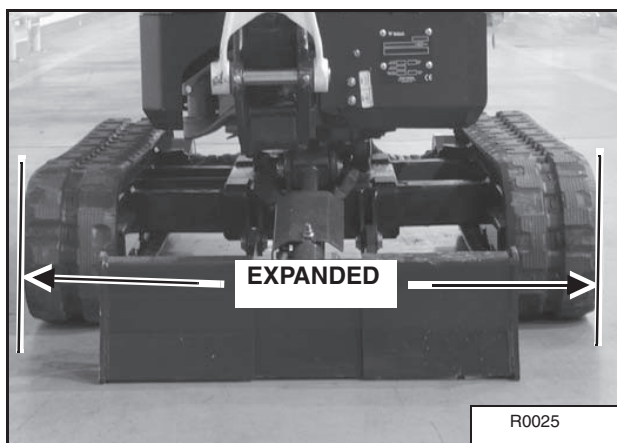
I-2193-0599

Figure 34



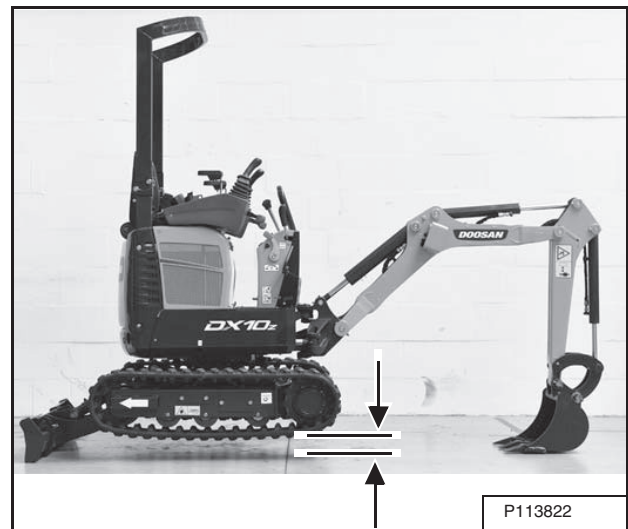
The excavator can be operated with the track frame retracted for transport on a trailer or to access narrow areas [Figure 34].

Figure 35



Expand the track frame [Figure 35] for increased digging performance.

Figure 36



With the boom and arm positioned over the blade, lower the blade until the tracks are raised 25 to 50 mm (1.0 - 2.0 in) off the ground [Figure 36].

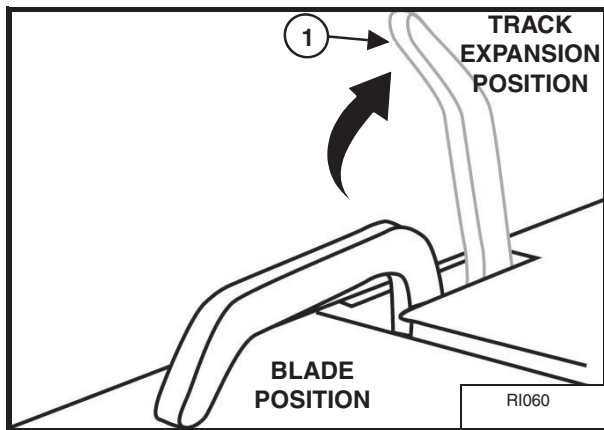
Rotate the upper structure 180 degrees.

Lower the boom and arm to raise the rear of the excavator until the track is 25 to 50 mm (1.0 - 2.0 in) off the ground [Figure 36].

TRACK FRAME EXPANSION (CONT'D)

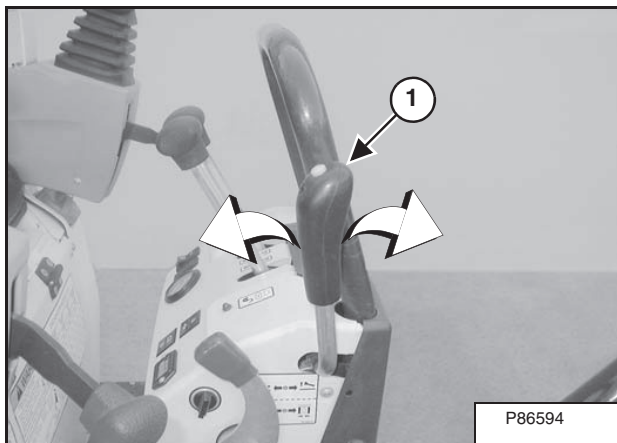
Expanding And Retracting The Tracks (Cont'd)

Figure 37



Raise the Blade / Track Expansion Lever (Item 1) [Figure 37] into the TRACK position.

Figure 38



Move the Blade / Track Expansion Lever (Item 1) [Figure 38] forward to expand the tracks.

Move the Blade / Track Expansion Lever (Item 1) [Figure 38] back to retract the tracks.

NOTE: Always return the Blade / Track Expansion Lever (Item 1) [Figure 37] to the BLADE position during operation so that the track does not move when using the blade lever.

NOTE: Always operate the machine with the tracks expanded all the way or retracted all the way.

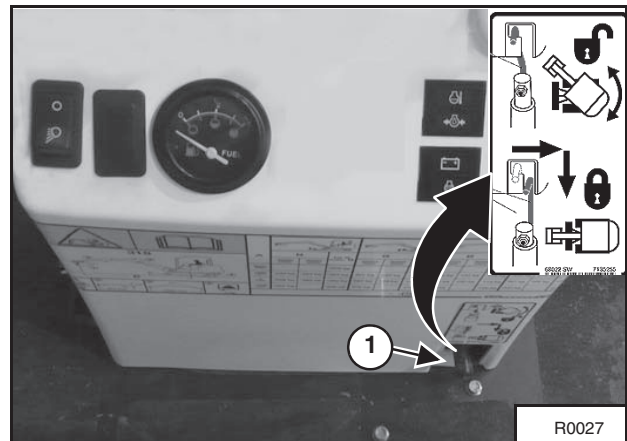
Raise the boom and arm to lower the rear of the excavator to the ground.

Raise the blade all the way.

Rotate the upperstructure 180 degrees.

UPPERSTRUCTURE SLEW LOCK

Figure 39



Move the slew lock pin (Item 1) [Figure 39] to the right and down to engage the upperstructure slew lock. Fit the pin properly to fully engage the slew lock. When the slew lock is engaged (locked), the upperstructure of the excavator is locked to the track frame and will not rotate.

NOTE: The upperstructure must be in the straight forward or straight backward position for the upperstructure to lock.

Move the slew lock pin (Item 1) [Figure 39] up and to the left to disengage the upperstructure from the track frame. Fit the lever properly to fully disengage the slew lock.

WARNING

AVOID INJURY

The upperstructure slew lock lever must be engaged when transporting the machine.

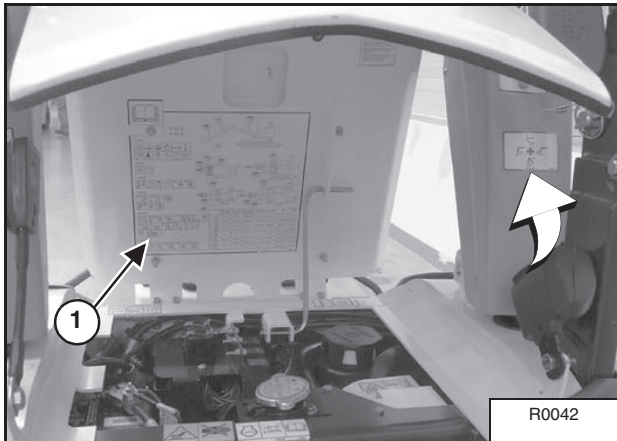
W-2197-0904

DAILY INSPECTION

Daily Inspection And Maintenance

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.

Figure 40



The Service Schedule decal (Item 1) [Figure 40] is located inside the tailgate.

A complete list of scheduled maintenance tasks is also located in the Service Schedule (See SERVICE SCHEDULE on page 54.)

! WARNING

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

W-2001-0502

NOTE: Fluids such as engine oil, hydraulic fluid, coolant, etc. must be disposed of in an environmentally safe manner. Some regulations require that certain spills and leaks on the ground must be cleaned in a specific manner. See local, state and federal regulations for correct disposal.

! 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

IMPORTANT

This machine is factory equipped with a spark arrester exhaust system.

The spark arrester muffler, if equipped, must be cleaned to keep it in working condition. The spark arrester muffler must be serviced by dumping the spark chamber every 100 hours of operation.

On some models, the turbocharger functions as the spark arrester and must operate correctly for proper spark arrester function.

If this machine is operated on flammable forest, brush, or grass covered land, a spark arrester attached to the exhaust system may be required and must be maintained in working order. Refer to local laws and regulations for spark arrester requirements.

I-2284-EN-0909

DAILY INSPECTION (CONT'D)

Daily Inspection and Maintenance (Cont'd)

Check the following items before each day of operation:

- Operator Canopy (TOPS) and mounting hardware.
- Check seat belt and mounting hardware. Replace seat belt if damaged.
- Check for damaged decals, replace as needed.
- Check control console lockouts.
- Check the attachment mounting system for damaged or loose parts.
- Check air cleaner and intake hoses / clamps.
- Check engine oil level and engine for leaks.
- Drain water from fuel filter.
- Check engine coolant level (in both the coolant recovery tank and in the radiator) and system for leaks.
- Check engine area for flammable materials.
- Check hydraulic fluid level and system for leaks.
- Check indicator lights for correct operation.
- Grease all pivot points.
- Check cylinder and attachment pivot points.
- Check the track tension.
- Repair broken and loose parts.
- Check front horn and motion alarm (if equipped) for proper function.



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

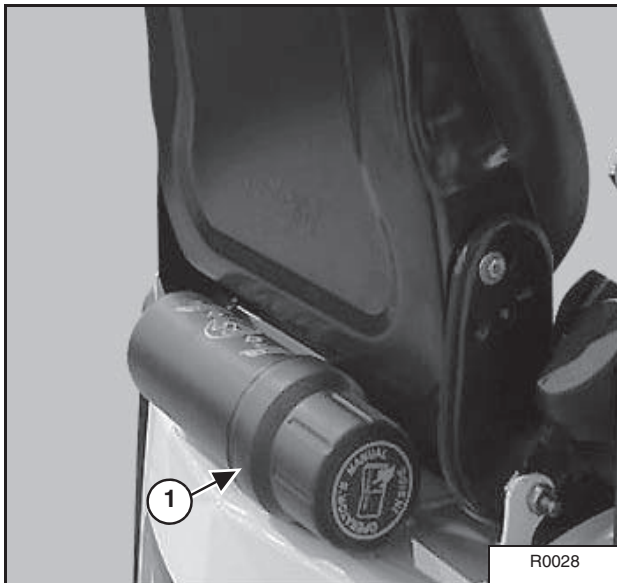
- Never direct the stream at a low angle toward the decal that could damage the decal causing it to peel from the surface.
- Direct the stream at a 90 degree angle and at least 300 mm (12 in) from the decal. Wash from the center of the decal toward the edges.

I-2226-0910

PRE-STARTING PROCEDURE

Before Starting The Engine

Figure 41



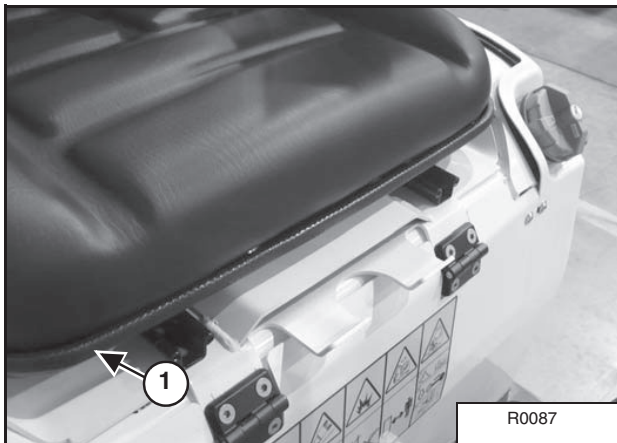
Read and understand the Operation & Maintenance Manual (Item 1) [Figure 41] before operating.

The Operation & Maintenance Manual and other manuals can be kept in a container (Item 1) [Figure 41] provided behind the operator's seat.

NOTE: Make sure the engine cover is latched.

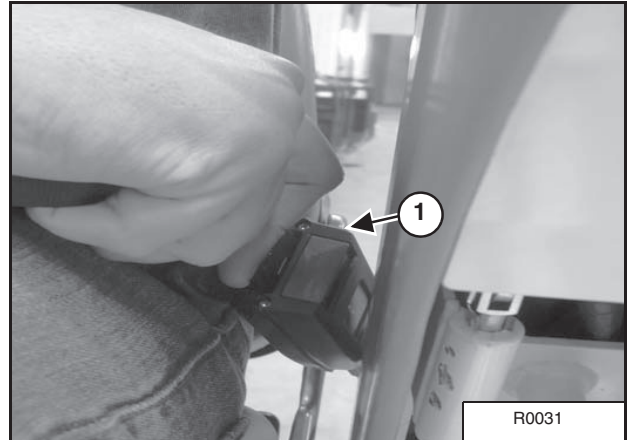
Use the canopy, the tracks and safety treads to enter.

Figure 42



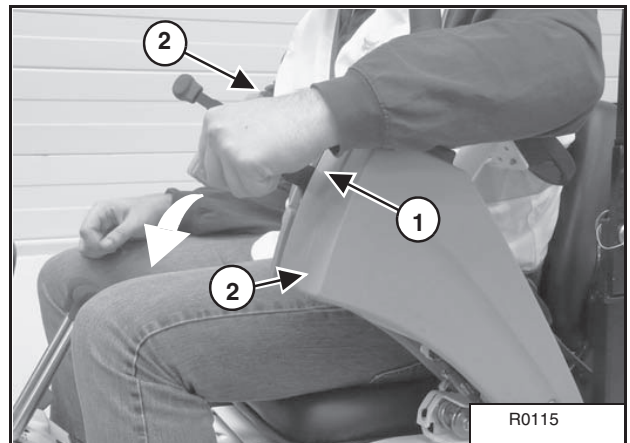
Release the seat lever (Item 1) [Figure 42] to adjust the seat forward or backward for comfortable operation.

Figure 43



Fasten the seat belt (Item 1) [Figure 43].

Figure 44



Lower the control lockout levers (Item 1) [Figure 44] before operating the machine.

NOTE: The control lockout levers must be in the down position for the hydraulic control levers to operate.

STARTING THE ENGINE

Key Switch

Perform the PRE-STARTING PROCEDURE. (See PRE-STARTING PROCEDURE on Page 37.)

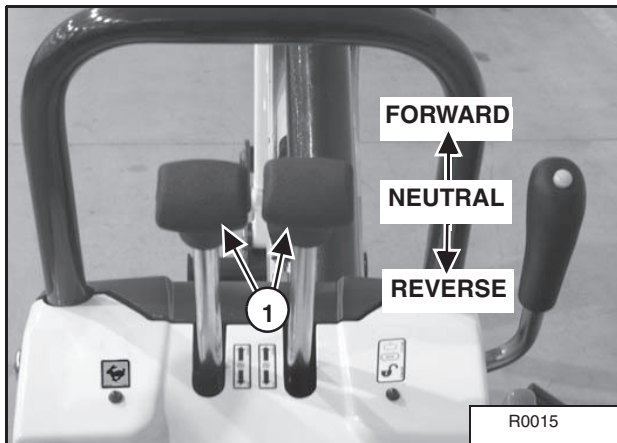
! WARNING

AVOID INJURY OR DEATH

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

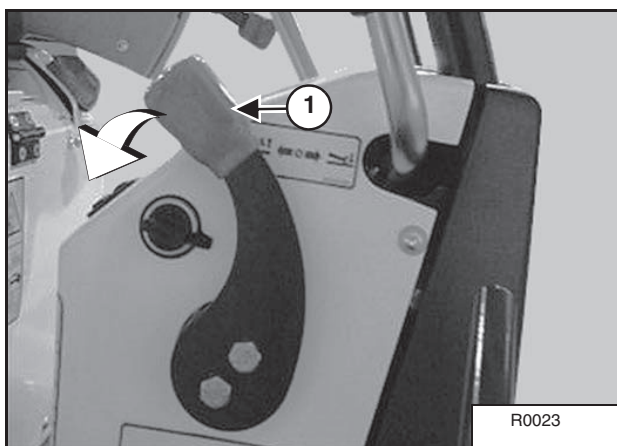
W-2135-1108

Figure 45



Put the steering levers (Item 1) [Figure 45] in the NEUTRAL position.

Figure 46



Move the engine speed control lever (Item 1) [Figure 46] to low idle.

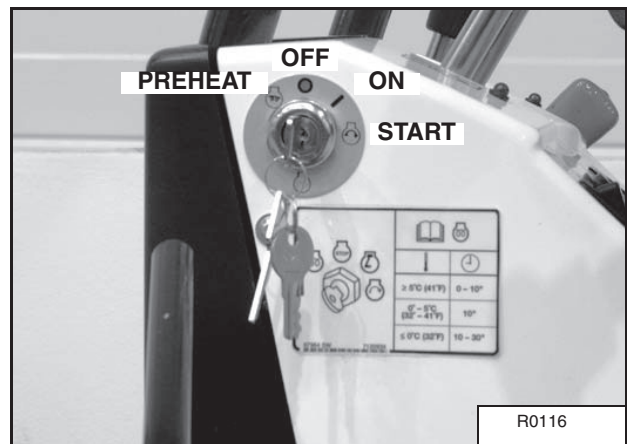
! WARNING

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

Figure 47



Turn the key to the PREHEAT position (if required) [Figure 47].

Turn the key to the START position [Figure 47] and release the key when the engine starts. It will return to the ON position.

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.

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

STARTING THE ENGINE (CONT'D)

Cold Temperature Starting Procedure

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 61.)

Make sure the battery is fully charged.

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 70.).

Install an engine heater.

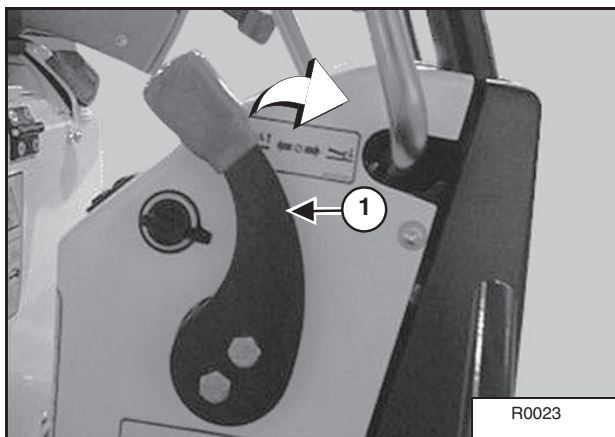
! WARNING

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

Figure 48



Push the engine speed control lever (Item 1) [Figure 48] fully forward.

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

! WARNING

AVOID SERIOUS INJURY OR DEATH

- Engines can have hot parts and hot exhaust gas. Keep flammable material away.
- Do not use machines in atmosphere containing explosive dust or gases.

