SERVICE MANUAL

FR480 / FR550 / FR650 / FR780 Tier 4B (final)
FR850 Tier 2

Forage Harvester

Part number 47956032
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February 2016

NEW HOLLAND AGRICULTURE

SERVICE MANUAL

FR480 Forage Cruiser Cursor 13, TIER 4B
FR550 Forage Cruiser Cursor 13, TIER 4B
FR650 Forage Cruiser Cursor 16, TIER 4B
FR780 Forage Cruiser Cursor 16, TIER 4B
FR850 Forage Cruiser Vector, TIER2

Link Product / Engine

Product	Market Product	Engine
FR480 Forage Cruiser Cursor 13, TIER 4B	North America	F3HFE613H*B007
FR550 Forage Cruiser Cursor 13, TIER 4B	North America	F3H FE613F*B007
FR650 Forage Cruiser Cursor 16, TIER 4B	North America	F3JFE613A*B005
FR780 Forage Cruiser Cursor 16, TIER 4B	North America	F3JFE613B*B006
FR850 Forage Cruiser Vector, TIER2	North America	FVAE2884X*B200

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INTRODUCTION

Contents

INTRODUCTION

(*) See content for specific models

Basic instructions - How to use and navigate through this Manual

FR480 Forage Cruiser	NA
FR550 Forage Cruiser	NA
FR650 Forage Cruiser	NA
FR780 Forage Cruiser	NA
FR850 Forage Cruiser	NA

Technical information

This manual has been produced by a new technical information system. This new system is designed to deliver technical information electronically through Web delivery (eTim), DVD and in paper manuals. A coding system called SAP has been developed to link the technical information to other Product Support functions, e.g., Warranty.

Technical information is written to support the maintenance and service of the functions or systems on a customer's machine. When a customer has a concern on his machine it is usually because a function or system on his machine is not working at all, is not working efficiently, or is not responding correctly to his commands. When you refer to the technical information in this manual to resolve that customer's concern, you will find all the information classified using the SAP coding, according to the functions or systems on that machine. Once you have located the technical information for that function or system then you will find all the mechanical, electrical or hydraulic devices, components, assemblies and sub assemblies for that function or system. You will also find all the types of information that have been written for that function or system, the technical data (specifications), the functional data (how it works), the diagnostic data (fault codes and troubleshooting) and the service data (remove, install adjust, etc.).

By integrating SAP coding into technical information, you will be able to search and retrieve just the right piece of technical information you need to resolve that customer's concern on his machine. This is made possible by attaching 3 categories to each piece of technical information during the authoring process.

The first category is the Location, the second category is the Information Type and the third category is the Product:

- LOCATION - is the component or function on the machine, that the piece of technical information is going to describe e.g. Fuel tank.
- INFORMATION TYPE - is the piece of technical information that has been written for a particular component or function on the machine e.g. Capacity would be a type of Technical Data that would describe the amount of fuel held by the Fuel tank.
- PRODUCT - is the model for which the piece of technical information is written.

Every piece of technical information will have those 3 categories attached to it. You will be able to use any combination of those categories to find the right piece of technical information you need to resolve that customer's concern on his machine.

That information could be:

- the description of how to remove the cylinder head
- a table of specifications for a hydraulic pump
- a fault code
- a troubleshooting table
- a special tool

How to use this manual

This manual is divided into Sections. Each Section is then divided into Chapters. Contents pages are included at the beginning of the manual, then inside every Section and inside every Chapter. An alphabetical Index is included at the end of a Chapter. Page number references are included for every piece of technical information listed in the Chapter Contents or Chapter Index.

Each Chapter is divided into four Information types:

- Technical Data (specifications) for all the mechanical, electrical or hydraulic devices, components and, assemblies.
- Functional Data (how it works) for all the mechanical, electrical or hydraulic devices, components and assemblies.
- Diagnostic Data (fault codes, electrical and hydraulic troubleshooting) for all the mechanical, electrical or hydraulic devices, components and assemblies.
- Service Data (remove disassembly, assemble, install) for all the mechanical, electrical or hydraulic devices, components and assemblies.

Sections

Sections are grouped according to the main functions or a systems on the machine. Each Section is identified by a number 00, 35, 55, etc. The amount of Sections included in the manual will depend on the type and function of the machine that the manual is written for. Each Section has a Contents page listed in alphabetic/numeric order. This table illustrates which Sections could be included in a manual for a particular product.

	PRODUCT				
	Tractors				
		Vehicles with working arms: backhoes, excavators, skid steers, ….			
			Combines, forage harvesters, balers, ….		
				Seeding, planting, floating, spraying equipment, ….	
SECTION					Mounted equipment and tools, ….
00 - Maintenance					
05 - Machine completion and equipment					
10 - Engine					
14 - Main gearbox and drive					
18 - Clutch					
21 - Transmission					
23 - Four wheel drive system					
25 - Front axle system					
27 - Rear axle system					
29 - Hydrostatic drive					
31 - Implement power take-off					
33 - Brakes and controls					
35 - Hydraulic systems					
36 - Pneumatic system					
37 - Hitches, drawbars and implement couplings					
39 - Frames and ballasting					
41 - Steering					
44 - Wheels					
46 - Steering clutches					
48 - Tracks and track suspension					
50 - Cab climate control					
55 - Electrical systems					
56 - Grape harvester shaking					
58 - Attachments/headers					
60 - Product feeding					
61 - Metering system					
62 - Pressing - Bale formation					

63 - Chemical applicators						
64 - Chopping						
66 - Threshing						
68 - Tying/Wrapping/Twisting						
69 - Bale wagons						
70 - Ejection						
71 - Lubrication system						
72 - Separation						
73 - Residue handling						
74 - Cleaning						
75 - Soil preparation/Finishing						
76 - Secondary cleaning / Destemmer						
77 - Seeding						
78 - Spraying						
79 - Planting						
80 - Crop storage / Unloading						
82 - Front loader and bucket						
83 - Telescopic single arm						
84 - Booms, dippers and buckets						
86 - Dozer blade and arm						
88 - Accessories						
89 - Tools						
90 - Platform, cab, bodywork and decals						

Section contents

Section	Number	Description
Maintenance	00	
Machine completion and equipment	05	
Engine	10	
Main gearbox and drive	14	
Clutch	18	
Transmission	21	
Four wheel drive system	23	
Front axle system	25	
Rear axle system	27	
Hydrostatic drive	29	
Implement power take-off	31	
Brakes and controls	33	
Hydraulic systems	35	This Section covers the central parts of the hydraulic system. The components that are dedicated to a specific function are listed in the Chapter where all the technical information for that function is included.
Pneumatic system	36	This Section covers the pneumatic system. The components that are dedicated to a specific function are listed in the Chapter where all the technical information for that function is included.
Hitches, drawbars and implement couplings	37	
Frames and ballasting	39	
Steering	41	
Wheels	44	
Steering clutches	46	
Tracks and track suspension	48	
Cab climate control	50	
Electrical systems	55	The Section covers the central parts of the electrical, electronic, and lighting systems. The components that are dedicated to a specific function are listed in the Chapter where all the technical information for that function is included.
Grape harvester shaking	56	
Attachments/headers	58	
Product feeding	60	
Metering system	61	
Pressing - Bale formation	62	
Chemical applicators	63	
Chopping	64	
Threshing	66	
Tying/Wrapping/Twisting	68	
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Lubrication system	71	
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Residue handling	73	
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Soil preparation/Finishing	75	
Secondary cleaning / Destemmer	76	
Seeding	77	
Spraying	78	
Planting	79	
Crop storage / Unloading	80	
Front loader and bucket	82	

Section	Number	Description
Telescopic single arm	83	
Booms, dippers and buckets	84	
Dozer blade and arm	86	
Accessories	88	
Tools	89	
Platform, cab, bodywork and decals	90	This Section covers all the main functions and systems related to the body of the machine, including the operators cab and the platform.

Chapters

Each Chapter is identified by a number e.g. Hydraulic Systems - Main check valve- 35.359. The first number is identical to the Section number i.e. Chapter 35.359 is inside Section 35, Hydraulic Systems. The second number is representative of the Chapter contained within the Section.
CONTENTS
The Chapter Contents lists all the technical data (specifications), functional data (how it works), service data (remove, install adjust, etc..) and diagnostic data (fault codes and troubleshooting) that have been written in that Chapter for that function or system on the machine.

Contents

HYDRAULIC SYSTEMS - 35
Main control valve - 359

FUNCTIONAL DATA

Main control valve - Sectional view (35.359 - C.10.A.30)

TECHNICAL DATA

Main control valve - General specifications (35.359 - D.40.A.10)

SERVICE

Main control valve - Remove (35.359 - F.10.A.10)

INDEX
The Chapter Index lists in alphabetical order all the types of information (called Information Units) that have been written in that Chapter for that function or system on the machine.

Information units and information search

Each chapter is composed of information units. Each information unit has a page reference within that Chapter. The information units provide a quick and easy way to find just the right piece of technical information you are looking for.

Example information unit	Main control valve - Sectional View (35.359)		
Information Unit SAP code	35		Hydraulic systems
SAP code classification		359	Main control valve

Page header and footer

The page header will contain the following references:

- Section and Chapter description

The page footer will contain the following references:

- Publication number for that Manual, Section or Chapter.
- Version reference for that publication.
- Publication date
- Section, chapter and page reference e.g.35.359 / 9

Foreword - Important notice regarding equipment servicing

FR480 Forage Cruiser	NA
FR550 Forage Cruiser	NA
FR650 Forage Cruiser	NA
FR780 Forage Cruiser	NA
FR850 Forage Cruiser	NA

All repair and maintenance work listed in this manual must be carried out only by qualified dealership personnel, strictly complying with the instructions given, and using, whenever possible, the special tools.

Anyone who performs repair and maintenance operations without complying with the procedures provided herein shall be responsible for any subsequent damages.

The manufacturer and all the organizations of its distribution chain, including - without limitation - national, regional, or local dealers, reject any responsibility for damages caused by parts and/or components not approved by the manufacturer, including those used for the servicing or repair of the product manufactured or marketed by the manufacturer. In any case, no warranty is given or attributed on the product manufactured or marketed by the manufacturer in case of damages caused by parts and/or components not approved by the manufacturer.

The manufacturer reserves the right to make improvements in design and changes in specifications at any time without notice and without incurring any obligation to install them on units previously sold. Specifications, descriptions, and illustrative material herein are as accurate as known at time of publication but are subject to change without notice.

In case of questions, refer to your NEW HOLLAND Sales and Service Networks.

Note to the Owner

FR480 Forage Cruiser	NA
FR550 Forage Cruiser	NA
FR650 Forage Cruiser	NA
FR780 Forage Cruiser	NA
FR850 Forage Cruiser	NA

Engine repair information:

The engine repair information is not contained within this manual.
For engine repair information, please refer to the respective Service Manual for the engine type used in your vehicle.

Fault Code Resolution (FCR) information:

For FCR information, please refer to the Electronic Service Tool (EST) or to the information given in the paper or electronic version of this manual.

Electronic Service Tool (EST) information:

The EST information and how to handle Control Modules (CM) (e.g.: resetting of the CM, etc.) is not contained within this manual.
For EST information, please refer to the Electronic Service Tool User's Guide.

Safety rules

FR480 Forage Cruiser	NA
FR550 Forage Cruiser	NA
FR650 Forage Cruiser	NA
FR780 Forage Cruiser	NA
FR850 Forage Cruiser	NA

Personal safety

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible death or injury.

Throughout this manual you will find the signal words DANGER, WARNING, and CAUTION followed by special instructions. These precautions are intended for the personal safety of you and those working with you.

Read and understand all the safety messages in this manual before you operate or service the machine.

DANGER indicates a hazardous situation that, if not avoided, will result in death or serious injury.

WARNING indicates a hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

FAILURE TO FOLLOW DANGER, WARNING, AND CAUTION MESSAGES COULD RESULT IN DEATH OR SERIOUS INJURY.

Machine safety

NOTICE: *Notice indicates a situation that, if not avoided, could result in machine or property damage.*

Throughout this manual you will find the signal word Notice followed by special instructions to prevent machine or property damage. The word Notice is used to address practices not related to personal safety.

Information

NOTE: *Note indicates additional information that clarifies steps, procedures, or other information in this manual.*

Throughout this manual you will find the word Note followed by additional information about a step, procedure, or other information in the manual. The word Note is not intended to address personal safety or property damage.

Safety rules - Ecology and the environment

FR480 Forage Cruiser	NA
FR550 Forage Cruiser	NA
FR650 Forage Cruiser	NA
FR780 Forage Cruiser	NA
FR850 Forage Cruiser	NA

Soil, air, and water quality is important for all industries and life in general. When legislation does not yet rule the treatment of some of the substances that advanced technology requires, sound judgment should govern the use and disposal of products of a chemical and petrochemical nature.

Familiarize yourself with the relative legislation applicable to your country, and make sure that you understand this legislation. Where no legislation exists, obtain information from suppliers of oils, filters, batteries, fuels, anti-freeze, cleaning agents, etc., with regard to the effect of these substances on man and nature and how to safely store, use, and dispose of these substances.

Helpful hints

- Avoid the use of cans or other inappropriate pressurized fuel delivery systems to fill tanks. Such delivery systems may cause considerable spillage.
- In general, avoid skin contact with all fuels, oils, acids, solvents, etc. Most of these products contain substances that may be harmful to your health.
- Modern oils contain additives. Do not burn contaminated fuels and or waste oils in ordinary heating systems.
- Avoid spillage when you drain fluids such as used engine coolant mixtures, engine oil, hydraulic fluid, brake fluid, etc. Do not mix drained brake fluids or fuels with lubricants. Store all drained fluids safely until you can dispose of the fluids in a proper way that complies with all local legislation and available resources.
- Do not allow coolant mixtures to get into the soil. Collect and dispose of coolant mixtures properly.
- The air-conditioning system contains gases that should not be released into the atmosphere. Consult an air-conditioning specialist or use a special extractor to recharge the system properly.
- Repair any leaks or defects in the engine cooling system or hydraulic system immediately.
- Do not increase the pressure in a pressurized circuit as this may lead to a component failure.
- Protect hoses during welding. Penetrating weld splatter may burn a hole or weaken hoses, allowing the loss of oils, coolant, etc.

Battery recycling

Batteries and electric accumulators contain several substances that can have a harmful effect on the environment if the batteries are not properly recycled after use. Improper disposal of batteries can contaminate the soil, groundwater, and waterways. NEW HOLLAND strongly recommends that you return all used batteries to a NEW HOLLAND dealer, who will dispose of the used batteries or recycle the used batteries properly. In some countries, this is a legal requirement.

Mandatory battery recycling

NOTE: *The following requirements are mandatory in Brazil.*

Batteries are made of lead plates and a sulfuric acid solution. Because batteries contain heavy metals such as lead, CONAMA Resolution 401/2008 requires you to return all used batteries to the battery dealer when you replace any batteries. Do not dispose of batteries in your household garbage.

Points of sale are obliged to:

- Accept the return of your used batteries
- Store the returned batteries in a suitable location
- Send the returned batteries to the battery manufacturer for recycling

Safety rules

FR480 Forage Cruiser	NA
FR550 Forage Cruiser	NA
FR650 Forage Cruiser	NA
FR780 Forage Cruiser	NA
FR850 Forage Cruiser	NA

LEGAL OBLIGATIONS

This machine may be equipped with special guarding or other devices in compliance with local legislation. Some to these require active use by the operator. Therefor, check local legislations on the usage of this machine.

ACCIDENT PREVENTION

Most accidents or injuries that occur in workshops are the result of non compliance to simple and fundamental safety principles. For this reason, IN MOST CASES THESE ACCIDENTS CAN BE AVOIDED by applying the fundamental safety principles, acting with the necessary caution and care.

Accidents may occur with all types of machine, regardless of how well the machine in question was designed and built.

⚠ CAUTION

Unexpected machine movement!
1. Disengage all drives.
2. Engage parking brake.
3. Lower all attachments to the ground, or raise and engage all safety locks.
4. Shut off engine.
5. Remove key from key switch.
6. Switch off battery key, if installed.
7. Wait for all machine movement to stop.
Failure to comply could result in minor or moderate injury.

C0038A

SAFETY REQUIREMENTS FOR FLUID POWER SYSTEMS AND COMPONENTS - HYDRAULICS

- Flexible hose assemblies must not be constructed from hoses which have been previously used as part of a hose assembly.
- Do not weld hydraulic pipes: when flexible hoses or piping are damaged, replace them immediately.
- It is forbidden to modify a hydraulic accumulator by machining, welding or any other way.
- Before removing hydraulic accumulators for servicing, the liquid pressure in the accumulators must be reduced to zero.
- Pressure check on hydraulic accumulators must be carried out by a method recommended by the accumulator manufacturer.
- Take care not to exceed the maximum allowed pressure of the accumulator. After any check or adjustment, check for leakages or gas in the hoses or tubes.

SAFETY RULES

General guidelines

- Carefully follow specified repair and maintenance procedures.
- When appropriate, use P.P.E (Personal Protective Equipment)
- Do not wear rings, wristwatches, jewellery, unbuttoned or loose articles of clothing such as: ties, torn clothing, scarves, open jackets or shirts with open zips that may remain entangled in moving parts. It is advised to wear approved safety clothing, e.g.: non-slip footwear, gloves, safety goggles, helmets, etc.

- Do not carry out repair operations with someone sitting in the driver's seat, unless the person is a trained technician who is assisting with the operation in question.
- Do not operate the machine or use any of the implements from different positions, other than the driver's seat.
- Do not carry out operations on the machine with the engine running, unless specifically indicated.
- Bring all hydraulic cylinders to the home positions (down, retracted, etc.) before engine shut down.
- Stop the engine and check that the hydraulic circuits are pressure-free before removing caps, covers, valves, etc.
- All repair and maintenance operations must be carried out using extreme care and attention.
- Service steps and platforms used in the workshop or elsewhere should be built according to the applicable standards and legislation.
- Disconnect the Power Take-Off (PTO) and label the controls to indicate that the machine is being serviced.
- Brakes are inoperative when manually released for repair or maintenance purposes. Use blocks or similar devices to secure the machine in these conditions.
- Only use specified towing points for towing the machine. Connect parts carefully. Make sure that all pins and/or locks are secured in position before applying traction. Never remain near the towing bars, cables or chains that are operating under load.
- When loading or unloading the machine from the trailer (or other means of transport), select a flat area capable of sustaining the trailer or truck wheels. Firmly secure the machine to the truck or trailer and lock the wheels in the position used by the carrier.
- Electric heaters, battery-chargers and similar equipment must only be powered by auxiliary power supplies with efficient ground insulation to avoid electrical shock hazards.
- Always use suitable hoisting or lifting devices when raising or moving heavy parts.
- Keep bystanders away.
- Never use gasoline, diesel oil or other inflammable liquids as cleaning agents. Use non-inflammable, non toxic commercially available solvents.
- Wear safety goggles with side guards when cleaning parts with compressed air.
- Never use open flames for lighting when working on the machine or checking for leaks.
- When carrying out checks with the engine running, request the assistance of an operator in the driver's seat. The operator must maintain visual contact with the service technician at all times.
- If operating outside the workshop, position the machine on a flat surface and lock in position. If working on a slope, lock the machine in position. Move to a flat area as soon as is safely possible.
- Maintenance and repair operations must be carried out in a clean and dry area. Clean up any water or oil spillage immediately.
- Do not create piles of oil or grease-soaked rags as they represent a serious fire hazard. Always store rags in a closed metal container.
- Before engaging the machine, make sure that there are no persons within the machine or implement range of action.
- Empty your pockets of all objects that may fall accidentally unobserved into the machine inner compartments.
- When metal parts are sticking out, use protective goggles or goggles with side guards, helmets, special footwear and gloves.
- When welding, use protective safety devices: tinted safety goggles, helmets, special overalls, gloves and footwear. All persons present in the area where welding is taking place must wear tinted goggles. NEVER LOOK DIRECTLY AT THE WELDING ARC WITHOUT SUITABLE EYE PROTECTION.

Machine start-up.

- Never run the engine in confined spaces that are not equipped with adequate ventilation for exhaust gas extraction.
- Never place the head, body, limbs, feet, hands or fingers near rotating and moving parts.

Hydraulic systems and fuel injection systems

- A liquid leaking from a tiny hole may be almost invisible but, at the same time, be powerful enough to penetrate the skin. Therefore, NEVER USE HANDS TO CHECK FOR LEAKS but use a piece of cardboard or paper for this purpose. If any liquid penetrates skin tissue, call for medical aid immediately. Failure to treat this condition with correct medical procedure may result in serious infection or death.
- In order to check the pressure in the system use suitable instruments.

Wheels and tires

- Make sure that the tires are correctly inflated at the pressure specified by the manufacturer. Periodically check the rims and tires for damage.
- Stand away from (at the side of) the tire when checking inflation pressure.
- Do not use parts of recovered wheels as incorrect welding brazing or heating may weaken and eventually cause damage to the wheel.
- Never cut or weld a rim mounted with an inflated tire.
- Deflate the tire before removing any objects that may be jammed in the tire tread.
- Never inflate tires using inflammable gases, as this may result in explosions and injury to bystanders.

Removal and installation

- Lift and handle all heavy parts using suitable hoisting equipment. Make sure that parts are sustained by appropriate hooks and slings. Use the hoisting eyebolts for lifting operations. Extra care should be taken if persons are present near the load to be lifted.
- Handle all parts carefully. Do not put your hands or fingers between parts. Wear suitable safety clothing - safety goggles, gloves and shoes.
- Avoid twisting chains or metal cables. Always wear safety gloves when handling cables or chains.
- Damaged or bent chains or cables are unreliable. Do not use them for lifting or towing. Always use suitable protective gloves when handling chains or cables.
- Chains should always be safely secured. Make sure that the hitch-up point is capable of sustaining the load in question. Keep the area near the hitch-up point, chains or cables free of all bystanders.
- Metal cables tend to fray with repeated use. Always use suitable protective devices (gloves, goggles, etc.) when handling cables.

Personal safety

FR480 Forage Cruiser	NA
FR550 Forage Cruiser	NA
FR650 Forage Cruiser	NA
FR780 Forage Cruiser	NA
FR850 Forage Cruiser	NA

⚠ WARNING

Heavy object!
ALWAYS use a hoist or get assistance to lift the component.
Failure to comply could result in death or serious injury.

W0086A

⚠ WARNING

Pressurized system!
Only use the bleed screw to bleed air from the fuel system. DO NOT loosen the fuel or injector lines to bleed air. Injury or damage can occur. Fuel or injector lines are under very high pressure.
Failure to comply could result in death or serious injury.

W0285A

Basic instructions - Shop and assembly

FR480 Forage Cruiser	NA
FR550 Forage Cruiser	NA
FR650 Forage Cruiser	NA
FR780 Forage Cruiser	NA
FR850 Forage Cruiser	NA

Shimming

For each adjustment operation, select adjusting shims and measure the adjusting shims individually using a micrometer, then add up the recorded values. Do not rely on measuring the entire shimming set, which may be incorrect, or the rated value shown on each shim.

Rotating shaft seals

For correct rotating shaft seal installation, proceed as follows:

1. Before assembly, allow the seal to soak in the oil it will be sealing for at least thirty minutes.
2. Thoroughly clean the shaft and check that the working surface on the shaft is not damaged.
3. Position the sealing lip facing the fluid.

   NOTE: *With hydrodynamic lips, take into consideration the shaft rotation direction and position the grooves so that they will move the fluid towards the inner side of the seal.*
4. Coat the sealing lip with a thin layer of lubricant (use oil rather than grease). Fill the gap between the sealing lip and the dust lip on double lip seals with grease.
5. Insert the seal in its seat and press down using a flat punch or seal installation tool. Do not tap the seal with a hammer or mallet.
6. While you insert the seal, check that the seal is perpendicular to the seat. When the seal settles, make sure that the seal makes contact with the thrust element, if required.
7. To prevent damage to the seal lip on the shaft, position a protective guard during installation operations.

O-ring seals

Lubricate the O-ring seals before you insert them in the seats. This will prevent the O-ring seals from overturning and twisting, which would jeopardize sealing efficiency.

Sealing compounds

Apply a sealing compound on the mating surfaces when specified by the procedure. Before you apply the sealing compound, prepare the surfaces as directed by the product container.

Spare parts

Only use CNH Original Parts or NEW HOLLAND Original Parts.

Only genuine spare parts guarantee the same quality, duration, and safety as original parts, as they are the same parts that are assembled during standard production. Only CNH Original Parts or NEW HOLLAND Original Parts can offer this guarantee.

When ordering spare parts, always provide the following information:

- Machine model (commercial name) and Product Identification Number (PIN)
- Part number of the ordered part, which can be found in the parts catalog

Protecting the electronic and/or electrical systems during charging and welding

To avoid damage to the electronic and/or electrical systems, always observe the following practices:

1. Never make or break any of the charging circuit connections when the engine is running, including the battery connections.
2. Never short any of the charging components to ground.
3. Always disconnect the ground cable from the battery before arc welding on the machine or on any machine attachment.
   - Position the welder ground clamp as close to the welding area as possible.
   - If you weld in close proximity to a computer module, then you should remove the module from the machine.
   - Never allow welding cables to lie on, near, or across any electrical wiring or electronic component while you weld.
4. Always disconnect the negative cable from the battery when charging the battery in the machine with a battery charger.

