SERVICE MANUAL

CR8.90 / CR9.90 / CX8.90
Tier 4A

CR8.90 PIN 1946 and above, CR9.90 PIN 1947 and above, CX8.90 PIN 1962 and above

CR10.90 / CX8.80
Tier 4B (final)

CR10.90 PIN 1947 and above, CX8.80 PIN 1957 and above

Combine

Part number 47956065
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SERVICE MANUAL

CR10.90 TIER 4B [1947 -]
CR8.90 TIER4A [1946 -]
CR9.90 TIER 4A [1947 -]
CX8.80 TIER 4B [1957 -]
CX8.90 TIER 4A [1962 -]

Link Product / Engine

Product	Market Product	Engine
CX8.80 TIER 4B [1957 -]	North America	F2CFE613C*B043
CX8.90 TIER 4A [1962 -]	North America	F3AFE613A*A
CR10.90 TIER 4B [1947 -]	North America	F3JFE613A*B003
CR8.90 TIER4A [1946 -]	North America	F3AFE613A*A
CR9.90 TIER 4A [1947 -]	North America	F3BFE613D*A

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INTRODUCTION

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INTRODUCTION

(*) See content for specific models

Foreword - Important notice regarding equipment servicing

CR10.90 TIER 4B [1947 -]	NA
CR8.90 TIER4A [1946 -]	NA
CR9.90 TIER 4A [1947 -]	NA
CX8.80	NA
CX8.90	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

CR10.90 TIER 4B [1947 -]	NA
CR8.90	NA
CR9.90	NA
CX8.80	NA
CX8.90	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:

The FCR information is not contained within the paper version of the manual.
For FCR information, please refer to the Electronic Service Tool (EST) or the 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

CR10.90	NA
CR8.90	NA
CR9.90	NA
CX8.80	NA
CX8.90	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.

Safety rules

CR10.90	NA
CR8.90	NA
CR9.90	NA
CX8.80	NA
CX8.90	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 and on machine decals, 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 which, if not avoided, will result in death or serious injury. The color associated with DANGER is RED.

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury. The color associated with WARNING is ORANGE.

CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. The color associated with CAUTION is YELLOW.

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

Machine safety

NOTICE: *Notice indicates a situation which, if not avoided, could result in machine or property damage. The color associated with Notice is BLUE.*

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 which 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.

Basic instructions

CR10.90	NA
CR8.90	NA
CR9.90	NA
CX8.80	NA
CX8.90	NA

SHIMMING

For each adjustment operation, select adjusting shims and measure 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 indicated on each shim.

ROTATING SHAFT SEALS

For correct rotating shaft seal installation, proceed as follows:

- before assembly, allow the seal to soak in the oil it will be sealing for at least thirty minutes
- thoroughly clean the shaft and check that the working surface on the shaft is not damaged
- position the sealing lip facing the fluid; with hydrodynamic lips, take into consideration the shaft rotation direction and position the grooves so that they will deviate the fluid towards the inner side of the seal
- coat the sealing lip with a thin layer of lubricant (use oil rather than grease) and fill the gap between the sealing lip and the dust lip on double lip seals with grease
- insert the seal in its seat and press down using a flat punch, do not tap the seal with a hammer or mallet
- whilst inserting the seal, check that it is perpendicular to the seat; once settled, make sure that it makes contact with the thrust element, if required
- to prevent damaging the seal lip on the shaft, position a protective guard during installation operations

O-RING SEALS

Lubricate the O-RING seals before inserting them in the seats, this will prevent them from overturning and twisting, which would jeopardise sealing efficiency.

SEALING COMPOUNDS

Apply one of the following sealing compounds on the mating surfaces marked with an X: RTV SILMATE, RHODORSIL CAF 1 or LOCTITE PLASTIC GASKET. Before applying the sealing compound, prepare the surfaces as follows:

- remove any incrustations using a metal brush
- thoroughly de-grease the surfaces using one of the following cleaning agents: trichlorethylene, petrol or a water and soda solution

COTTER PINS

When fitting split cotter pins, ensure that the pin notch is positioned in the direction of the force required to stress the pin. Spiral cotter pins do not require special positioning.

PROTECTING THE ELECTRONIC/ ELECTRICAL SYSTEMS DURING CHARGING OR WELDING

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

1. Never make or break any of the charging circuit connections, including the battery connections, when the engine is running.
2. Never short any of the charging components to ground.
3. Always disconnect the ground cable from the battery before arc welding on the combine or on any header attached to the combine.
   - position the welder ground clamp as close to the welding area as possible
   - if welding in close proximity to a computer module, then the module should be removed from the combine
   - never allow welding cables to lay on, near or across any electrical wiring or electronic component while welding is in progress
4. **⚠ 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.

