SERVICE MANUAL

E85CMSR

Midi Excavator

Part number 47516729A
English
April 2013

NEW HOLLAND CONSTRUCTION

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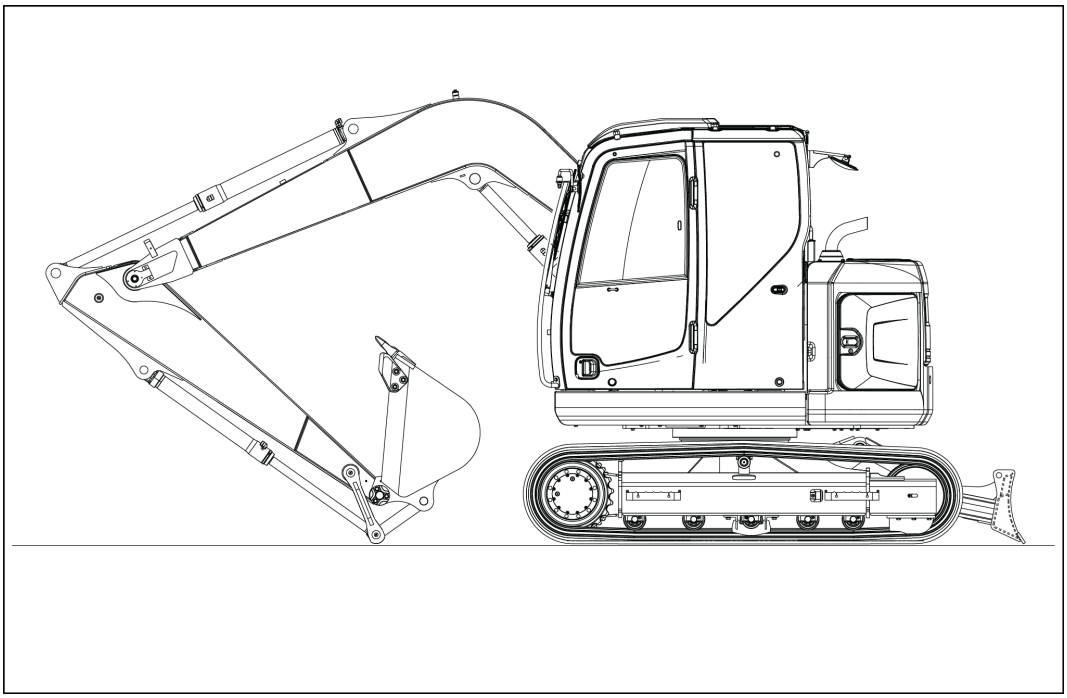
CONSTRUCTION

SERVICE MANUAL



E85CMSR

Contents

INTRODUCTION

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INTRODUCTION

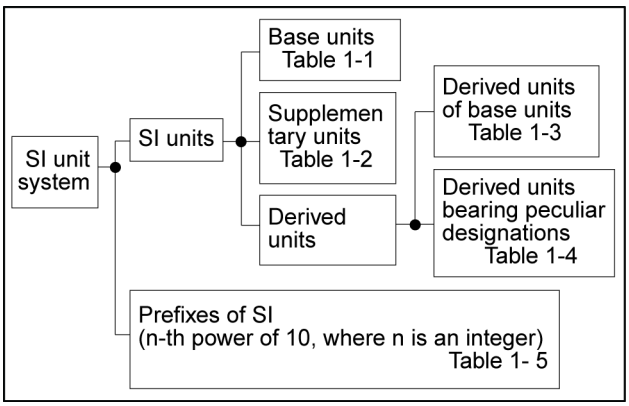
International symbols

Introduction

Although this manual uses the SI units system. Outline of SI units system is described here.