W-2051-0212

Figure 49

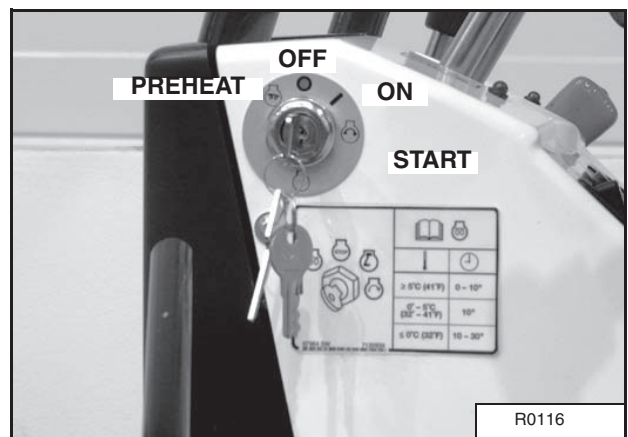
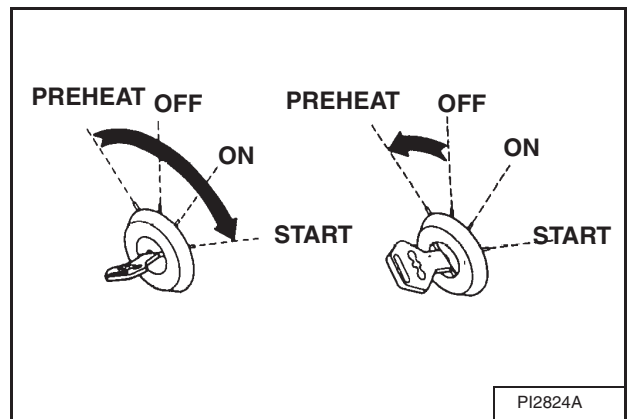


Figure 50



Turn the key to the PREHEAT position [Figure 49]. The light (Item 4) [Figure 5] will come ON. Preheat the engine for 15 seconds maximum.

Turn the key to the START position [Figure 49] and release the key when the engine starts. It will return to the ON position.

When the engine speed increases, move the engine speed control lever to the low idle position.

Turn the key switch OFF to stop the engine [Figure 49],

STARTING THE ENGINE (CONT'D)

Warning The Hydraulic System



WARNING

During cold weather 0°C (32°F) and below, do not operate machine until the engine has run for at least five (5) minutes at less than half throttle. This warm-up period is necessary. Do not operate controls during warm-up period. When temperatures are below -30°C (-20°F), the hydraulic oil must be heated or kept warm. The hydraulic system will not get enough oil at low temperatures. Park the machine in an area where the temperature will be above -18°C (0°F), is possible.

W-2381-0211

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

BUCKETS AND ATTACHMENTS

Installing

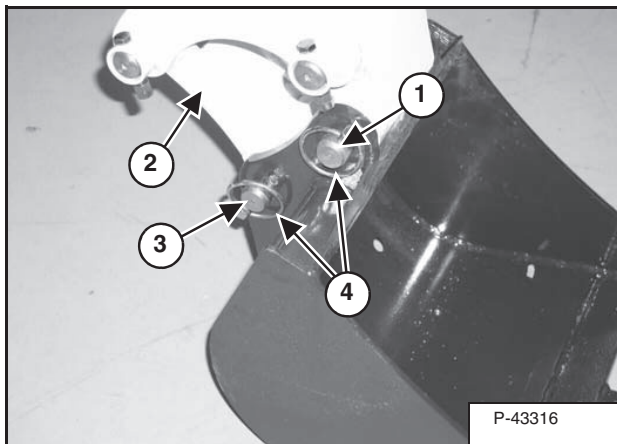
! WARNING

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 51



Install the arm into the bucket, align the hole, install the pivot pin (Item 1) [Figure 51].

Install the link (Item 2) into the bucket, align the hole, install the pivot pin and washer (Item 3) [Figure 51].

Install the retainer pins (Item 4) [Figure 51]. Add grease to the pivot pins before operation.

Removing

Park the excavator on flat level ground and put the bucket on the ground.

Remove the retainer pins (Item 4), washers and pivot pin (Item 1 and 3) [Figure 51]. Keep the pivot pins clean.

! 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

Inspecting 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, 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:

- Inspect 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 can 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.

Driving On Public Roads

When operating on a public road or motorway, always follow local regulations. For example: Slow Moving Vehicle Sign or direction signals can be required.

Always follow local regulations. For more information, contact your local Doosan dealer.

! WARNING

AVOID INJURY OR DEATH

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

W-2374-0500

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

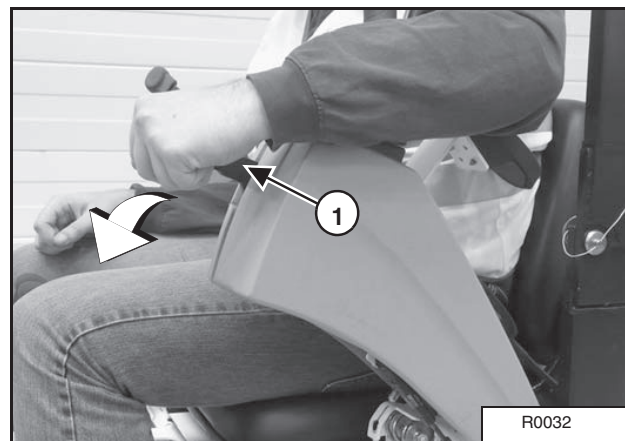
Lowering The Work Equipment (Engine STOPPED)

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

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

Use the control lever to lower the boom.

Figure 52



The control lockout levers (Item 1) [Figure 52] disengage the hydraulic control functions from the control joysticks when they are raised.

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

The control lockout lever(s) must be in the locked down position, and the key switch in the ON position.

Use the control lever to lower the boom fully.

Lower the control console(s) to engage the hydraulic control functions of the joysticks [Figure 52].

OPERATING PROCEDURE (CONT'D)

Object Handling

The excavator must be equipped with the optional lift eye link (Item 1) [Figure 53]. See your Doosan dealer for available Kits.

Do not exceed the Rated Lift Capacity. (See MACHINE SIGNS (DECALS) on Page 15.)

WARNING

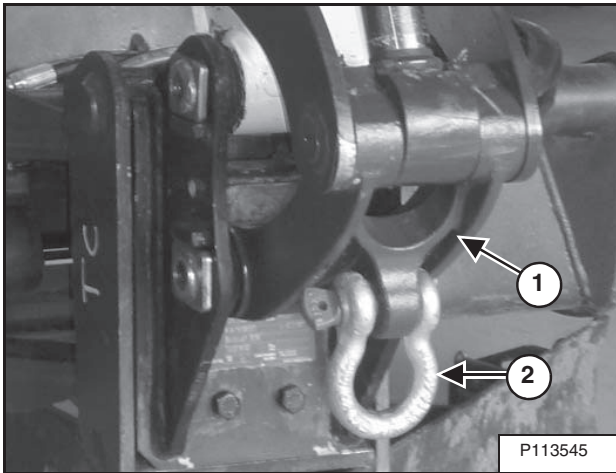
AVOID INJURY OR DEATH

- Do not exceed rated lift capacity.
- Excessive load can cause tipping or loss of control.
- Excessive load can cause failure of the lift eye and cause the load to drop.

W-2991-0714

Extend the bucket cylinder completely and lower the boom to the ground. Stop the engine. Exit the excavator. (See STOPPING THE EXCAVATOR on Page 48.)

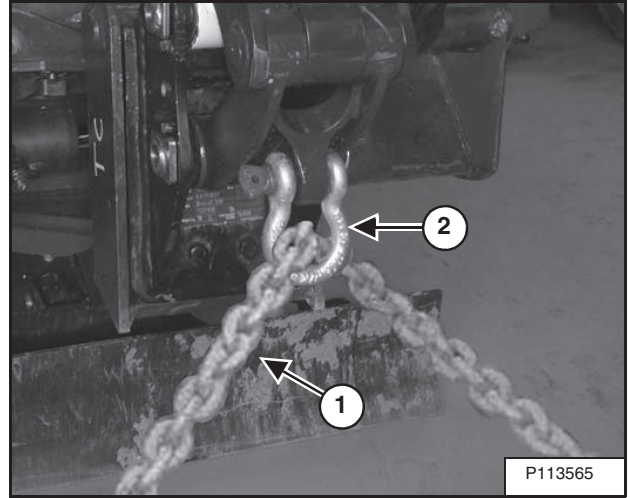
Figure 53



Install a clevis (Item 2) through the lift eye (Item 1) [Figure 53].

NOTE: Visually check the lifting eye, the clevis and the lifting chain (lifting device) for any damage. Replace any damage components before lifting.

Figure 54

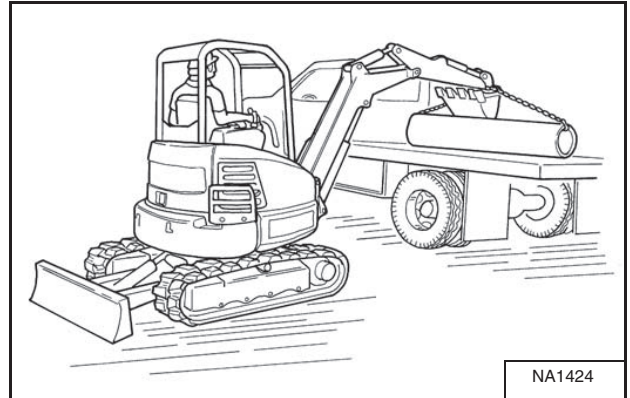


Install a lift chain (Item 1) (or other type of lifting device) through the clevis (Item 2) [Figure 54] and connect to the object to be lifted.

NOTE: Always use chains or other types of lifting devices that are intended for this type of use and that are of adequate strength for the object being lifted.

Enter the excavator, fasten the seat belt and start the engine. (See PRE-STARTING PROCEDURE on Page 37.)

Figure 55



Make sure the load is evenly weighted and centred on the lifting chain (or other type of lifting device), and is secured to prevent the load from shifting [Figure 55].

Operate the controls slowly and smoothly to avoid suddenly swinging the lifted load.

Lift and position the load. When the load is placed in a secured position and tension is removed from the lift chain, remove the chain from the load and from the lift eye.

OPERATING PROCEDURE (CONT'D)

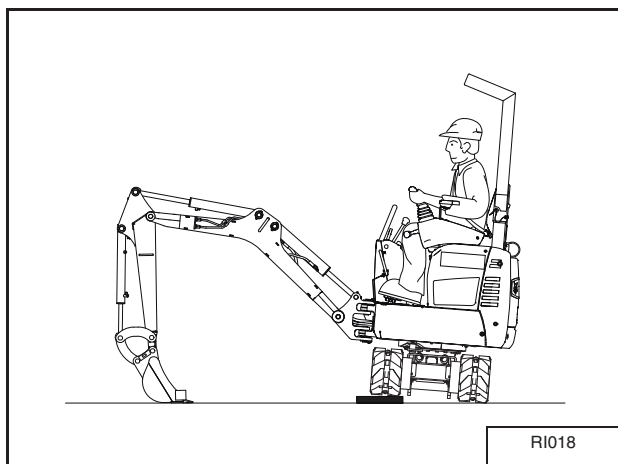
Driving The Excavator

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

Avoid driving 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 drive on and prevent the excavator from getting stuck.

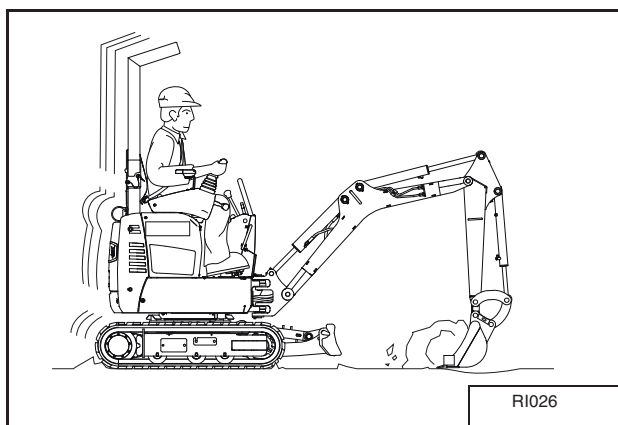
Figure 56



If one or both tracks have become stuck in soft or wet ground, raise one track at a time turning the upperstructure and pushing the bucket against the ground **[Figure 56]**.

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

Figure 57



The bucket can 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 57]**.

OPERATING PROCEDURE (CONT'D)

Operating On Slopes

NOTE: Always expand tracks when working on slopes or in rough conditions.

! WARNING

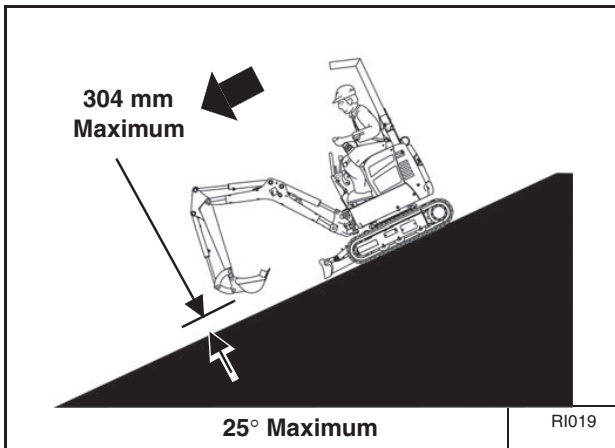
AVOID INJURY OR DEATH

- 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 engine speed control lever.

Figure 58



When going down or backing up grades that exceed 25 degrees, put the machine in the position shown, and run the engine slowly [Figure 58].

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

Avoid driving 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 centred and attachments as low as possible when travelling on slopes or in rough conditions. Look in the direction of travel.
- Always fasten seat belt.

W-2498-EN-1009

Figure 59

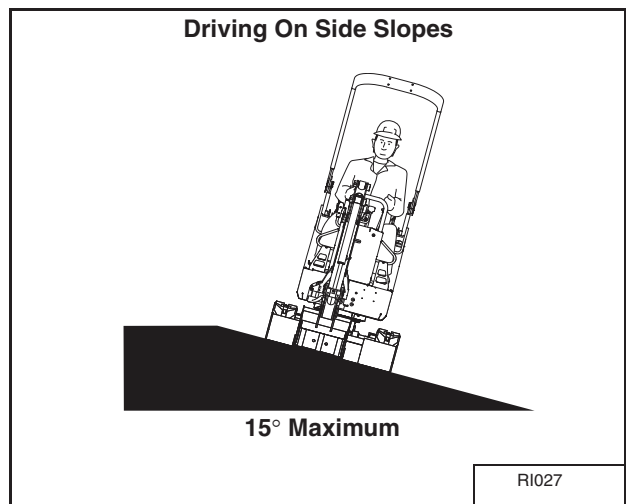
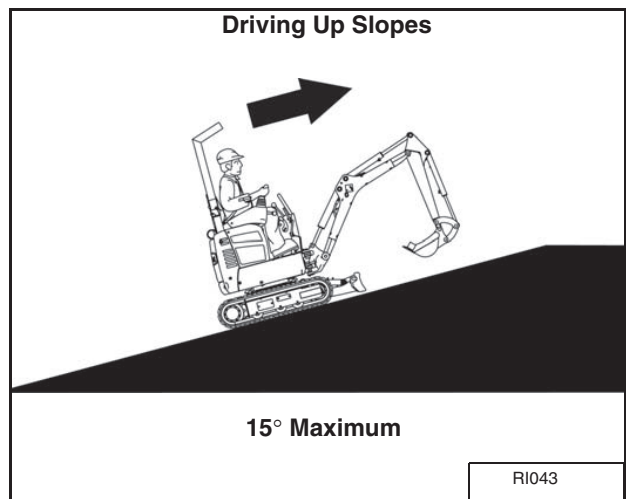


Figure 60

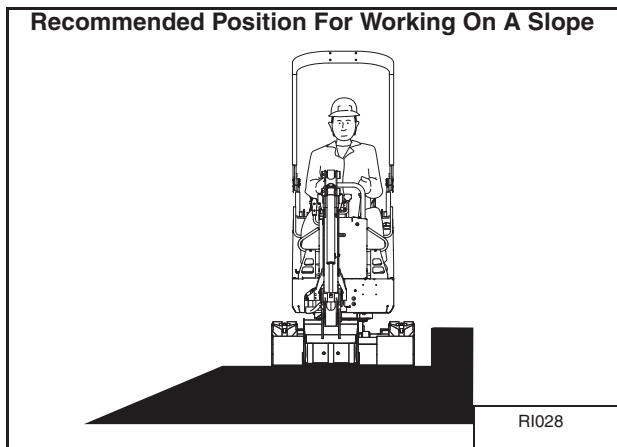


When going up slopes or on side slopes that are 15 degrees or less, position the machine as shown and run the engine slow [Figure 59] and [Figure 60].

OPERATING PROCEDURE (CONT'D)

Operating On Slopes (Cont'd)

Figure 61



When operating on a slope, level the work area before beginning [Figure 61].

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

Do not work on slopes which are over 15 degrees.

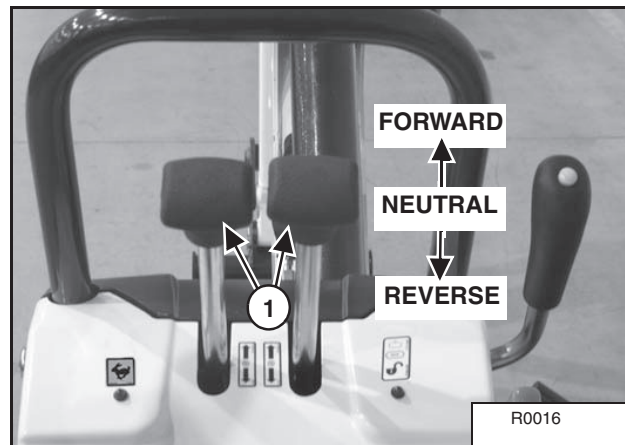
Use a slow work cycle.

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 soil far enough away from the trench or hole to prevent the possibility of a cave-in.

Figure 62



To brake the machine when going down a slope, move the steering levers (Item 1) [Figure 62] 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 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.

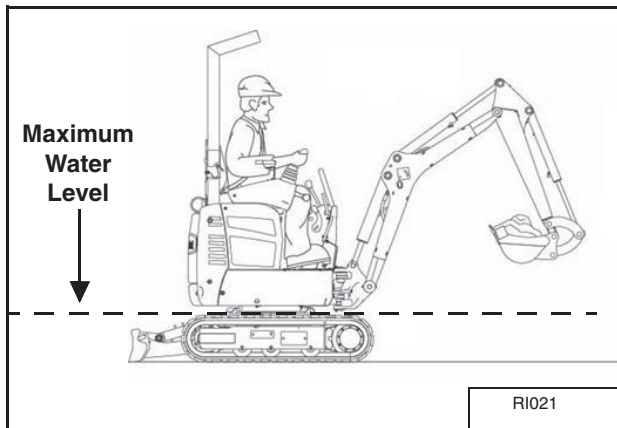
Start the engine and resume operation.

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 63



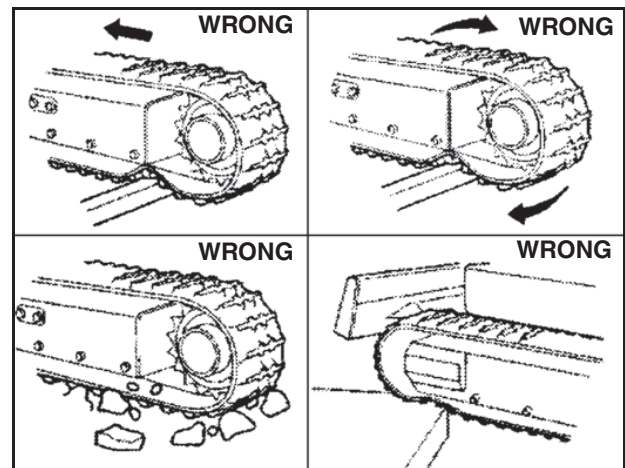
Do not operate or immerse the excavator in water higher than the bottom of the swing bearing **[Figure 63]**.

