

Product: New Holland FR450 / FR500 / FR600 / FR700 / FR850 Forage Harvester Service Repair Manual

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SERVICE MANUAL

FR450 / FR500 / FR600 / FR700 / FR850

Forage Harvester

Part number 47812470

English

February 2015
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SERVICE MANUAL

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47812470 23/02/2015

EN

Link Product / Engine

Product	Market Product	Engine
FR850 FR850 TIER 2 [5803 -]	North America	FVAE2884X*B200
FR450 FR450 TIER 3 [5803 -]	North America	F2CE9684U*E151
FR500 FR500 TIER 4A	North America	F3BFE613E*A
FR600 FR600 TIER 3 [5803 -]	North America	F3CE0684E*E920
FR450 FR450 TIER 4A	North America	F2CFE613A*A
FR500 FR500 TIER 3 [5803 -]	North America	F3BE0684J*E919

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INTRODUCTION

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(*) See content for specific models

Basic instructions - How to use and navigate through this Manual

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.

SECTION	PRODUCT			
	Tractors			
00 - Maintenance	Vehicles with working arms: backhoes, excavators, skid steers,			
05 - Machine completion and equipment	Combines, forage harvesters, balers,			
10 - Engine	Seeding, planting, floating, spraying equipment,			
14 - Main gearbox and drive	Mounted equipment and tools,			
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				

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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	
Bale wagons	69	
Ejection	70	
Lubrication system	71	
Separation	72	
Residue handling	73	
Cleaning	74	
Soil preparation/Finishing	75	
Secondary cleaning / Destemmer	76	
Seeding	77	
Spraying	78	
Planting	79	
Crop storage / Unloading	80	
Front loader and bucket	82	

INTRODUCTION

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

Advice

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

Anyone who carries out the above operations without complying with the instructions shall be responsible for the 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 due to the anomalous behavior of parts and/or components not approved by the manufacturer himself, 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 due to an anomalous behavior of parts and/or components not approved by the manufacturer.

The information in this manual is up-to-date at the date of the publication. It is the policy of the manufacturer for continuous improvement. Some information may not be updated due to modifications of a technical or commercial type, as well as to suit the laws and regulations of different countries.

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

Note to the Owner

FR450	NA
FR500	NA
FR600	NA
FR850	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

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

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

LEGAL OBLIGATIONS

This machine may be equipped with special guarding or other devices in compliance with local legislation. Some of 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.

INTRODUCTION

- 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

⚠ 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

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

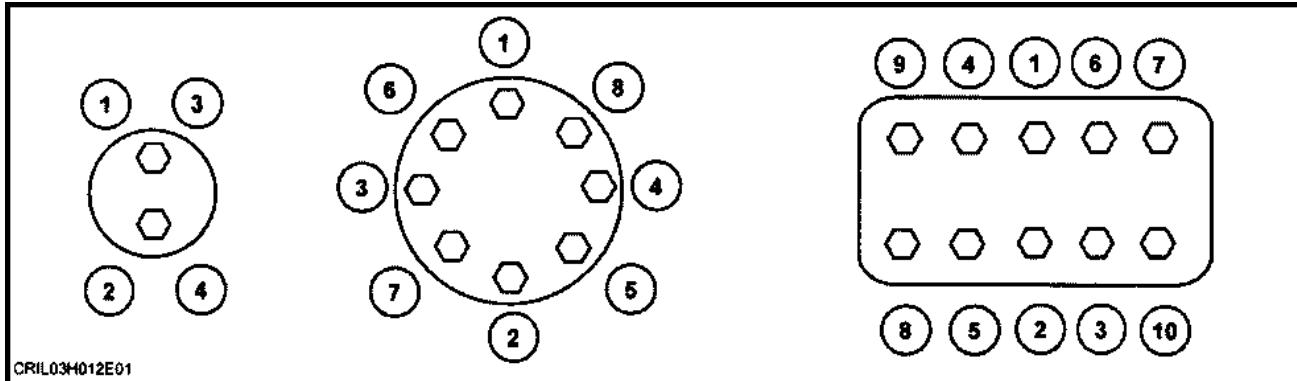
Torque

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.