Given here in under are an excerpt of the units that are related to this manual :

1. Etymology of SI Units
   English : International system of units
2. Construction of SI unit system



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Basic units

Table1-1

Quantities	Designation	Sign
Length	Meter	m
Mass	Kilogram	kg
Time	Second	s
Current	Ampere	A
Thermodynamic temperature	Kelvin	K
Gram molecule	Mol	mol
Luminous intensity	Candela	cd

Supplementary units

Table1-2

Quantities	Designation	Sign
Plain angle	Radian	rad
Solid angle	Steradian	sr

Derived units of basic units

Table1-3

Quantities	Designation	Sign
Area	Square meter	m^2
Volume	Cubic meter	m^3
Velocity	Meter per second	m/s
Acceleration	Meter per second/second	m/s^2
Density	Kilogram per cubic meter	kg/m^3

Derived units bearing peculiar designations

Table1-4

Quantities	Unit	Symbol	Formula
Frequency	Hertz	Hz	1Hz = 1/s
Force	Newton	N	$kg \cdot m/s^2$
Pressure and stress	Pascal	Pa	N/m^2
Energy, work and quantity of heat	Joule	J	N•m
Power	Watt	W	J/s
Quantity of electricity	Coulomb	C	A•s
Electric potential difference, voltage, and electromotive force	Volt	V	W/A

Quantities	Unit	Symbol	Formula
Quantity of static electricity and electric capacitance	Farad	F	C/V
Electric resistance	Ohm	Ω	V/A
Celcius temperature	Celcius degree or degree	°C	(t+273.15)K
Illuminance	Lux	lx	l m/m^2

Prefixes of SI

Table1-5

Prefix		Power
Designation	**Sign**	
Giga	G	10^9
Mega	M	10^6
Kilo	k	10^3
Hecto	h	10^2
Deca	da	10
Deci	d	10^{-1}
Centi	c	10^{-2}
Milli	m	10^{-3}
Micro	μ	10^{-6}
Nano	n	10^{-9}
Pico	p	10^{-12}

Unit conversion table

Table1-6

Quantities	JIS	SI	Remarks
Mass	kg	kg	
Force	kgf	N	**1 kgf = 9.807 N**
Torque	kgm	N•m	**1 kgm = 9.807 N·m**
Pressure	Kg/cm²	MPa	**1 Kg/cm² = 0.09807 MPa**
Motive power	PS	kW	**1PS = 0.7355 kW**
Revolution	RPM	min^{-1}	**1 RPM = 1 min^{-1}**

Safety rules

ATTENTION: *Do not operate or perform any maintenance on this machine until all instructions found in the OPERATOR'S MANUAL and this MANUAL have been thoroughly read and understood. Improper operation or maintenance of this machine may cause accidents and could result in serious injury or death.*
Always keep the manual in storage.
If it is missing or damaged, place an order with an authorized our Distributor for a replacement. If you have any questions, please consult an authorized our Distributor.

1. Most accidents, which occur during operation, are due to neglect of precautionary measures and safety rules. Sufficient care should be taken to avoid these accidents. Erroneous operation, lubrication or maintenance services are very dangerous and may cause injury or death of personnel. Therefore all precautionary measures, NOTES, DANGERS, WARNINGS and CAUTIONS contained in the manual and on the machine should be read and understood by all personnel before starting any work with or on the machine.
2. Operation, inspection, and maintenance should be carefully carried out, and safety must be given the first priority. Messages of safety are indicated with marks. The safety information contained in the manual is intended only to supplement safety codes, insurance requirements, local laws, rules and regulations.
3. Messages of safety appear in the manual and on the machine : All messages of safety are identified by either word of "DANGER", "WARNING" and "CAUTION".

1. Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury and is represented as follows:

2. Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury and is represented as follows:

3. Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against possible damage to the machine and its components and is represented as follows:
4. It is very difficult to forecast every danger that may occur during operation. However, safety can be ensured by fully understanding proper operating procedures for this machine according to methods recommended by Manufacturer.
5. While operating the machine, be sure to perform work with great care, so as not to damage the machine, or allow accidents to occur.
6. Continue studying the manual until all Safety, Operation and Maintenance procedures are completely understood by all persons working with the machine.

Safety precautions

ATTENTION: *The proper and safe lubrication and maintenance for this machine, recommended by Manufacturer, are outlined in the OPERATOR'S MANUAL for the machine.*
Improper performance of lubrication or maintenance procedures are dangerous and could result in injury or death. Read and understand the MANUAL before performing any lubrication or maintenance.

The serviceman or mechanic may be unfamiliar with many of the systems on this machine. This makes it important to use caution when performing service work. A knowledge of the system and or components is important before the removal or disassembly of any component.
Because of the size of some of the machine components, the serviceman or mechanic should check the weights noted in this manual. Use proper lifting procedures when removing any components.

The following is a list of basic precautions that must always be observed.