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   Always use the jump stud posts installed on the machine to jump start the machine or to charge the batteries. Refer to the Operator's Manual for more information!

NOTICE: *If welding must be performed on the unit, either the combine or the header (if it is attached), the battery ground cable must be disconnected. The electronic monitoring system and charging system will be damaged if this is not done. Refer to the Operator's Manual for more information!*

Remove the battery ground cable. Reconnect the cable when welding is completed.

SPARE PARTS

Only use "CNH Original Parts" or " NEW HOLLAND 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 Parts" can offer this guarantee.
When ordering spare parts, always provide the following information:

- machine model (commercial name) and serial number
- part number of the ordered part, which can be found in the "Microfiches" or the "Service Parts Catalogue", used for order processing

TOOLS

The tools that NEW HOLLAND suggests and illustrate in this manual have been:

- specifically researched and designed for use with NEW HOLLAND machines
- essential for reliable repair operations
- accurately built and rigorously tested so as 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

NOTE: *Wear limit values indicated for certain parts should be considered to be recommended, but not binding. The terms "front", "rear", "right-hand" and "left-hand" (when referred to different parts) are determined from the rear, facing in the direction of travel of the machine during operation.*

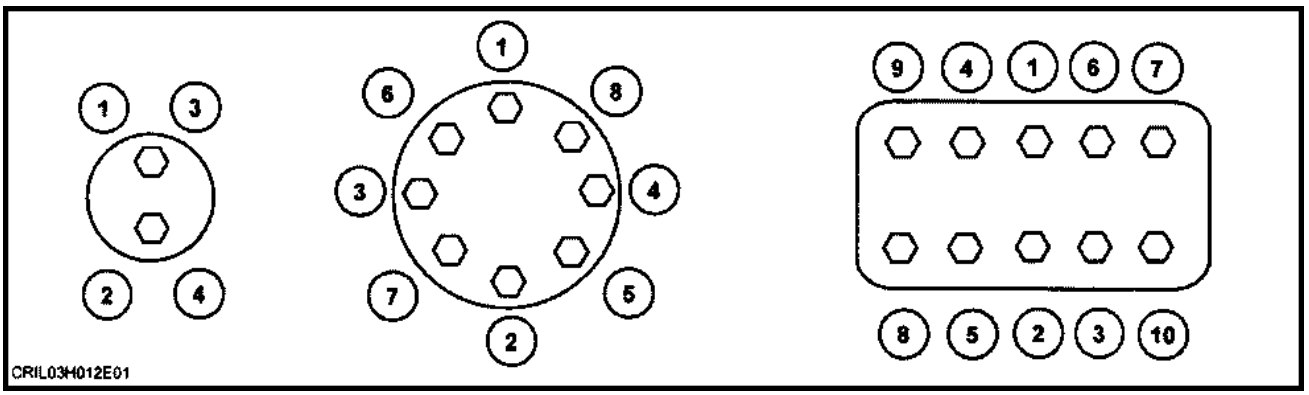
Torque

CR10.90	NA
CR8.90	NA
CR9.90	NA
CX8.80	NA
CX8.90	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.