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.

Avoiding Track Damage

Figure 64



- Do not travel or turn on a sharp edge or stepped grade.
- The illustration **[Figure 64]** shows operating conditions to avoid to prevent damage to the rubber tracks.
- Do not turn sharply on a surface with a high-friction factor such as concrete or asphalt.
- Keep oil off the track. Clean any oil spills.
- Do not operate on a beach or in an area which can cause excessive corrosion.
- If the machine is not used for a long period of time, keep it indoors to prevent direct exposure to sunlight, rain, snow, etc.

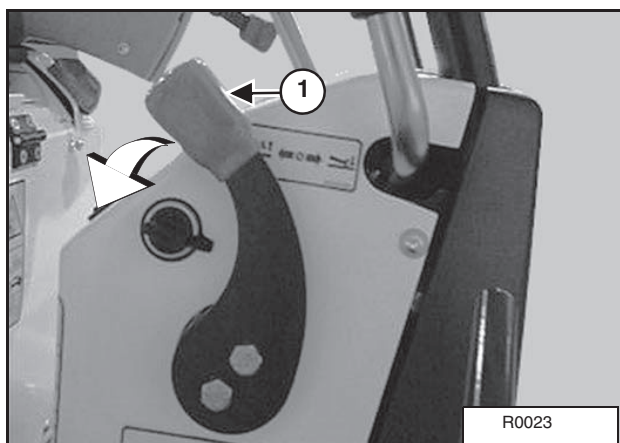
STOPPING THE EXCAVATOR

Figure 65



Stop the machine on level ground. Lower the work equipment and the blade to the ground [Figure 65].

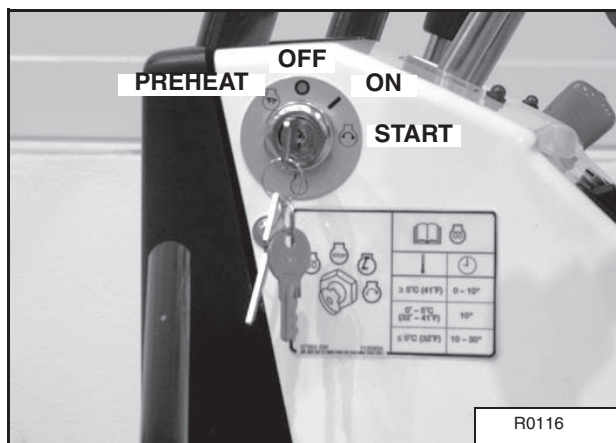
Figure 66



Move the engine speed control lever fully down [Figure 66] and run the engine at idle speed for about 5 minutes to allow it to cool.

Stop the engine.

Figure 67



Turn the key to the OFF position [Figure 67].

Raise the control lockout levers.

Disconnect the seat belt. Remove the key from the switch to prevent operation of machine by unauthorised personnel. Exit machine.

LIFTING THE EXCAVATOR

Fully extend the cylinders of the bucket, arm and boom.

Raise the blade all the way.

Turn the upper structure so that the boom is at the opposite end as the blade.

Put all the controls in neutral and engage the swing lock. (See UPPERSTRUCTURE SLEW LOCK on Page 34.)

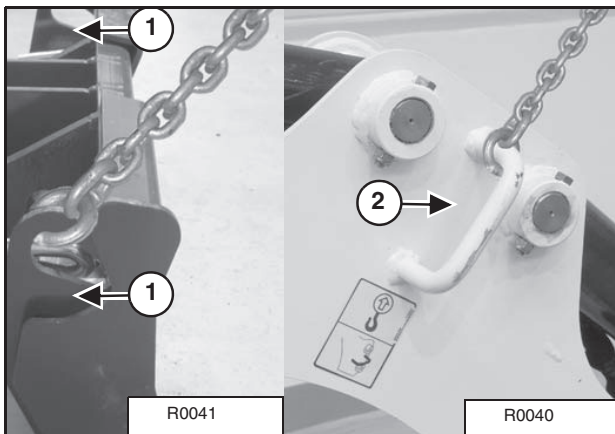
WARNING

AVOID INJURY OR DEATH

- **Use a lifting fixture 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. Engage the upperstructure slew lock.**
- **Never lift with operator on machine.**

W-2202-EN-0909

Figure 68



Fasten the chains to the ends of the blade (Item 1) [Figure 68] and up to a lifting fixture above the canopy.

Fasten a chain in the hook of the boom (Item 2) [Figure 68].

TRANSPORTING THE EXCAVATOR

Loading Onto Transport Vehicle

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.

Align the ramps with the centre of the transport vehicle. Secure the ramps to the truck (or trailer) 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 to be supported when loading or unloading to prevent the front of the transport from raising.

Determine the direction of the track movement before moving the machine (blade forward). Engage the swing lock. (See UPPERSTRUCTURE SLEW LOCK on Page 34.)

Figure 69



Move the machine forward onto the transport vehicle [Figure 69].

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.

Put blocks under the front and rear of the track shoes.

TRANSPORTING THE EXCAVATOR (CONT'D)

Fastening To Transport Vehicle

Figure 70

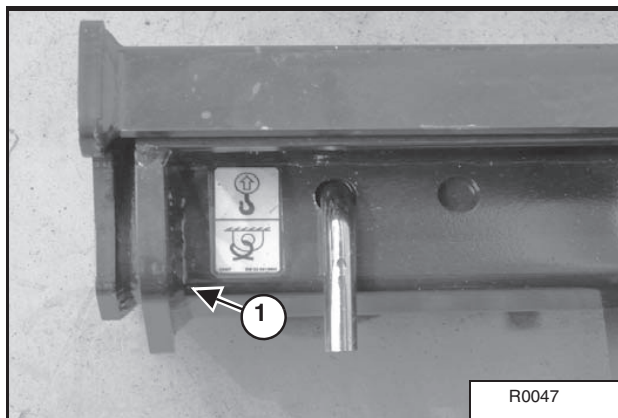
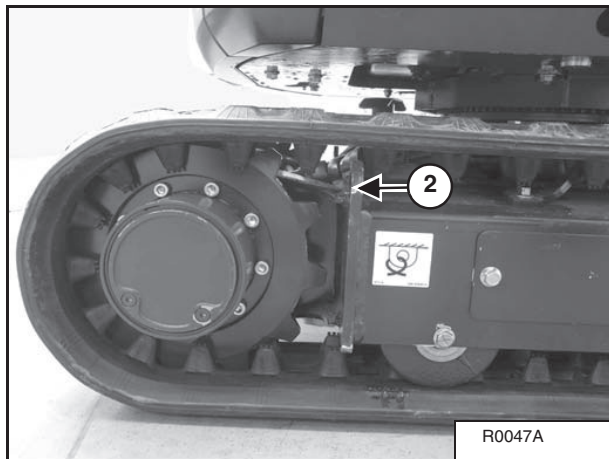
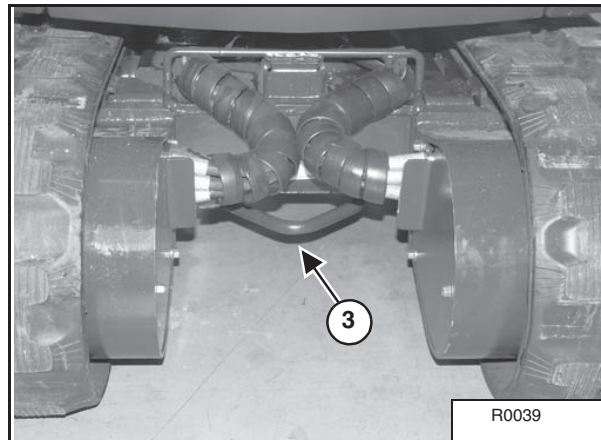


Figure 71



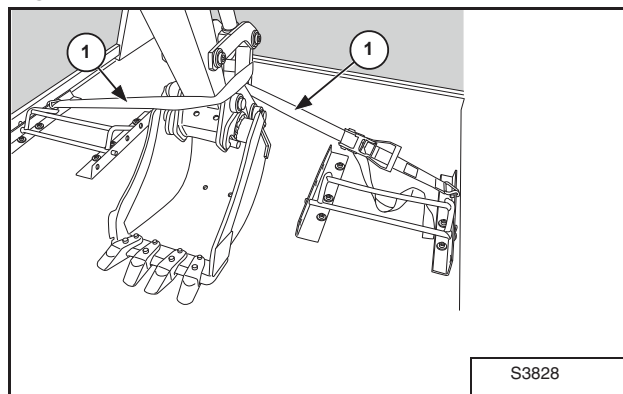
Fasten chains to the front corners of the blade (Item 1) [Figure 70], to both sides of the tracks (Item 2) [Figure 71] and to the tie down loop at the rear of the track frame (Item 3) [Figure 72].

Figure 72



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

Figure 73



- When on the transport vehicle, loop the chains through the holes in the mounting frame.
- Loop the chain (Item 1) [Figure 73] around the bucket link.

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

PREVENTIVE MAINTENANCE

MAINTENANCE SAFETY	53
SERVICE SCHEDULE	54
Maintenance Intervals	54
TAILGATE	56
Opening And Closing The Tailgate	56
AIR CLEANER	57
Daily Check	57
Replacing The Filters	57
SEAT BELT	58
Inspection And Maintenance	58
FUEL SYSTEM	59
Fuel Specifications	59
Biodiesel Blend Fuel	59
Filling The Fuel Tank	60
Removing Water From The Fuel Filter	60
Replacing The Fuel Filter	60
Draining The Fuel Tank	60
Removing Air From The Fuel System	61
ENGINE LUBRICATION SYSTEM	61
Checking And Adding Engine Oil	61
Engine Oil Chart	61
Replacing Oil And Filter	62
COOLING SYSTEM	63
Cleaning The Cooling System	63
Checking The Coolant Level	63
Replacing The Coolant	64
ALTERNATOR FAN BELT	65
Adjusting The Alternator Belt	65
ELECTRICAL SYSTEM	67
Description	67
Fuses	67
Relays And Diodes	67
Battery Maintenance	68
Maintaining Battery Charge Level	68
Battery Service During Machine Storage	68
Battery Testing	69
Battery Charging	69
Using A Booster Battery (Jump Starting)	70
Removing And Installing The Battery	71

HYDRAULIC SYSTEM	72
Checking And Adding Hydraulic Fluid	72
Hydraulic / Hydrostatic Fluid Chart	73
Replacing The Hydraulic Filter	73
Draining Hydraulic Oil	74
Diagnostic Couplers	75
CONTROL LOCKOUT LEVERS	76
Inspection And Maintenance	76
TRACK TENSION	77
Adjusting	77
DRIVE MOTOR	79
Checking Oil Level	79
Draining The Drive Motor	79
BLADE EXTENSION	80
Description	80
Extending And Retracting	80
TRACK ROLLER AND IDLER LUBRICATION	81
Procedure	81
LUBRICATION OF THE HYDRAULIC EXCAVATOR	81
Blade	81
Boom Swing And Boom Base	82
Boom, Middle	82
Frame Fittings	84
Track Expansion Tube	84
EXCAVATOR STORAGE AND RETURN TO SERVICE	85
Storage	85
Return To Service	85

MAINTENANCE SAFETY



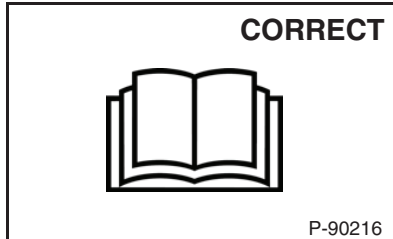
WARNING

Training is necessary before operating or servicing machine. Read and understand the Operation and Maintenance Manual and signs (stickers) 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

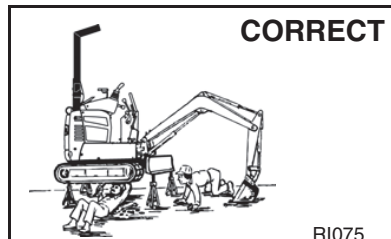


Safety Alert Symbol: This symbol with a warning statement, means: "Warning, be alert! Your safety is involved!" Carefully read the message that follows.



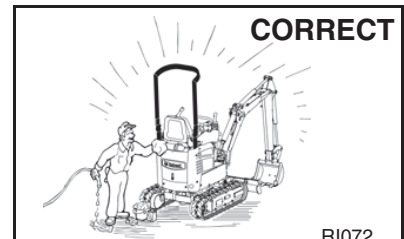
P-90216

Never service the Doosan Compact Excavator without instructions.



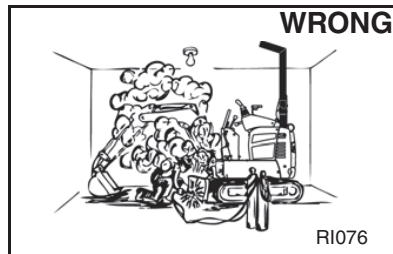
RI075

Use the correct procedure to lift and support the excavator.



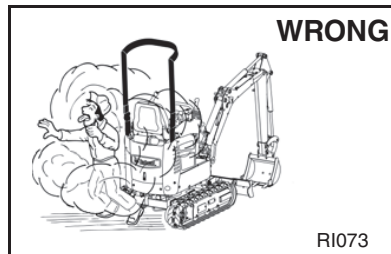
RI072

Cleaning and maintenance are required daily.



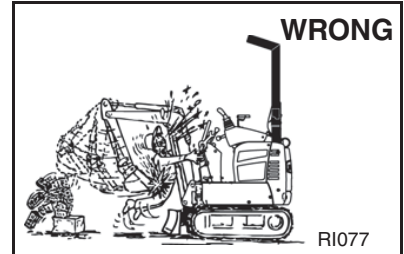
RI076

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



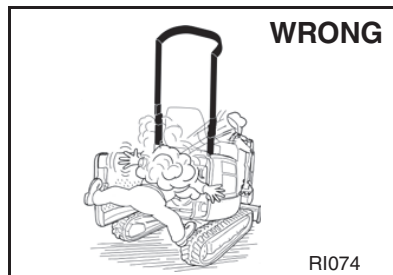
RI073

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



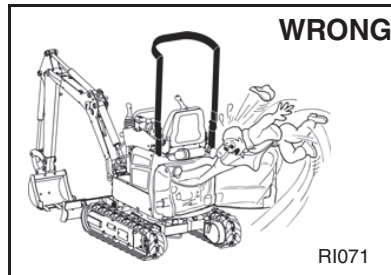
RI077

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



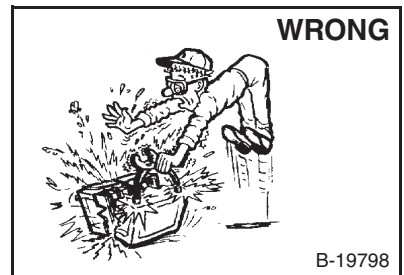
RI074

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.



RI071

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.



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 and Maintenance Manual can be performed by the owner/operator without any specific technical training. Maintenance procedures which are **not** in the Operation and Maintenance Manual must be performed **ONLY BY QUALIFIED DOOSAN SERVICE PERSONNEL**. Always use genuine Doosan replacement parts.

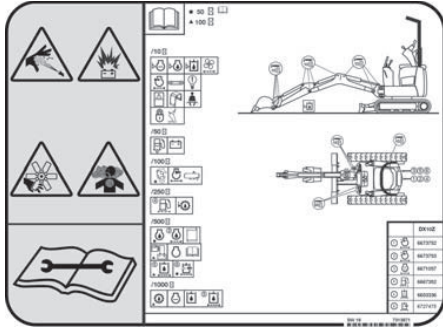
MSW33DH-0117

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 61.)
- **Engine Air Filters and Air System** - Check air clearer condition indicator. Service only when required. Check for leaks and damaged components. (See Page 57.)
- **Engine Cooling System** - Clean debris from oil cooler, radiator and grille. Check coolant level COLD and add premixed coolant as needed. (See Page 63.)
- **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.
- **Control Console Lockout** - Check the control console lockout lever for proper operation. Clean dirt and debris from moving parts. (See Page 76.)
- **Motion Alarm** - Check for proper function (if equipped).
- **Operator Canopy (TOPS)** - Check the canopy condition and mounting hardware. (See Page 26.)
- **Indicators and Lights** - Check for correct operation of all indicators and lights. (See Page 23.)
- **Safety Signs and Safety Tread** - Check for damaged signs (decals) and safety tread. Replace any signs and safety treads that are damaged. (See Page 15.)
- **Hydraulic Fluid** - Check fluid level and add as needed. (See Page 72.)
- **Track Tension** - Check tension and adjust as needed. (See Page 77.)
- **Pivot Points** - Grease all machinery pivot points. Grease track expansion. Grease clamp (if equipped). (See Page 81.)

First 50 Hours

- **Engine Oil and Filter** - Replace oil and filter. (See Page 62.)
- **Drive Belts (Alternator)** - Check condition. Adjust belt tension. Replace as needed. (See Page 65.)

Every 50 Hours

- **Swing Bearing** - Grease swing bearing and swing pinion. Service every 10 hours when operating in water. (See Page 81.)
- **Battery** - Check cables, connections, and electrolyte level; add distilled water as needed. (See Page 68.)
- **Fuel Tank** - Drain water and sediment from fuel tank and fuel filter. (See Page 60.)

WARNING

AVOID INJURY OR DEATH

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual 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-EN-0614

SERVICE SCHEDULE (CONT'D)

Maintenance Intervals (Cont'd)

First 100 Hours

- **Alternator and Starter** - Check connections.
- **Drive Motors (Final Drive)** - Replace fluid. (See Page 79.)
- **Hydraulic Filter** - Replace the hydraulic filter. (See Page 73.)

Every 100 Hours

- **Drive Belts (Alternator / Fan)** - Check condition. Replace as needed. (See Page 65.)

Every 250 Hours Or Every 12 Months

- **Fuel Filter** - Replace fuel filter. (See Page 60.)
- **Travel Motors (Final Drive)** - Check fluid level and add as needed. (See Page 79.)

Every 500 Hours Or Every 12 Months

- **Engine Oil and Filter** - Replace oil and filter. (See Page 62.)
- **Cooling System** - Clean debris from radiator / hydraulic fluid cooler. (See Page 63.)
- **Hydraulic Filter and Hydraulic Reservoir Breather Cap** - Replace the hydraulic filter and the reservoir breather cap. (See Page 73.)
- **Alternator and Starter** - Check connections.
- **Engine Valves** - Adjust the engine valve clearance. See your dealer for service.

Every 1000 Hours Or Every 12 Months

- **Hydraulic Fluid and Filters** - Replace hydraulic fluid and filters. (See Page 73.)
- **Travel Motors (Final Drive)** - Replace fluid. (See Page 79.)

Every 24 Months

- **Coolant** - Replace the coolant. (See Page 63.)