1. Read and understand all Warning plates and decal on the machine before Operating, Maintaining or Repairing this machine.
2. Always wear protective glasses and protective shoes when working around machines. In particular, wear protective glasses when using hammers, punches or drifts on any part of the machine or attachments. Use welders gloves, hood/goggles, apron and the protective clothing appropriate to the welding job being performed. Do not wear loose fitting or torn clothing. Remove all rings from fingers, loose jewelry, confine long hair and loose clothing before working on this machinery.
3. Disconnect the battery and hang a "Do Not Operate" tag in the Operators Compartment. Remove ignition keys.
4. If possible, make all repairs with the machine parked on a firm level surface. Block the machine so it does not roll while working on or under the machine. Hang a "Do Not Operate" tag in the Operators Compartment.
5. Do not work on any machine that is supported only by lift, jacks or a hoist. Always use blocks or jack stands, capable of supporting the machine, before performing any disassembly.

   ATTENTION: *Do not operate this machine unless you have read and understand the instructions in the OPERATOR'S MANUAL. Improper machine operation is dangerous and could result in injury or death.*
6. Relieve all pressure in air, oil or water systems before any lines, fittings or related items are disconnected or removed. Always make sure all raised components are blocked correctly and be alert for possible pressure when disconnecting any device from a system that utilizes pressure.
7. Lower the bucket, dozer, or other attachments to the ground before performing any work on the machine. If this cannot be done, make sure the bucket, dozer, ripper or other attachment is blocked correctly to prevent it from dropping unexpectedly.
8. Use steps and grab handles when mounting or dismounting a machine. Clean any mud or debris from steps, walkways or work platforms before using. Always face to the machine when using steps, ladders and walkways. When it is not possible to use the designed access system, provide ladders, scaffolds, or work platforms to perform safe repair operations.
9. To avoid back injury, use a hoist when lifting components which weigh 20kg (45lbs) or more. Make sure all chains, hooks, slings, etc., are in good condition and are the correct capacity. Be sure hooks are positioned correctly. Lifting eyes are not to be side loaded during a lifting operation.
10. To avoid burns, be alert for hot parts on machines which have just been stopped and hot fluids in lines, tubes and compartments.
11. Be careful when removing cover plates. Gradually back off the last two capscrews or nuts located at opposite ends of the cover or device and carefully pry cover loose to relieve any spring or other pressure, before removing the last two capscrews or nuts completely.
12. Be careful when removing filler caps, breathers and plugs on the machine. Hold a rag over the cap or plug to prevent being sprayed or splashed by liquids under pressure. The danger is even greater if the machine has just been stopped because fluids can be hot.
13. Always use the proper tools that are in good condition and that are suited for the job at hand. Be sure you understand how to use them before performing any service work.
14. Reinstall all fasteners with the same part number. Do not use a lesser quality fastener if replacements are necessary.
15. Repairs which require welding should be performed only with the benefit of the appropriate reference information and by personnel adequately trained and knowledgeable in welding procedures. Determine type of metal

being welded and select correct welding procedure and electrodes, rods or wire to provide a weld metal strength equivalent at least to that of the parent metal. Make sure to disconnect battery before any welding procedures are attempted.

16. Do not damage wiring during removal operations. Reinstall the wiring so it is not damaged nor will be damaged in operation of the machine by contacting sharp corners, or by rubbing against some object or hot surface. Do not connect wiring to a line containing fluid.
17. Be sure all protective devices including guards and shields are properly installed and functioning correctly before starting a repair. If a guard or shield must be removed to perform the repair work, use extra caution and replace the guard or shield after repair is completed.
18. The maintenance and repair work while holding the bucket raised is dangerous due to the possibility of a falling attachment. Don't fail to lower the attachment and place the bucket to the ground before starting the work.
19. Loose or damaged fuel, lubricant and hydraulic lines, tubes and hoses can cause fires. Do not bend or strike high pressure lines or install ones which have been bent or damaged. Inspect lines, tubes and hoses carefully. Do not check for leaks with your hands. Very small (pinhole) leaks can result in a high velocity oil stream that will be invisible close to the hose. This oil can penetrate the skin and cause personal injury. Use card-board or paper to locate pinhole leaks.
20. Tighten connections to the correct torque. Make sure that all heat shields, clamps and guards are installed correctly to avoid excessive heat, vibration or rubbing against other parts during operation. Shields that protect against oil spray onto hot exhaust components in event of a line, tube or seal failure must be installed correctly.
21. Do not operate a machine if any rotating part is damaged or contacts any other part during operation. Any high speed rotating component that has been damaged or altered should be checked for balance before reusing.
22. Be careful when servicing or separating the tracks (crawlers). Chips can fly when removing or installing a track (crawlers) pin. Wear safety glasses and long sleeve protective clothing. Tracks (crawlers) can unroll very quickly when separated. Keep away from front and rear of machine. The machine can move unexpectedly when both tracks (crawlers) are disengaged from the sprockets. Block the machine to prevent it from moving.