   NOTICE: *If you must weld on the unit, you must disconnect the battery ground cable from the machine battery. The electronic monitoring system and charging system will be damaged if this is not done.*
5. Remove the battery ground cable. Reconnect the cable when you complete welding.

⚠ WARNING

Battery acid causes burns. Batteries contain sulfuric acid.
Avoid contact with skin, eyes or clothing. Antidote (external): Flush with water. Antidote (eyes): flush with water for 15 minutes and seek medical attention immediately. Antidote (internal): Drink large quantities of water or milk. Do not induce vomiting. Seek medical attention immediately.
Failure to comply could result in death or serious injury.

W0111A

Special tools

The special tools that NEW HOLLAND suggests and illustrate in this manual have been specifically researched and designed for use with NEW HOLLAND machines. The special tools are essential for reliable repair operations. The special tools are accurately built and rigorously tested to offer efficient and long-lasting operation.

By using these tools, repair personnel will benefit from:

- Operating in optimal technical conditions
- Obtaining the best results
- Saving time and effort
- Working in safe conditions

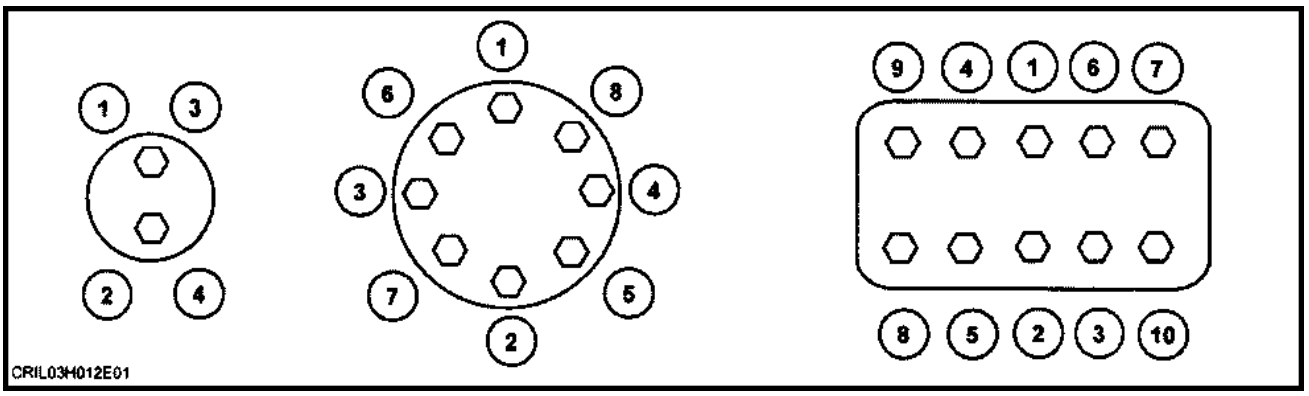
Torque

FR480 Forage Cruiser	NA
FR550 Forage Cruiser	NA
FR650 Forage Cruiser	NA
FR780 Forage Cruiser	NA
FR850 Forage Cruiser	NA

Minimum hardware tightening torques (in N m or lb in /lb ft) for normal assembly applications unless otherwise stated

NOTICE: *Shown below is the suggested initial torque tightening sequences for general applications, tighten in sequence from item 1 through to the last item of the hardware.*

The minimum hardware tightening torque on drawings, in specifications etc. have priority.
The applicable CNH Standard is ENS7001.

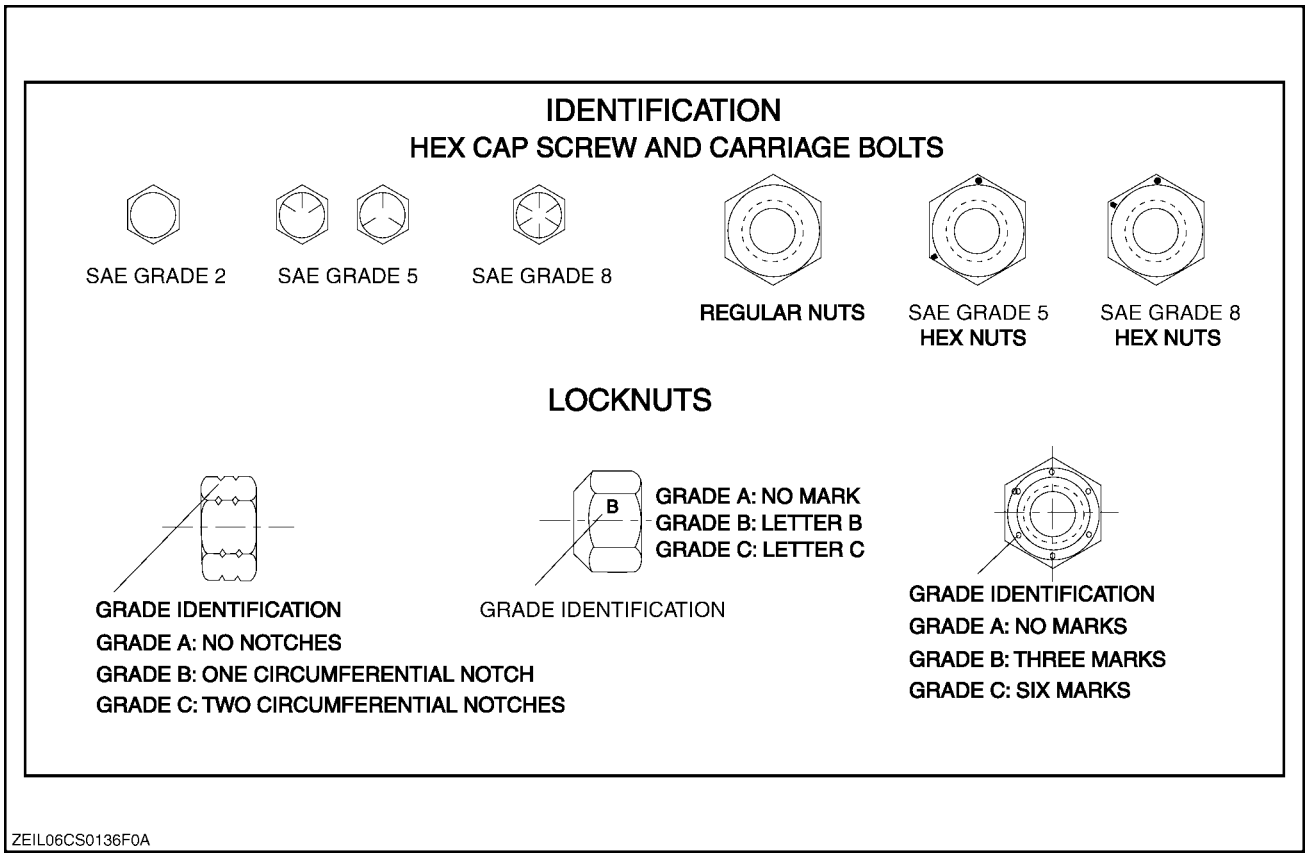


DF5019-1 1

Metric hardware

	Class 8.8 in N m (lb in or lb ft)			Class 10.9 in N m (lb in or lb ft)		
Nominal Size	Plated nut	Lock nut	Hardened nut	Plated nut	Lock nut	Hardened nut
M3	**1.3 N·m (11.5 lb in)**	**0.7 N·m (6.2 lb in)**	**1.2 N·m (10.6 lb in)**	**1.8 N·m (15.9 lb in)**	**0.9 N·m (8.0 lb in)**	**1.6 N·m (14.2 lb in)**
M4	**2.9 N·m (25.7 lb in)**	**1.6 N·m (14.2 lb in)**	**2.6 N·m (23.0 lb in)**	**4.2 N·m (37.2 lb in)**	**2.3 N·m (20.4 lb in)**	**3.7 N·m (32.7 lb in)**
M5	**5.9 N·m (52.2 lb in)**	**3.2 N·m (28.3 lb in)**	**5.3 N·m (46.9 lb in)**	**8.5 N·m (75.2 lb in)**	**4.6 N·m (40.7 lb in)**	**7.6 N·m (67.3 lb in)**
M6	**10.1 N·m (89.4 lb in)**	**5.5 N·m (48.7 lb in)**	**9.1 N·m (80.5 lb in)**	**14.5 N·m (10.7 lb ft)**	**7.9 N·m (69.9 lb in)**	**13 N·m (9.6 lb ft)**
M8	**24.5 N·m (18.1 lb ft)**	**13.5 N·m (10.0 lb ft)**	**22 N·m (16.2 lb ft)**	**35.1 N·m (25.9 lb ft)**	**19.3 N·m (14.2 lb ft)**	**31.5 N·m (23.2 lb ft)**
M10	**48.7 N·m (35.9 lb ft)**	**26.8 N·m (19.8 lb ft)**	**43.8 N·m (32.3 lb ft)**	**69.5 N·m (51.3 lb ft)**	**38.2 N·m (28.2 lb ft)**	**62.5 N·m (46.1 lb ft)**
M12	**85 N·m (62.7 lb ft)**	**46.7 N·m (34.4 lb ft)**	**76.5 N·m (56.4 lb ft)**	**121 N·m (89.2 lb ft)**	**66.5 N·m (49.0 lb ft)**	**108.9 N·m (80.3 lb ft)**
M14	**135 N·m (99.6 lb ft)**	**74.2 N·m (54.7 lb ft)**	**121.5 N·m (89.6 lb ft)**	**193 N·m (142.3 lb ft)**	**106.1 N·m (78.3 lb ft)**	**173.7 N·m (128.1 lb ft)**
M16	**210 N·m (154.9 lb ft)**	**115.5 N·m (85.2 lb ft)**	**189 N·m (139.4 lb ft)**	**301 N·m (222 lb ft)**	**165.5 N·m (122.1 lb ft)**	**270.9 N·m (199.8 lb ft)**
M18	**299 N·m (220.5 lb ft)**	**164.4 N·m (121.3 lb ft)**	**269.1 N·m (198.5 lb ft)**	**414 N·m (305.4 lb ft)**	**227.7 N·m (167.9 lb ft)**	**372.6 N·m (274.8 lb ft)**
M20	**425 N·m (313.5 lb ft)**	**233.72 N·m (172.4 lb ft)**	**382.5 N·m (282.1 lb ft)**	**587 N·m (432.9 lb ft)**	**322.8 N·m (238.1 lb ft)**	**528.3 N·m (389.7 lb ft)**
M22	**579 N·m (427 lb ft)**	**318.4 N·m (234.8 lb ft)**	**521.1 N·m (384.3 lb ft)**	**801 N·m (590.8 lb ft)**	**440.5 N·m (324.9 lb ft)**	**720.9 N·m (531.7 lb ft)**
M24	**735 N·m (542.1 lb ft)**	**404.2 N·m (298.1 lb ft)**	**661.5 N·m (487.9 lb ft)**	**1016 N·m (749.4 lb ft)**	**558.8 N·m (412.1 lb ft)**	**914.4 N·m (674.4 lb ft)**

	Class 8.8 in N m (lb in or lb ft)			Class 10.9 in N m (lb in or lb ft)		
Nominal Size	**Plated nut**	**Lock nut**	**Hardened nut**	**Plated nut**	**Lock nut**	**Hardened nut**
M27	**1073 N·m (791.4 lb ft)**	**590.1 N·m (435.2 lb ft)**	**967.5 N·m (713.6 lb ft)**	**1486 N·m (1096 lb ft)**	**817.3 N·m (602.8 lb ft)**	**1337 N·m (986.1 lb ft)**
M30	**1461 N·m (1077.6 lb ft)**	**803.5 N·m (592.6 lb ft)**	**1315 N·m (969.9 lb ft)**	**2020 N·m (1489.9 lb ft)**	**1111 N·m (819.4 lb ft)**	**1818 N·m (1340.9 lb ft)**



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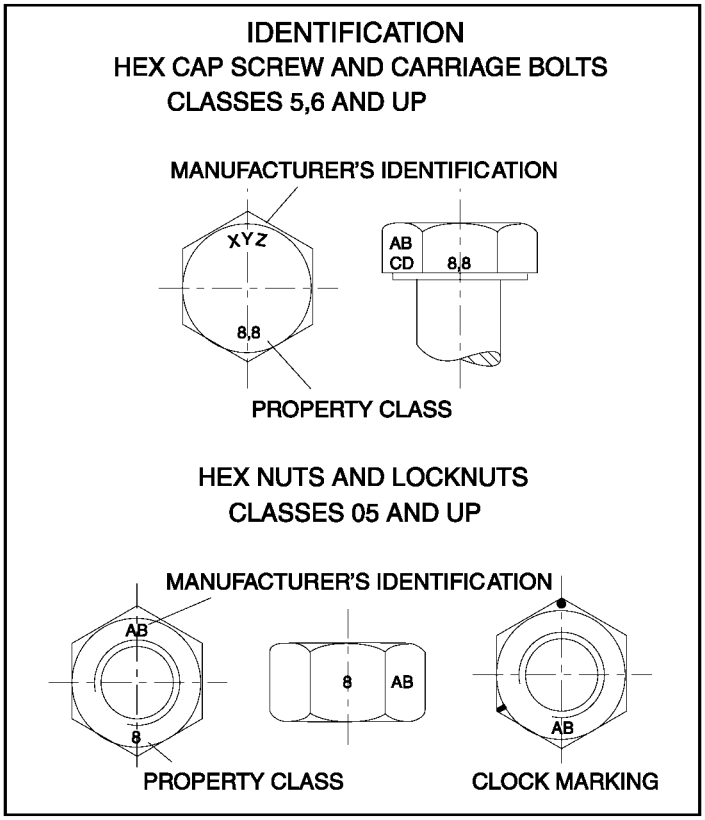

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Torque - Standard torque data for hydraulic connections

FR480 Forage Cruiser	NA
FR550 Forage Cruiser	NA
FR650 Forage Cruiser	NA
FR780 Forage Cruiser	NA
FR850 Forage Cruiser	NA

General information

- Hydraulic connections require a minimum assembly torque in order to provide zero leakage at rated pressure with adequate fatigue resistance. Over-torquing of a hydraulic connection can also lead to leakage or failure. For some connections, NEW HOLLAND requires a different torque value than is listed in the ISO and SAE standards.
- The torque values in this document should be used whenever possible or applicable.

  NOTICE: *Always follow the instructions in this manual for specific torque values when you service components. The information in this section is for general guidance only when a procedure contains no specific torque value.*

Tolerance

- The tolerance for all torque values is ± **10 %**. This tolerance must include all assembly variation, not only the torque wrench repeatability.

Lubrication

Application of grease or other lubricants to hydraulic connectors should be avoided. If clean hydraulic oil is already on the connection, it is not required to remove the oil. Generally, application of grease:

- May cause a significant change in the torque required to properly tighten the connection.
- May reduce the connection's resistance to vibration.
- Excessive grease may displace an elastomer seal during tightening.
- Grease extrusion when connection is tightened may be mistaken for leakage.

NEW HOLLAND products generally use O-Ring Boss (ORB) connectors that have Teflon™-coated O-rings, eliminating the need for O-ring lubrication during installation. For connections which are made into aluminum manifolds or with stainless steel connectors, it may be required to apply a lubricant to prevent galling.

Use of **LOCTITE®** and other thread-locking compounds is prohibited. These compounds:

- May cause a significant change in the torque required to properly tighten the connections.
- Reduce the serviceability of the joint.
- May prevent the O-ring from properly sealing if the compound gets on the O-ring.

Torque values for metric O-Ring Boss (ORB) port connections

	S-Series *		L-Series **	
Metric thread	**Ferrous N·m (lb ft) ± 10 %**	**Non-Ferrous N·m (lb ft) ± 10 %**	**Ferrous N·m (lb ft) ± 10 %**	**Non-Ferrous N·m (lb ft) ± 10 %**
M8 x 1	10.5 (7.7)	6.3 (4.6)	8.5 (6.3)	5 (3.7)
M10 x 1	21 (15.5)	12.5 (9.2)	15.5 (11.4)	9.3 (6.9)
M12 x 1.5	37 (27.3)	22 (16.2)	27 (19.9)	16 (11.8)
M14 x 1.5	47 (34.7)	28 (20.7)	37 (27.3)	22 (16.2)
M16 x 1.5	58 (42.8)	35 (25.8)	42 (31)	25 (18.4)
M18 x 1.5	74 (54.6)	44 (32.5)	47 (34.7)	28 (20.7)
M22 x 1.5	105 (77.4)	63 (46.5)	63 (46.5)	38 (28)
M27 x 2	178 (131.3)	107 (78.9)	105 (77.4)	63 (46.5)
M30 x 2	225 (166)	135 (99.6)	136 (100.3)	82 (60.5)
M33 x 2	325 (239.7)	195 (143.8)	168 (123.9)	101 (74.5)
M42 x 2	345 (254.5)	207 (152.7)	220 (162.3)	132 (97.4)
M48 x 2	440 (324.5)	264 (194.7)	273 (201.4)	164 (121)
M60 x 2	525 (387.2)	315 (232.3)	330 (243.4)	198 (146)

* S-Series connectors are used with O-Ring Face Seals (ORFS).

** L-Series connectors are used with **37 °** flare.

Torque values for metric O-Ring Boss (ORB) port plugs

	Ferrous		Non-ferrous
Metric thread	**Internal hex N·m (lb ft) ± 10 %**	**External hex N·m (lb ft) ± 10 %**	**N·m (lb ft) ± 10 %**
M8 x 1	8.5 (6.3)	10.5 (7.7)	6.3 (4.6)
M10 x 1	16 (11.8)	21 (15.5)	12.5 (9.2)
M12 x 1.5	23 (17)	37 (27.3)	22 (16.2)
M14 x 1.5	47 (34.7)	47 (34.7)	28 (20.7)
M16 x 1.5	58 (42.8)	58 (42.8)	35 (25.8)
M18 x 1.5	74 (54.6)	74 (54.6)	44 (32.5)
M22 x 1.5	105 (77.4)	105 (77.4)	63 (46.5)
M27 x 2	178 (131.3)	178 (131.3)	107 (78.9)
M30 x 2	225 (166)	225 (166)	135 (99.6)
M33 x 2	325 (239.7)	325 (239.7)	195 (143.8)
M42 x 2	345 (254.5)	345 (254.5)	207 (152.7)
M48 x 2	440 (324.5)	440 (324.5)	264 (194.7)
M60 x 2	525 (387.2)	525 (387.2)	315 (232.3)

Torque values for port connections (British Standard Pipe Parallel (BSPP) thread ports and stud ends)

	Metric tube Outside Diameter (OD) mm (in)		Ferrous		Non-Ferrous	
BSPP thread G- Gas; A- medium coarse threads	**S-Series ***	**L-Series ****	**S-Series N·m (lb ft) ± 10 %**	**L-Series N·m (lb ft) ± 10 %**	**S-Series N·m (lb ft) ± 10 %**	**L-Series N·m (lb ft) ± 10 %**
G 1/8 A	–	6 (0.236)	–	21 (15.5)	–	12.5 (9.2)
G 1/4 A	6 (0.236) or 8 (0.315)	8 (0.315) or 10 (0.394)	63 (46.5)	53 (39.1)	38 (28)	32 (23.6)
G 3/8 A	10 (0.394) or 12 (0.472)	12 (0.472)	95 (70.1)	84 (62)	57 (42)	50 (36.9)
G 1/2 A	16 (0.630)	15 (0.591) or 18 (0.709)	136 (100.3)	105 (77.4)	82 (60.5)	63 (46.5)
G 3/4 A	20 (0.787)	22 (0.866)	210 (154.9)	210 (154.9)	126 (92.9)	126 (92.9)
G 1 A	25 (0.984)	28 (1.102)	400 (295)	400 (295)	240 (177)	240 (177)
G 1 1/4 A	30 (1.181)	35 (1.378)	525 (387.2)	525 (387.2)	315 (232.3)	315 (232.3)
G 1 1/2 A	38 (1.496)	42 (1.654)	660 (486.8)	660 (486.8)	396 (292.1)	396 (292.1)

* S-Series connectors are used with O-Ring Face Seals (ORFS).

** L-Series connectors are used with **37 °** flare.

Torque values for metric port connections (Metric face-seal ports and stud ends)

	Metric tube Outside Diameter (OD) mm (in)		Ferrous		Non-Ferrous	
Metric thread	**S-Series ***	**L-Series ****	**S-Series N·m (lb ft) ± 10 %**	**L-Series N·m (lb ft) ± 10 %**	**S-Series N·m (lb ft) ± 10 %**	**L-Series N·m (lb ft) ± 10 %**
M10 x 1	–	4 (0.157)	–	21 (15.5)	–	12.5 (9.2)
M12 x 1.5	4 (0.157)	6 (0.236)	47 (34.7)	32 (23.6)	28 (20.7)	19 (14)
M14 x 1.5	5 (0.197)	7 (0.276)	63 (46.5)	53 (39.1)	38 (28)	32 (23.6)
M16 x 1.5	7 (0.276)	9 (0.354)	84 (62)	63 (46.5)	50 (36.9)	38 (28)
M18 x 1.5	8 (0.315)	11 (0.433)	105 (77.4)	84 (62)	63 (46.5)	50 (36.9)
M20 x 1.5	10 (0.394)	–	147 (108.4)	–	88 (64.9)	–
M22 x 1.5	12 (0.472)	14 (0.551)	158 (116.5)	147 (108.4)	95 (70.1)	88 (64.9)
M26 x 1.5	–	18 (0.709)	–	210 (154.9)	–	126 (92.9)
M27 x 1.2	16 (0.630)	–	210 (154.9)		126 (92.9)	–
M33 x 2	20 (0.787)	23 (0.906)	400 (295)	400 (295)	240 (177)	240 (177)
M42 x 2	25 (0.984)	30 (1.181)	525 (387.2)	525 (387.2)	315 (232.3)	315 (232.3)
M48 x 2	32 (1.260)	36 (1.417)	630 (464.7)	630 (464.7)	396 (292.1)	396 (292.1)

* S-Series connectors are used with O-Ring Face Seals (ORFS).

** L-Series connectors are used with **37 °** flare.

Torque values for Inch O-Ring Boss (ORB) port non-adjustable connections

			S-Series *		L-Series **	
SAE dash size	UN/UNF thread size	Inch tube OD mm (in)	Ferrous N·m (lb ft) ± 10 %	Non-Ferrous N·m (lb ft) ± 10 %	Ferrous N·m (lb ft) ± 10 %	Non-Ferrous N·m (lb ft) ± 10 %
2	5/16-24	3.18 (0.125)	–	–	8.5 (6.3)	5 (3.7)
3	3/8-24	4.76 (0.187)	15.5 (11.4)	9.3 (6.9)	10.5 (7.7)	6.3 (4.6)
4	7/16-20	6.35 (0.250)	37 (27.3)	22 (16.2)	19 (14)	11.5 (8.5)
5	1/2-20	7.94 (0.313)	42 (31)	25 (18.4)	26 (19.2)	15.5 (11.4)
6	9/16-18	9.52 (0.375)	47 (34.7)	28 (20.7)	32 (23.6)	19 (14)
8	3/4-16	12.7 (0.500)	89 (65.6)	53 (39.1)	53 (39.1)	32 (23.6)
10	7/8-14	15.88 (0.625)	121 (89.2)	73 (53.8)	63 (46.5)	38 (28)
12	1-1/16-12	19.05 (0.750)	178 (131.3)	107 (78.9)	100 (73.8)	60 (44.3)
14	1-3/16-12	22.22 (0.875)	225 (166)	135 (99.6)	131 (96.6)	79 (58.3)
16	1-5/16-12	25.4 (1.000)	283 (208.7)	170 (125.4)	156 (115.1)	94 (69.3)
20	1-5/8-12	31.75 (1.250)	300 (221.3)	180 (132.8)	210 (154.9)	126 (92.9)
24	1-7/8-12	38.1 (1.500)	388 (286.2)	233 (171.9)	220 (162.3)	132 (97.4)
32	2-1/2-12	50.8 (2.000)	388 (286.2)	233 (171.9)	315 (232.3)	189 (139.4)

* S-Series connectors are used with O-Ring Face Seals (ORFS).