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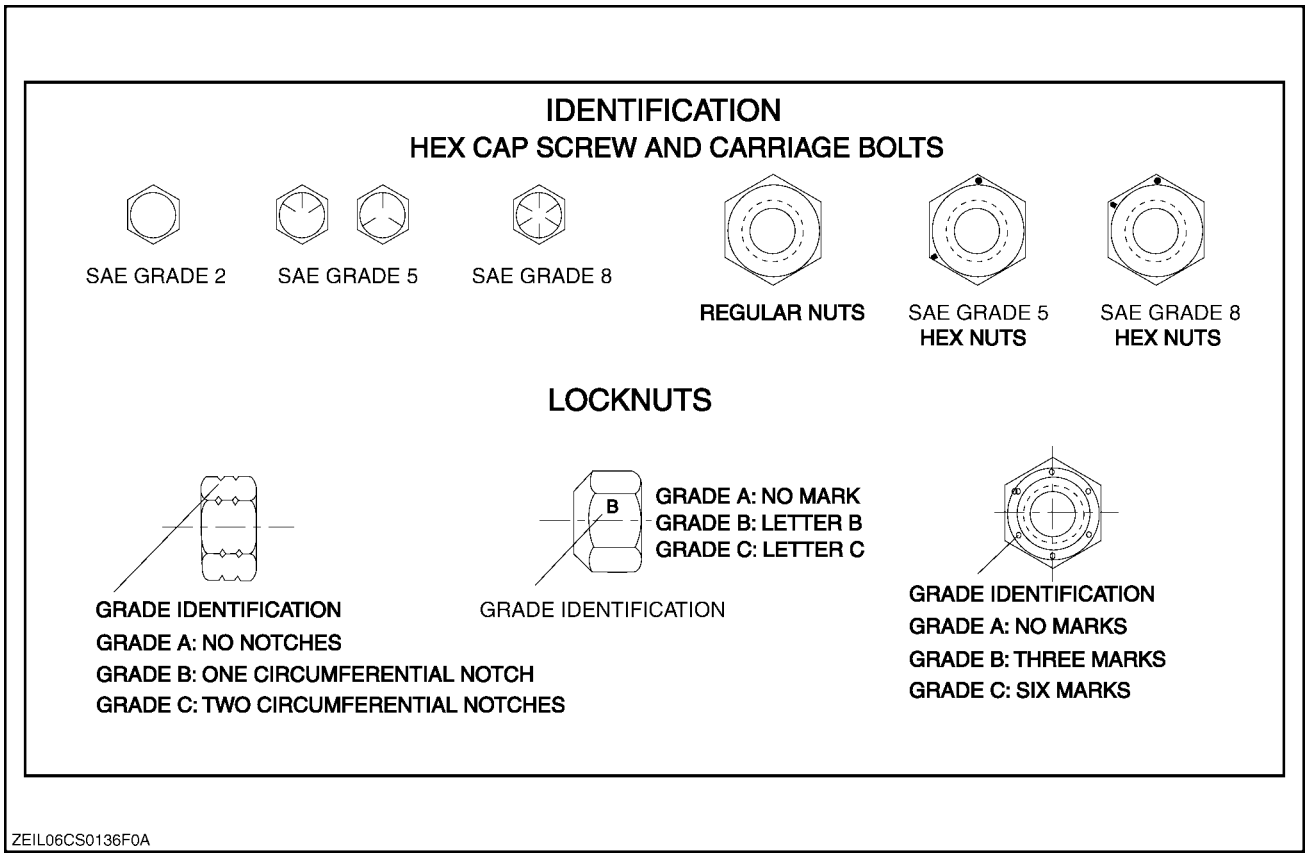
Metric hardware

	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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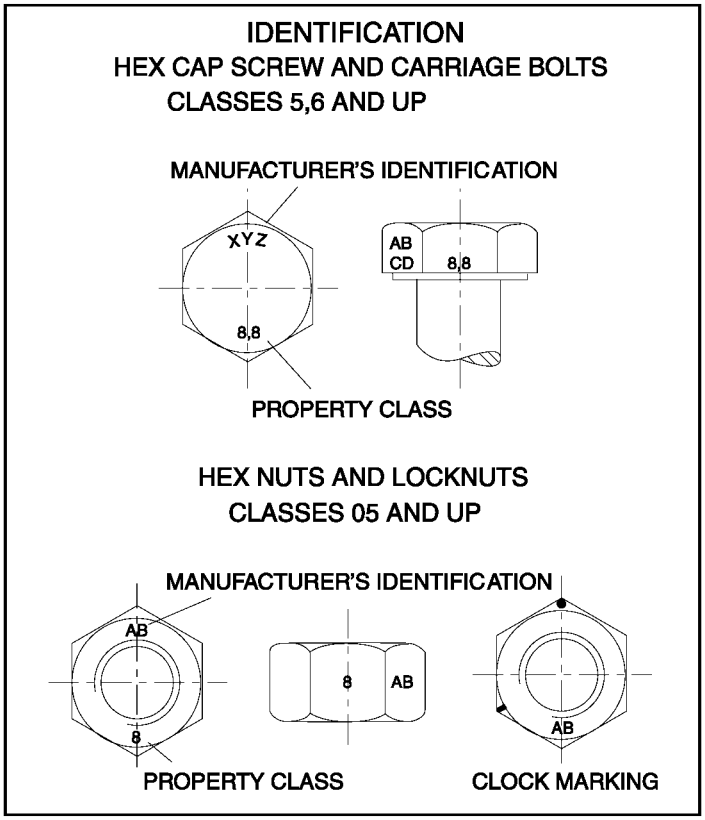

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Torque - Standard torque data for hydraulic connections

CR10.90	NA
CR9.90	NA
CX8.80	NA
CX8.90	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)