Personal safety

PREPARATION BEFORE DISASSEMBLING

Knowledge of operating procedure

Read Operator's Manual carefully to understand the operating procedure.

Cleaning machines

Clean machines of soil, mud, and dust before carrying into the service shop. Carrying a soiled machine into the service shop, causes making less efficient work and damage of parts.

Inspecting machines

Confirm the disassembling section before starting work, determine the disassembly procedure taking the conditions in work shop into account, and request to procure necessary parts in advance.

Recording

Record the following items to keep contact and prevent malfunction from recurring:

1. Inspecting date, place
2. Model name, serial number and record on hourmeter
3. Trouble condition, place, cause
4. Visible oil leak, water leak and damage
5. Clogging of filters, oil level, oil quality, oil contamination and looseness.
6. Examine the problems on the basis of monthly operation rate with the last inspection date and records on hourmeter.

Arrangement and cleaning in service shop

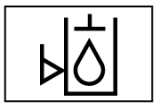
1. Tools required for repair work.
2. Prepare the places to put the disassembled parts.
3. Prepare oil pans for leaking oil, etc.

SAFETY WHEN DISASSEMBLING AND ASSEMBLING

Safety

1. Wear appropriate clothing, safety shoes, safety helmet, goggles, and clothes with long sleeves.
2. Attach “Don’t operate” tag to control lever, and begin a meeting before starting the work.
3. Before starting inspection and maintenance stop the engine.
4. Confirm the position of first-aid kit and fire extinguisher, and also where to make contact for emergency measure and ambulance to prepare for accidents and fire.
5. Choose a hard, lever and safe place, and put attachment on the ground without fail.
6. Use hoist, etc. to remove parts of heavy weight (**23 kg** (**51 lb**) or more).
7. Use proper tools, and change or repair defective tools.
8. Machine and attachment required to work in the lifting condition should be supported with supports or blocks securely.

DISASSEMBLING AND ASSEMBLING HYDRAULIC EQUIPMENT



Removing hydraulic equipment assy

1. Before removing pipes, release the pressure of hydraulic oil tank, or open the cover on the return side to tank, and take out the filter.
2. Drain the oil in the removed pipes into pan to prevent the oil from spilling on the ground.
3. Pipes with plugs or caps to prevent oil leaking, entry of dust, etc.
4. Clean the outside surface of equipment, etc. before disassembling, and drain hydraulic oil and gear oil before putting them on working bench.

Disassembling hydraulic equipment

1. Since performance and function of hydraulic equipment after disassembly and assembly results in immunity from responsibility on the manufacture’s side, disassembly, assembly and modification without permission are strictly prohibited.
2. If it is unavoidably necessary to disassemble and modify, it should be carried out by experts or personnel qualified through service training.
3. Make match mark on parts for reassembling.
4. Before disassembling, read disassembling instruction in advance, and determine if the disassembly and assembly are permitted or not.
5. For parts which are required to use jig and tools, don’t fail to use the specified jig and tools.
6. For parts which can not be removed in the specified procedure, never force removal. First check for the cause.
7. The removed parts should be put in order and tagged so as to install on proper places without confusion.
8. For common parts, pay attention to the quantity and places.

Inspecting parts

1. Check that the disassembled parts are free from adherence, interference and uneven working face.
2. Measure the wear of parts and clearance, and record the measured values.

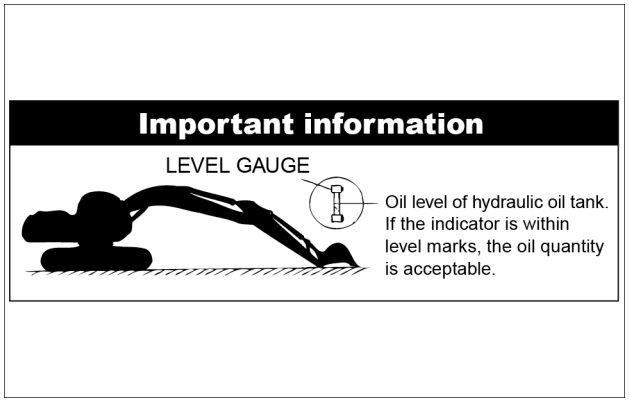
3. If an abnormality is detected, repair or replace the parts.