** L-Series connectors are used with **37 °** flare.

Torque values for inch O-Ring Boss (ORB) port adjustable connections

			S-Series *		L-Series **	
SAE dash size	UN/UNF thread size	Inch tube OD mm (in)	Ferrous N·m (lb ft) ± 10 %	Non-Ferrous N·m (lb ft) ± 10 %	Ferrous N·m (lb ft) ± 10 %	Non-Ferrous N·m (lb ft) ± 10 %
2	5/16-24	3.18 (0.125)	–	–	8.5 (6.3)	5 (3.7)
3	3/8-24	4.76 (0.187)	10.5 (7.7)	9.3 (6.9)	10.5 (7.7)	6.3 (4.6)
4	7/16-20	6.35 (0.250)	21 (15.5)	21 (15.5)	19 (14)	11.5 (8.5)
5	1/2-20	7.94 (0.313)	42 (31)	25 (18.4)	26 (19.2)	15.5 (11.4)
6	9/16-18	9.52 (0.375)	47 (34.7)	28 (20.7)	32 (23.6)	19 (14)
8	3/4-16	12.7 (0.500)	89 (65.6)	53 (39.1)	53 (39.1)	32 (23.6)
10	7/8-14	15.88 (0.625)	121 (89.2)	73 (53.8)	63 (46.5)	38 (28)
12	1-1/16-12	19.05 (0.750)	178 (131.3)	107 (78.9)	100 (73.8)	60 (44.3)
14	1-3/16-12	22.22 (0.875)	225 (166)	135 (99.6)	131 (96.6)	79 (58.3)
16	1-5/16-12	25.4 (1.000)	285 (210.2)	170 (125.4)	156 (115.1)	94 (69.3)
20	1-5/8-12	31.75 (1.250)	300 (221.3)	180 (132.8)	210 (154.9)	126 (92.9)
24	1-7/8-12	38.1 (1.500)	388 (286.2)	233 (171.9)	220 (162.3)	132 (97.4)
32	2-1/2-12	50.8 (2.000)	388 (286.2)	233 (171.9)	315 (232.3)	189 (139.4)

* S-Series connectors are used with O-Ring Face Seals (ORFS).

** L-Series connectors are used with **37 °** flare.

Torque values for inch O-Ring Boss (ORB) port plugs

		Ferrous		Non-Ferrous
SAE dash size	UN/UNF thread size	Internal hex N·m (lb ft) ± 10 %	External hex N·m (lb ft) ± 10 %	N·m (lb ft) ± 10 %
2	5/16-24	7.5 (5.5)	12.5 (9.2)	7.5 (5.5)
3	3/8-24	14.5 (10.7)	21 (15.5)	12.5 (9.2)
4	7/16-20	21 (15.5)	37 (27.3)	22 (16.2)
5	1/2-20	28 (20.7)	42 (31)	25 (18.4)
6	9/16-18	47 (34.7)	47 (34.7)	28 (20.7)
8	3/4-16	89 (65.6)	89 (65.6)	53 (39.1)
10	7/8-14	116 (85.6)	116 (85.6)	70 (51.6)
12	1-1/16-12	176 (129.8)	176 (129.8)	106 (78.2)
14	1-3/16-12	247 (182.2)	247 (182.2)	148 (109.2)
16	1-5/16-12	284 (209.5)	284 (209.5)	170 (125.4)
20	1-5/8-12	357 (263.3)	357 (263.3)	214 (157.8)
24	1-7/8-12	441 (325.3)	441 (325.3)	265 (195.5)
32	2-1/2-12	536 (395.3)	536 (395.3)	322 (237.5)

Torque values for four-bolt flange connections (Metric Screws, Class 10.9)

Metric size mm	Imperial size in	Screw code 61	Code 61 N·m (lb ft) ± 10 %	Screw code 62	Code 62 N·m (lb ft) ± 10 %
13	1/2	M8 x 1.25	34 (25.1)	M8 x 1.25	34 (25.1)
19	3/4	M10 x 1.5	74 (54.6)	M10 x 1.5	74 (54.6)
25	1	M10 x 1.5	74 (54.6)	M12 x 1.75	137 (101)
32	1-1/4	M10 x 1.5	74 (54.6)	M12 x 1.75	137 (101)
				M14 x 1.5	189 (139.4)
38	1-1/2	M12 x 1.75	137 (101)	M16 x 2	310 (228.6)
51	2	M12 x 1.75	137 (101)	M20 x 2.5	575 (424.1)
64	2-1/2	M12 x 1.75	137 (101)	M24 x 3	575 (424.1)
76	3	M16 x 2	310 (228.6)	M30 x 3.5	680 (501.5)
89	3-1/2	M16 x 2	310 (228.6)	–	–
102	4	M16 x 2	310 (228.6)	–	–
127	5	M16 x 2	310 (228.6)	–	–

Torque values for four-bolt flange connections (Metric Screws, Class 8.8)

Metric size mm	Imperial size in	Screw code 61	Code 61 N·m (lb ft) ± 10 %	Screw code 62	Code 62 N·m (lb ft) ± 10 %
13	1/2	M8 x 1.25	29 (21.4)	M8 x 1.25	29 (21.4)
19	3/4	M10 x 1.5	57(42)	M10 x 1.5	57(42)
25	1	M10 x 1.5	57(42)	M12 x 1.75	100 (73.8)
32	1-1/4	M10 x 1.5	57(42)	M12 x 1.75	100 (73.8)
				M14 x 1.5	160 (118)
38	1-1/2	M12 x 1.75	100 (73.8)	M16 x 2	250 (184.4)
51	2	M12 x 1.75	100 (73.8)	M20 x 2.5	500 (368.8)
64	2-1/2	M12 x 1.75	100 (73.8)	M24 x 3	575 (424.1)
76	3	M16 x 2	250 (184.4)	M30 x 3.5	680 (501.5)
89	3-1/2	M16 x 2	250 (184.4)	–	–
102	4	M16 x 2	250 (184.4)	–	–
127	5	M16 x 2	250 (184.4)	–	–

Torque values for four-bolt flange connections (Inch Screws, Grade 8)

Metric size mm	Imperial size in	Screw code 61	Code 61 N·m (lb ft) ± 10 %	Screw code 62	Code 62 N·m (lb ft) ± 10 %
13	1/2	5/16-18	34 (25.1)	5/16-18	34 (25.1)
19	3/4	3/8-16	63 (46.5)	3/8-16	63 (46.5)
25	1	3/8-16	63 (46.5)	7/16-14	97 (71.5)
32	1-1/4	7/16-14	97 (71.5)	1/2-13	158 (116.5)
38	1-1/2	1/2-13	158 (116.5)	5/8-11	310 (228.6)
51	2	1/2-13	158 (116.5)	3/4-10	473 (348.9)
64	2-1/2	1/2-13	158 (116.5)	–	–
76	3	5/8-11	310 (228.6)	–	–
89	3-1/2	5/8-11	310 (228.6)	–	–
102	4	5/8-11	310 (228.6)	–	–
127	5	5/8-11	310 (228.6)	–	–

Tapered thread connection tightening

British Standard Pipe Taper (BSPT) thread size (inch)	National Pipe Thread Fuel (NPTF) thread size (inch)	Turns from finger tight
1/8-28	1/8-27	2 - 3
1/4-19	1/4-18	2 - 3
3/8-19	3/8-18	2 - 3
1/2-14	1/2-14	2 - 3
3/4-14	3/4-14	2 - 3
1-11	1-11 1/2	1.5 - 2.5
1-1/4-11	1-1/4-11 1/2	1.5 - 2.5
1-1/2-11	1-1/2-11 1/2	1.5 - 2.5
2-11	2-11 1/2	1.5 - 2.5

Torque values for banjo bolt connections (Copper washer style)

Bolt thread (metric)	Hex size (mm)	Torque N·m (lb ft) ± 10 %
M8 x 1.25	13	13 (9.6)
M10 x 1.25	17	16 (11.8)
M12 x 1.5	17	40 (29.5)
M14 x 1.5	19	45 (33.2)
M16 x 1.5	22	48 (35.4)
M18 x 1.5	24	50 (36.9)
M20 x 1.5	27	73 (53.8)
M22 x 1.5	32	73 (53.8)
M24 x 1.5	32	73 (53.8)

Torque values for O-Ring Face Seals (ORFS) connections

SAE dash size	UN/UNF thread size	Inch tube OD (mm)	Metric tube OD (mm)	Hex size (mm) (Reference only)	* Swivel nut torque N·m (lb ft) ± 10 %	** Swivel nut torque N·m (lb ft) ± 10 %
4	9/16-18	6.35	6	17	27 (19.9)	27 (19.9)
5	5/8-18	7.94	8	19	34 (25.1)	34 (25.1)
6	11/16-16	9.52	10	22	44 (32.5)	44 (32.5)
8	13/16-16	12.7	12	24	65 (47.9)	65 (47.9)
10	1-14	15.88	16	30	100 (73.8)	100 (73.8)
12	1-3/16-12	19.05	20	36	150 (110.6)	131 (96.6)
14	1-5/16-12	22.23	22	41	163 (120.2)	131 (96.6)
16	1-7/16-12	25.4	25	41	210 (154.9) ***	131 (96.9)
20	1-11/16-12	31.75	30	50	280 (206.5) ***	178 (131.3)
24	2-12	38.1	38	60	375 (276.6) ***	210 (154.9)

* High/Medium-pressure applications > **50 bar** (**725 psi**).

** Low-pressure applications < **50 bar** (**725 psi**).

*** It is recommended to use a four-bolt flange connection instead of O-Ring Face Seals (ORFS) sizes "16" and up.

Torque values for 37 ° flare connections - Joint Industry Council (JIC)

SAE dash size	UN/UNF thread size	Metric tube OD (mm)	Inch tube OD (mm)	Swivel nut torque N·m (lb ft) ± 10 %
2	5/16-24	–	3.18	8.25 (6.1)
3	3/8-24	–	4.76	11.5 (8.5)
4	7/16-20	6	6.35	15.5 (11.4)
5	1/2-20	8	7.94	20 (14.8)
6	9/16-18	10	9.52	25 (18.4)
8	3/4-16	12	12.7	52 (38.4)
10	7/8-14	16	15.88	81 (59.7)
12	1-1/16-12	20	19.05	112 (82.6)
14	1-3/16-12	–	22.22	133 (98.1)
16	1-5/16-12	25	25.4	155 (114.3)
20	1-5/8-12	30/32	31.75	180 (132.8)
24	1-7/8-12	38	38.1	225 (166)
32	2-1/2-12	50	50.8	348 (256.7)

Torque values for 30 ° flare, 60 ° cone connections

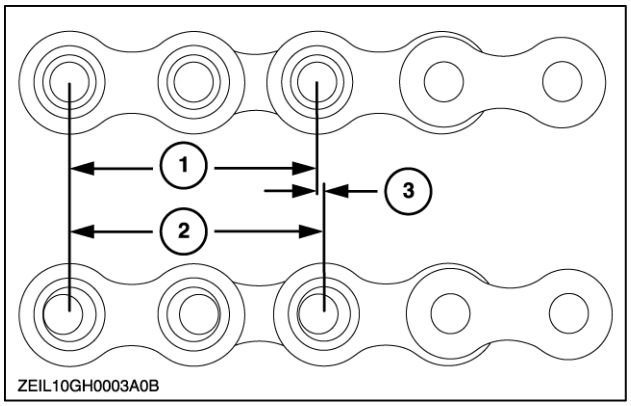
Nominal size (mm)	British Standard Pipe Parallel (BSPP) thread size	Hex size (mm)	Swivel nut torque N·m (lb ft) ± 10 %
5, 6, 6.3	G 1/4	17	25 (18.4)
8, 9, 10	G 3/8	19	34 (25.1)
12, 12.5	G 1/2	22	64 (47.2)
15, 16, 19	G 3/4	30	132 (97.4)
25	G 1	36	196 (144.6)
31.5, 32	G 1-1/4	46	225 (166)
38	G 1-1/2	50	255 (188.1)
50, 51	G 2	65	316 (223.1)

Basic instructions - Chain Wear Tables - Roller Chains

FR480 Forage Cruiser	NA
FR550 Forage Cruiser	NA
FR650 Forage Cruiser	NA
FR780 Forage Cruiser	NA
FR850 Forage Cruiser	NA

Chain Wear

The individual joints in a roller chain articulate as they enter and leave the sprockets. This articulation results in wear on the pins and bushings. A material is worn away from these surfaces the chain will gradually elongate.



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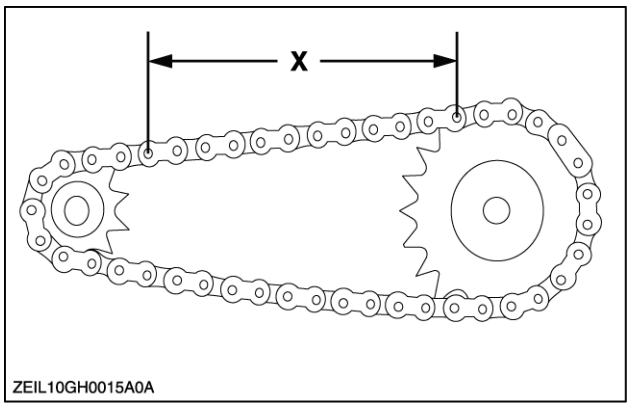
Chains do not "stretch" - material is removed from pin and bushing.

(1): 2x pitch
(2): 2x pitch + wear
(3): elongation due to pin and bushing wear.

Elongation is normal and may be minimized by proper lubrication and drive maintenance. The rate of wear is dependent upon: the relationship between the load and the amount of bearing area between pin and bushing, the material and surface condition of the bearing surfaces, the adequacy of lubrication and the frequency and degree of articulation between pins and bushings.
The latter is determined by the quantity of sprockets in the drive, their speeds, the number of teeth and the length of the chain in pitches.



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Measurement of Chain For Wear Elongation

Relatively accurate wear measurements can be made by using the above illustration. Measure as closely as possible from the center of one pin to the center of another. The more pitches (pins) contained within the measurement increase the accuracy. If the measured value exceeds the nominal by more than the allowable percentage the chain should be replaced.
The maximum allowable wear elongation is approximately **3 %** for most industrial applications, based upon sprocket design. The allowable chain wear in percent can be calculated using the relationship: 200/ **(N)**, where **(N)** is the number of teeth in the large sprocket.

This relationship is often useful since the normal maximum allowable chain wear elongation of **3 %** is valid only up to 67 teeth in the large sprocket. In drives having fixed center distances, chains running in parallel or where smoother operation is required, wear should be limited to approximately **1.5 %**.

For example, if 40 pitches (40 pins) of a #40 chain were measured and the result was **523 mm** (**20.6 in**) or greater (using **3 %** as the maximum allowable wear), the chain should be replaced. Anything less than **523 mm** (**20.6 in**) would still be acceptable by most industrial standards.

WEAR LIMITS ON ROLLER CHAIN

Strand Length in Pitches	No. 40 Chain (08A)		No. 50 Chain (10A)		No. 60 Chain (12A)		No. 80 Chain (16A)	
	New	Replace	New	Replace	New	Replace	New	Replace
40P	508 mm (20.0 in)	523 mm (20.6 in)	635 mm (25.0 in)	654 mm (25.7 in)	762 mm (30.0 in)	787 mm (31.0 in)	1016 mm (40.0 in)	1047 mm (41.2 in)
50P	635 mm (25.0 in)	654 mm (25.7 in)	793 mm (31.2 in)	817 mm (32.2 in)	952 mm (37.5 in)	981 mm (38.6 in)	1270 mm (50.0 in)	1308 mm (51.5 in)
60P	762 mm (30.0 in)	784 mm (30.9 in)	952 mm (37.5 in)	981 mm (38.6 in)	1143 mm (45.0 in)	1177 mm (46.3 in)	1524 mm (60.0 in)	1568 mm (61.7 in)
70P	889 mm (35.0 in)	914 mm (36.0 in)	1111 mm (43.7 in)	1144 mm (45.0 in)	1333 mm (52.5 in)	1371 mm (54.0 in)	1778 mm (70.0 in)	1828 mm (72.0 in)
80P	1016 mm (40.0 in)	1047 mm (41.2 in)	1270 mm (50.0 in)	1308 mm (51.5 in)	1524 mm (60.0 in)	1568 mm (61.7 in)	2032 mm (80.0 in)	2095 mm (82.5 in)
90P	1143 mm (45.0 in)	1177 mm (46.3 in)	1428 mm (56.2 in)	1473 mm (58.0 in)	1714 mm (67.5 in)	1765 mm (69.5 in)	2286 mm (90.0 in)	2355 mm (92.7 in)
100P	1270 mm (50.0 in)	1308 mm (51.5 in)	1578 mm (62.1 in)	1635 mm (64.4 in)	1905 mm (75.0 in)	1962 mm (77.2 in)	2540 mm (100.0 in)	2616 mm (103.0 in)

STANDARD ROLLER CHAIN SIZES - NEW CHAINS

Chain No.	150 Chain No.	Pitch	Width	Roller Diameter
40	08A	12.7 mm (0.5 in)	7.9 mm (0.3 in)	7.9 mm (0.3 in)
50	10A	15.8 mm (0.6 in)	9.5 mm (0.4 in)	10.1 mm (0.4 in)
60	12A	19 mm (0.7 in)	12.7 mm (0.5 in)	11.9 mm (0.5 in)
80	16A	25.4 mm (1.0 in)	15.8 mm (0.6 in)	15.8 mm (0.6 in)
100	20A	31.7 mm (1.2 in)	19 mm (0.7 in)	19 mm (0.7 in)
120	24A	38.1 mm (1.5 in)	25.4 mm (1.0 in)	22.2 mm (0.9 in)
140	28A	44.4 mm (1.7 in)	25.4 mm (1.0 in)	25.4 mm (1.0 in)
160	32A	50.8 mm (2.0 in)	31.7 mm (1.2 in)	28.5 mm (1.1 in)
180	*	57.1 mm (2.2 in)	35.7 mm (1.4 in)	35.7 mm (1.4 in)
200	40A	63.4 mm (2.5 in)	38.1 mm (1.5 in)	39.6 mm (1.6 in)

* No. 150 Number does not exist.

Conversion factors

FR480 Forage Cruiser	NA
FR550 Forage Cruiser	NA
FR650 Forage Cruiser	NA
FR780 Forage Cruiser	NA
FR850 Forage Cruiser	NA

Length

1 mm	**=**	**0.0393 in**	**1 in**	**=**	**25.4 mm**
1 km	**=**	**0.621 miles**	**1 miles**	**=**	**1.609 km**
1 m	**=**	**3.281 ft**	**1 ft**	**=**	**0.3048 m**

Area

1 ha	**=**	**2.471 ac**	**1 ac**	**=**	**0.404 US fl oz**
1 m²	**=**	**10.76 ft²**	**1 ft²**	**=**	**0.0923 m²**

Volume

1 litre	**=**	**0.26 US gal**	**1 US gal**	**=**	**3.78 litre**
1 litre	**=**	**0.0.28 Bu**	**1 Bu**		**35.23 litre**
1 litre	**=**	**1.057 US quart**	**1 US quart**	**=**	**0.9464 litre**
1 cm³ (cc)	**=**	**0.061 in³**	**1 in³**	**=**	**16.38 cm³** (cc)
1 m³	**=**	**35.31 ft³**	**1 ft³**	**=**	**0.028 m³**
1 ml	**=**	**0.033 US fl oz**	**1 US fl oz**	**=**	**29.57 ml**

Mass

1 kg	**=**	**2.204 lb**	**1 lb**	**=**	**0.4536 kg**

Torque

1 N·m	**=**	**0.7376 lb ft**	**1 lb ft**	**=**	**1.3558 N·m**

Power

1 kW	**=**	**1.358 Hp**	**1 Hp**	**=**	**0.746 kW**

Pressure

1 bar	**=**	**100 kPa**			
1 bar	**=**	**14.505 psi**	**1 psi**	**=**	**0.06894 bar**

Temperature

1 °C	**=**	**((1.8 x ° C) + 32) °F**	**1 °F**	**=**	**(0.56 x (° F - 32)) °C**

Flow

1 l/min	**=**	**0.2642 US gpm**	**1 US gpm**	**=**	**3.7853 l/min**

Speed

1 km/h	**=**	**0.62 mph**	**1 mph**	**=**	**1.6 km/h**

General specification - System protection data

FR480 Forage Cruiser	NA
FR550 Forage Cruiser	NA
FR650 Forage Cruiser	NA
FR780 Forage Cruiser	NA
FR850 Forage Cruiser	NA

In case of an emergency, in order to prevent the engine or the hydrostatic system damage, or to protect your personal safety, the engine will automatically be shut off, if the elements mentioned in the table below occur:

NOTICE: *If it is necessary to move the forage harvester for safety reasons, the engine can be (re-) started after an automatic engine shut off.*
Proceed as follows:
- Switch off the ignition key
- Press and hold the lower part of the "engine throttle button"
*- At the same time start the engine with the ignition key (the engine will shut off after **30 s**)*
In this case, the operator is responsible for any engine damage or failure!

Time till engine shut off												
Time till cutterhead disengagement and engine speed to low idle												
Time till feed rolls disengagement												
Derate value vehicle (FCM)												
Derate value engine control unit (ECU)												
Alarm raised based on			FPT cursor 13* FR480, FR550	FPT cursor 16* FR650, FR780	FPT Vector V8* FR850	FPT cursor 13* FR480, FR550	FPT cursor 16* FR650, FR780	FPT Vector V8* FR850			
Alarm / Trigger												
Feed rolls hydrostatic oil pressure low	A1104	ON/OFF pressure switch, goes ON when pressure low (CM does not read pressure value)	-	-	-	**5 bar** (**73 psi**)			**0 s**	**1 s**	**2 s**
Header hydrostatic oil pressure low	A1105		-	-	-	**5 bar** (**73 psi**)			**0 s**	**1 s**	**2 s**
Ground drive 1 hydrostatic oil pressure low	A2004		-	-	-	**5 bar** (**73 psi**)			**0 s**	**1 s**	**2 s**
Ground drive 2 hydrostatic oil pressure low	A2004		-	-	-	**5 bar** (**73 psi**)			**0 s**	**1 s**	**2 s**
Engine oil pressure low	A2125	CAN message from ECU, goes ON when engine oil pressure low (CM does not know pressure value)	Curve speed dependant	Curve speed dependant	Curve speed dependant	-	-	-	**0 s**	**1 s**	**7 s**
Engine coolant temperature high	A2123	-	**106 °C** (**223 °F**)	**106 °C** (**223 °F**)	**106 °C** (**223 °F**)	**110 °C** (**230 °F**)	**110 °C** (**230 °F**)	-	**0 s**	**1 s** (engine at **1000 RPM**)	never
Engine coolant level low	A2104	ON/OFF switch goes OFF when level low (CM does not read level value)	-	-	-	-	-	-	**5 s**	**6 s**	**30 s**
Control pressure low	A2203	-	-	-	-	**20 bar** (**290 psi**)			**0 s**	**1 s**	**2 s**
Fuel temperature high	A2207	CAN message from ECU, goes on when fuel temperature high (CM does not know temperature value)	**70 °C** (**158 °F**)	**80 °C** (**176 °F**)	**80 °C** (**176 °F**)	-	-	-	**0 s**	**1 s** (engine at **1000 RPM**)	never

Time till engine shut off											
Time till cutterhead disengagement and engine speed to low idle											
Time till feed rolls disengagement											
Derate value vehicle (FCM)											
Derate value engine control unit (ECU)											
Alarm raised based on			FPT cursor 13* FR480, FR550	FPT cursor 16* FR650, FR780	FPT Vector V8* FR850	FPT cursor 13* FR480, FR550	FPT cursor 16* FR650, FR780	FPT Vector V8* FR850			
Alarm											
Trigger											
Engine rail pressure low	A2208	CAN message from ECU, goes on when rail pressure low (CM does not know pressure value)	Curve speed dependant	Curve speed dependant	Curve speed dependant	-	-	-	**0 s**	**1 s**	**7 s**
Engine rail pressure high	A2209	CAN message from ECU, goes on when rail pressure high (CM does not know pressure value)	**2250 bar** (**32625 psi**)	**2350 bar** (**34075 psi**)	**1700 bar** (**24650 psi**)	-	-	-	**0 s**	**1 s**	**7 s**
Main clutch pressure high	A3008	-	-	-	-	**40 bar** (**580 psi**)			**5 s**	**10 s**	**20 s**
Intake air temperature high	A2124	-	**75 °C** (**167 °F**)	**75 °C** (**167 °F**)	**80 °C** (**176 °F**)	**75 °C** (**167 °F**)	**75 °C** (**167 °F**)	-	**0 s**	**1 s** (engine at **1000 RPM**)	never
* Developed by FPT (Fiat Powertrain Technologies)											

Product identification

FR Forage Cruiser series	NA

EXPLANATION OF MACHINE SERIAL NUMBERS

Example : n° 725902002

72 5902002: The first two digits identify the model within a product line:

FR450 = 51

FR480 = 71

FR500 = 52

FR550 = 72

FR600 = 53

FR650 = 73

FR780 = 74

FR850 = 55

72 5 902002: The third digit indicates the product line.

CR-CX-CS-CSX Combine Harvesters:	1
TC Combine Harvesters:	9
Combine Headers:	9
Forage Harvesters:	5
Grass Pickup:	3
Square Balers:	4

725 902 002: These three digits indicate the batch in which the machine was made.

72 5902 002: Product line number 5 and batch 902 together form the series number.

725902 002: The last 3 digits are a sequential number for each model within a batch.