TAILGATE

Opening And Closing The Tailgate

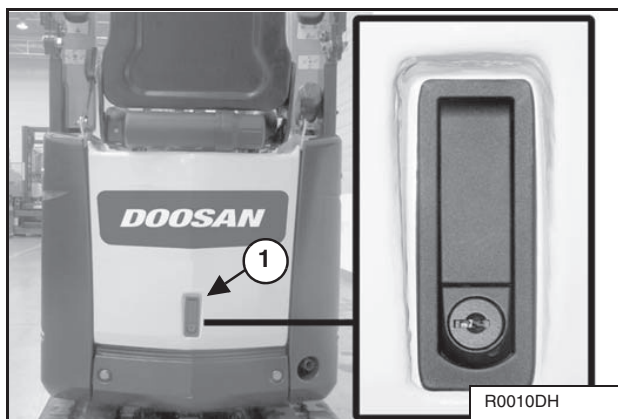
WARNING

AVOID INJURY OR DEATH

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

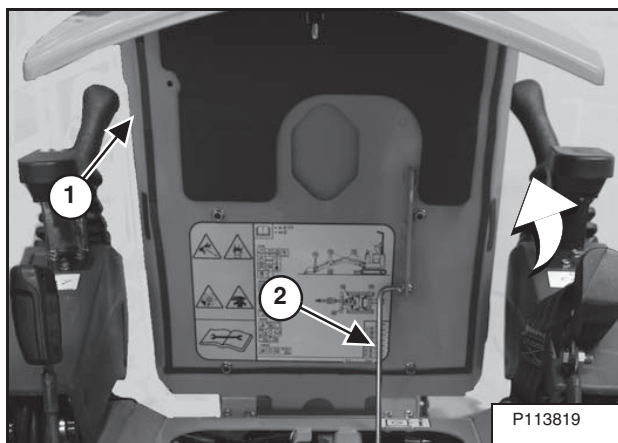
W-2012-0497

Figure 74



Release the latch (Item 1) [Figure 74] and pull the tailgate open.

Figure 75



Lift up fully on the tailgate (Item 1) till blocking the retaining rod (Item 2) [Figure 75] secures the tailgate in the open position.

To close the tailgate, slow lift the tailgate (Item 1) and release retaining rod and slowly lower the tailgate. Push on the tailgate until the latch is closed.

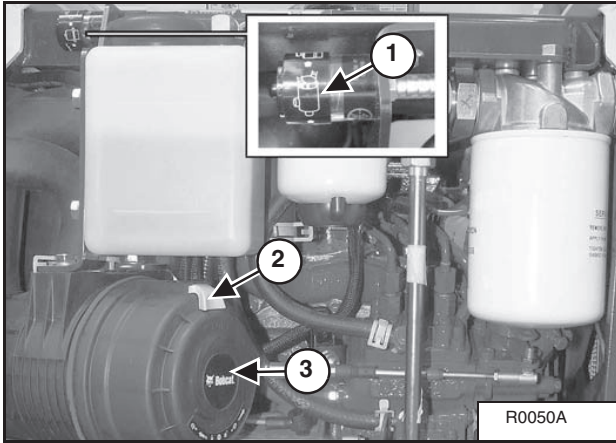
NOTE: The tailgate can be locked using the start key.

AIR CLEANER

(See SERVICE SCHEDULE on Page 54.) for the correct service interval.

Daily Check

Figure 76



Check the condition indicator (Item 1) [Figure 76]. If the red ring shows in the condition indicator, the filter needs to be replaced.

Replacing The Filters

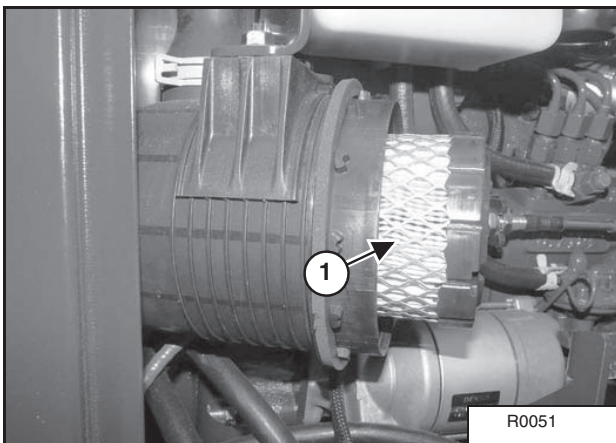
Outer Filter

Pull out the locking tab (Item 2) [Figure 76].

Turn the dust cup (Item 3) [Figure 76] anticlockwise about 1/8 turn.

Remove and clean the dust cup

Figure 77



Pull the outer filter (Item 1) [Figure 77] from the air cleaner housing.

Check the housing for damage.

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

Install the new outer filter.

Install the dust cup (Item 3) [Figure 76] and turn it clockwise about 1/8 turn.

Push the locking tab in (Item 2) [Figure 76].

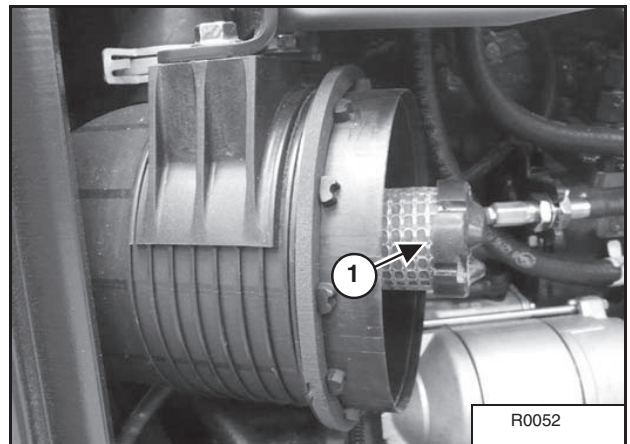
Check the air intake hose and the air cleaner housing for damage. Make sure all connections are tight.

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 on the top of the condition indicator (Item 1) [Figure 76] and start the engine. Run at full rpm, then reduce engine speed and stop the engine. If the red ring shows in the condition indicator, replace the inner filter.

Figure 78



Remove the dust cup (Item 3) [Figure 76], the outer filter (Item 1) [Figure 77] and the inner filter (Item 1) [Figure 78].

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 reset the condition indicator (Item 1) [Figure 76] (the red ring will not show anymore).

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 yearly or more often if the machine is exposed to severe environmental conditions or applications.

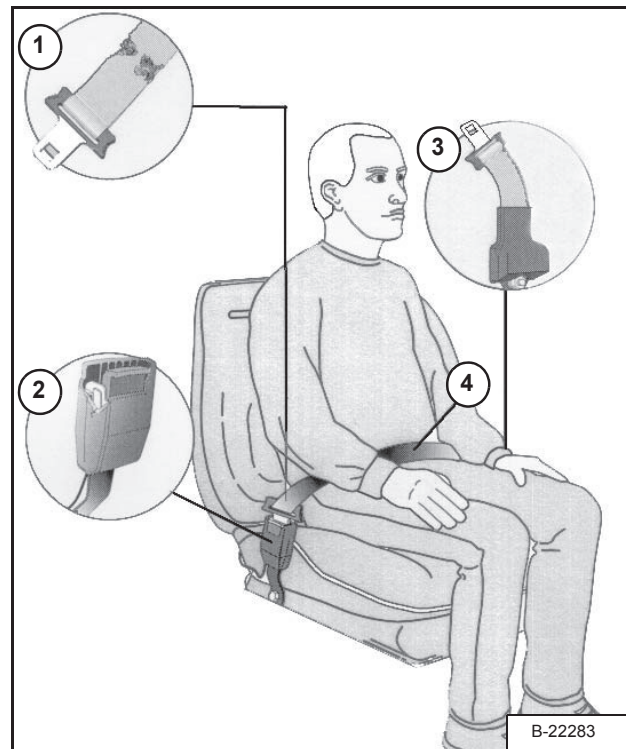
The seat belt system should be repaired or replaced if it shows cuts, fraying, extreme or unusual wear, significant discolourations due to ultraviolet (UV) rays from the sun, dusty / dirty conditions, abrasion to the seat belt webbing, or damage to the buckle, latch plate, retractor (if equipped), or hardware.

The items below are referenced in **[Figure 79]**.

1. Check the seat belt 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 proper function. Make sure latch plate is not excessively worn, deformed or buckle is not damaged.
3. Check the retractor web storage device (if equipped) by extending the seat belt webbing to determine if it extends and retracts the 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 can have weakened.

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

Figure 79



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 that 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:

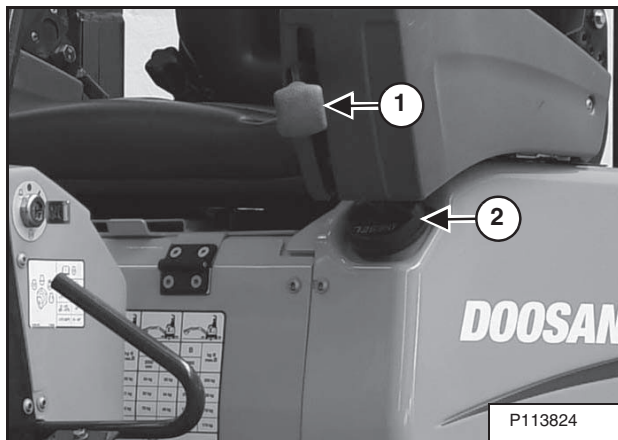
- Ensure the fuel tank is as full as possible at all times to prevent moisture from collecting in the fuel tank.
- Ensure that the fuel tank cap is securely tightened.
- Biodiesel blend fuel can damage painted surfaces, remove all spilled fuel from painted surfaces immediately.
- Drain all water from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

Figure 80



Raise the left console (Item 1) Remove the fuel fill cap (Item 2) under the left console using the key **[Figure 80]**.

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!**

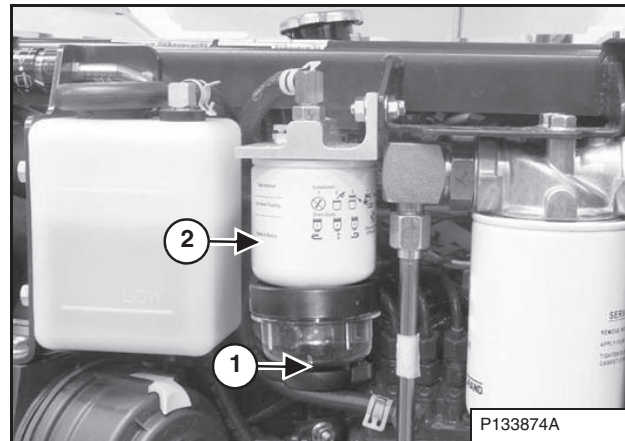
Install and tighten the fuel fill cap.

(See SERVICE SCHEDULE on Page 54.) for the service interval when to remove water from or replace the fuel filter.

Removing Water From The Fuel Filter

Open the tailgate.

Figure 81



Loosen the drain (Item 1) **[Figure 81]** at the bottom of the filter to drain water from the filter.

Replacing The Fuel Filter

Remove the filter (Item 2) **[Figure 81]**.

Clean the area around the filter housing. Put clean oil on the seal of the new filter. Install the fuel filter and tighten by hand.

Remove the air from the fuel system. (See Removing Air From The Fuel System on Page 61.)

Draining The Fuel Tank

Remove the fuel line at the engine and put the end of the hose in a fuel can, squeeze the primer bulb (if equipped) and drain the fuel tank that way (siphon action).

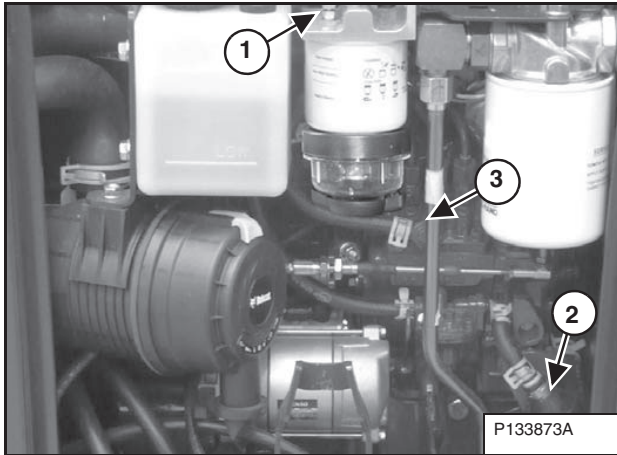
(See SERVICE SCHEDULE on Page 54.) for the correct service interval.

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 82



Open the fuel filter vent (Item 1) **[Figure 82]**.

Operate the hand pump (priming bulb) (Item 2) **[Figure 82]** until the fuel flows from the vent with no air bubbles.

Close the vent (Item 1) **[Figure 82]** on the fuel filter housing.

Start the engine and let it run at low idle. It may be necessary to open the vent at the fuel injection pump (Item 3) **[Figure 82]** 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.

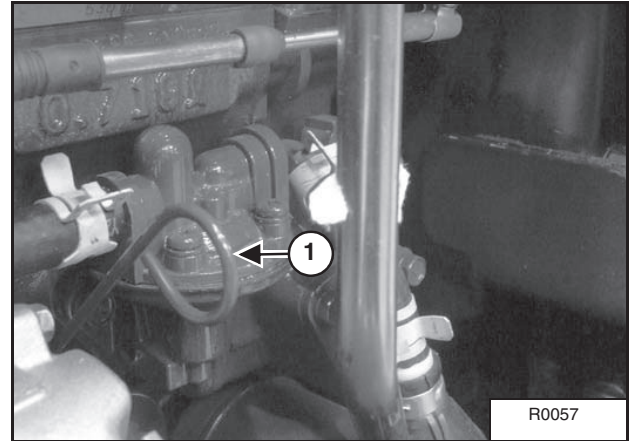
W-2072-EN-0909

ENGINE LUBRICATION SYSTEM

Checking And Adding Engine Oil

Check the engine oil every day before starting the engine for the work shift.

Figure 83

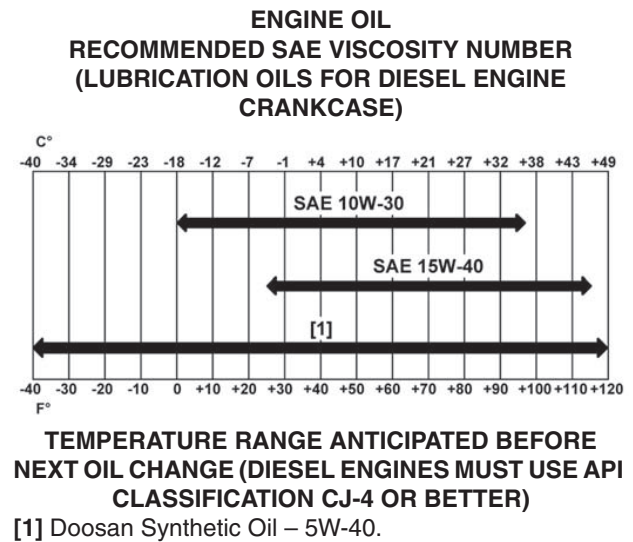


Open the rear door and remove the dipstick (Item 1) **[Figure 83]**.

Keep the oil level between the marks on the dipstick.

Engine Oil Chart

Figure 84



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 Classification of CJ-4 or better **[Figure 84]**.

ENGINE LUBRICATION SYSTEM (CONT'D)

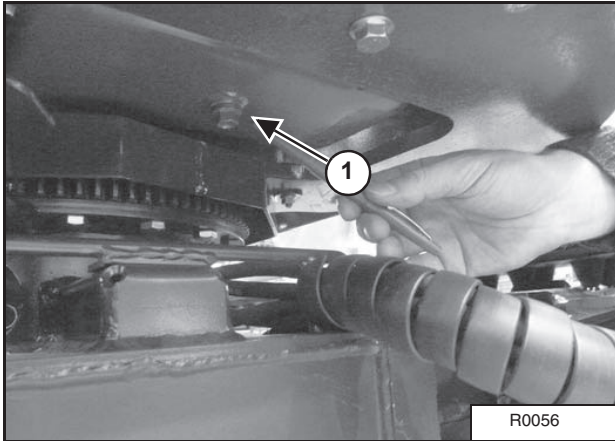
Replacing Oil And Filter

(See SERVICE SCHEDULE on Page 54.) for the service interval for replacing the engine oil and filter.

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

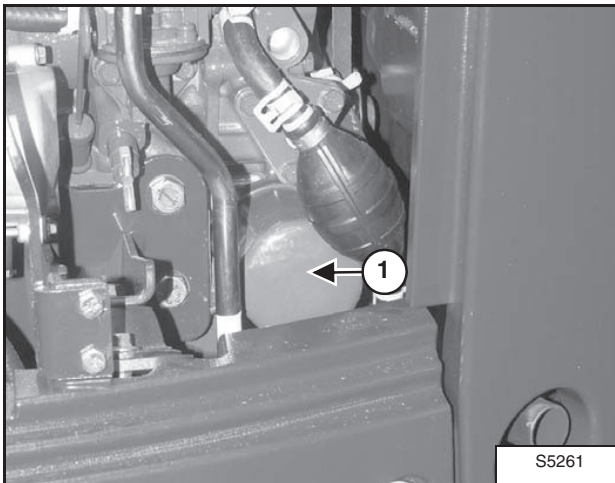
Open the tailgate.

Figure 85



Remove the drain plug (Item 1) [Figure 85] from the drain hose. Drain the oil into a container and recycle or dispose of used oil in an environmentally safe manner.

Figure 86



Remove the oil filter (Item 1) [Figure 86] and clean the filter housing surface.

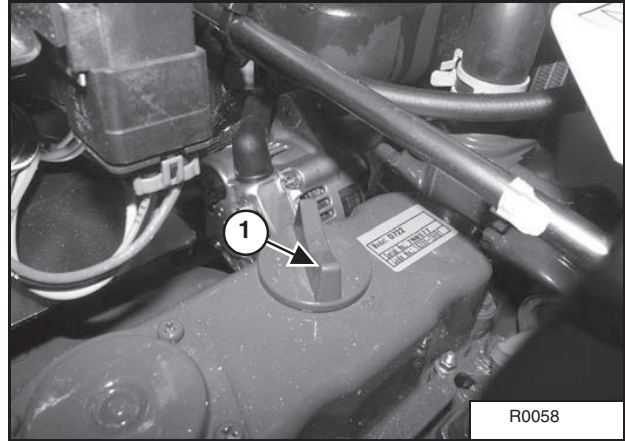
Use a genuine Doosan filter.

Put clean oil on the filter gasket.

Install the filter and tighten by hand.

Install and tighten the drain plug (Item 1) [Figure 85].

Figure 87



Remove the fill cap (Item 1) [Figure 87].

Put 2,8 L of oil into the engine.

Use a good quality motor oil that meets the correct API Service Classification [Figure 87].

Install the fill cap.

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.

COOLING SYSTEM

Check the cooling system every day to prevent overheating, loss of performance or engine damage.

Cleaning The Cooling System

Open the tailgate.

Use air pressure or water pressure to clean the radiator and oil cooler.

Checking The Coolant Level

! WARNING

AVOID BURNS

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

W-2070-1203

! WARNING

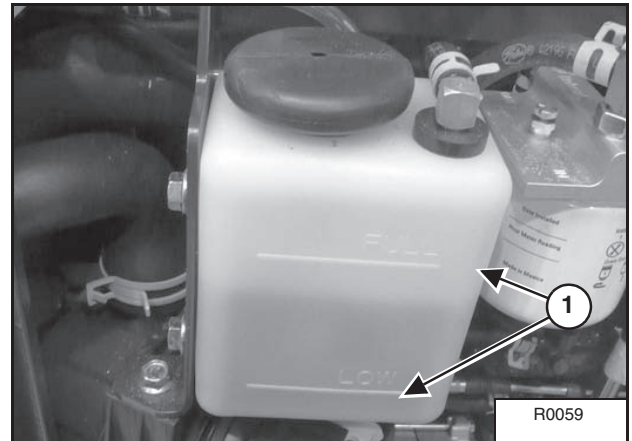
AVOID INJURY OR DEATH

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

Figure 88



The coolant level must be between the marks (Item 1) [Figure 88] on the coolant recovery tank.