Metric hardware

Nominal Size	Class 8.8 in N m (lb in or lb ft)			Class 10.9 in N m (lb in or lb ft)		
	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)
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)

**IDENTIFICATION
HEX CAP SCREW AND CARRIAGE BOLTS**



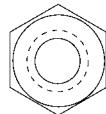
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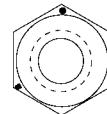
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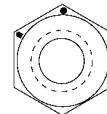
SAE GRADE 8



REGULAR NUTS

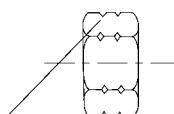


SAE GRADE 5
HEX NUTS



SAE GRADE 8
HEX NUTS

LOCKNUTS

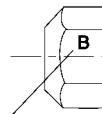


GRADE IDENTIFICATION

GRADE A: NO NOTCHES

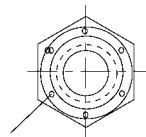
GRADE B: ONE CIRCUMFERENTIAL NOTCH

GRADE C: TWO CIRCUMFERENTIAL NOTCHES



GRADE IDENTIFICATION

GRADE A: NO MARK
GRADE B: LETTER B
GRADE C: LETTER C



GRADE IDENTIFICATION

GRADE A: NO MARKS

GRADE B: THREE MARKS

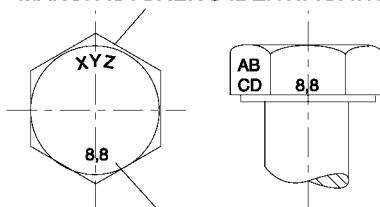
GRADE C: SIX MARKS

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**IDENTIFICATION
HEX CAP SCREW AND CARRIAGE BOLTS
CLASSES 5,6 AND UP**

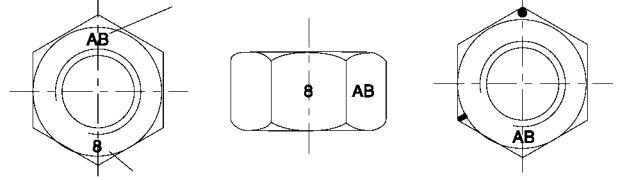
MANUFACTURER'S IDENTIFICATION



PROPERTY CLASS

**HEX NUTS AND LOCKNUTS
CLASSES 05 AND UP**

MANUFACTURER'S IDENTIFICATION



PROPERTY CLASS

CLOCK MARKING

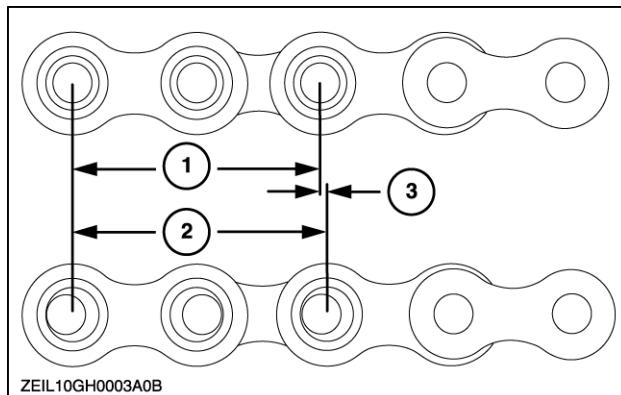
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Basic instructions - Chain Wear Tables - Roller Chains

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.



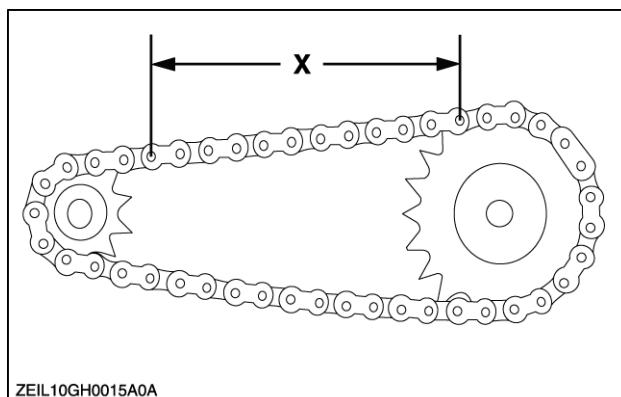
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Chains do not "stretch" - material is removed from pin and bushing.

- (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.