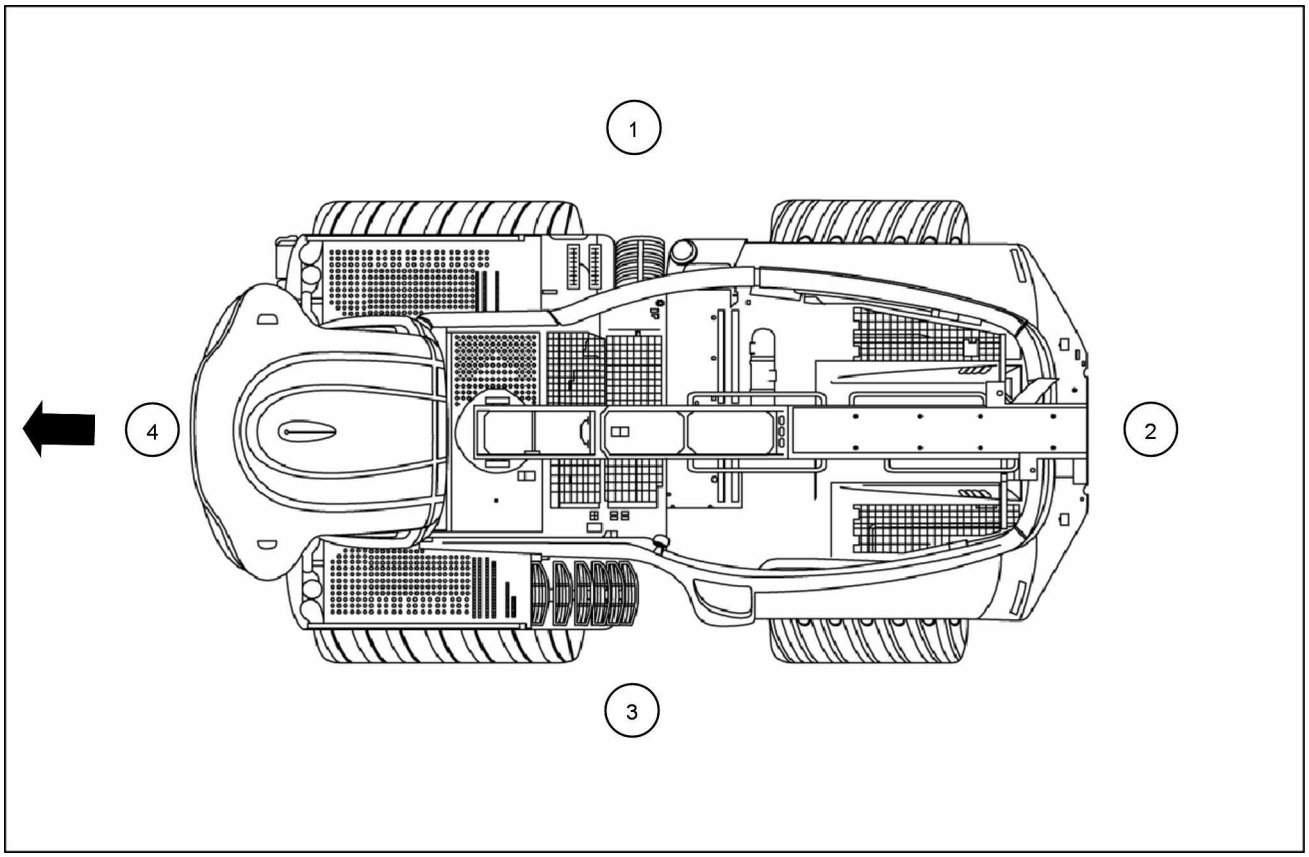
Summarizing we can say that this machine is the second FR550 of series 5902.

Product identification

FR480 Forage Cruiser	NA
FR550 Forage Cruiser	NA
FR650 Forage Cruiser	NA
FR780 Forage Cruiser	NA
FR850 Forage Cruiser	NA

NOTE: *Throughout this operator's manual, references to the right-hand side and the left-hand side of the machine are determined by standing at the rear of the machine and facing the direction of travel during working operation.*

The following overhead view illustration is a general representation of the machine. The illustration indicates the sides, front, and rear orientations of the machine as referred to throughout this manual, relevant to the direction of travel during working operation.



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NOTE: *The arrow indicates the machine direction of travel during working operation.*

(1) Right-hand side of the machine
(2) Rear of the machine
(3) Left-hand side of the machine
(4) Front of the machine

SERVICE MANUAL

Engine

FR480 Forage Cruiser Cursor 13, TIER 4B
FR550 Forage Cruiser Cursor 13, TIER 4B
FR650 Forage Cruiser Cursor 16, TIER 4B
FR780 Forage Cruiser Cursor 16, TIER 4B
FR850 Forage Cruiser Vector, TIER2

Contents

Engine - 10

Engine - 10

Engine and crankcase - 001

FR480 Forage Cruiser Cursor 13, TIER 4B
FR550 Forage Cruiser Cursor 13, TIER 4B
FR650 Forage Cruiser Cursor 16, TIER 4B
FR780 Forage Cruiser Cursor 16, TIER 4B
FR850 Forage Cruiser Vector, TIER2

Contents

Engine - 10

Engine and crankcase - 001

SERVICE

(*) See content for specific models

Engine - Remove

FR480 Forage Cruiser	NA
FR550 Forage Cruiser	NA
FR650 Forage Cruiser	NA
FR780 Forage Cruiser	NA

⚠ DANGER

Heavy objects!
Lift and handle all heavy components using lifting equipment with adequate capacity. Always support units or parts with suitable slings or hooks. Make sure the work area is clear of all bystanders.
Failure to comply will result in death or serious injury.

D0076A

⚠ WARNING

Fall hazard!
Use a sturdy platform when working above ground level.
Failure to comply could result in death or serious injury.

W0926A

⚠ WARNING

Jack stands can slip or fall over. Dropping, tipping, or slipping of machine or its components is possible.
DO NOT work under a vehicle supported by jack stands only. Park machine on a level surface. Block wheels. Support machine with safety stands.
Failure to comply could result in death or serious injury.

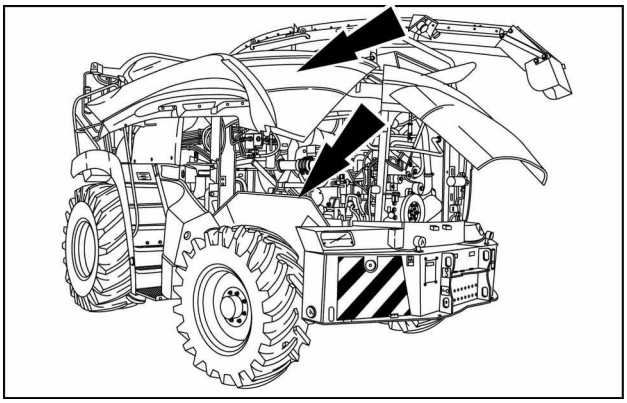
W0069A

NOTE: *The engine removal is done on FR480 but the instructions and figures can be used as a guideline for all other models, except for the FR850.*

NOTE: *When disconnecting fluid lines, have a suitable container available to collect any residual fluids. Use stops and/or plugs to prevent fluids spill and to protect against dirt ingress.*

Shieldings

1. Move the spout to the extreme left or right.
2. Remove both the side shieldings. See **Side shields - Remove (90.105)**.
3. Remove the rear fenders.
4. For better access remove the steering wheels. See **Rear wheel - Remove (44.520)**.



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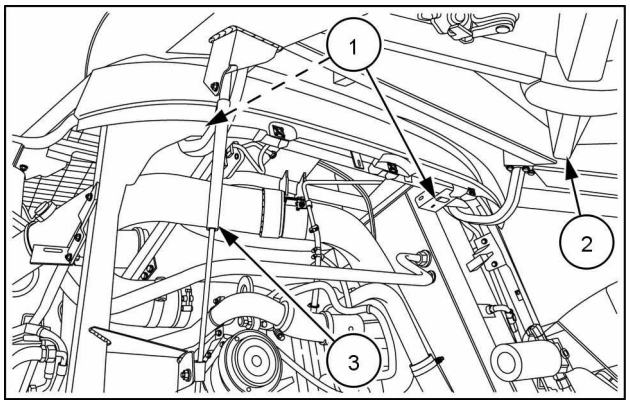
5. Remove the rear shield.
   - Support the rear shield **(2)**. Ask the assistance of a second person or use a suitable lifting device.
   - Lift up the bottom clip from the gas strut **(3)**, then remove the gas strut **(3)** from the pivot bolt.
   - Remove the hardware **(1)**.
   - Remove the rear shield **(2)**.



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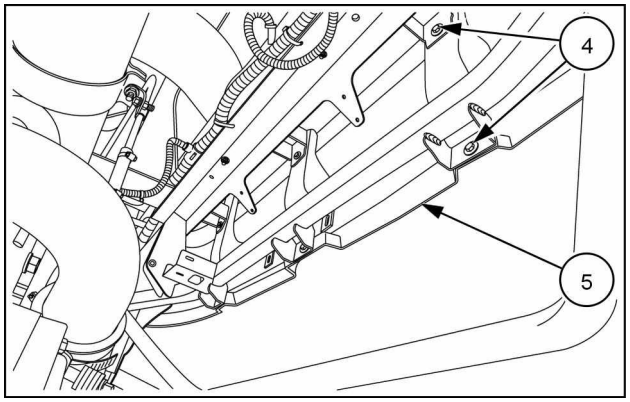
6. Remove the hardware **(4)** (six in total) and remove the top rear shield **(5)**.



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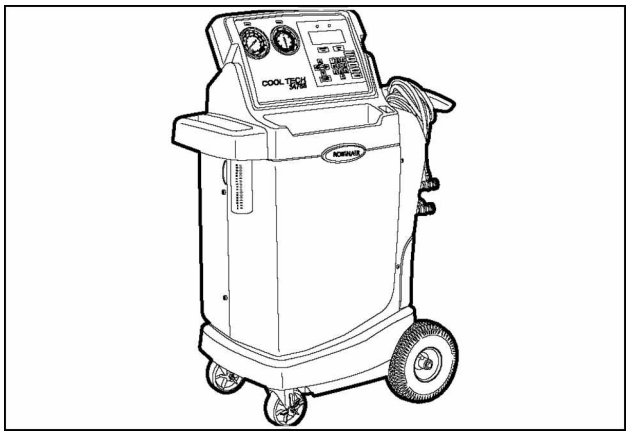
Discharge the air-conditioning circuit

7. Discharge the air-conditioning circuit. See chapter “Air Conditioning” in the service manual.



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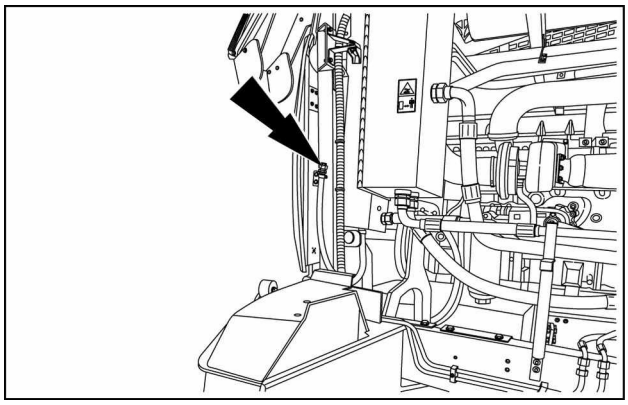
Drain Fluids

8. Drain the hydraulic oil reservoir.



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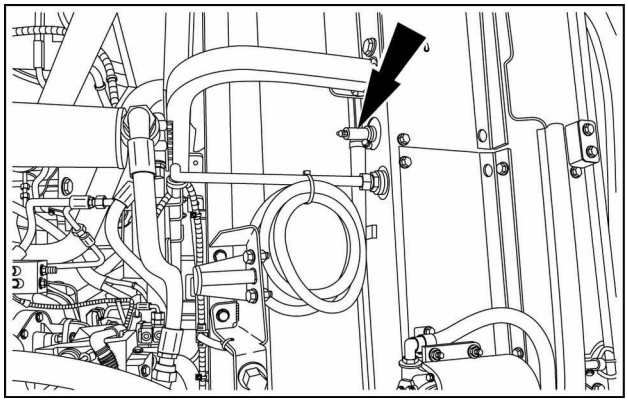
9. Drain the engine coolant:
   - Engine coolant radiator



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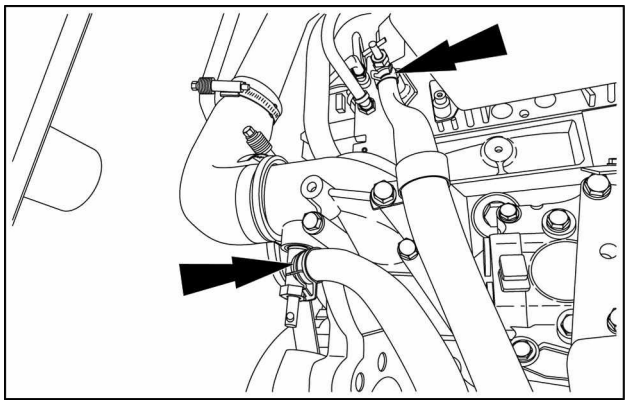
   - Engine coolant intake. Close the tap, remove the hose, drain coolant, open the tap and drain fluid.
   - Engine coolant outlet. Close the tap, remove the hose, drain coolant, open the tap and drain fluid.

NOTE: *Still some coolant in the tubes.*



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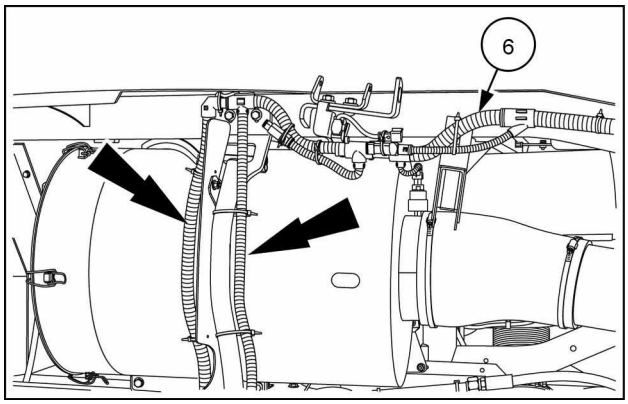
Wiring harnesses

10. On the left-hand side of the machine, remove all the straps and disconnect all the connectors of the two wiring harness branches (see arrows) going down of the wiring harness **(6)** and lay the wiring harness branches on top of the roof assembly. See **Wiring harnesses - Overview (55.100)** in the service manual.

NOTE: *Remove the air filter clogging sensor and the main gearbox rpm sensor to prevent damage.*



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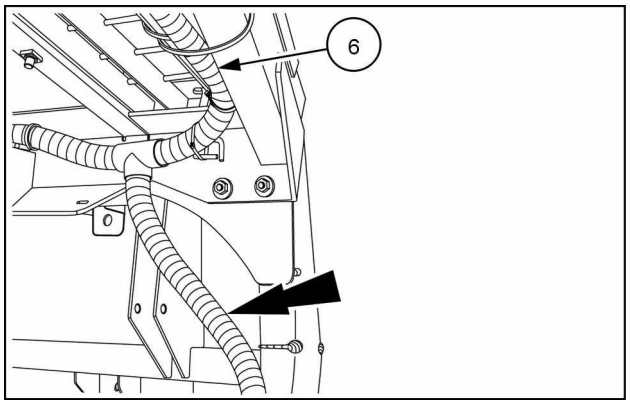
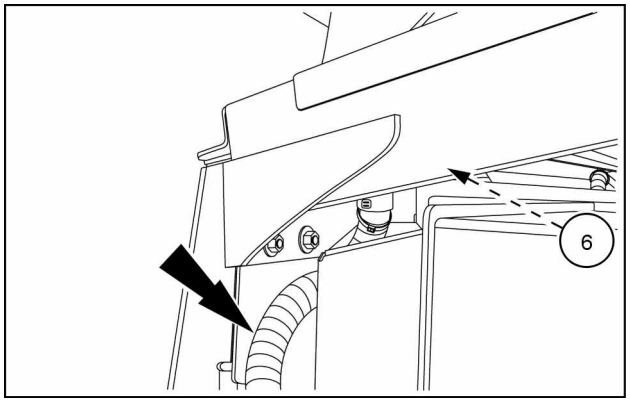
11. Remove all the straps and disconnect all the connectors of the wiring harness branch (see arrow) going down of the wiring harness **(6)** and lay the wiring harness branch on top of the roof assembly. See the location diagram in the service manual.



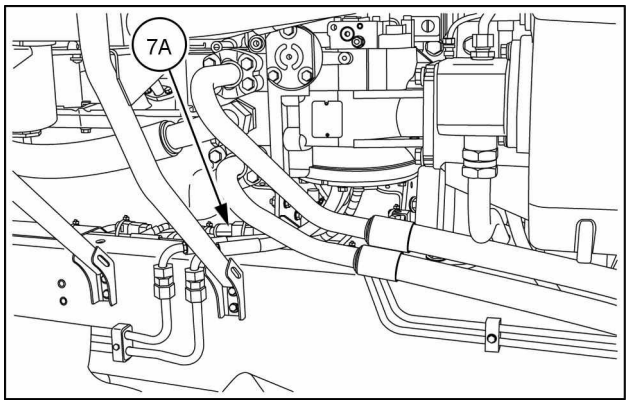
ZEIL15FR00120AA 9

12. On the left hand side of the machine, remove all the straps and disconnect all the connectors of the wiring harness branch (see arrow) going down of the wiring harness **(6)** and lay the wiring harness branch on top of the roof assembly. See the location diagram in the service manual.



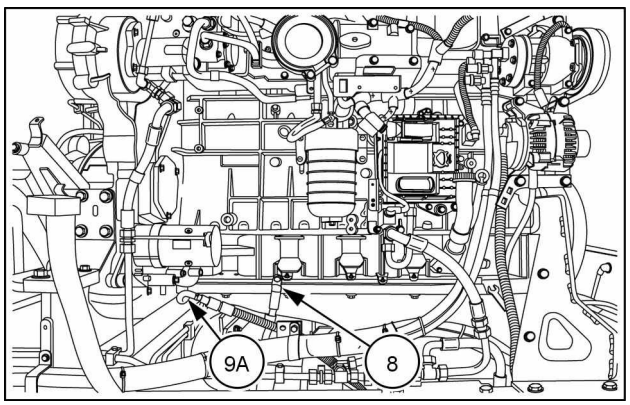
ZEIL15FR00121AA 10

13. On the right-hand side of the machine, disconnect the connector **(7A)**.



ZEIL15FR00132AA 11

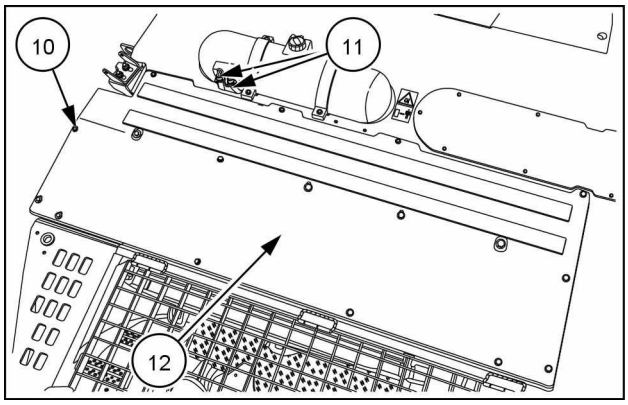
14. Disconnect the ground cable **(8)** from the engine.
15. Disconnect the positive lead **(9A)** from the starter motor.



ZEIL15FR00148AA 12

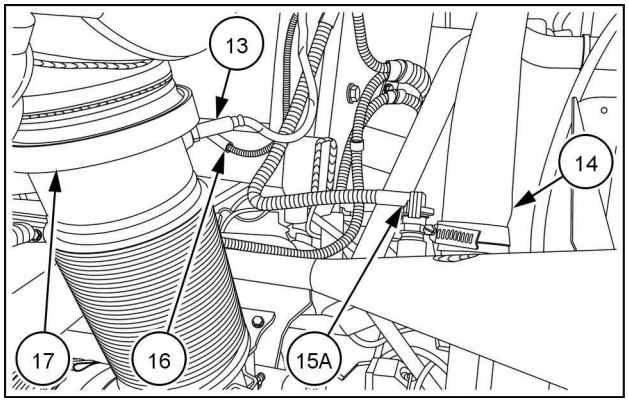
Roof assembly

16. Remove the hardware **(10)** (fourteen in total) and the cooling group cover plate **(12)**.
17. Disconnect the hoses **(11)** from the engine coolant reservoir.

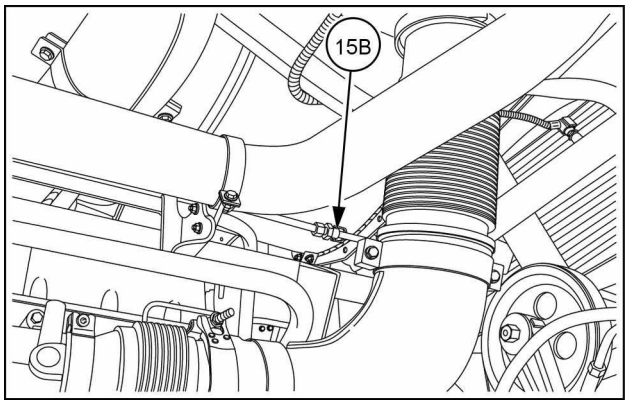


ZEIL15FR00091AA 13

18. Remove the hose **(14)** from the engine coolant intake tube.
19. Disconnect the **Diesel Exhaust Fluid (DEF)/Ad-Blue®** injector coolant lines **(15A)** and **(15B)**. See also Figure **15**.
20. Remove the NOx sensor **(13)** from the exhaust.
21. Remove the temperature sensor **(16)**.
22. Remove the clamp **(17)**.

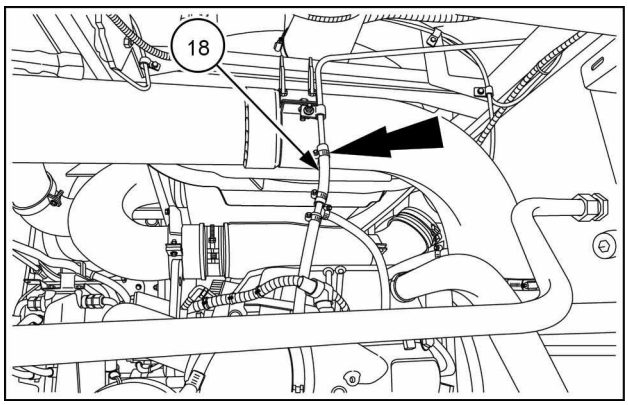


ZEIL15FR00092AA 14



ZEIL15FR00093AA 15

23. Disconnect the hose **(18)** from the coolant tube at the point indicated by the arrow.

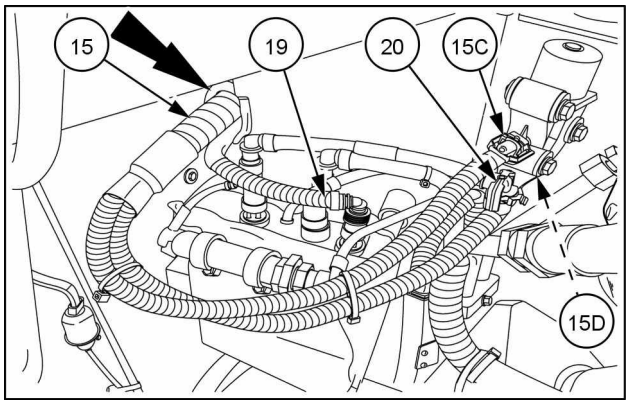


ZEIL15FR00094AA 16

24. On the left-hand side of the machine, disconnect the **DEF/AdBlue®** feed line from the supply module.

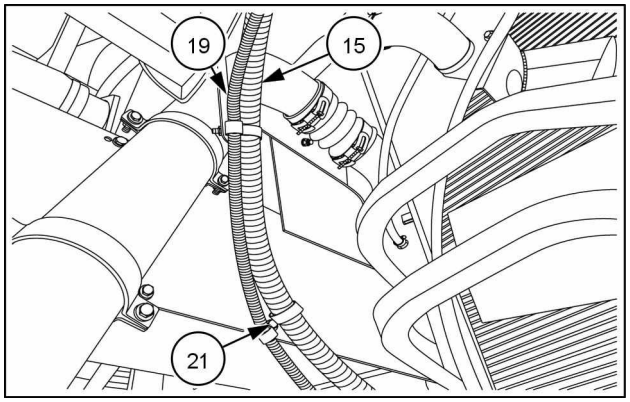
NOTE: *Have a suitable container ready and use the appropriate plugs on the* ***DEF/AdBlue®*** *supply module and the* ***DEF/AdBlue®*** *feed line* ***(19)****. Clean up any DEF/AdBlue® spill immediately.*

25. Disconnect the **DEF/AdBlue®** coolant line **(20)**.
26. Disconnect the **DEF/AdBlue®** coolant lines **(15C)** and **(15D)** from the heater valve.