Reassembling hydraulic equipment

1. During the parts cleaning, ventilate the room.
2. Before assembly, clean parts roughly first, and then completely.
3. Remove adhering oil by compressed air, and apply hydraulic oil or gear oil, and then assemble them.
4. Replace the removed O-ring, back-up rings and oil seal with new ones, and apply grease oil on them before assembling.
5. Removes dirt and water on the surface on which liquid sealant are applied, decrease them, and apply liquid sealant on them.
6. Before assembling, remove rust preventives on new parts.
7. Use special tools to fit bearings, bushing and oil seal.
8. Assemble parts matching to the marks.
9. After completion, check that there is no omission of parts.

Installing hydraulic equipment

1. Confirm hydraulic oil and lubrication oil.
2. Air release is required in the following cases:
   A. Change of hydraulic oil
   B. Replacement of parts on suction pipe side
   C. Removing and attaching hydraulic pump
   D. Removing and attaching swing motor
   E. Removing and attaching travel motor
   F. Removing and attaching hydraulic cylinder
3. For air bleed of hydraulic pump and swing motor, loosen drain plug on the upper part, start engine, and run in low idling, then bleed air until hydraulic oil is comes out. After completion of comes, tighten plug securely.
4. For air bleed of travel motor and hydraulic cylinder, starts engine and operate it for **10 min** or more at no load and low speed.
5. Air in pilot circuit can be bleed out by only operating digging, swing and traveling motions thoroughly.
6. Check hydraulic oil level.
   Move attachments to hydraulic oil check position, and check hydraulic oil level of tank. Refill oil if the oil level is lower than the specified level.
   How to check oil level of hydraulic oil tank.



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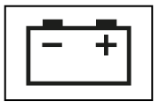
ATTENTION: *If hydraulic oil and lubricating oil are not filled and also air bleed is not performed, the hydraulic equipment may be damaged.*

ATTENTION: *For cylinder, don't move it to the stroke end at beginning.*

ELECTRICAL EQUIPMENT



1. The disassembly of electrical equipment is not allowed.
2. Handle equipment with care so as not to drop it or bump it.
3. Connector should be removed by unlocking while holding the connector.
   Never stress in tension to the caulked section by pulling wire.
4. Check that connector is connected and locked completely.
5. Engine key Off before removing and connecting connector.
6. Engine key Off before touching terminals of starter and alternator.
7. Remove battery grounding terminal before beginning work close to battery and battery relay with tools.
8. Wash machine with care so as not to splash water on electrical equipment and connector.
9. When water has entered in the waterproofed connector, the removing of water is not easy. So check the removed waterproofed connector with care to protect it from entry of water. If moisture adheres on it, dry it completely before connecting.

⚠ 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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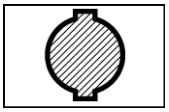
HYDRAULIC PARTS



O-ring

- Check that O-ring is free from flaw and has elasticity before fitting.
- Even if the size of O-ring is equal, the usage differs, for example in dynamic and static sections, the rubber hardness also differs according to the pressure force, and also the quality differs depending on the materials to be seated. So, choose proper O-ring.
- Fit O-ring so as to be free from distortion and bend.
- Floating seal should be put in pairs.

Flexible hose (F hose)

- Even if the connector and length of hose are the same, the parts differ according to the withstanding pressure. Use proper parts.
- Tighten it to the specified torque, and check that it is free from twist, over tension, interference, and oil leak.

WELD REPAIR

1. The weld repair should be carried out by qualified personnel in the specified procedure after disconnecting the grounding cable of battery. If the grounding cable is not disconnected, the electrical equipment may be damaged.
2. Remove parts which may cause fire due to the entry of spark beforehand.
3. Repair attachments which are damaged, giving particular attention to the plated section of piston rod to protect it from sparks, and don't fail to cover the section with flame-proof clothes.