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

COOLING SYSTEM (CONT'D)

Replacing The Coolant

(See SERVICE SCHEDULE on Page 54.) for the service interval for replacing the engine oil and filter.

WARNING

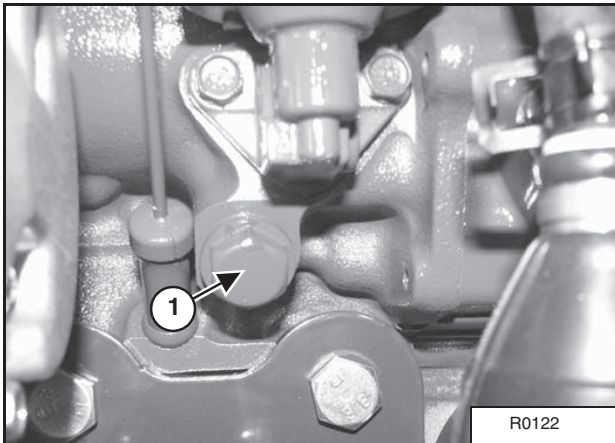
AVOID BURNS

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

W-2070-1203

When the engine is cool, remove the radiator cap.

Figure 89



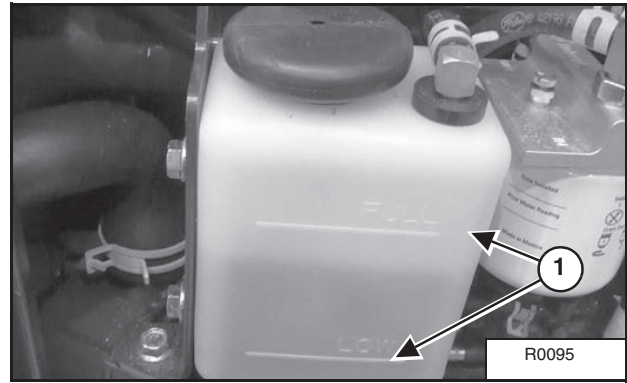
Open the drain valve (Item 1) [Figure 89] on the engine block and drain the coolant into a container.

After all the coolant is removed, close the drain valve.

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

Mix the coolant in a separate container. (See Fluid Capacities on Page 93.)

Figure 90



The coolant level must be between the marks (Item 1) [Figure 90] on the coolant recovery tank.

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 -37°C (-34°F) 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.

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.

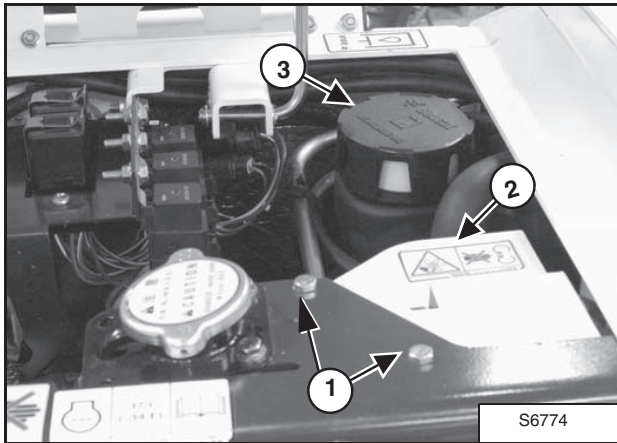
I-2124-0497

ALTERNATOR FAN BELT

Adjusting The Alternator Belt

Replace the belt if it has stretched or there are cracks in the belt. Replace the pulley if the belt makes contact with the bottom of the groove in the pulley.

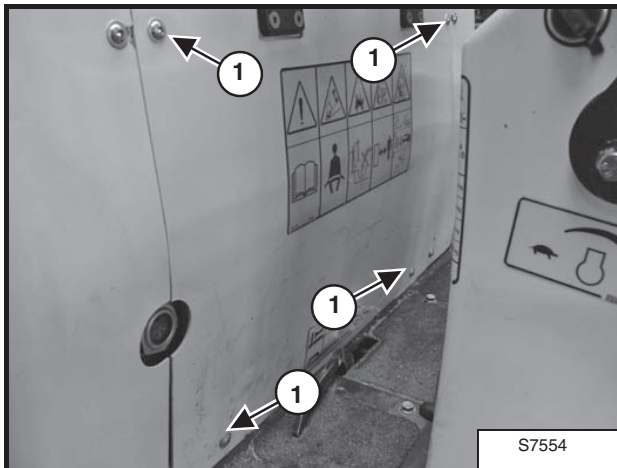
Figure 91



Remove the two bolts (Item 1) and remove the fan cover (Item 2) [Figure 91].

Remove the fill cap (Item 3) [Figure 91] from the hydraulic reservoir.

Figure 92



Remove the four bolts (Item 1) [Figure 92].

Remove the cover.

Figure 93

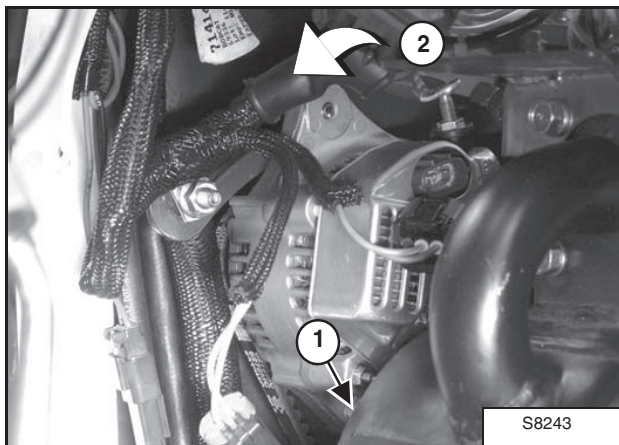


Loosen the upper alternator bolt using a angled wrench [Figure 93].

ALTERNATOR FAN BELT (CONT'D)

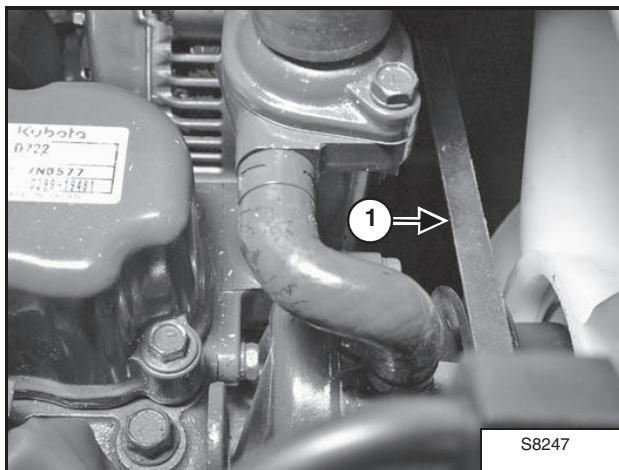
Adjusting The Alternator Belt (Cont'd)

Figure 94



Loosen the lower alternator mounting and adjustment bolt (Item 1) [Figure 94].

Figure 95



If a belt tension tool is available, move the alternator toward the front of the machine (Item 2) [Figure 94] until the belt (Item 1) [Figure 95] has (New belt = 56 to 60 lbf or Used belt = 48 to 52 lbf) tension.

If a belt tension tool is not available, move the alternator toward the front of the machine (Item 2) [Figure 94] until the belt (Item 1) [Figure 95] has 13 mm (0.50 in) movement at the middle of the belt span with 58 N (13 lb) of force.

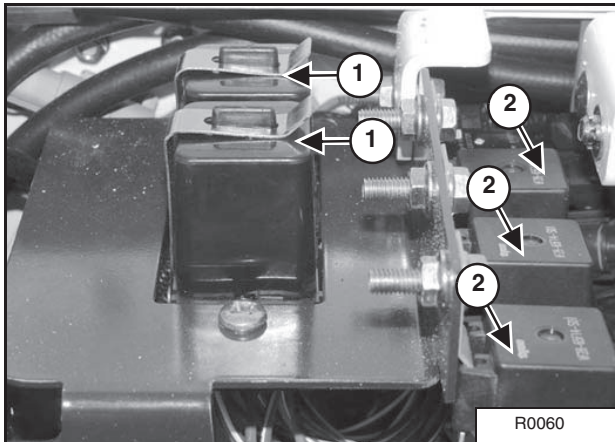
Tighten the mounting and adjustment bolts.

Install the cover, fill cap and fan apron.

ELECTRICAL SYSTEM

Description

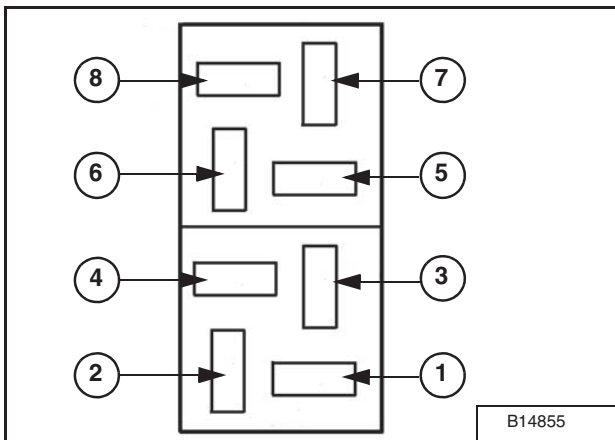
Figure 96



The excavator has a 12 volt, negative ground electrical system. The electrical system is controlled by fuses and relays located on top of the engine compartment (1 & 2) [Figure 96]. The fuses will protect the electrical system when there is an electrical overload. The reason for the overload must be found before starting the engine again.

Fuses

Figure 97



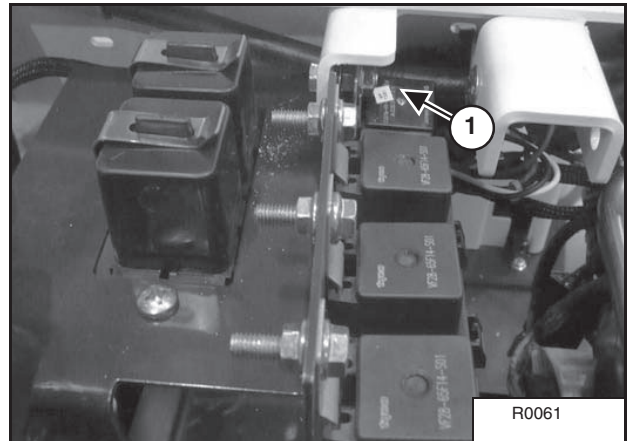
1. Power Socket - 15 A
2. Ignition - 10 A (SW)
3. Timer - 25 A (UNSW)
4. Beacon - 10 A
5. Switch Power - 10 A
6. Valves horn - 10 A
7. Switched timer - 10 A
8. Light - 10 A

Always replace fuses using the same type and capacity

Relays And Diodes

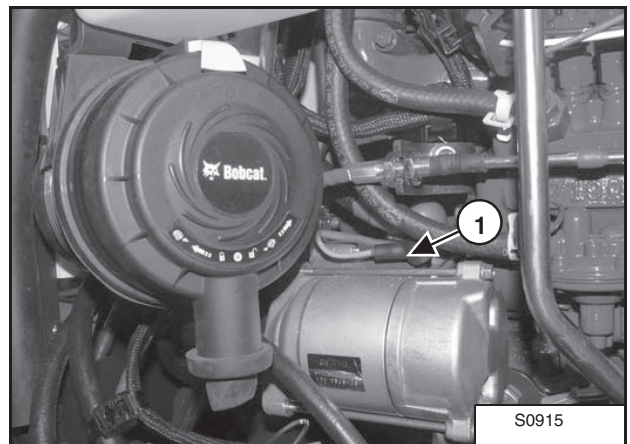
The three electrical relays (Item 2) [Figure 96] are located on top of engine compartment. The three relays control the starter, glow plugs and switched power circuits.

Figure 98



The fuel shut-off timer (Item 1) [Figure 98] is located on top of the engine compartment.

Figure 99



There are 2 diodes in the harness behind the starter (Item 1) [Figure 99]. The starter is located next to the cleaner, behind the access panel under the seat. The diodes are for alternator feedback protection and the glow plug during start function.

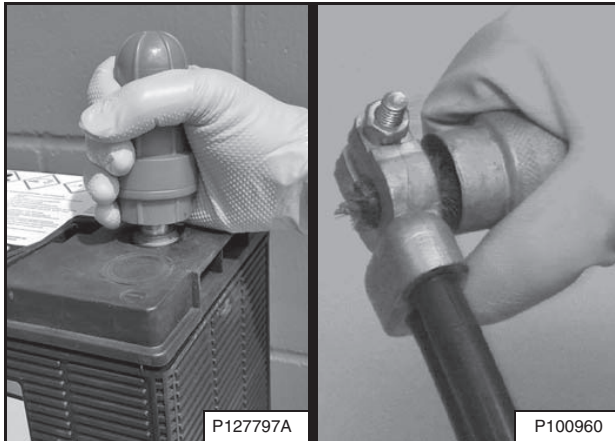
ELECTRICAL SYSTEM (CONT'D)

Battery Maintenance

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 54.)

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 100



Simple steps for reliability and long battery life:

- Keep battery posts and terminals clean [Figure 100].
- 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 69.)
- Check the battery state of charge every 30 days on machines that are not frequently used. (See Battery Testing on Page 69.)

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.

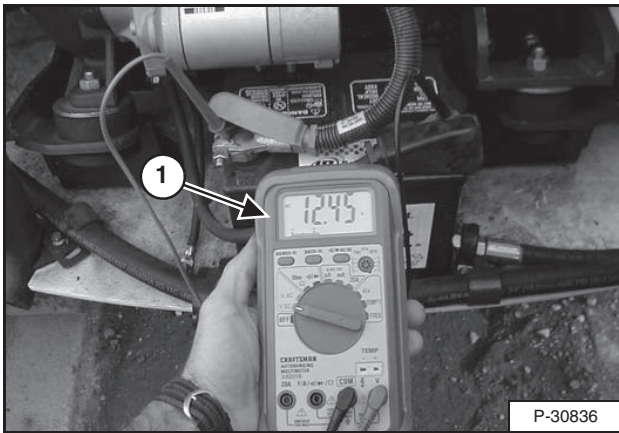
Battery Service During Machine Storage

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 101



The simplest and most common check to determine battery state of charge is to use a digital multimeter or voltmeter (Item 1) [Figure 101].

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:

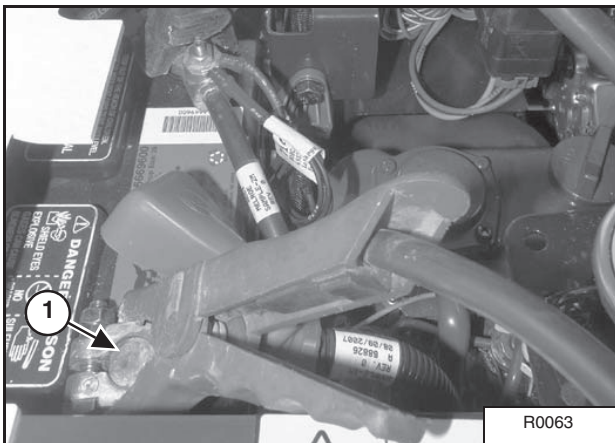
When jump starting the excavator from a battery installed in a second machine, make sure the engine is **NOT** running while using the glow plugs. High voltage spikes from a running machine can burn out the glow plugs.

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.

Engage the upperstructure slew lock. Be sure the key switch is OFF. The booster battery must be 12 volt.

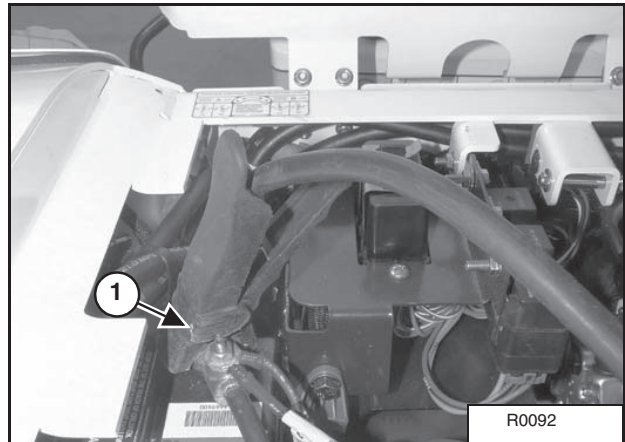
Figure 102



Remove the cover to the left of the operator's seat to access the battery.

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 102] of the excavator battery.

Figure 103



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 bolt at the front left corner of the excavator (Item 1) [Figure 103].

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

Start the engine. After the engine has started, remove the negative (-) cable first (Item 1) [Figure 103].

Disconnect the cable from the excavator battery (Item 1) [Figure 102].

ELECTRICAL SYSTEM (CONT'D)

Removing And Installing The Battery

! WARNING

AVOID INJURY OR DEATH

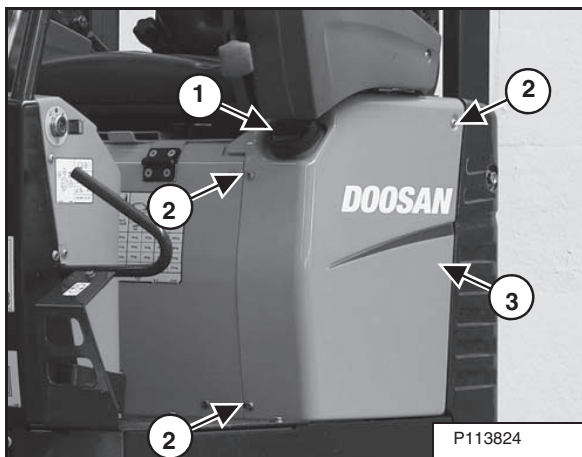
Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

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

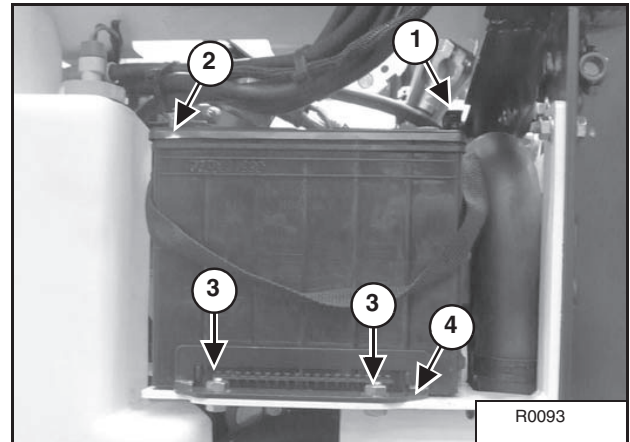
Figure 104



The battery is located to the left of the operator's seat. Remove the fuel cap (Item 1) with the start key and then the 3 bolts (Item 2) to remove the cover (Item 3) [Figure 104].

NOTE: Reinstall the fuel cap as soon as the cover is removed to contamination.

Figure 105



Disconnect the negative (-) cable (Item 1) [Figure 105] first.

Disconnect the positive (+) cable (Item 2) [Figure 105].