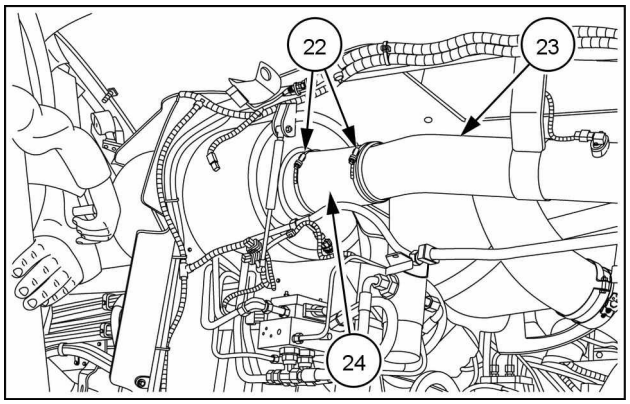
ZEIL15FR00102AA 17

27. On the left-hand side of the machine, remove the hardware **(21)** and carefully pull the **DEF/AdBlue®** coolant lines and the **DEF/AdBlue®** feed line **(15)** through the hole. See arrow Figure **17**.



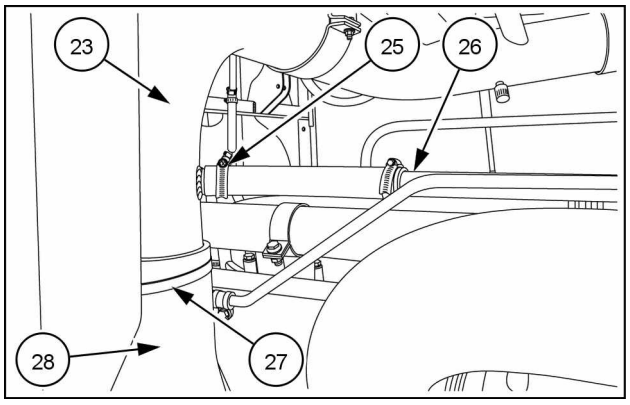
ZEIL15FR00101AA 18

28. Loosen the clamps **(22)** of the rubber coupler **(24)** and slide the rubber coupler **(24)** on the air intake tube **(23)**.



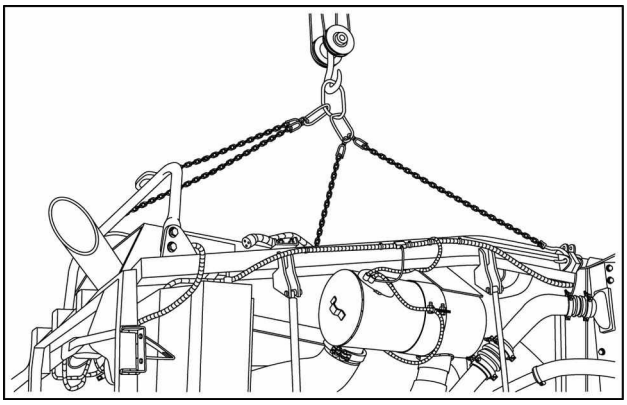
ZEIL15FR00196AA 19

29. Loosen the clamp **(25)** and remove the breather tube **(26)** rubber coupler from the air intake tube **(23)**.
30. Loosen the clamp **(27)** and remove the rubber elbow coupler **(28)** from the air intake tube **(23)**.



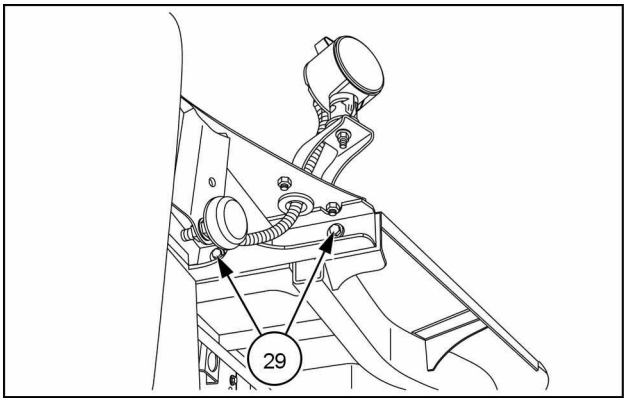
ZEIL15FR00191AA 20

31. Support the roof assembly with a suitable lifting device. Use the lifting eyes near the front hinges of the side shieldings, and use the spout support as shown.



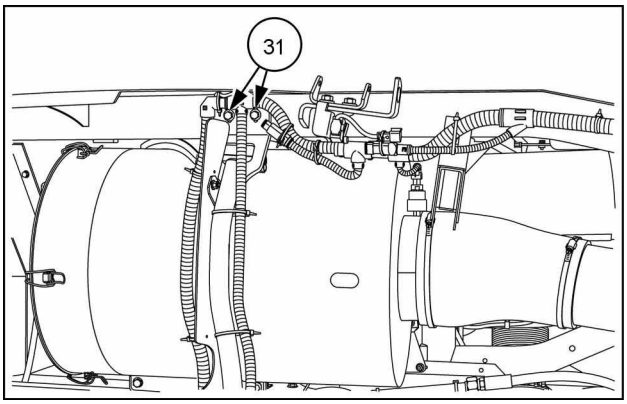
ZEIL15FR00116AA 21

32. On the left-hand side of the machine, remove the hardware **(29)**.



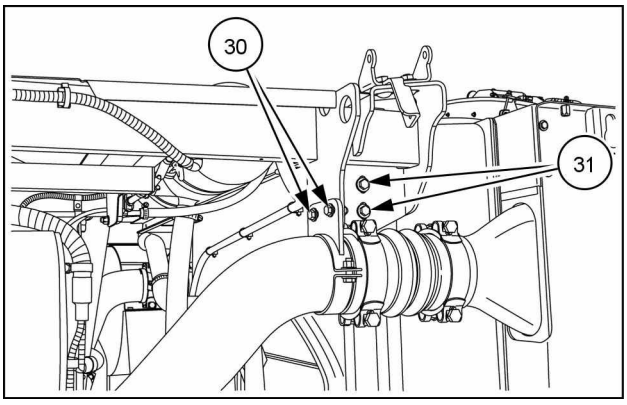
ZEIL15FR00117AA 22

33. Remove the hardware **(31)**.



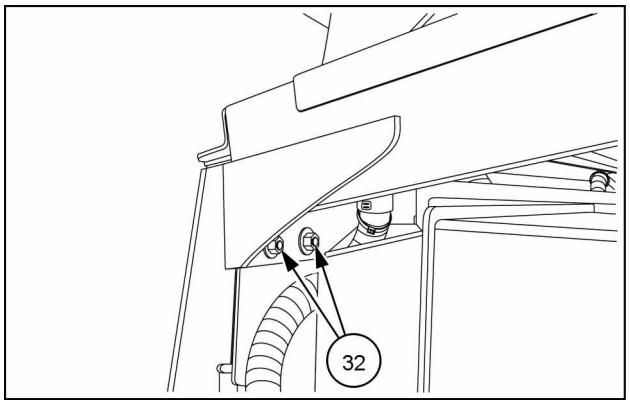
ZEIL15FR00198AA 23

34. On the right-hand side of the machine, remove the hardware **(30)** and the hardware **(31)**.



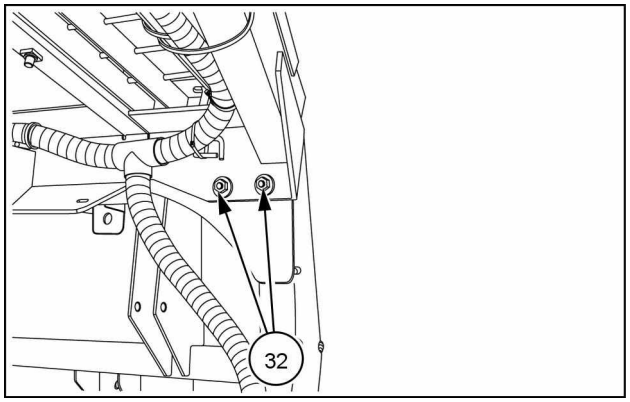
ZEIL15FR00118AA 24

35. On the right-hand side of the rear frame, remove the hardware **(32)**.



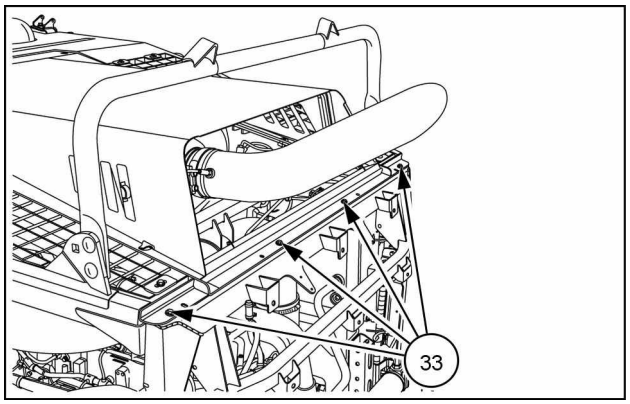
ZEIL15FR00121AA 25

36. On the left-hand side of the rear frame remove the hardware **(32)**.



ZEIL15FR00120AA 26

37. Remove the hardware **(33)**.

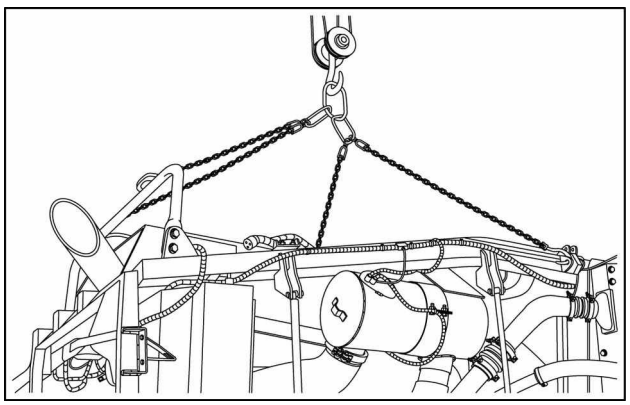


ZEIL15FR00119AA 27

38. Make sure nothing remains connected to the roof assembly. Remove the roof assembly.

NOTE: *Make sure that the chains are set in such a way that the roof assembly, when lifted, is properly balanced.*

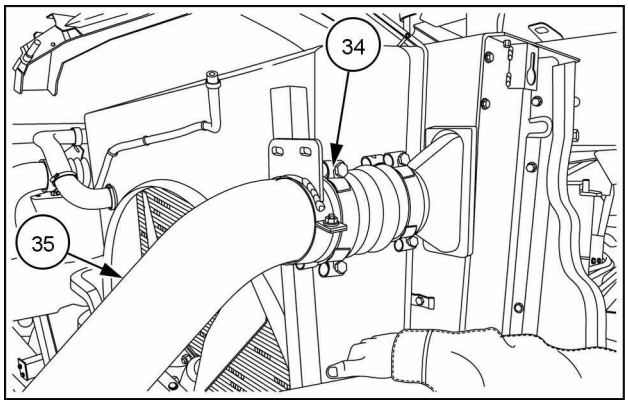
NOTE: *Make sure nothing remains connected when you lift up the roof assembly.*



ZEIL15FR00116AA 28

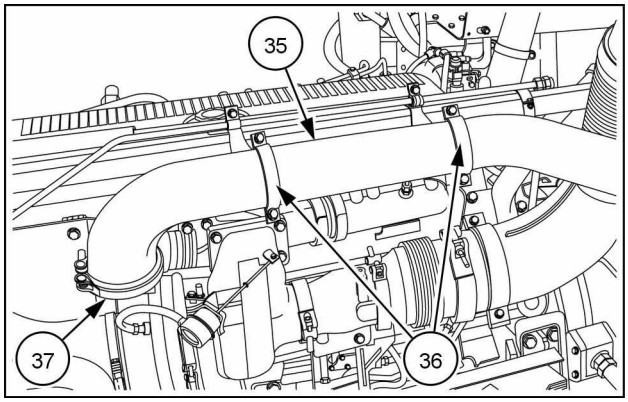
Air and coolant tubes

39. Loosen the clamp **(34)** of the cooling group air intake tube **(35)**.



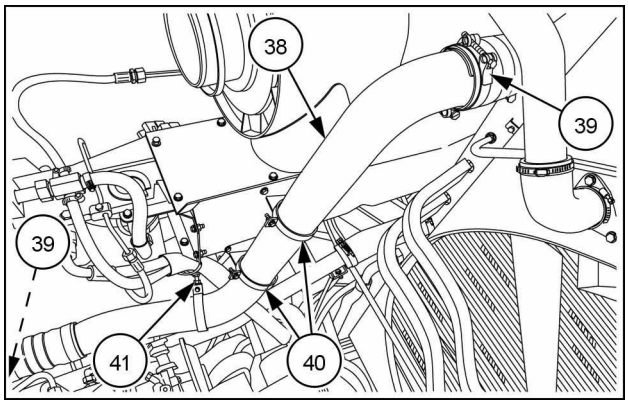
ZEIL15FR00138AA 29

40. Loosen the clamp **(37)**.
41. Remove the clamp hardware **(36)**. Remove the air intake tube **(35)**.



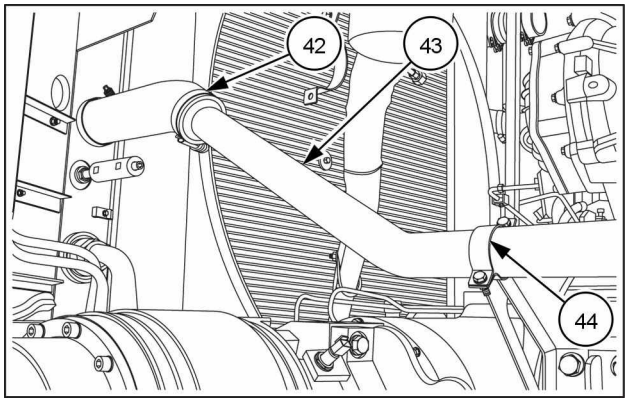
ZEIL15FR00137AA 30

42. Loosen the clamp **(39)** of the engine air intake tube **(38)**.
43. On the engine, loosen the clamp **(39)** of the engine air intake tube **(38)** at the engine air intake piece (not shown).
44. Remove the clamp hardware **(40)**.
45. Remove the pig tail **(41)** from the engine air intake tube **(38)**.



ZEIL15FR00140AA 31

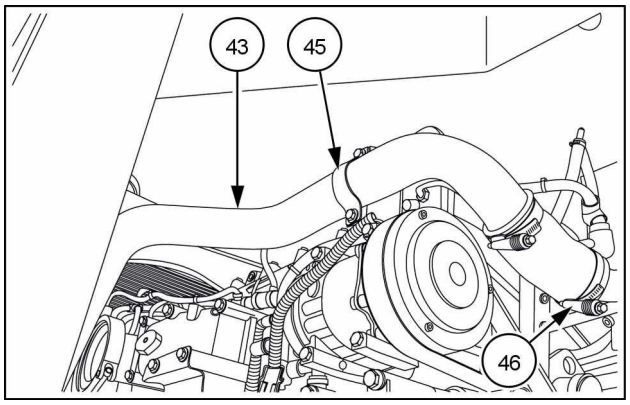
46. Loosen the hose clamp **(42)** of the engine coolant outlet tube **(43)**.
47. Remove the clamp hardware **(44)** of the engine coolant outlet tube **(43)**.



ZEIL15FR00144AA 32

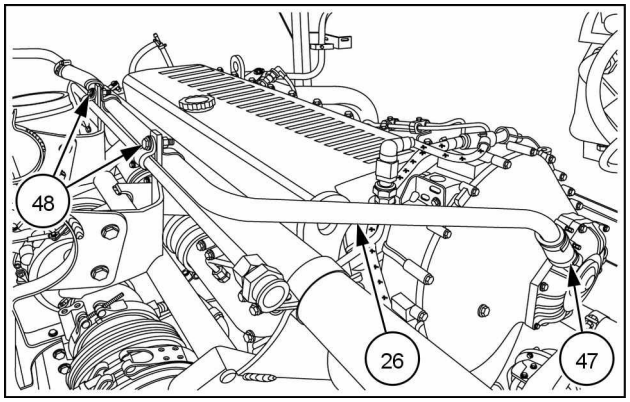
48. Loosen the hose clamp **(46)** of the engine coolant outlet tube **(43)**.
49. Remove the clamp hardware **(45)** and remove the engine coolant outlet tube **(43)**.

NOTE: *The tube is full of engine coolant.*



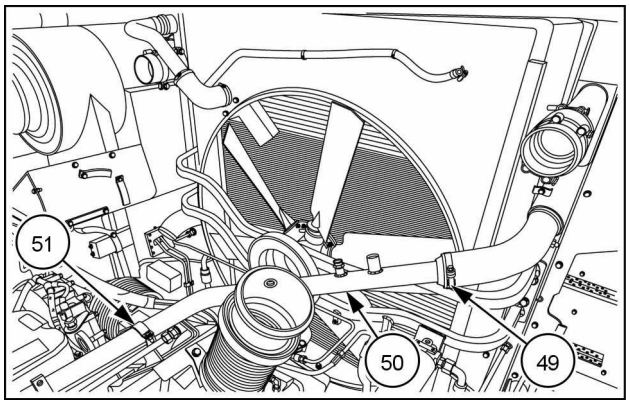
ZEIL15FR00145AA 33

50. Loosen the hose clamp **(47)**.
51. Remove the clamps **(48)** and remove the breather tube **(26)**.



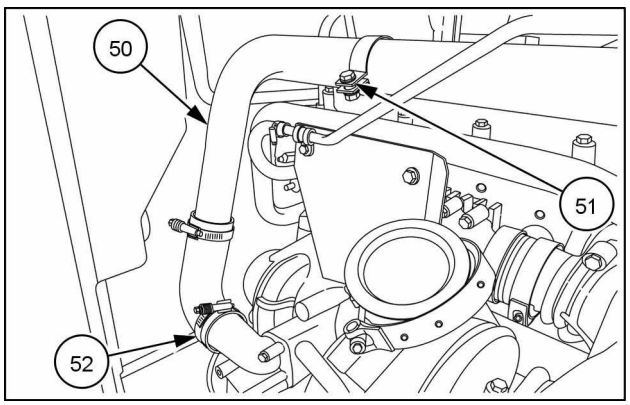
ZEIL15FR00139AA 34

52. Loosen the hose clamp **(49)** of the engine coolant inlet tube **(50)**.
53. Remove the clamp hardware **(51)**.



ZEIL15FR00142AA 35

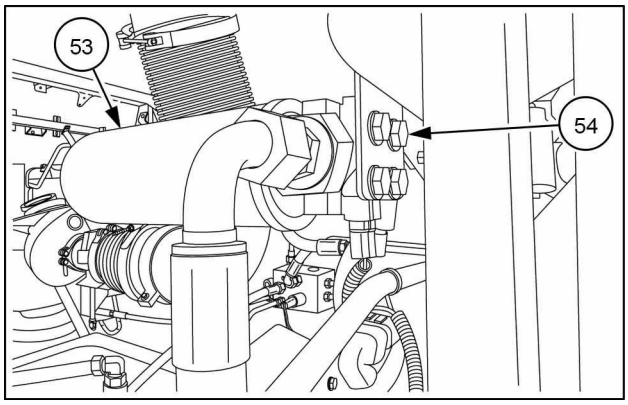
54. Loosen the hose clamp **(52)**.
55. Remove the clamp hardware **(51)** and remove the engine coolant inlet tube **(50)**.



ZEIL15FR00141AA 36

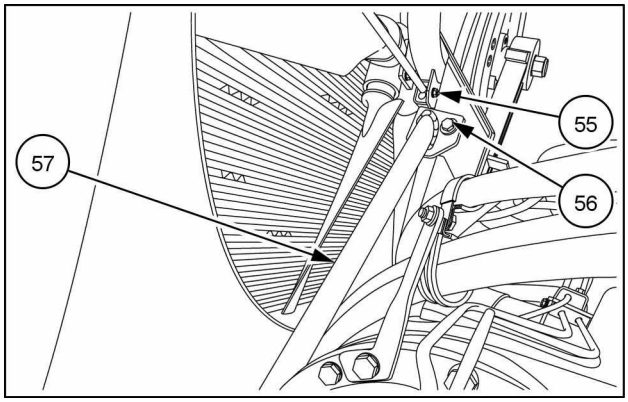
Cooling fan

56. On the fan support, remove the hardware **(54)** of the oil filter **(53)**. Lay the oil filter **(53)** down without removing the hoses.



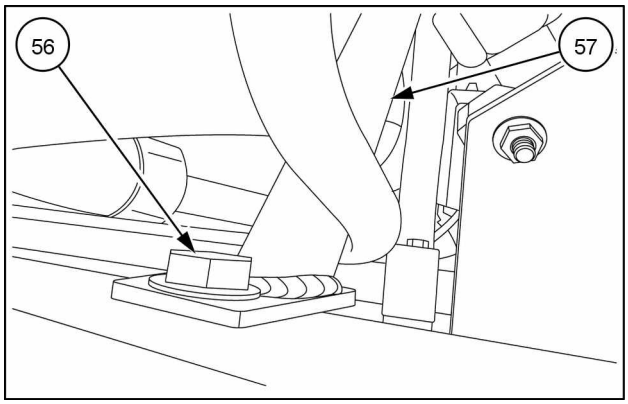
ZEIL15FR00126AA 37

57. Remove the hardware **(56)** of the support **(57)**.
58. Remove the clamp hardware **(55)**.



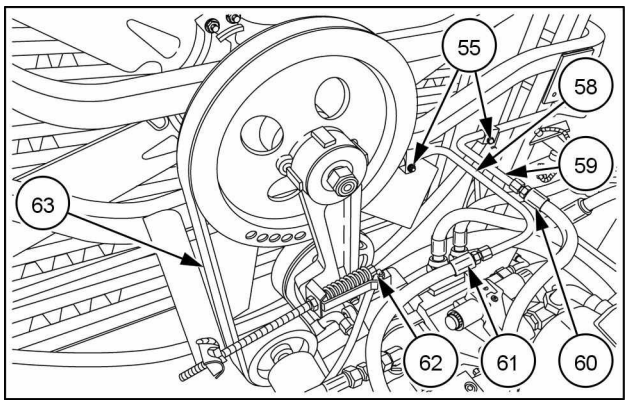
ZEIL15FR00127AA 38

59. On the left-hand side of the machine, under the main gearbox clutch shaft, remove the hardware **(56)** and the support **(57)**.



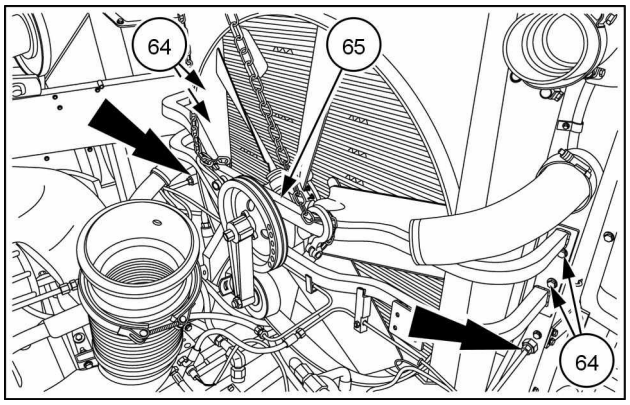
ZEIL15FR00128AA 39

60. Release the tension of the fan drive belt tensioner **(62)**. Remove the fan drive belt **(63)**.
61. Disconnect the hose **(60)** and the hose **(61)**.
62. Remove the clamps **(55)**.
63. Remove the tube **(58)** and the tube **(59)**. See also the arrows in Figure **41**.



ZEIL15FR00125AA 40

64. Support the fan **(65)**. Use a suitable lifting device.
65. Remove the hardware **(64)** and remove the fan **(65)** from the machine.

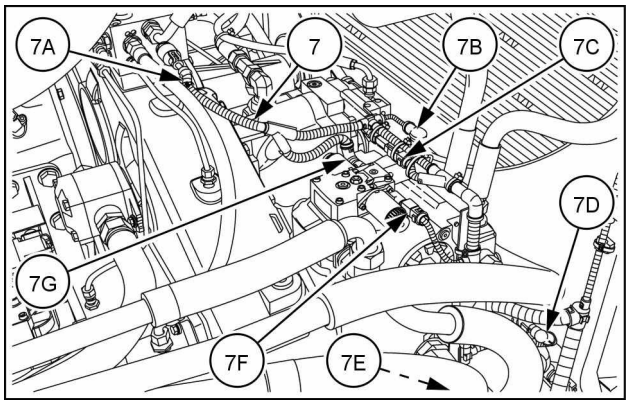


ZEIL15FR00129AA 41

Hydraulics

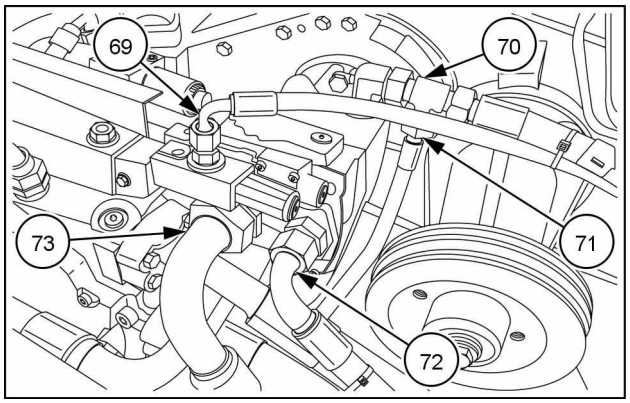
66. Disconnect the connectors **(7A)**, **(7B)**, **(7C)**, **(7D)**, **(7E)**, **(7F)** and **(7G)** of the wire harness **(7)**. See also Figure **45**.

NOTE: *Connectors **(7B)** and **(7E)** are connected to the pressure sensors who can only be found on machines with variable displacement hydro motor. These machines have a maximum road speed of **40 km/h**.*



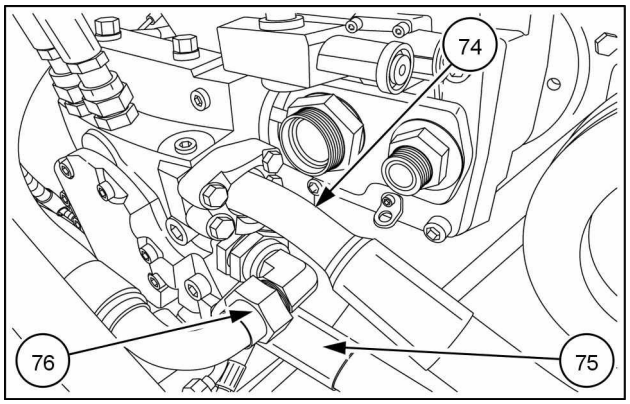
ZEIL15FR00134AA 42

67. Remove the hose **(69)**, the hose **(71)**, the hose **(70)**, the hose **(72)** and the hose **(73)**.



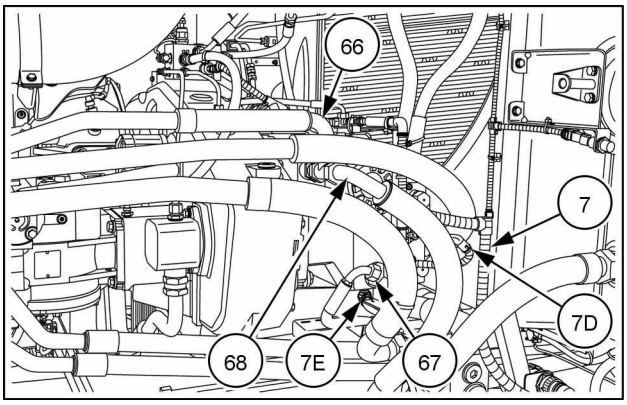
ZEIL15FR00136AA 43

68. Remove the hose **(74)**, the hose **(76)** and the hose **(75)**.



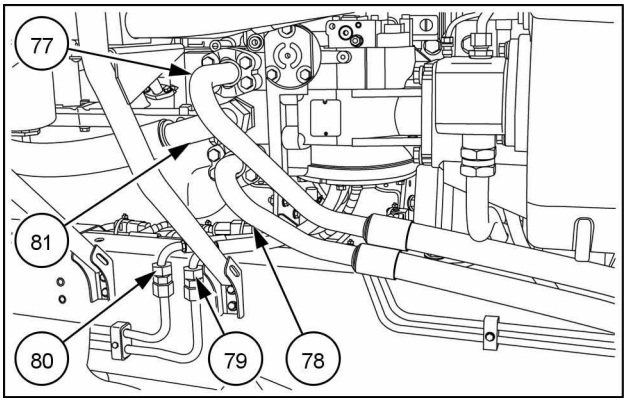
ZEIL15FR00135AA 44

69. Remove the hose **(66)**, the hose **(67)**, and the hose **(68)**.



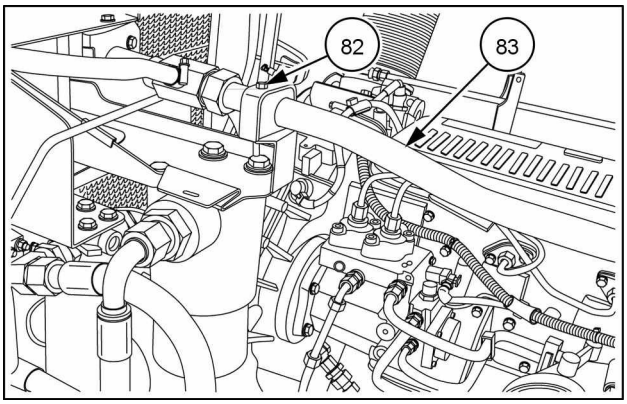
ZEIL15FR00133AA 45

70. Remove the hose **(77)**, the hose **(81)**, the hose **(78)**, the hose **(79)** and the hose **(80)**.



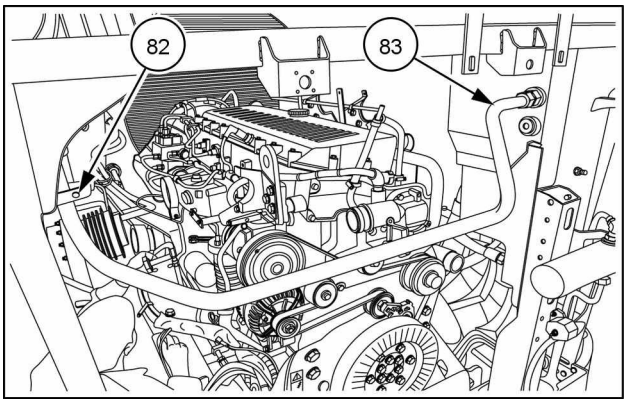
ZEIL15FR00132AA 46

71. Remove the clamp hardware **(82)**. Disconnect the tube **(83)**.



ZEIL15FR00146AA 47

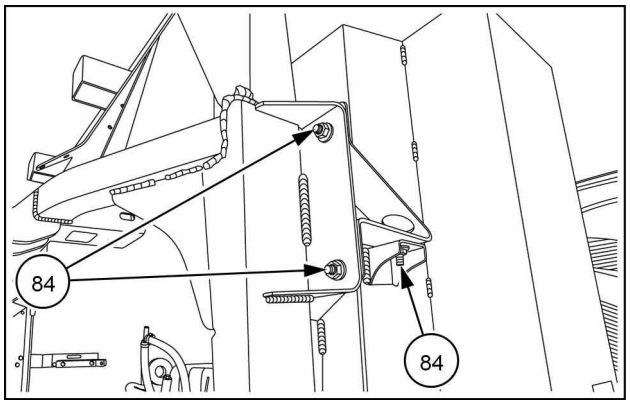
72. Remove the clamp hardware **(82)**. Remove the tube **(83)**.



ZEIL15FR00147AA 48

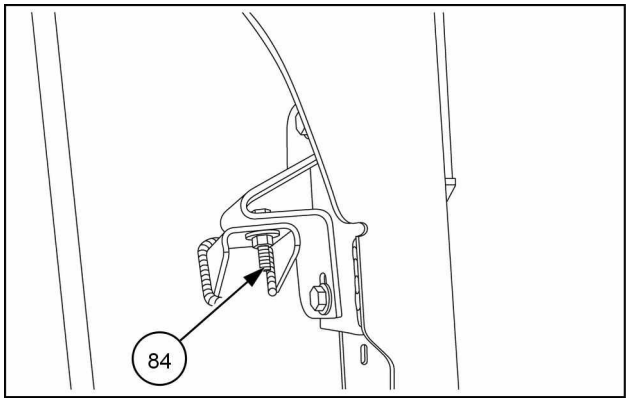
Rear Frame

73. On the rear right-hand side of the machine. Remove the hardware **(84)**.



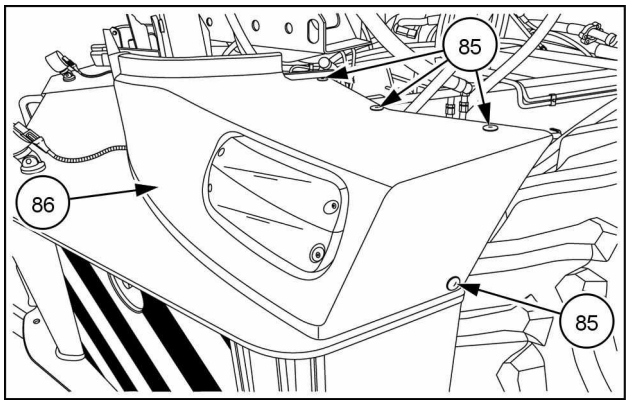
ZEIL15FR00154AZ 49

74. On the rear right-hand side of the machine. Remove the hardware **(84)**.



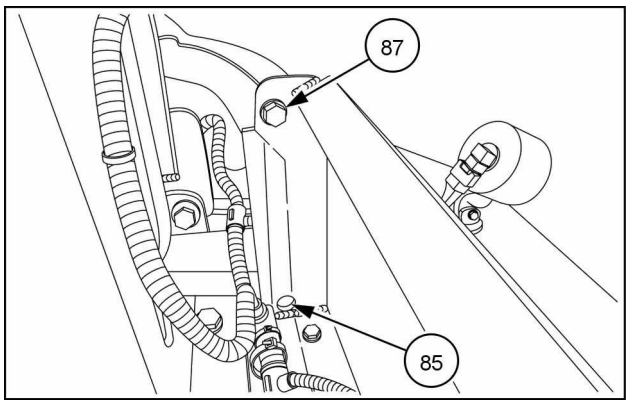
ZEIL15FR00155AA 50

75. On the rear right-hand side light cover **(86)**. Remove the plastic rivet **(85)**.



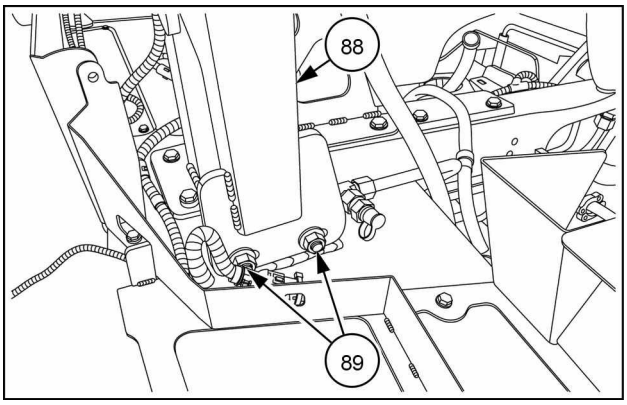
ZEIL15FR00156AA 51

76. Remove the hardware **(87)** and the plastic rivets **(85)**.
77. Remove the right-hand side light cover **(86)**. See Figure **51**.



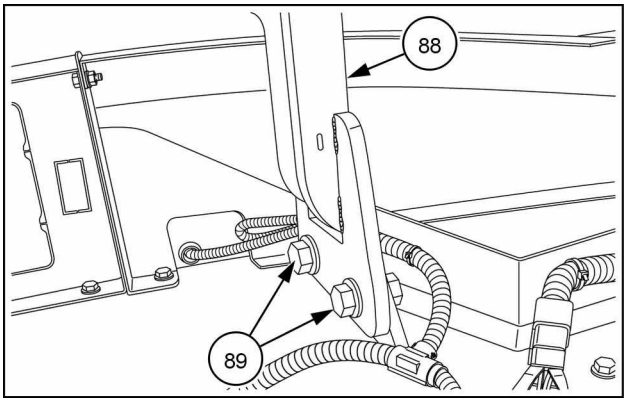
ZEIL15FR00157AA 52

78. Ask assistance of a second person or use a suitable lifting device to support the rear frame **(88)**.
79. Remove the hardware **(89)**.



ZEIL15FR00158AA 53

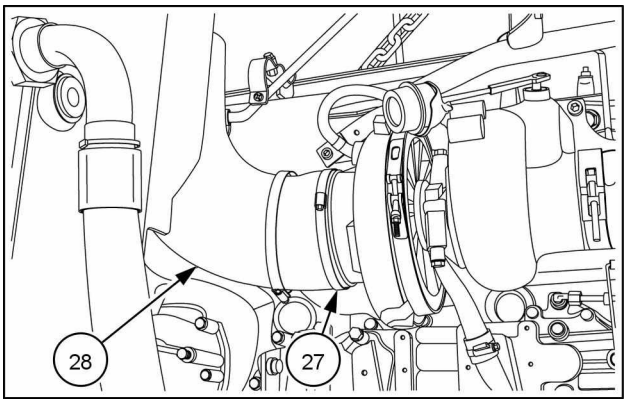
80. On the left-hand side of the rear frame **(88)**. Remove the hardware **(89)** and remove the rear frame **(88)**.



ZEIL15FR00159AA 54

Engine supports, fuel and air-conditioning lines

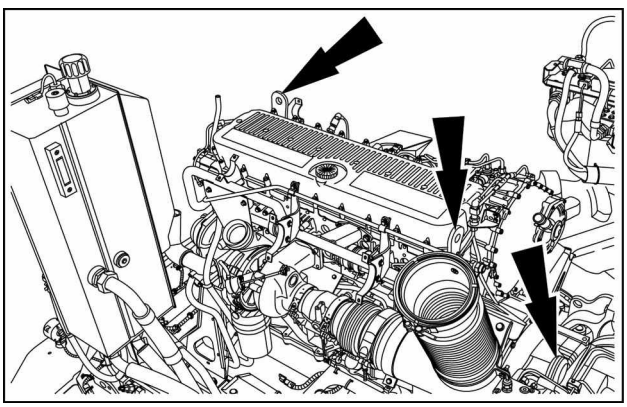
81. Loosen the hose clamp **(27)** and remove the rubber elbow coupler **(28)**.



ZEIL15FR00149AA 55

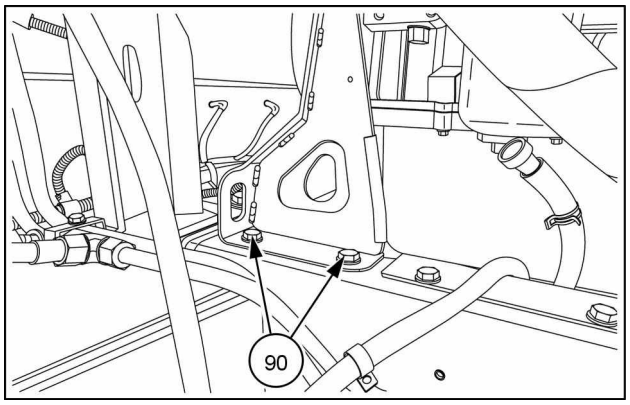
82. Support the engine on all three points shown. Use a suitable lifting device.

NOTE: *Make sure that the chains are set in such a way that the engine, when lifted, is properly balanced. It could be difficult to remove the engine, if not balanced properly.*



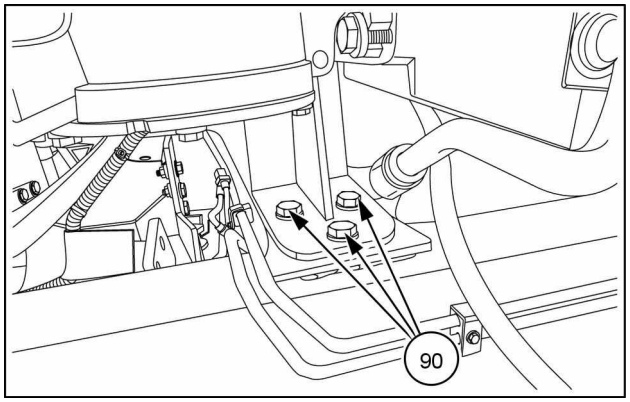
ZEIL15FR00197AA 56

83. On the right-hand side of the machine, remove the hardware **(90)**.



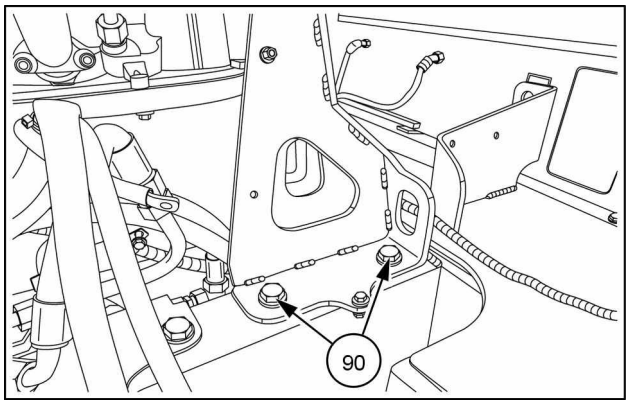
ZEIL15FR00150AA 57

84. Remove the hardware **(90)**.



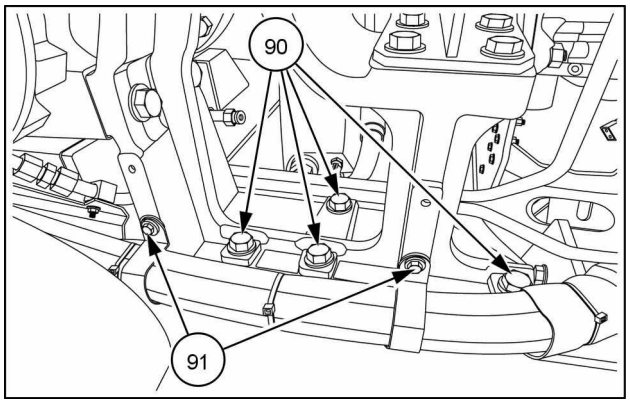
ZEIL15FR00152AA 58

85. On the left-hand side of the machine, remove the hardware **(90)**.



ZEIL15FR00151AA 59

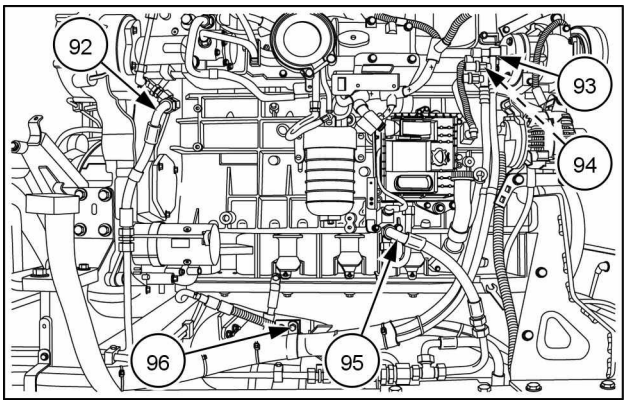
86. Remove the clamp hardware **(91)**.
87. Remove the hardware **(90)**.



ZEIL15FR00153AA 60

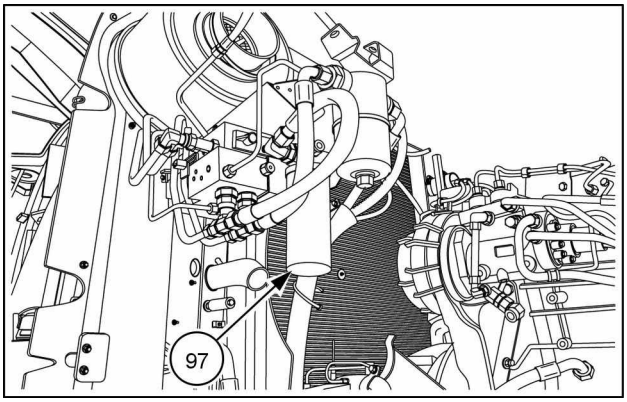
88. Remove the fuel feed line **(95)** and the fuel return line **(92)**.

89. Remove the air-conditioning lines **(93)** and **(96)**.



ZEIL15FR00148AA 61

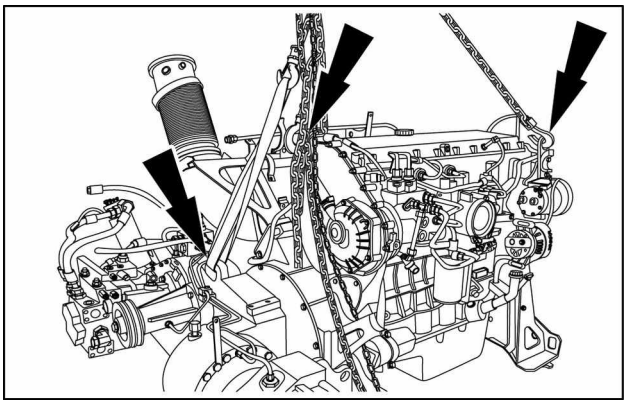
90. Remove the oil filter **(97)**.



ZEIL15FR00160AA 62

91. Make sure nothing remains connected to the engine. Remove the engine.

NOTE: *Make sure that the chains are set in such a way that the engine, when lifted, is properly balanced. It could be difficult to remove the engine, if not balanced properly.*



ZEIL15FR00161AA 63

Engine - Install

FR480 Forage Cruiser	NA
FR550 Forage Cruiser	NA
FR650 Forage Cruiser	NA
FR780 Forage Cruiser	NA

⚠ DANGER

Heavy objects!
Lift and handle all heavy components using lifting equipment with adequate capacity. Always support units or parts with suitable slings or hooks. Make sure the work area is clear of all bystanders.
Failure to comply will result in death or serious injury.

D0076A

⚠ WARNING

Fall hazard!
Use a sturdy platform when working above ground level.
Failure to comply could result in death or serious injury.

W0926A

⚠ WARNING

Jack stands can slip or fall over. Dropping, tipping, or slipping of machine or its components is possible.
DO NOT work under a vehicle supported by jack stands only. Park machine on a level surface. Block wheels. Support machine with safety stands.
Failure to comply could result in death or serious injury.

W0069A

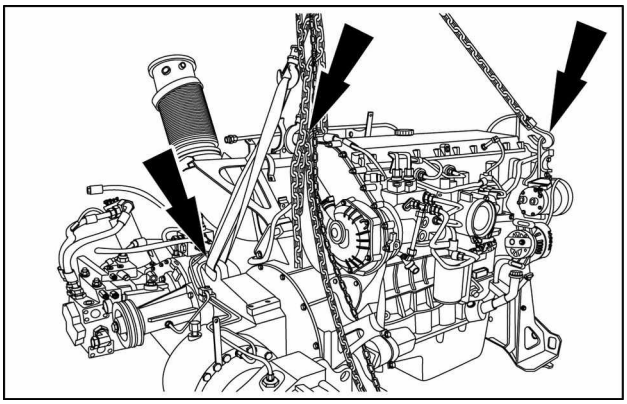
NOTE: *The engine installation is done on FR480 but the instructions and figures can be used as a guideline for all other models, except for the FR850.*

NOTE: *When disconnecting fluid lines, have a suitable container available to collect any residual fluids. Use stops and/or plugs to prevent fluids spill and to protect against dirt ingress.*

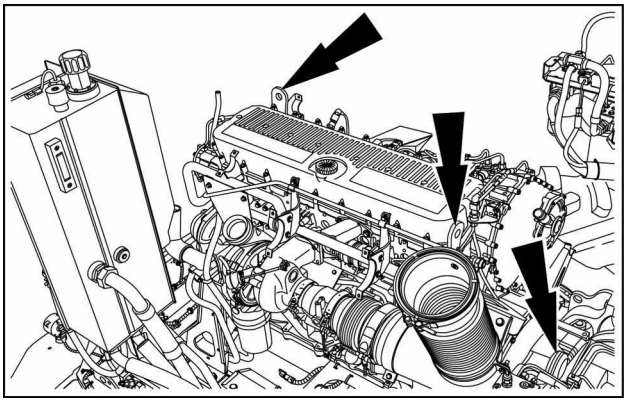
Engine supports, fuel and air-conditioning lines

1. Use a suitable lifting device and position the engine on the machine.

NOTE: *Make sure that the chains are set in such a way that the engine, when lifted, is properly balanced. It could be difficult to install the engine, if not balanced properly.*