Loosen the bolts (Item 3) [Figure 105] and remove the hold-down clamp (Item 4) to 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 105] last to prevent sparks.

To replace the cover, first remove the fuel cap (Item 1), install the cover (Item 3) and tighten the 3 bolts (Item 2). Reinstall the fuel cap using the start key [Figure 104].

! 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 Fluid

Put the machine on a flat level surface.

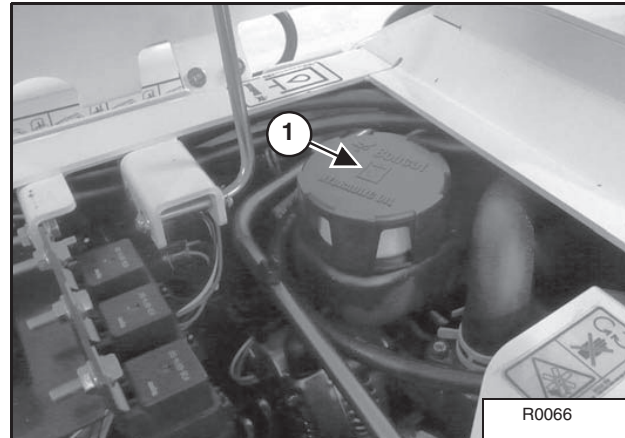
Retract the arm and bucket cylinders, put the bucket on the ground and lower the blade. Stop the engine.

Figure 106



The fluid must be at the centre of the sight gauge (Item 1) [Figure 106].

Figure 107



Open the tailgate. Remove the oil fill cap (Item 1) [Figure 107]. Check the condition of the screen in the fill neck of the reservoir. The screen must be installed in the fill neck when adding oil.

Add the correct fluid to the reservoir until it is at the centre of the sight gauge (Item 1) [Figure 106].

Install the cap. Close the tailgate.

WARNING

AVOID INJURY OR DEATH

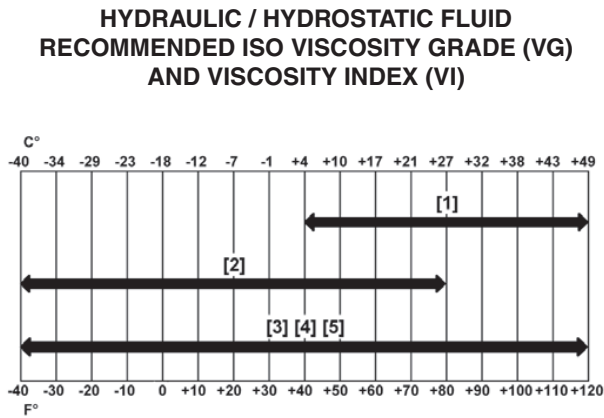
Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

HYDRAULIC SYSTEM (CONT'D)

Hydraulic / Hydrostatic Fluid Chart

Figure 108



TEMPERATURE RANGE ANTICIPATED DURING MACHINE USE

- [1] VG 100; Minimum VI 130
- [2] VG 46; Minimum VI 150
- [3] Doosan All-Season Fluid
- [4] Doosan Synthetic Fluid
- [5] Doosan Biodegradable Hydraulic / Hydrostatic Fluid (Unlike biodegradable fluids that are vegetable based, Doosan biodegradable fluid is formulated to prevent oxidation and thermal breakdown at operating temperatures.)

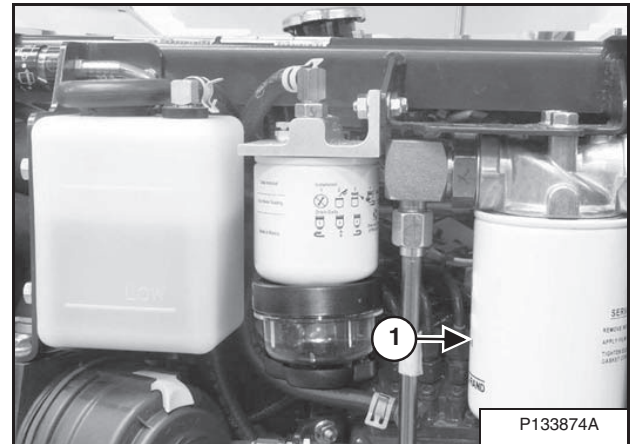
Install the oil fill cap.

Replacing The Hydraulic Filter

(See SERVICE SCHEDULE on Page 54.) for the correct service interval.

Open the tailgate.

Figure 109



Remove the hydraulic filter (Item 1) [Figure 109].

Clean the housing where the filter gasket makes contact.

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

Start the engine. Run the excavator through the hydraulic functions. Stop the engine. Check the fluid level at the sight gauge (Item 2) [Figure 106] and add as needed. Check the filter area for leaks.

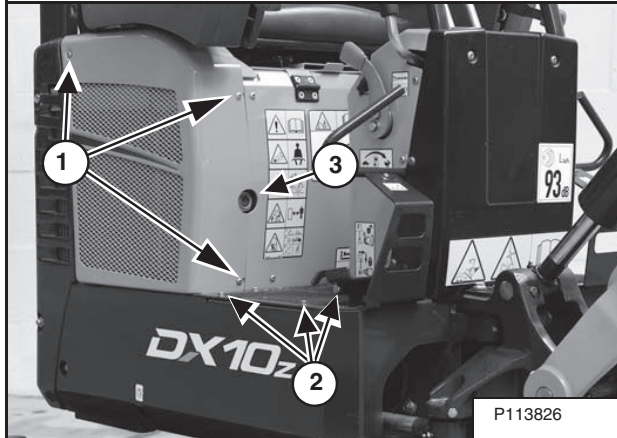
HYDRAULIC SYSTEM (CONT'D)

Draining Hydraulic Oil

(See SERVICE SCHEDULE on Page 54.) for the correct service interval.

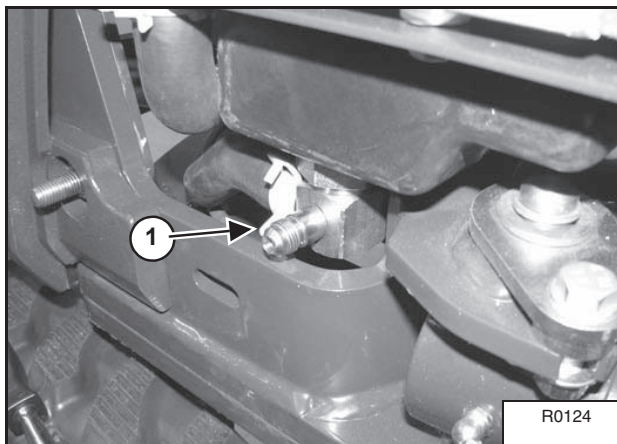
Retract the arm and bucket cylinders, lower the bucket to the ground. Stop the engine.

Figure 110



To gain access to drain the hydraulic oil, loosen the three bolts (Item 1) from the cover. Pivot the cover downward. Then remove the plate on the floor by loosening the bolts (Item 2) [Figure 110].

Figure 111



Before removing the cap, place a container under the drain plug (Item 1) [Figure 111] to collect the oil.

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

IMPORTANT

Fluid such as engine oil, hydraulic fluid, coolants, grease, etc. must be disposed of in an environmentally safe manner. Some regulations require that certain spills and leaks on the ground must be cleaned in a specific manner. See local regulations for the correct disposal.

I-2067-EN-0711

IMPORTANT

If the fluid is being drained because of a system failure, remove and clean all hydraulic lines.

I-2045-0788

Reinstall the cap (Item 1) [Figure 111].

Add fluid to the reservoir until it is at the centre of the sight gauge (Item 3) [Figure 110]. (See Checking And Adding Hydraulic Fluid on Page 72.)

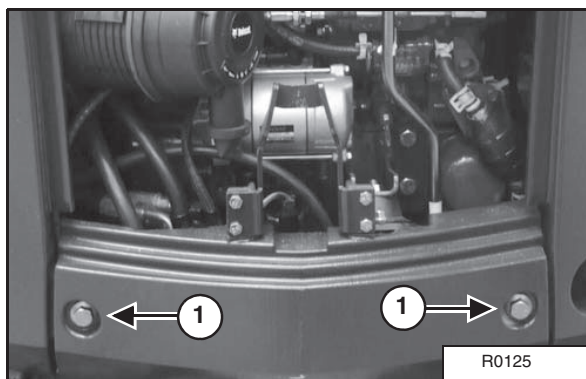
Run the excavator through the hydraulic functions. Stop the engine. Check the fluid level and add as needed.

Replace the plate and the right cover.

HYDRAULIC SYSTEM (CONT'D)

Diagnostic Couplers

Figure 112

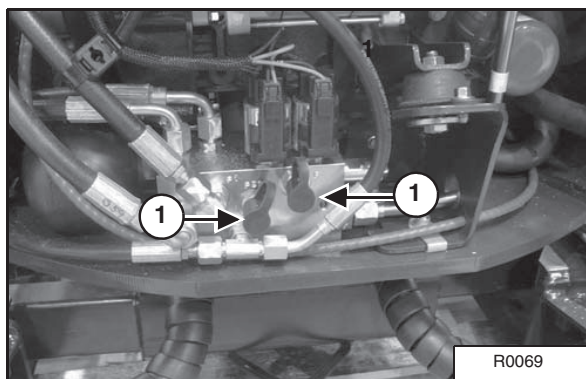


NOTE: The centre counterweight weighs 19,5 kg (43 lb). Support the counterweight with a lifting device and straps before removing the bolts.

To gain access, remove the counterweight by removing the two bolts (Item 1) [Figure 112].

The diagnostic couplers can be used by your Doosan dealer to check circuit pressures.

Figure 113

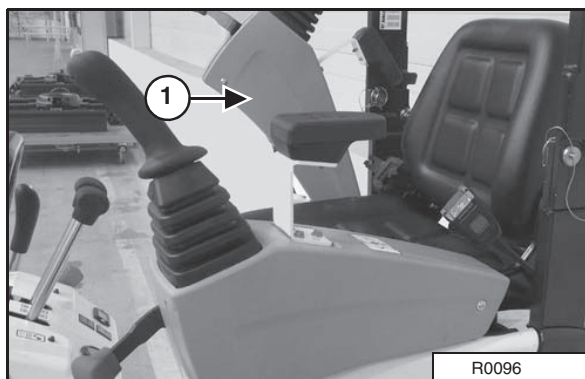


The two diagnostic couplers (Item 1) [Figure 113] are located on the hydraulic block.

CONTROL LOCKOUT LEVERS

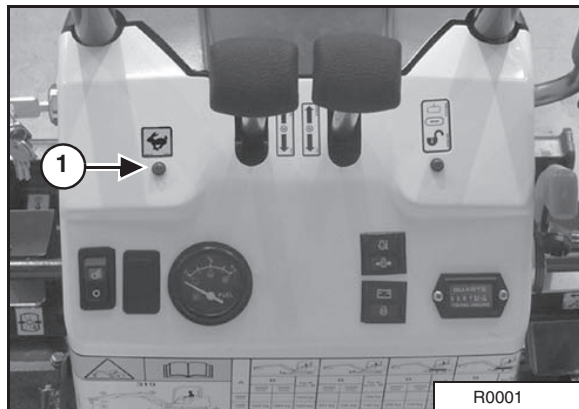
Inspection And Maintenance

Figure 114



When a console is raised [Figure 114], the hydraulic control joysticks and traction system must not function.

Figure 115



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

Raise the right console (Item 1) [Figure 114]. The green light (Item 1) [Figure 115] on the console will go off.

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.

Lower the right console. Raise the left console and repeat the inspection procedure.

The joystick control levers and traction system must be deactivated when either console is raised.

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

TRACK TENSION

NOTE:The wear of undercarriage parts varies with working conditions and types of soil conditions. Maintain the correct track tension by inspecting regularly. (See **SERVICE SCHEDULE** on Page 54.) for the correct service interval.

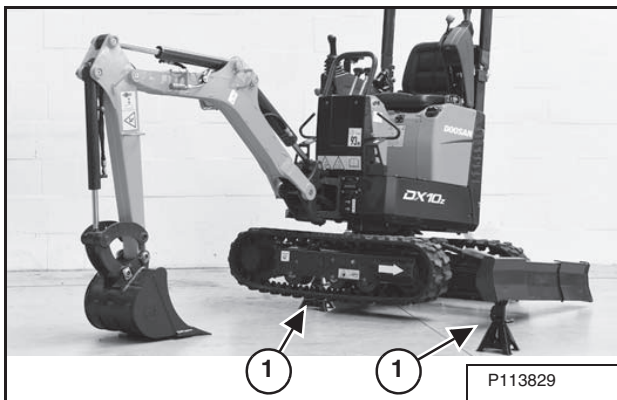
Adjusting

Figure 116



Raise one side of the machine (approximately 102 mm) using the boom and arm as shown in **[Figure 116]**.

Figure 117



Raise the blade fully and install jackstands (Item 1) **[Figure 117]** under the blade and the track frame. Lower the machine until all machine weight is on the jackstands **[Figure 117]**.

Stop the engine.

Figure 118

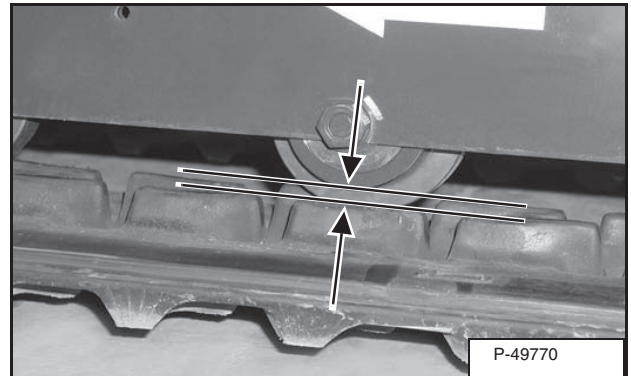
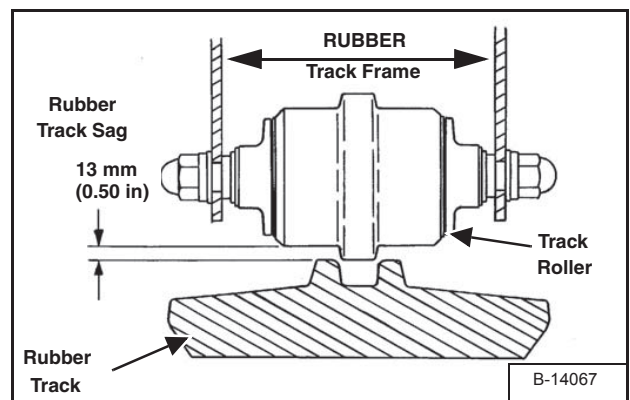


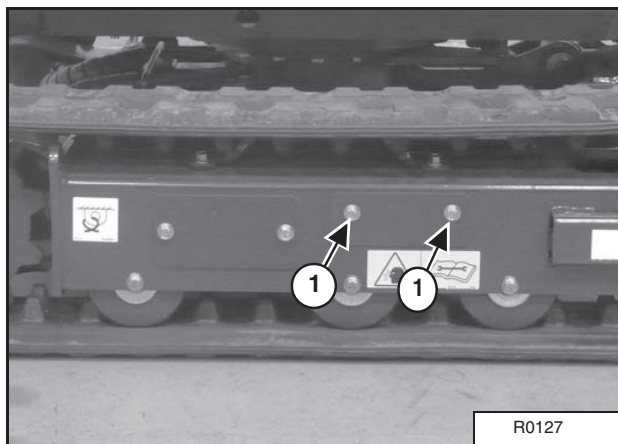
Figure 119



Measure the rubber track sag at the middle track roller **[Figure 118]**. Do not get your fingers into pinch points between the track and the track roller. Use a 13 mm (0.50 in) bolt or dowel to check the gap between the contact edge of the roller and top edge of the track guide lug **[Figure 118]** and **[Figure 119]**.

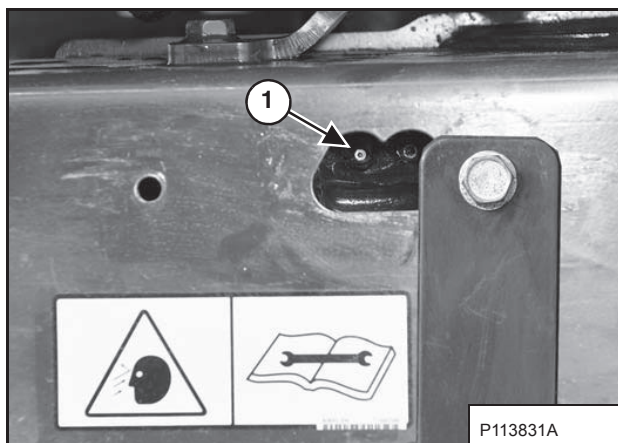
TRACK TENSION (CONT'D)

Figure 120



Loosen the two bolts (Item 1) [Figure 120] from the cover. Pivot the cover downward.

Figure 121



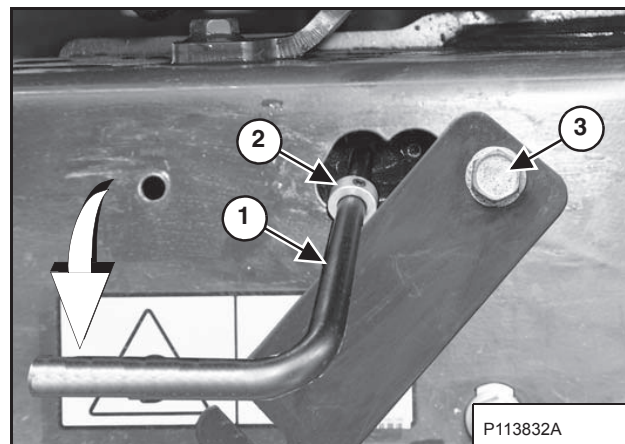
Increase Track Tension

Add grease to the fitting (Item 1) [Figure 121] until the track tension is correct [Figure 119].

NOTE: Do not remove track tension fitting unless pressure is released. See [Figure 122].

NOTE: If replacement is necessary, always replace track tension fitting (Item 1) [Figure 121] with the genuine Doosan parts. The fitting is a special fitting designed for high pressure.

Figure 122



Decrease Track Tension

! WARNING

HIGH PRESSURE GREASE CAN CAUSE SERIOUS INJURY

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

W-2994-0515

Pressure must be released from the grease cylinder to decrease track tension.

Install the bleed tool (7277225) on the track tension fitting (Item 1), adjust and tighten the collar (Item 2) [Figure 122] to fit behind the edge of the access cover.

Tighten the access cover bolt (Item 3) [Figure 122] to secure the tool.

Turn the tool 90° anticlockwise and let the grease flow into a container. Release pressure until the track adjustment is correct [Figure 119].

Tighten the track tension fitting to 24 – 30 N•m (18 – 22 ft-lb) torque. Pivot the access cover closed and tighten the access cover bolts.

If the track tension is still loose after adjusting, it indicates the track is worn. See your dealer for replacement parts.

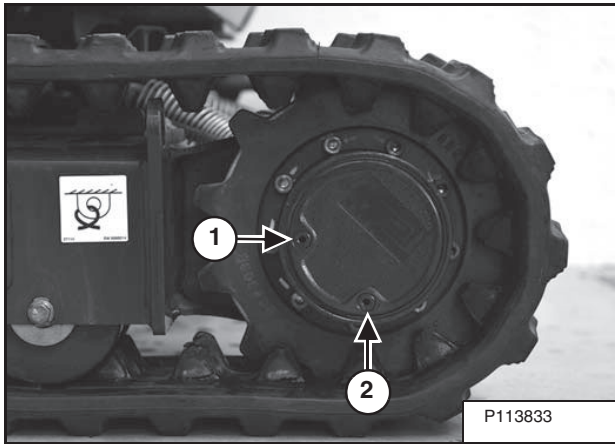
Raise the excavator and remove the jackstands.