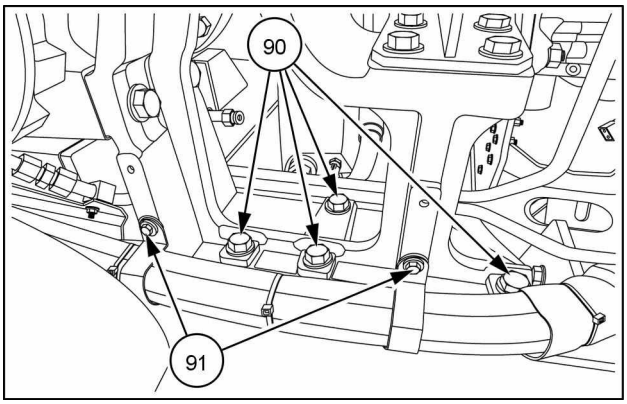


ZEIL15FR00161AA 1



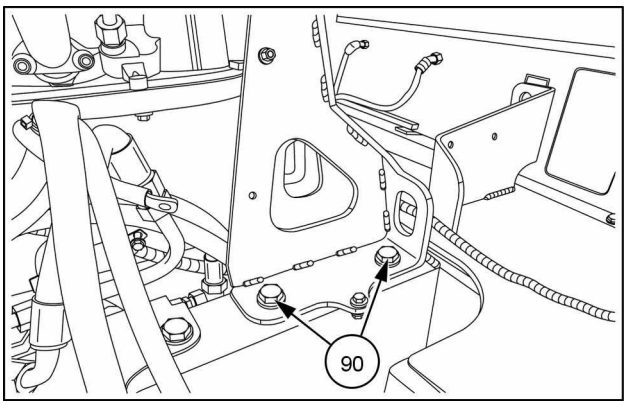
ZEIL15FR00197AA 2

2. On the left-hand side of the machine, install the hardware **(90)**.
3. Install the clamp hardware **(91)**.



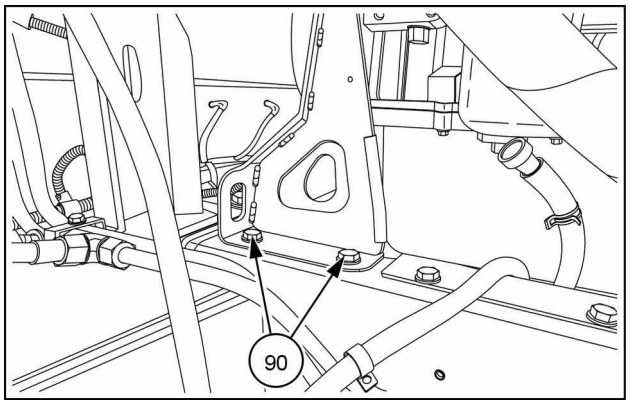
ZEIL15FR00153AA 3

4. Install the hardware **(90)**.



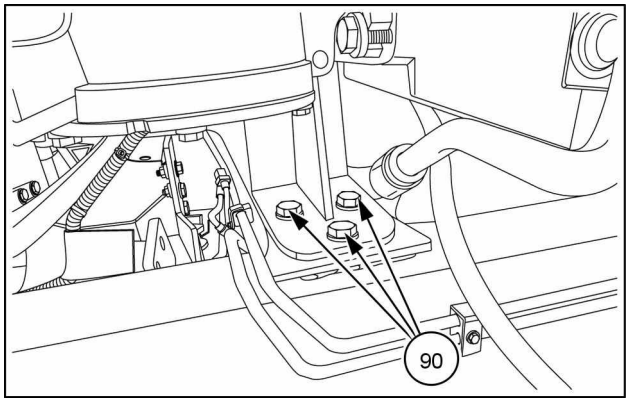
ZEIL15FR00151AA 4

5. On the right-hand side of the machine, install the hardware **(90)**.



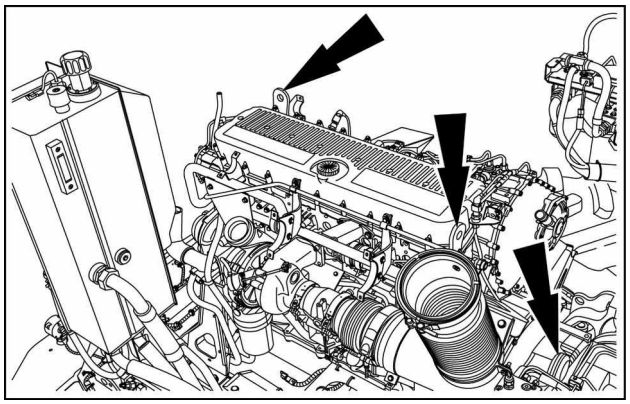
ZEIL15FR00150AA 5

6. Install the hardware **(90)**.



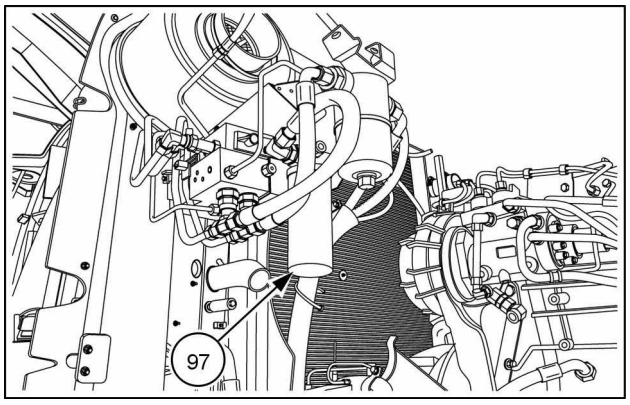
ZEIL15FR00152AA 6

7. Remove the chains from the lifting eyes.



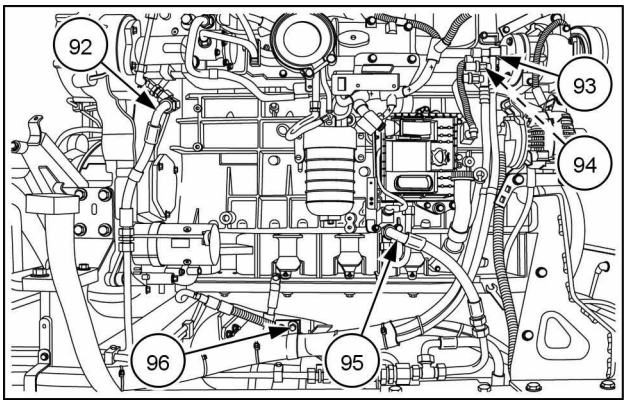
ZEIL15FR00197AA 7

8. Install the oil filter **(97)**.



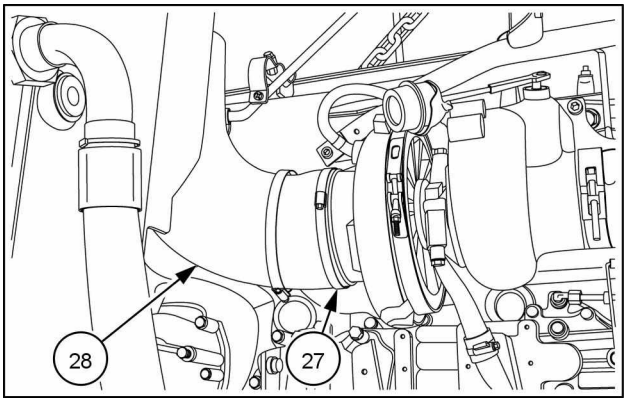
ZEIL15FR00160AA 8

9. Install the fuel feed line **(95)** and the fuel return line **(92)**.
10. Install the air-conditioning lines **(93)** and **(94)**.
11. Install the clamp hardware **(96)**.



ZEIL15FR00148AA 9

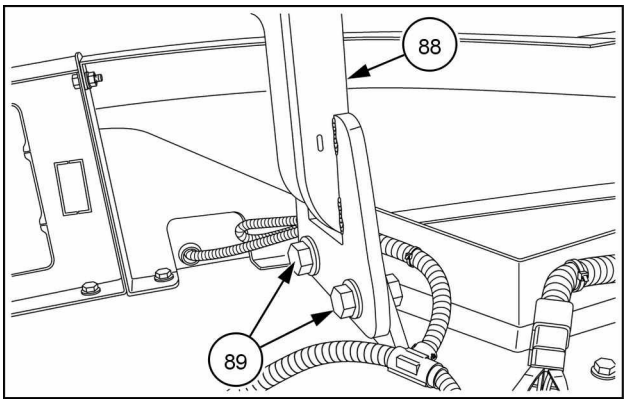
12. Install the rubber elbow coupler **(28)** and tighten the hose clamp **(27)**.



ZEIL15FR00149AA 10

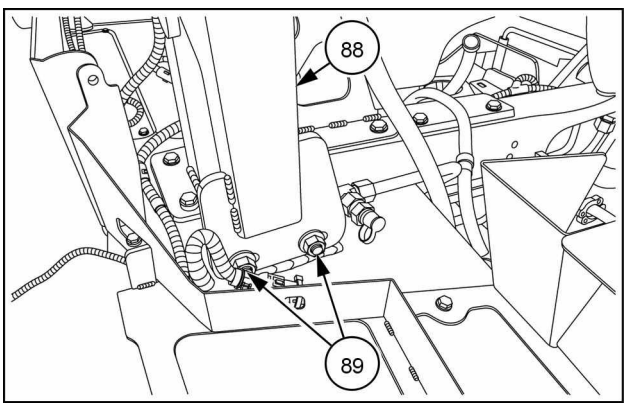
Rear frame

13. Ask assistance of a second person or use a suitable lifting device to support the rear frame **(88)**.
14. Install the rear frame **(88)** on the machine. Use the hardware **(89)**.



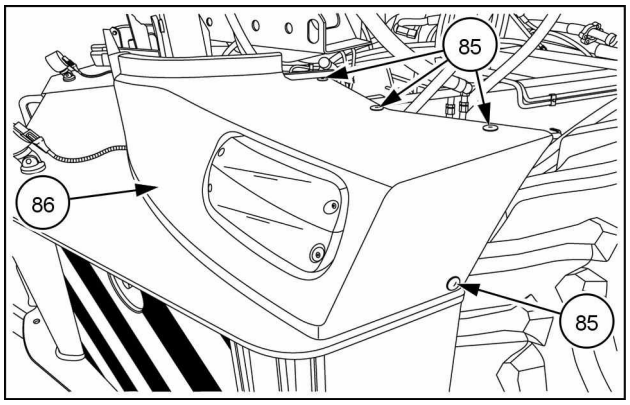
ZEIL15FR00159AA 11

15. Install the hardware **(89)**.



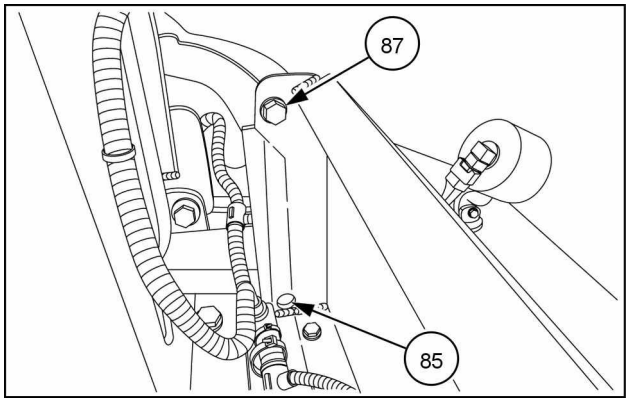
ZEIL15FR00158AA 12

16. On the rear right-hand side, install the right-hand side light cover **(86)**. Use the plastic rivets **(85)**.



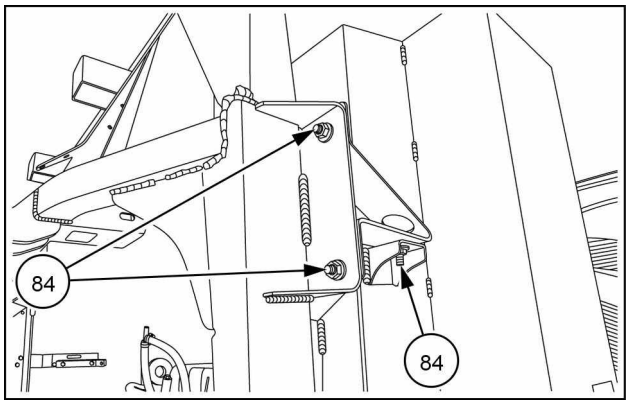
ZEIL15FR00156AA 13

17. Install the plastic rivet **(85)** and the hardware **(87)**.



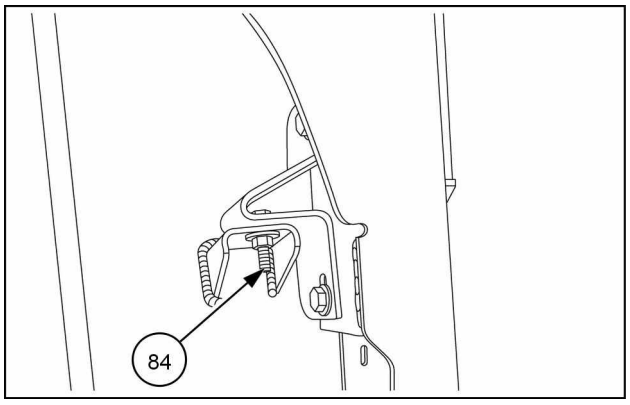
ZEIL15FR00157AA 14

18. On the rear right-hand side of the machine, install the hardware **(84)**.



ZEIL15FR00154AZ 15

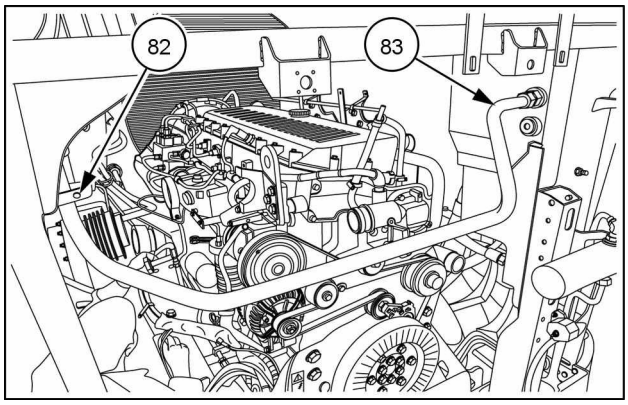
19. Install the hardware **(84)**.



ZEIL15FR00155AA 16

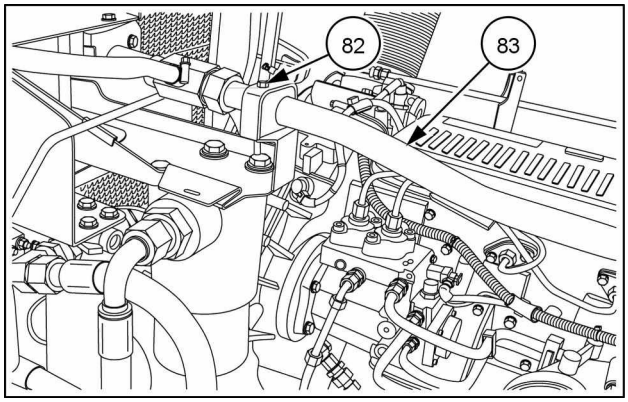
Hydraulics

20. Install the tube **(83)**. Use the clamp hardware **(82)**, see also Figure **39**.



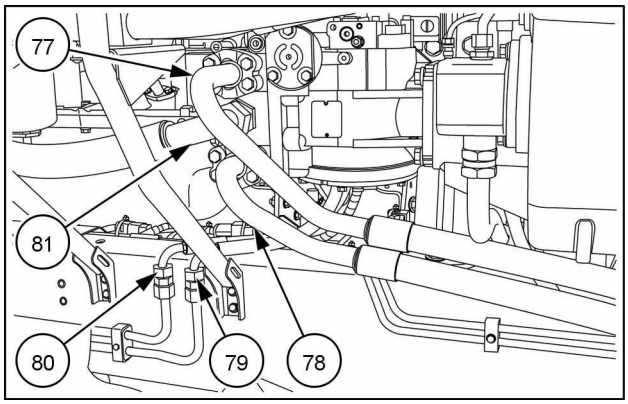
ZEIL15FR00147AA 17

21. Install the tube **(83)**. Install the clamp hardware **(82)**.



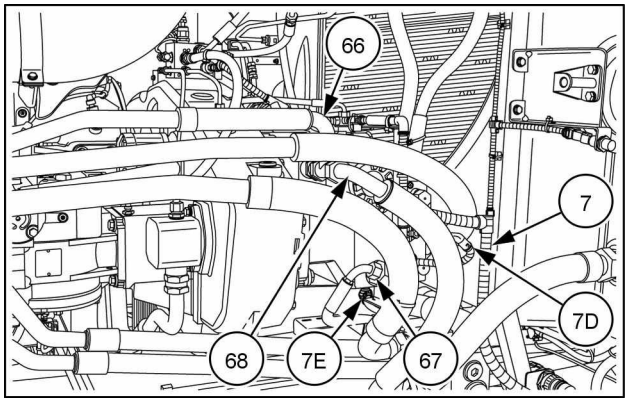
ZEIL15FR00146AA 18

22. Install the hose **(80)** and the hose **(79)**.
23. Install the hose **(78)**, the hose **(81)** and the hose **(77)**.



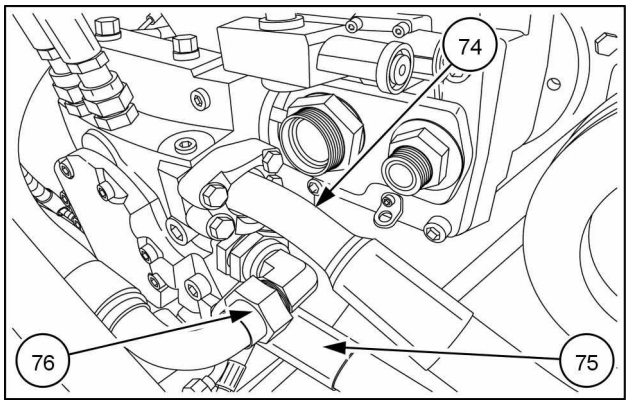
ZEIL15FR00132AA 19

24. Install the hose **(68)**, the hose **(67)**, and the hose **(66)**.



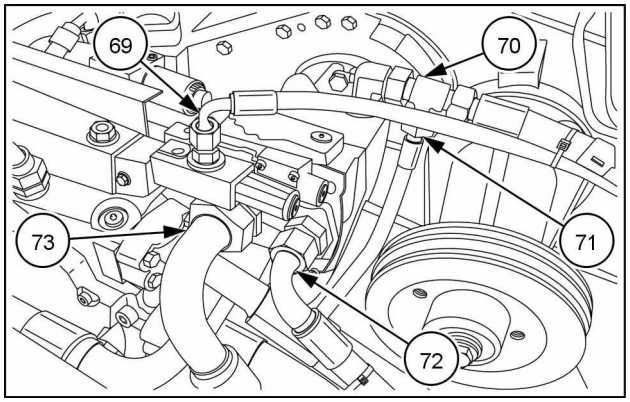
ZEIL15FR00133AA 20

25. Install the hose **(75)**, the hose **(76)** and the hose **(74)**.



ZEIL15FR00135AA 21

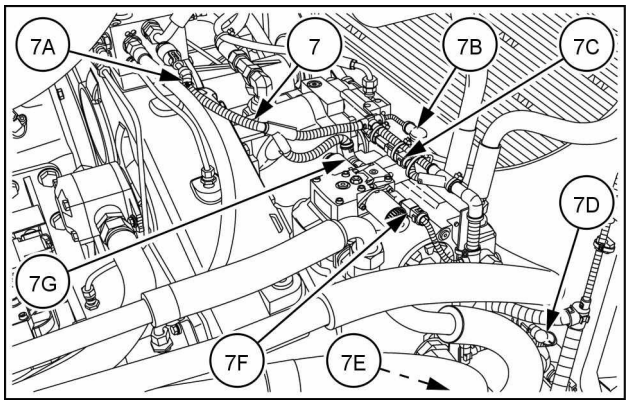
26. Install the hose **(73)**, the hose **(72)**, the hose **(70)**, the hose **(71)** and the hose **(69)**.



ZEIL15FR00136AA 22

27. Connect the connectors **(7A)**, **(7B)**, **(7C)**, **(7D)**, **(7E)**, **(7F)** and **(7G)** of the wire harness **(7)**. See also Figure **20**.

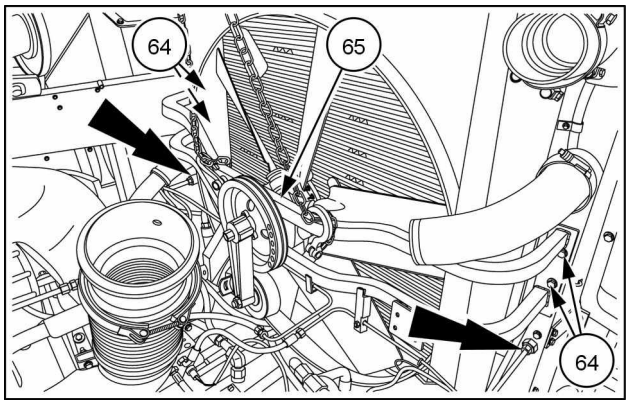
NOTE: *Connectors **(7B)** and **(7E)** are connected to the pressure sensors who can only be found on machines with variable displacement hydro motor. These machines have a maximum road speed of **40 km/h**.*



ZEIL15FR00134AA 23

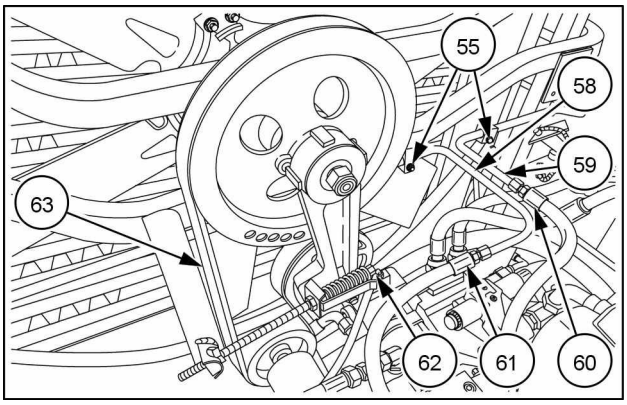
Cooling fan

28. Position the fan **(65)** on the back of the cooling group. Use a suitable lifting device.
29. Install the fan **(65)**. Use the hardware **(64)**.



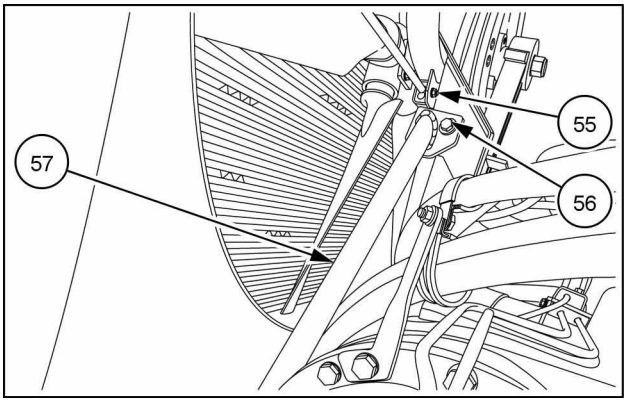
ZEIL15FR00129AA 24

30. Instal the tube **(58)** and the tube **(59)**. See also the arrows in Figure **36**.
31. Install the clamps **(55)**.
32. Connect the hose **(60)** and the hose **(61)**.
33. Install the fan drive belt **(63)**. Tighten the fan drive belt tensioner **(62)** to the correct tension. See “Belts and chains” in the operator’s manual.



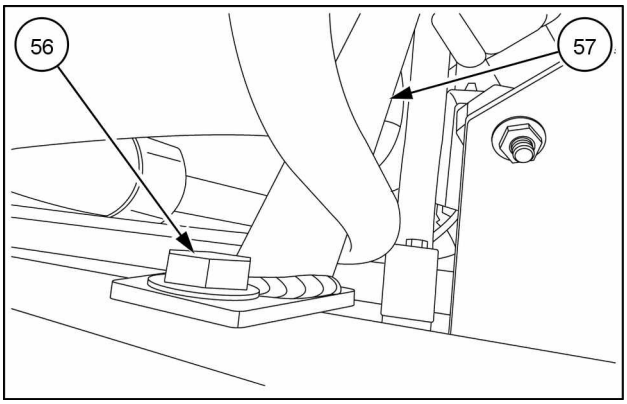
ZEIL15FR00125AA 25

34. Install the support **(57)**. Use the hardware **(56)**. See also Figure **27**.
35. Install the clamp hardware **(55)**.



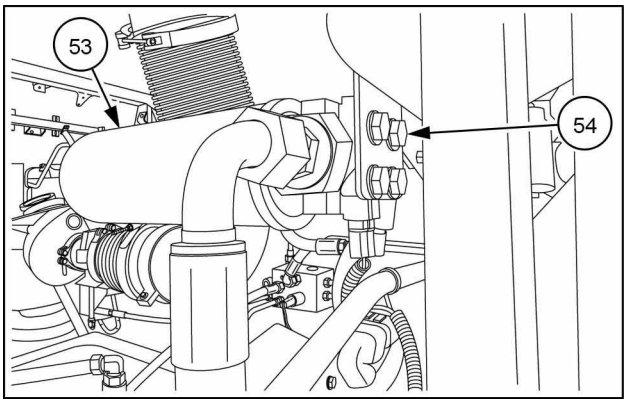
ZEIL15FR00127AA 26

36. On the left-hand side of the machine, under the main gearbox clutch shaft, install the support **(57)**. Use the hardware **(56)**.



ZEIL15FR00128AA 27

37. On the right-hand side, on the fan support, install the oil filter **(53)**. Use the hardware **(54)**.

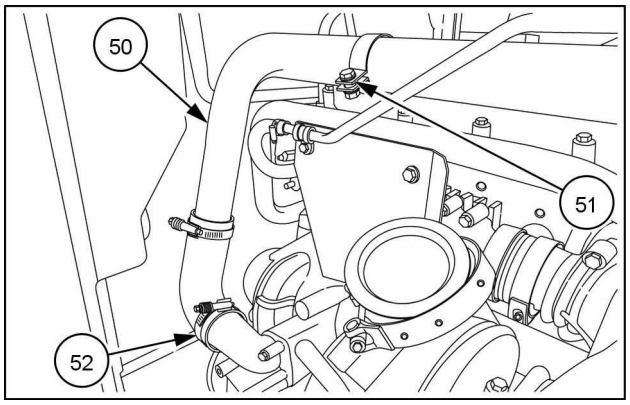


ZEIL15FR00126AA 28

Air and coolant tubes

38. Install the engine coolant inlet tube **(50)** between engine and cooling group. Use the clamp hardware **(51)**. See also Figure **30**.
39. Tighten the hose clamp **(52)**.

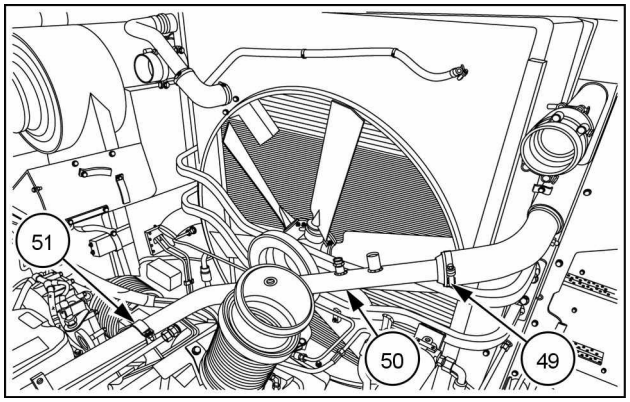
NOTE: *Torque between **11 - 13 N·m (8.11 - 9.59 lb ft)**.*



ZEIL15FR00141AA 29

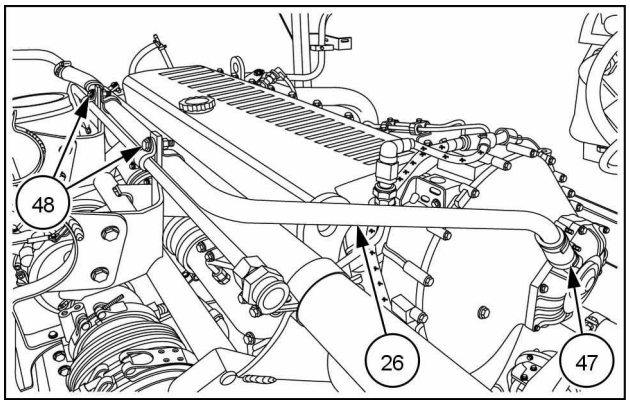
40. Install the clamp hardware **(51)**.
41. Tighten the hose clamp **(49)** of the engine coolant inlet tube **(50)**.

NOTE: *Torque between **11 - 13 N·m (8.11 - 9.59 lb ft)**.*



ZEIL15FR00142AA 30

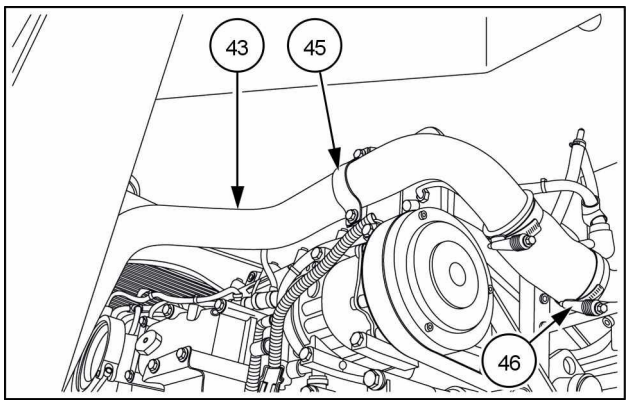
42. Install the breather tube **(26)**. Use the clamps **(48)**.
43. Tighten the hose clamp **(47)**.



ZEIL15FR00139AA 31

44. Install the engine coolant outlet tube **(43)**. Install the clamp hardware **(45)**. See also Figure **33**.
45. Tighten the hose clamp **(46)** of the engine coolant outlet tube **(43)**.

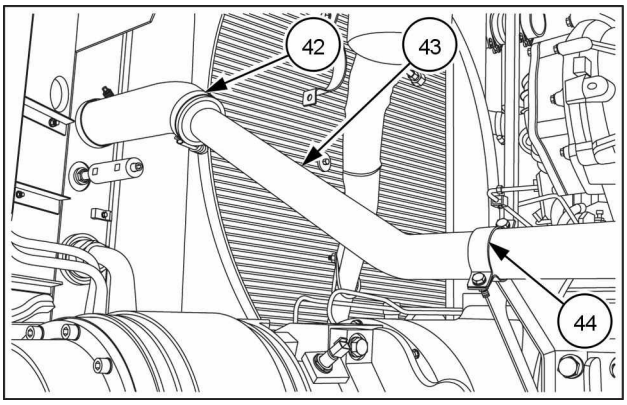
NOTE: *Torque between **11 - 13 N·m (8.11 - 9.59 lb ft)**.*



ZEIL15FR00145AA 32

46. Install the engine coolant outlet tube **(43)**. Install the clamp hardware **(44)**.
47. Tighten the hose clamp **(42)** of the engine coolant outlet tube **(43)**.

NOTE: *Torque between* ***11 - 13 N·m*** *(****8.11 - 9.59 lb ft****).*

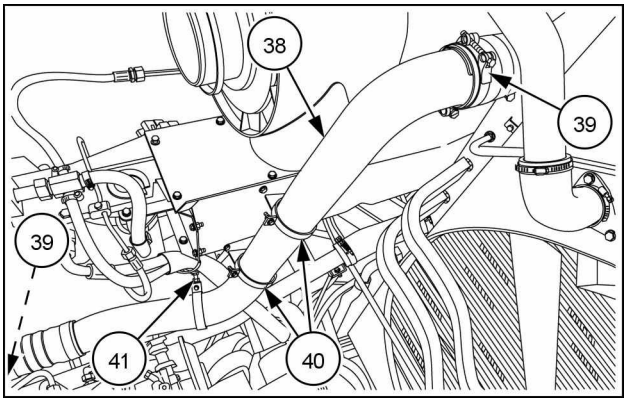


ZEIL15FR00144AA 33

48. Install the engine air intake tube **(38)** between the engine air intake piece (not shown) and the cooling group outlet. Tighten the clamps **(39)**

NOTE: *Torque between* ***40 - 50 N·m*** *(****29.50 - 36.88 lb ft****).*

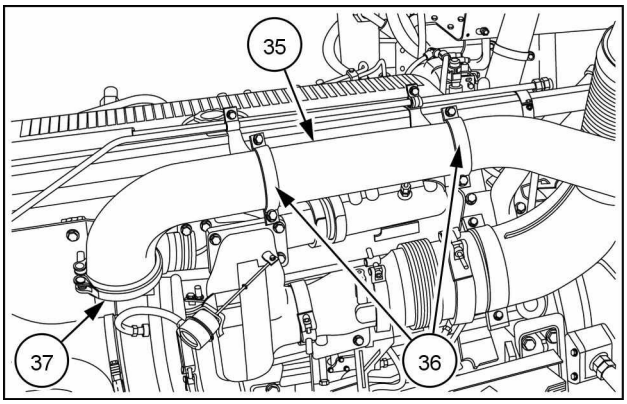
49. Install the clamp hardware **(40)**.
50. Install the pig tail **(41)** on the engine air intake tube **(38)**.



ZEIL15FR00140AA 34

51. Install the air intake tube **(35)**. Install the clamp hardware **(36)**.
52. Tighten the clamp **(37)**.

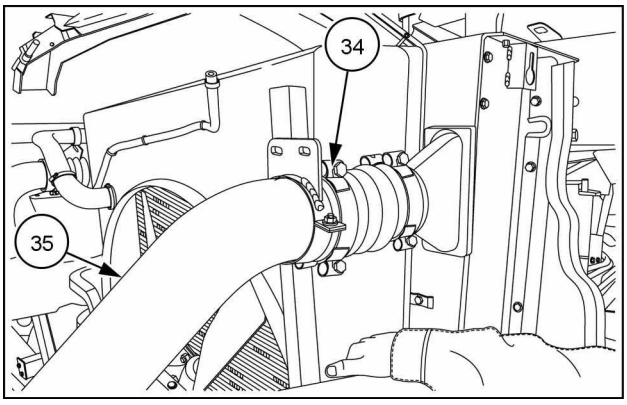
NOTE: *Torque between* ***11 - 13 N·m*** *(****8.11 - 9.59 lb ft****)*



ZEIL15FR00137AA 35

53. Tighten the clamp **(34)** of the cooling group air intake tube **(35)**.

NOTE: *Torque between* ***40 - 50 N·m*** *(****29.50 - 36.88 lb ft****).*



ZEIL15FR00138AA 36

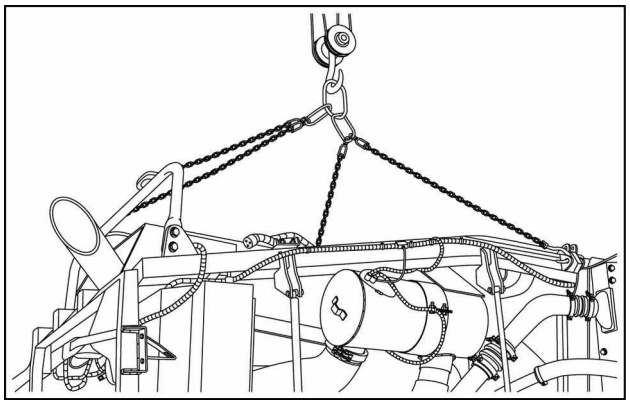
Roof assembly

54. Position the roof assembly on the machine. Use the lifting eyes near the front hinges of the side shieldings, and use the spout support as shown.

NOTE: *Make sure that the rubber coupler sits ready is slid back on the air intake tube* ***(23)*** *before installing the roof assembly. See Figure* ***47****.*

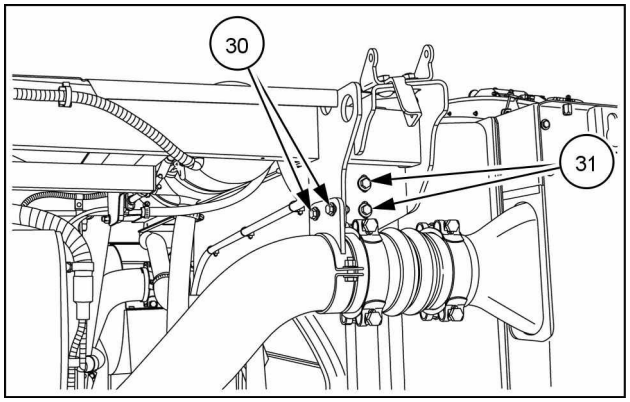
NOTE: *Make sure that the chains are set in such a way that the roof assembly, when lifted, is properly balanced.*

NOTE: *When lowering check alignment of the air intake tube* ***(23)*** *and rubber elbow coupler* ***(28)*** *see Figure* ***46****.*



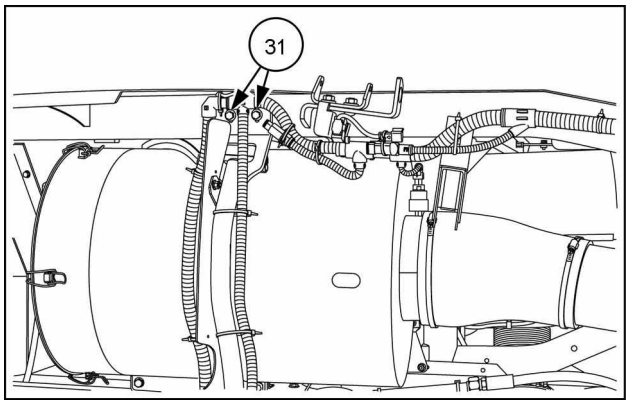
ZEIL15FR00116AA 37

55. On the right-hand side of the machine, install the hardware **(30)** and the hardware **(31)**.



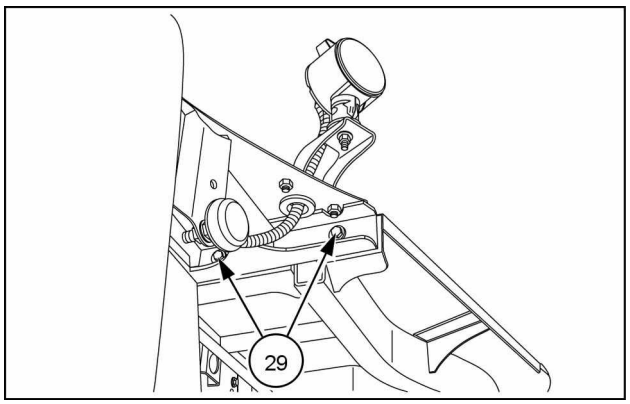
ZEIL15FR00118AA 38

56. On the left-hand side of the machine, install the hardware **(31)**.



ZEIL15FR00198AA 39

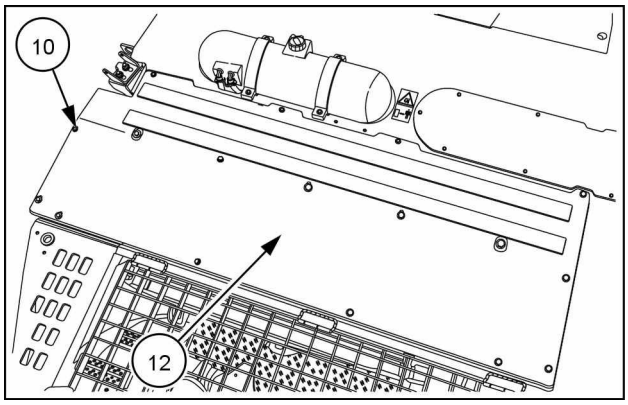
57. On the left-hand side of the machine, install the hardware **(29)**.



ZEIL15FR00117AA 40

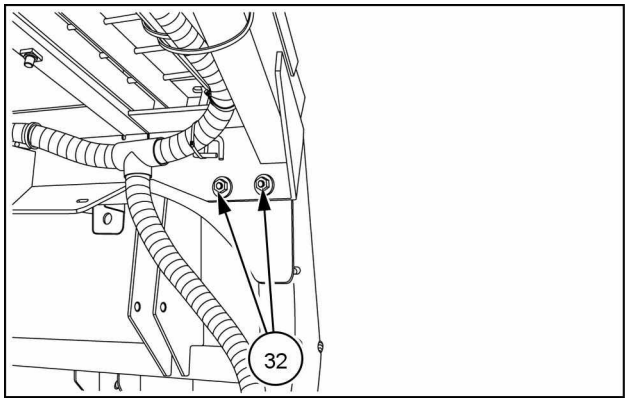
58. Install the cooling group cover plate **(12)**. Use the hardware **(10)** (fourteen in total).

NOTE: *If the holes do not align properly, loosen the hardware in the previous steps. Then adjust the position of the roof assembly and tighten the hardware.*



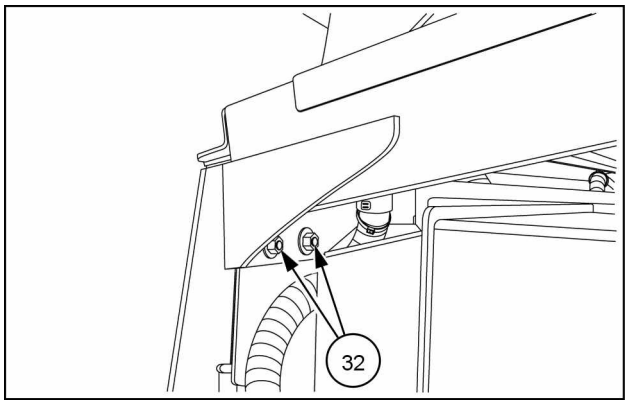
ZEIL15FR00091AA 41

59. On the left-hand side of the rear frame install the hardware **(32)**.



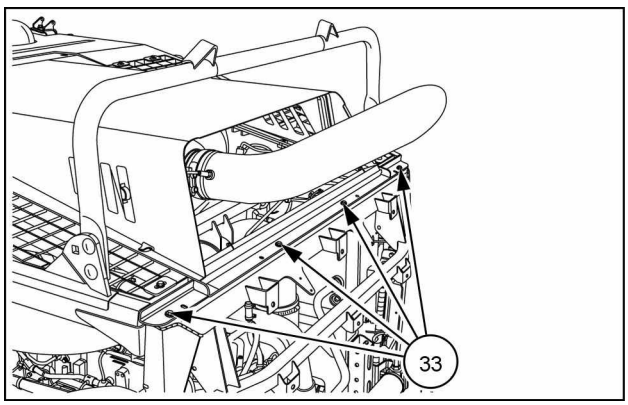
ZEIL15FR00120AA 42

60. On the right-hand side of the rear frame, install the hardware **(32)**.



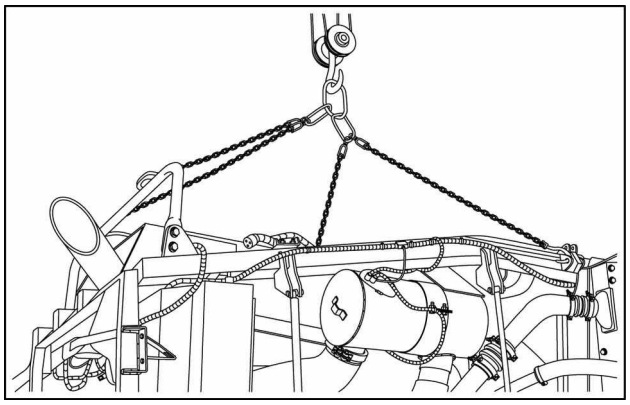
ZEIL15FR00121AA 43

61. Install the hardware **(33)**.



ZEIL15FR00119AA 44

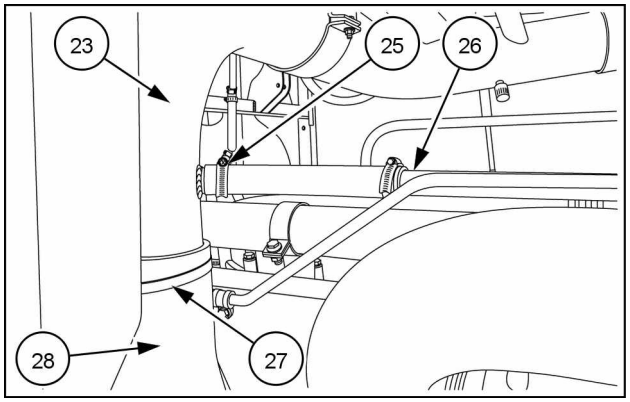
62. Remove the chains from the roof assembly.



ZEIL15FR00116AA 45

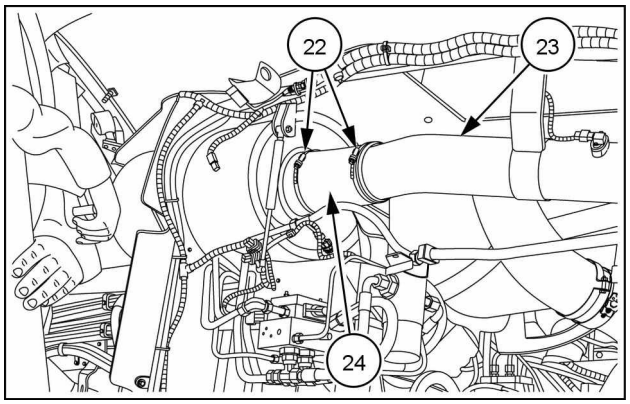
63. Install the rubber elbow coupler **(28)** on the air intake tube **(23)** and tighten the clamp **(27)**

64. Install the breather tube **(26)** rubber coupler on the air intake tube **(23)** and tighten the clamp **(25)**.



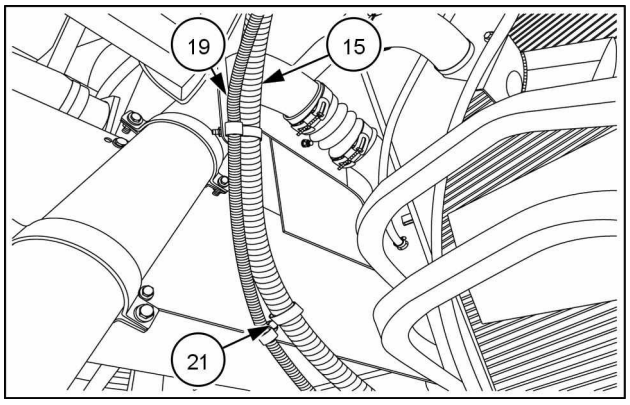
ZEIL15FR00191AA 46

65. On the air intake tube **(23)**, slide the rubber coupler **(24)** forward onto the air filter. Tighten the clamps **(22)** of the rubber coupler **(24)**.



ZEIL15FR00196AA 47

66. On the left-hand side of the machine, carefully insert the **DEF/AdBlue®** coolant lines and the **DEF/AdBlue®** feed line **(15)** through the hole. See arrow Figure **49**. Install the hardware **(21)**.



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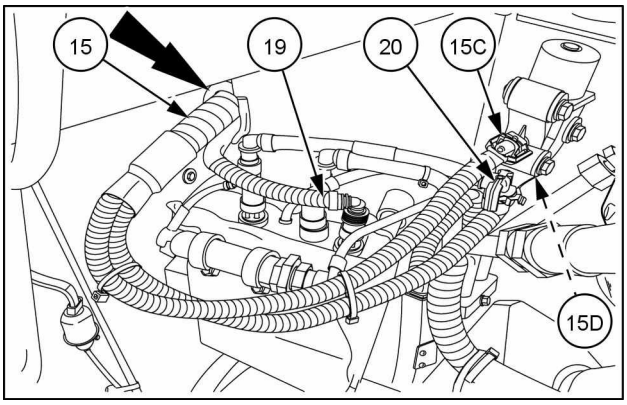
67. On the left-hand side of the machine, connect the **DEF/AdBlue®** feed line to the supply module.

NOTE: *Have a suitable container ready and use the appropriate plugs on the* ***DEF/AdBlue®*** *supply module and the* ***DEF/AdBlue®*** *feed line* ***(19)****. Clean up any DEF/AdBlue® spill immediately.*

68. Connect the **DEF/AdBlue®** coolant lines **(15C)** and **(15D)** to the heater valve.

69. Connect the **DEF/AdBlue®** coolant line **(20)**.



ZEIL15FR00102AA 49

70. Install the hose **(14)** on the engine coolant intake tube.

71. Connect the **Diesel Exhaust Fluid (DEF)/AdBlue®** injector coolant lines **(15A)** and **(15B)**. See also Figure **51**.

72. Install the NOx sensor **(13)** on the exhaust.

NOTE: *Apply* ***ANTI-SEIZE ASW - HIGH-TECH ASSEMBLY PASTE*** *on the threads.*

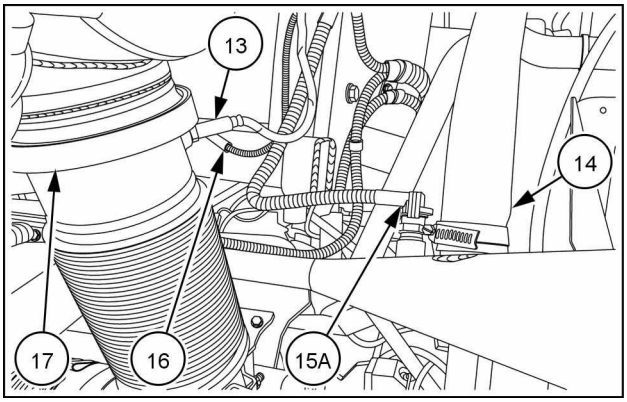
NOTE: *Torque between* ***40 - 60 N·m*** *(****29.5 - 44.25 lb ft****).*

73. Install the temperature sensor **(16)**.

NOTE: *Torque between* ***40 - 50 N·m*** *(****29.5 - 36.88 lb ft****)*

74. Install the clamp **(17)**.

NOTE: *Torque between* ***11 - 13 N·m*** *(****8.11 - 0.0 lb ft****).*



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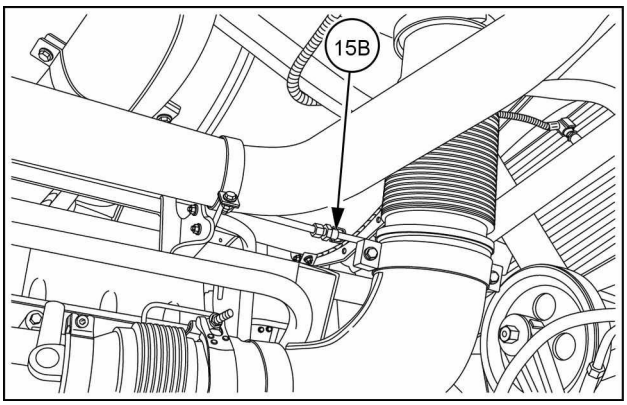

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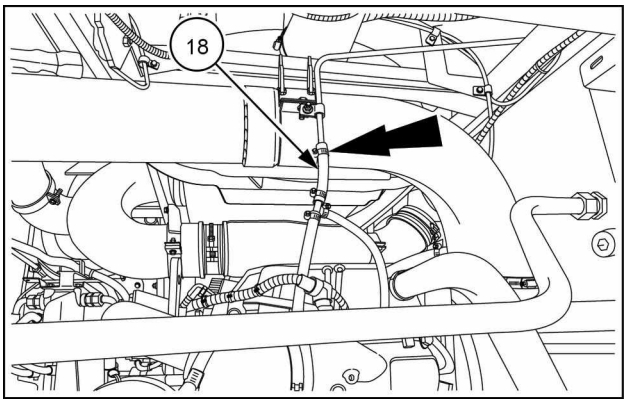
75. Connect the hose **(18)** to the coolant tube at the point indicated by the arrow.



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