Repeat the procedure for the other side.

DRIVE MOTOR

Checking Oil Level

Figure 123



Put the machine on a level surface with the plugs positioned as shown (Items 1 and 2) **[Figure 123]**.

Remove the plug (Item 1) **[Figure 123]**. The oil level should be at the bottom edge of the plug hole.

Add gear lube through the plug hole if the oil level is below the hole. See Chart for capacity and type.

Install and tighten the top plug.

Repeat procedure for the other side.

Draining The Drive Motor

(See SERVICE SCHEDULE on Page 54.) for the correct service interval.

Put the machine on a level surface with the plugs positioned as shown (Items 1 and 2) **[Figure 123]**.

Remove the bottom plug (Item 2) and the top plug (Item 1) **[Figure 123]** and drain into container. Recycle or dispose of the used lubricant in an environmentally safe manner.

After all the gear lube is removed, install the bottom plug (Item 2) **[Figure 123]**.

Add gear lube to the top plug hole (Item 1) **[Figure 123]** until the gear lube level is at the bottom edge of the plug hole. (See Fluid Capacities on Page 93.)

Install and tighten the top plug.

Repeat the procedure for the other side.

BLADE EXTENSION

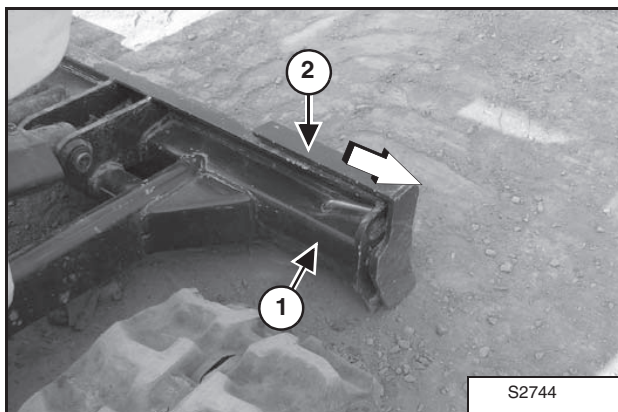
Description

The blade extensions are used to match the blade width to the track width. Secure the blade extensions in the retracted position when transporting the excavator or when a narrow operating width is needed. Under normal operating conditions, the blade width should match the track width.

Extending And Retracting

Extending

Figure 124



Raise the blade from the ground. Stop the engine.

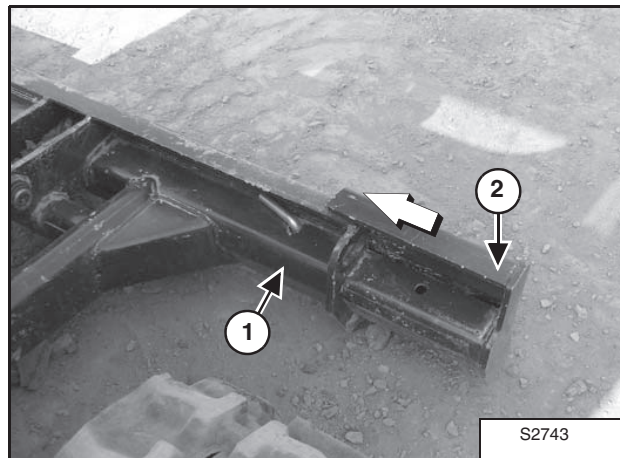
Remove the pin (Item 1) **[Figure 124]**.

Slide the blade extension (Item 2) **[Figure 124]** away from the blade frame into the extended position.

Secure the blade extension in the extended position with the pin.

Retracting

Figure 125



Raise the blade from the ground. Stop the engine.

Remove the pin (Item 1) **[Figure 125]**.

Slide the blade extension (Item 2) **[Figure 125]** toward the blade frame into the retracted position.

Secure the blade extension in the retracted position with the pin.

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

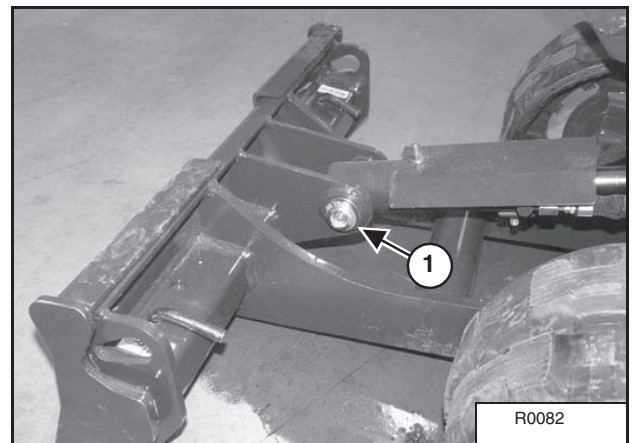
Lubricate the Hydraulic Excavator as specified in the SERVICE SCHEDULE (See SERVICE SCHEDULE on Page 54.) for the best performance of the machine.

Record the operating hours each time you lubricate the Hydraulic Excavator.

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

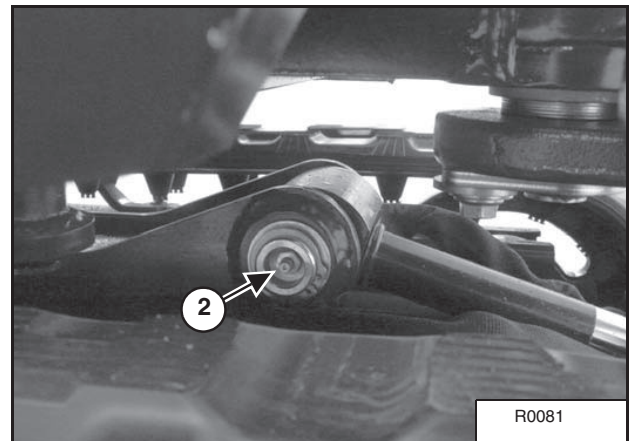
Blade

Figure 126



1. Blade Cylinder-Base End, every 8 – 10 hours (Item 1) [Figure 126]

Figure 127

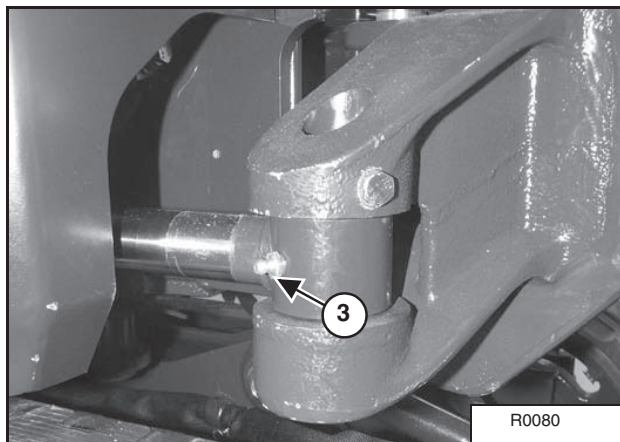


2. Blade Pivots, every 8 – 10 hours (Item 2) [Figure 127]

LUBRICATION OF THE HYDRAULIC EXCAVATOR (CONT'D)

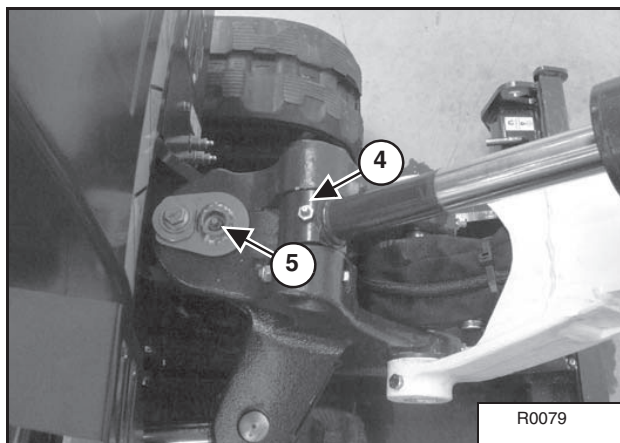
Boom Swing And Boom Base

Figure 128



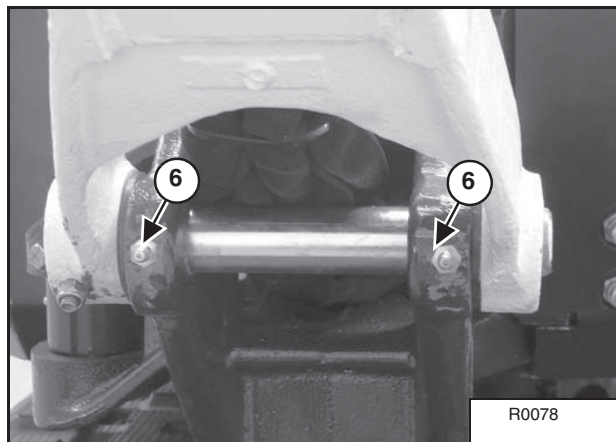
3. Boom Swing Cylinder, Rod End, every 8 – 10 hours (Item 3) **[Figure 128]**.

Figure 129



4. Boom Cylinder, Rod End (Item 4) **[Figure 129]**.
5. Boom Swing Pivot, every 8 – 10 hours (Item 5) **[Figure 129]**.

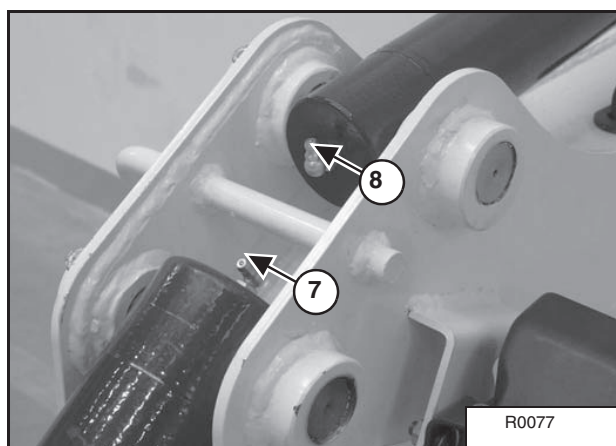
Figure 130



6. Boom, Base Pivot, every 8 – 10 hours (Item 6) **[Figure 130]**.

Boom, Middle

Figure 131

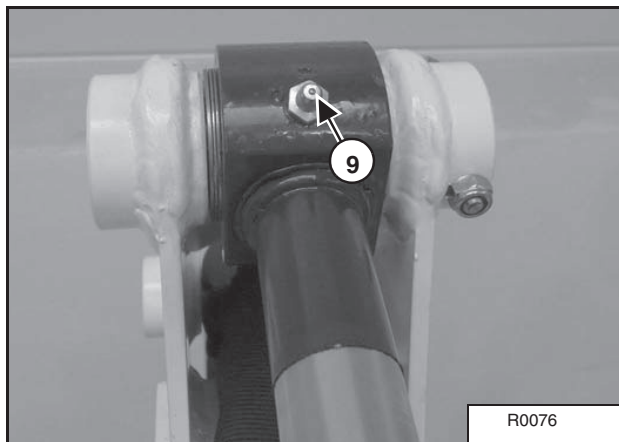


7. Boom Cylinder, Base End, every 8 – 10 hours (Item 7) **[Figure 131]**.
8. Arm Cylinder, Base End, every 8 – 10 hours (Item 8) **[Figure 131]**.

LUBRICATING THE EXCAVATOR (CONT'D)

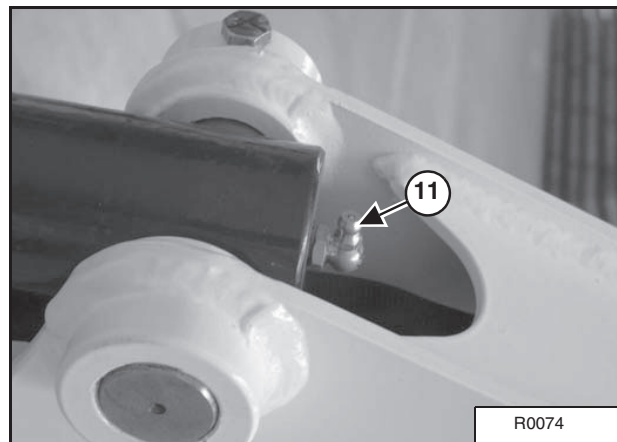
Boom And Arm

Figure 132



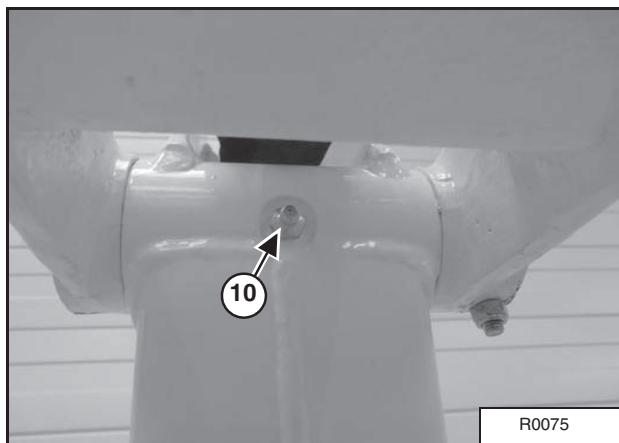
9. Arm Cylinder, Rod End, every 8 – 10 hours (Item 9) [Figure 132].

Figure 134



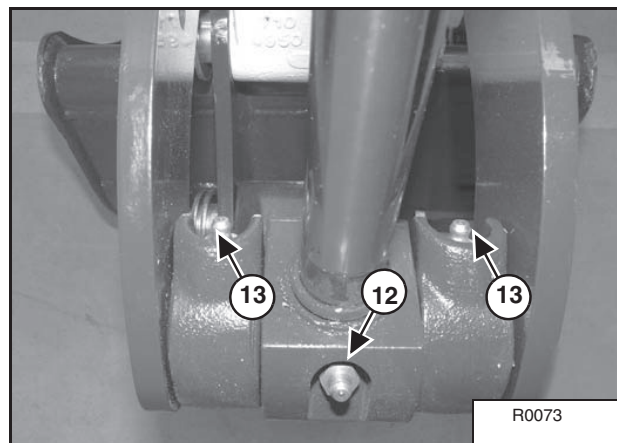
11. Bucket Cylinder, Base End, every 8 – 10 hours (Item 11) [Figure 134].

Figure 133



10. Arm Pivot, every 8 – 10 hours (Item 10) [Figure 133].

Figure 135



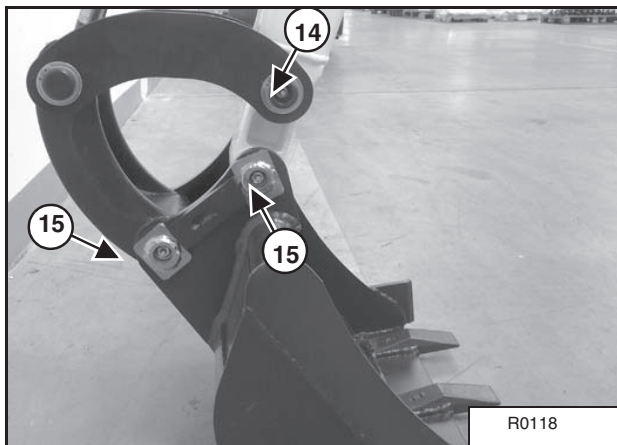
12. Bucket Cylinder, Rod End, every 8 – 10 hours (Item 12) [Figure 135].

13. Bucket Link, Bucket Cylinder Pivot, every 8 – 10 hours (Item 13) [Figure 135].

LUBRICATING THE EXCAVATOR (CONT'D)

Boom And Arm (Cont'd)

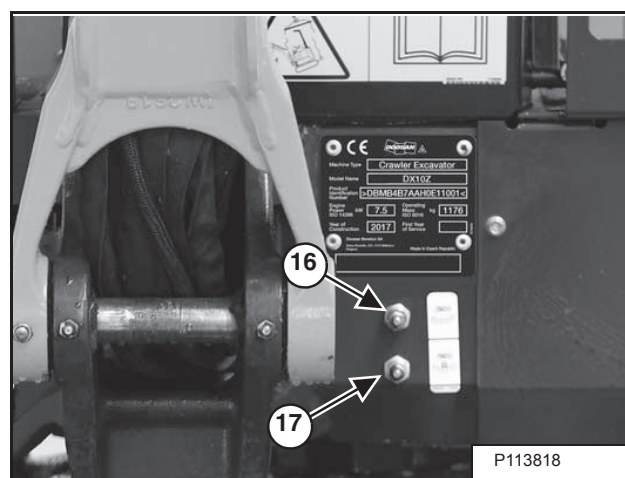
Figure 136



- 14. Bucket Link Pivot, every 8 – 10 hours (Item 14) [Figure 136].
- 15. Bucket Pivots, every 8 – 10 hours (Item 15) [Figure 136].

Frame Fittings

Figure 137

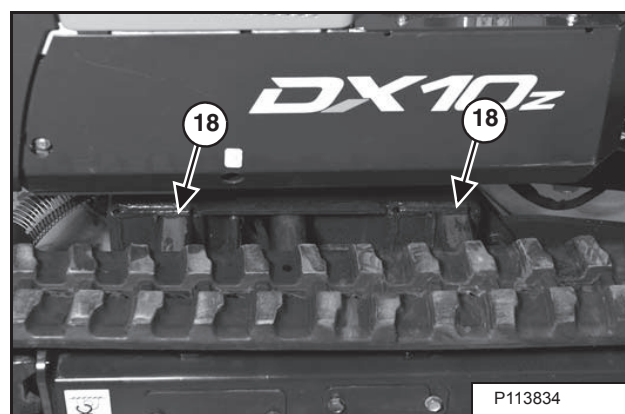


- 16. Swing Circle Bearing, every 50 hours (Item 16) [Figure 137].
- 17. Swing Circle Pinion, every 50 hours (Item 17) [Figure 137]. Pump 4 times with a grease gun. Rotate the upper structure 180° and repeat.

NOTE: Do not over-grease the swing circle; damage to the seal could result. Pump 4 – 5 times with a grease gun. Rotate the upperstructure 90° and repeat three more times.

Track Expansion Tube

Figure 138



- 18. Track Expansion Tube, as required (Item 18) [Figure 138].

NOTE: Spread lubriplate gearshield extra heavy grease evenly on wear surfaces on both sides of excavator as required.

EXCAVATOR STORAGE AND RETURN TO SERVICE

Storage

Sometimes it can 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 fluid 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.

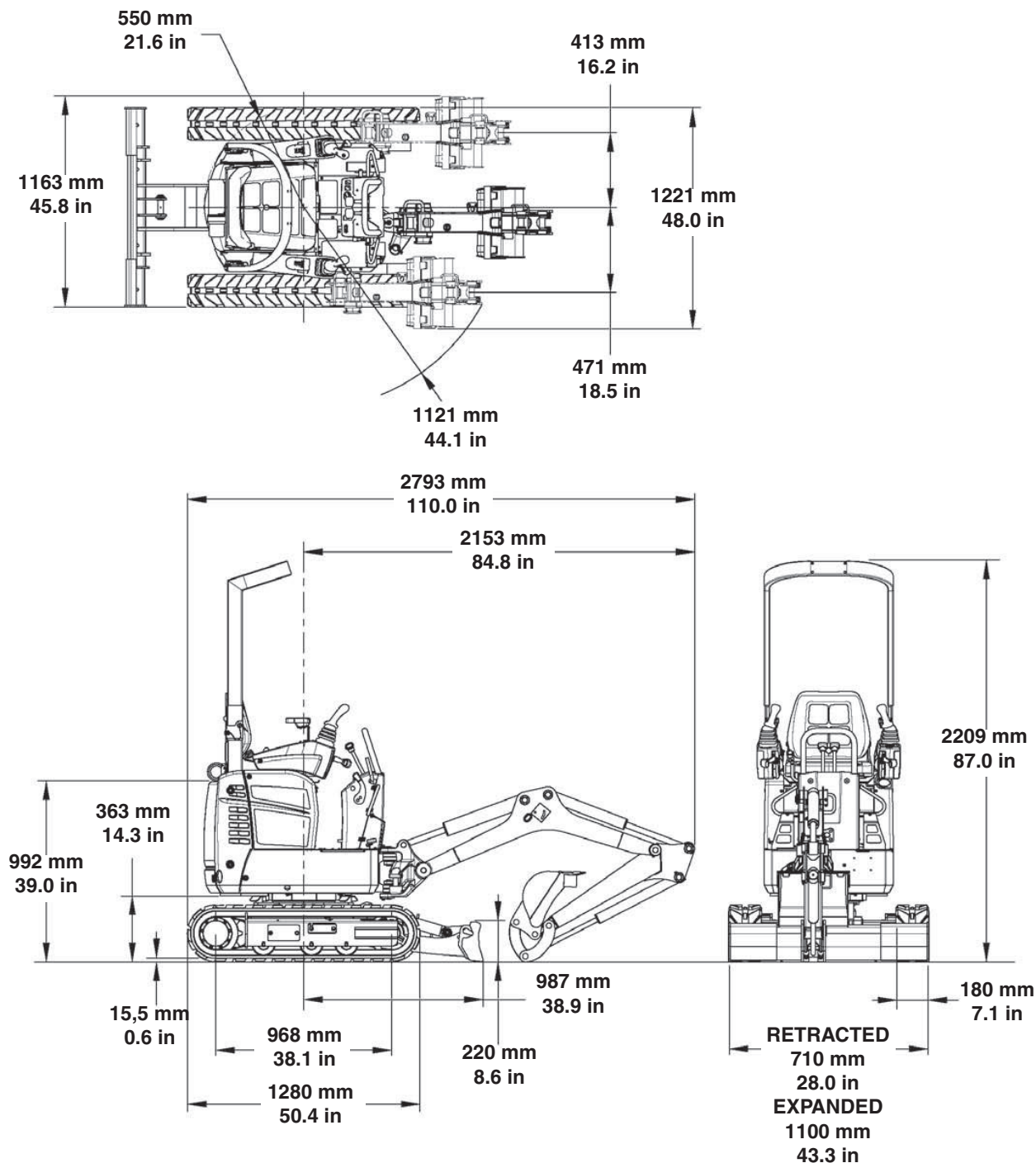
SPECIFICATIONS

EXCAVATOR SPECIFICATIONS	87
Machine Dimensions	87
Working Range	88
Lift Capacity (Object Handling Applications Excluded)	89
Performance	90
Function Time	90
Weights	90
Controls	90
Engine	91
Electrical	91
Hydraulic System	91
Hydraulic Cylinders	92
Drive System	92
Traction	92
Fluid Capacities	93
Instrumentation	93
Environmental	93
Temperature Range	93

EXCAVATOR SPECIFICATIONS

Machine Dimensions

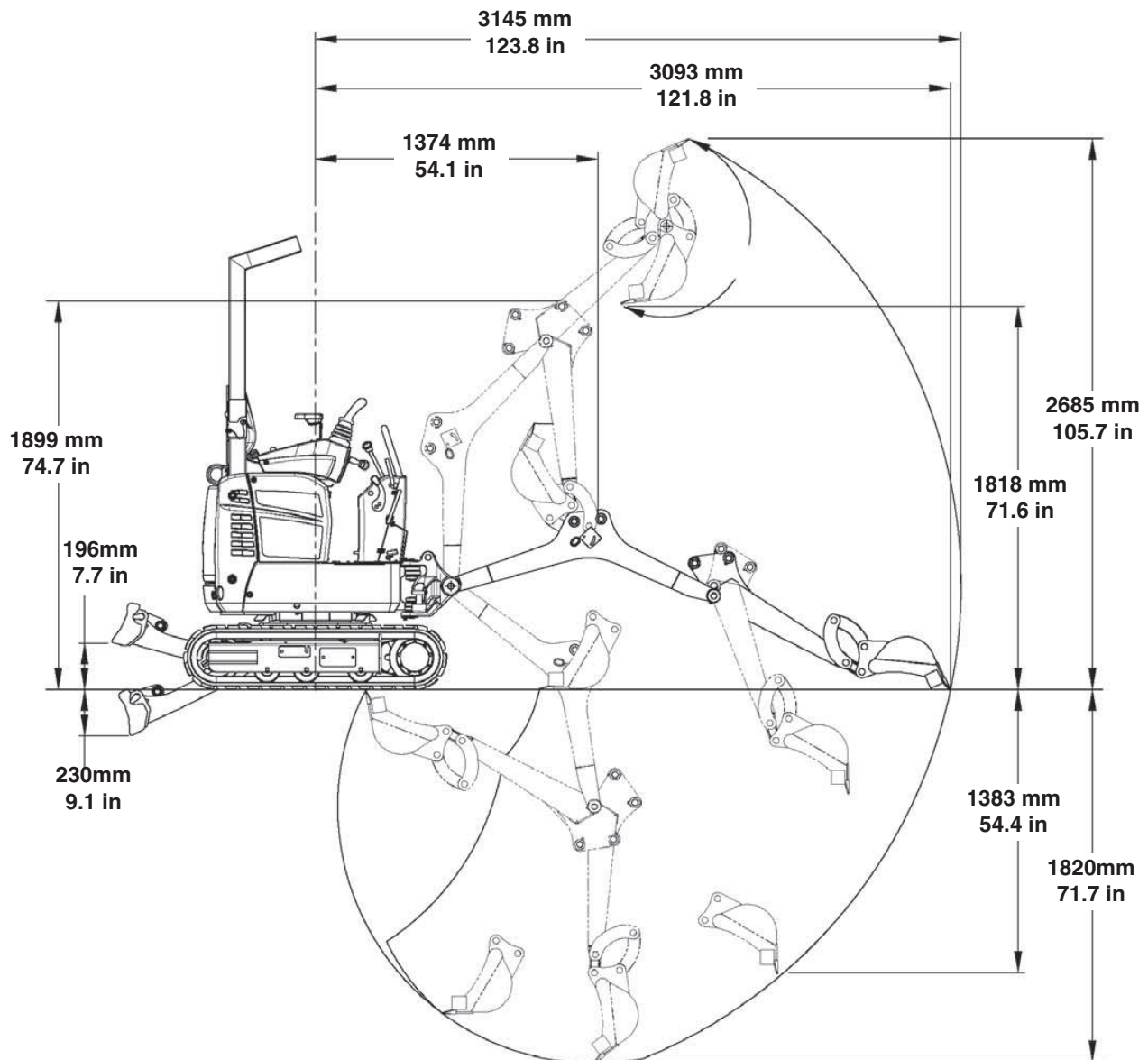
- All dimensions are given in mm.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



EXCAVATOR SPECIFICATIONS (CONT'D)

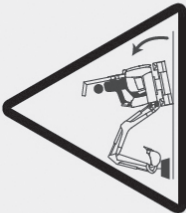
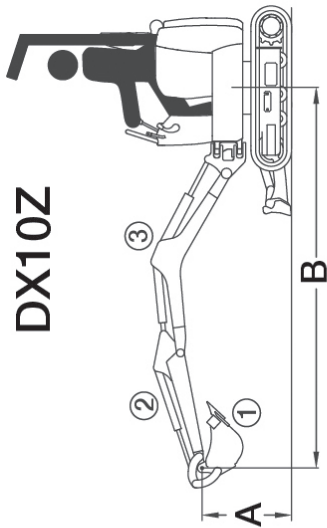
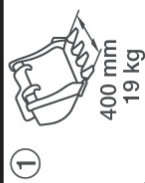
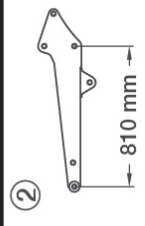
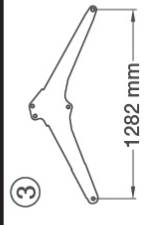
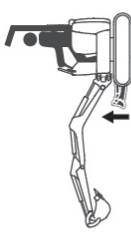
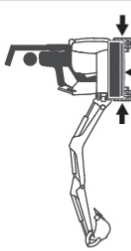
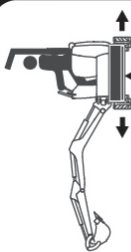
Working Range

- All dimensions are given in mm.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



EXCAVATOR SPECIFICATIONS (CONT'D)

Lift Capacity (Object Handling Applications Excluded)

		DX10Z 	  	 	SW 167313870							
						A						
							B	kg @ max.B	B	kg @ max.B	B	kg @ max.B
								2000 mm		2000 mm		2000 mm
		2000 mm	206 kg	192 kg	94 kg	90 kg	211 kg	200 kg				
		1000 mm	197 kg	121 kg	92 kg	54 kg	204 kg	129 kg				
		0 mm	174 kg	116 kg	78 kg	48 kg	181 kg	119 kg				
		-1000 mm	171 kg	171 kg	75 kg	73 kg	184 kg	174 kg				

EXCAVATOR SPECIFICATIONS (CONT'D)

Performance

Digging force, arm (ISO 6015)	5550 N (1248 lbf)
Digging force, bucket (ISO 6015)	8294 N (1865 lbf)
Drawbar pull (theoretical at 90% efficiency)	9905 N (2227 lbf)
Ground pressure	29,7 kPa (4.18 psi)

Function Time

Boom raise	4.2 s
Boom lower	4.2 s
Bucket curl	3.2 s
Bucket dump	2.3 s
Arm retract	3.9 s
Arm extend	2.6 s
Boom swing left	4.1 s
Boom swing right	3.2 s
Blade raise	1.7 s
Blade lower	1.2 s
Slew rate	9 rpm
Undercarriage expand	5.0 s
Undercarriage retract	3.5 s

Weights

Operating weight with TOPS, rubber tracks, 400 mm bucket and 75kg operator	1176 kg (2593 lb)
--	-------------------

Controls

Engine	Hand levers on right hand side
Starting	Key-type starter switch and shutdown
Blade	Right hand lever
Boom swing	Right foot pedal
Hydraulics	Two levers control boom, bucket, arm and upperstructure slew
Auxiliary hydraulics	Left-hand foot pedal
Upperstructure slew brake	Hydraulic lock on motor
Holding brake for upper structure slew	Pin lock
Steering	Direction and speed controlled by two hand levers

EXCAVATOR SPECIFICATIONS (CONT'D)

Engine

Make / Model	Kubota / D722-E4B-BCZ-6 (Stage 5)
Fuel	Diesel
Cooling	Liquid
Horsepower: – Gross power (ISO 14396) – Gross power (SAE J1995) – Net power (SAE J1349 / ISO 9249)	7,5 kW (10.0 hp) @ 2000 rpm 7,6 kW (10.2 hp) @ 2000 rpm 7,4 kW (9.9 hp) @ 2000 rpm
Maximum governed speed	2000 rpm
High idle speed	2370 rpm
Low idle speed	1300 – 1400 rpm
Torque: – Gross torque (SAE J1995) – Net torque (SAE J1349 / ISO 9249)	40,1 N•m (39.6 lb-ft) @ 1600 rpm 39,1 N•m (28.8 lb-ft) @ 1600 rpm
Number of cylinders	3
Displacement	0.72 L (43.9 cu in)
Bore	67 mm (2.64 in)
Stroke	68 mm (2.68 in)
Lubrication	Forced lubrication with cartridge type filter
Crankcase ventilation	Closed breathing
Air filter	Dual dry replaceable paper cartridge
Ignition	Compression ignited (diesel)
Starting aid	Intake air heater

Electrical

Alternator	12 V - 40 A - open frame with internal regulator
Battery	12 V - 500 cold cranking A at -18 °C, 90 min reserve capacity
Starter	12 V - reduction drive - 1,4 kW

Hydraulic System

Pump Type	Double gear pump
Pump capacity	2 @ 10.0 l/min (2.64 gpm) @ 2000 RPM
System relief pressure for implement circuits	18400 kPa - 19200 kPa (184 - 192 bar) (2669 psi - 2785 psi)
System relief pressure for travel circuits	18400 kPa - 19200 kPa (184 - 192 bar) (2669 psi - 2785 psi)
System relief pressure for auxiliary circuits	18400 kPa - 19200 kPa (184 - 192 bar) (2669 psi - 2785 psi)
System relief pressure for slew circuits	8400 kPa (84 bar) (1218 psi)
Main hydraulic filter bypass	172 kPa (1.72 bar) (25 psi)
Boom port relief base end	23200 kPa (232 bar) (3365 psi)
Arm port relief base end	22500 kPa (225 bar) (3263 psi)
Bucket port relief base end	23200 kPa (232 bar) (3365 psi)
Control valve	Nine-spool parallel type, open centre
Hydraulic filter	Full-flow replaceable
Fluid lines	SAE standard tubelines, hoses, and fittings
Auxiliary flow	20 l/min (5.3 gpm)

EXCAVATOR SPECIFICATIONS (CONT'D)

Hydraulic Cylinders

Boom cylinder	Cushion up
Boom cylinder bore	63,5 mm (2.50 in)
Boom cylinder rod	31,8 mm (1.25 in)
Boom cylinder stroke	312,4 mm (12.30 in)
Arm cylinder	Cushion
Arm cylinder bore	50,8 mm (2.00 in)
Arm cylinder rod	31,8 mm (1.25 in)
Arm cylinder stroke	325,6 mm (12.82 in)
Bucket cylinder	No cushion
Bucket cylinder bore	44,5 mm (1.75 in)
Bucket cylinder rod	25,4 mm (1.00 in)
Bucket cylinder stroke	385,1 mm (15.16 in)
Boom swing cylinder	No cushion
Boom swing cylinder bore	57,1 mm (2.25 in)
Boom swing cylinder rod	31,8 mm (1.25 in)
Boom swing cylinder stroke	274,6 mm (10.81 in)
Blade cylinder	No cushion
Blade cylinder bore	50,8 mm (2.00 in)
Blade cylinder rod	31,8 mm (1.25 in)
Blade cylinder stroke	96,8 mm (3.81 in)
Undercarriage cylinder	No cushion
Undercarriage cylinder bore	44,5 mm (1.75 in)
Undercarriage cylinder rod	25,4 mm (1.00 in)
Undercarriage cylinder stroke	400,1 mm (15.75 in)

Drive System

Travel motor	Each track is driven by hydrostatic axial piston motor
Drive reduction	Two-stage planetary gear reduction 23.04:1

Traction

Track width, rubber, standard	180 mm (7.1 in)
Track adjusters	Grease type adjusters, rubber
Track type, standard	Half-pitch, rubber
Travel speed	2,1 km/h (1.3 mph)
Travel speed, high range (option)	2,8 km/h (1.7 mph)
Undercarriage	Sealed track rollers with box section track roller frame
Number of track rollers per side	3
Gradeability travelling down or backing up slopes	25°
Gradeability travelling on side slopes	15°
Gradeability travelling up side slopes	15°

EXCAVATOR SPECIFICATIONS (CONT'D)

Fluid Capacities

Cooling system	3,0 L (3.2 U.S. qt)
Engine lubrication plus oil filter	2,8 L (3.0 U.S. qt)
Fuel reservoir	16,0 L (16.9 U.S. qt)
Hydraulic reservoir	2,6 L (2.8 U.S. qt)
Hydraulic system with bucket and arm cylinder retracted, bucket on the ground, and blade down	9,4 L (9.9 U.S. qt)
Travel motor (each)	0,5 L (0.5 U.S. qt)

Instrumentation

• Hour meter • Fuel gauge • Engine temperature gauge with audible alarm • Engine oil pressure indicator with audible alarm • Charging system indicator with audible alarm • Air intake heater indicator • Console indicator

Environmental

DECLARED SINGLE-NUMBER NOISE EMISSION VALUES In accordance with ISO 4871	
Noise level per Directive 2000/14/EC - L_{wA}	93.0 dB
Operator noise level per Directive 2006/42/EC - L_{pA}	82.0 dB

DECLARED VIBRATION EMISSION VALUES In accordance with EN 12096		
	Value	Uncertainty
Whole-body vibration per ISO 2631-1	0,68 m/s ²	0,34 m/s ²
Hand-arm vibration per ISO 5349-1	0,7 m/s ²	---

ENGINE CO ₂ EMISSION VALUES	
CO ₂ emission	1019,8 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)
-----------------------	---------------------------------

WARRANTY

WARRANTY	95
----------------	----

WARRANTY

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.

4700401A-EN (08-18)

ALPHABETICAL INDEX

AIR CLEANER	57	STARTING THE ENGINE	38
ALTERNATOR FAN BELT	65	STEERING LEVERS	27
BLADE CONTROL	32	STOPPING THE EXCAVATOR	48
BLADE EXTENSION	80	TAILGATE	25
BUCKETS AND ATTACHMENTS	41	TAILGATE	56
CONTROL LOCKOUT LEVERS	76	TRACK FRAME EXPANSION	33
COOLING SYSTEM	63	TRACK ROLLER AND IDLER LUBRICATION	81
DAILY INSPECTION	35	TRACK TENSION	77
DECLARATION OF CONFORMITY	3	TRANSPORTING THE EXCAVATOR	49
DELIVERY REPORT	6	UPPERSTRUCTURE SLEW LOCK	34
DOOSAN COMPANY IS ISO 9001 CERTIFIED	4	WARRANTY	95
DRIVE MOTOR	79		
ELECTRICAL SYSTEM	67		
ENGINE LUBRICATION SYSTEM	61		
ENGINE SPEED CONTROL	24		
EXCAVATOR IDENTIFICATION	7		
EXCAVATOR SPECIFICATIONS	87		
EXCAVATOR STORAGE AND RETURN TO SERVICE	85		
FEATURES, ACCESSORIES AND ATTACHMENTS	8		
FIRE PREVENTION	12		
FUEL SYSTEM	59		
HYDRAULIC CONTROLS	29		
HYDRAULIC SYSTEM	72		
INSTRUMENTS AND CONSOLES	23		
INTENDED USE	22		
LIFTING THE EXCAVATOR	49		
LUBRICANTS AND FLUIDS	5		
LUBRICATION OF THE HYDRAULIC EXCAVATOR	81		
MACHINE SIGNS (DECALS)	15		
MAINTENANCE SAFETY	53		
OPERATING PROCEDURE	42		
OPERATOR CANOPY (TOPS)	26		
OPERATOR CANOPY (TOPS)	8		
OPERATOR SAFETY WARNING	1		
PRE-STARTING PROCEDURE	37		
PUBLICATIONS AND TRAINING RESOURCES	14		
REGULAR MAINTENANCE ITEMS	4		
SAFETY INSTRUCTIONS	10		
SEAT BELT	58		
SERIAL NUMBER LOCATIONS	6		
SERVICE SCHEDULE	54		