ENVIRONMENTAL ISSUES

1. Engine should be started and operated in the place where air can be sufficiently ventilated.
2. Waste disposal
   The following parts follows the regulation:
   Waste oil, waste container and battery.
3. Precautions for handling hydraulic oil.
   Hydraulic oil may cause inflammation of eyes.
   Wear goggles to protect eyes on handling it.
   - When it has got in eyes.
     Wash eyes with water until the stimulus is gone.
   - When it was swallowed.
     Don’t force him to vomit it, but immediately receive medical treatment.
   - When it has adhered on skin.
     Wash with soap and water.
4. Others
   For spare parts, grease and oil, use NEW HOLLAND CONSTRUCTION genuine ones.

Torque - Tightening torques for capscrews and nuts

Table “Metric coarse thread (not plated)” and table “Metric fine thread (not plated)” indicate tightening torques applicable to cases where no special note is given.

Over tightening of bolts may result in a twist-off and a fracture under load.

Insufficient tightening may lead to a loosening or loss of bolts. Always tighten bolts to proper torques.

Tightening torque for metric coarse threads (not plated)

Classification	4.8T		7T		10.9T	
Nominal size	No lubrication	Oil lubrication	No lubrication	Oil lubrication	No lubrication	Oil lubrication
M6 x 1	3.9 - 4.9 N·m (2.88 - 3.6 lb ft)	3.3 - 4.1 N·m (2.4 - 3.0 lb ft)	8.6 - 10.6 N·m (6.3 - 7.8 lb ft)	7.3 - 8.9 N·m (5.4 - 6.6 lb ft)	15.6 - 19.2 N·m (11.5 - 14.2 lb ft)	13.2 - 16.2 N·m (9.7 - 11.9 lb ft)
M8 x 1.25	9.6 - 11.8 N·m (7.1 - 8.7 lb ft)	8.1 - 9.9 N·m (6.0 - 7.3 lb ft)	21.5 - 25.5 N·m (15.9 - 18.8 lb ft)	17.6 - 21.6 N·m (13.0 - 15.9 lb ft)	38.3 - 46.1 N·m (28.2 - 34.0 lb ft)	31.4 - 39.2 N·m (23.2 - 28.9 lb ft)
M10 x 1.5	19.6 - 23.6 N·m (14.5 - 17.4 lb ft)	16.1 - 19.7 N·m (11.9 - 14.5 lb ft)	41.2 - 51 N·m (30.4 - 37.6 lb ft)	35.3 - 43.1 N·m (26.0 - 31.8 lb ft)	74.6 - 92.2 N·m (55.0 - 68.0 lb ft)	63.7 - 77.5 N·m (47.0 - 57.2 lb ft)
M12 x 1.75	32.4 - 40.2 N·m (23.9 - 29.6 lb ft)	28.5 - 34.3 N·m (21.0 - 25.3 lb ft)	71.6 - 87.2 N·m (52.8 - 64.3 lb ft)	59.8 - 73.6 N·m (44.1 - 54.3 lb ft)	128 - 158 N·m (94.4 - 116.5 lb ft)	109 - 133 N·m (80.4 - 98.1 lb ft)
M14 x 2	52 - 63.8 N·m (38.4 - 47.1 lb ft)	44.1 - 53.9 N·m (32.5 - 39.8 lb ft)	113 - 139 N·m (83.3 - 102.5 lb ft)	96 - 116 N·m (70.8 - 85.6 lb ft)	206 - 246 N·m (151.9 - 181.4 lb ft)	172 - 210 N·m (126.9 - 154.9 lb ft)
M16 x 2	79.5 - 97.1 N·m (58.6 - 71.6 lb ft)	67.6 - 81.4 N·m (49.9 - 60.0 lb ft)	171 - 211 N·m (126.1 - 155.6 lb ft)	145 - 177 N·m (106.9 - 130.5 lb ft)	304 - 382 N·m (224.2 - 281.7 lb ft)	255 - 313 N·m (188.1 - 230.9 lb ft)
M18 x 2.5	110 - 134 N·m (81.1 - 98.8 lb ft)	93 - 113 N·m (68.6 - 83.3 lb ft)	236 - 294 N·m (174.1 - 216.8 lb ft)	206 - 246 N·m (151.9 - 181.4 lb ft)	432 - 530 N·m (318.6 - 390.9 lb ft)	363 - 441 N·m (267.7 - 325.3 lb ft)
M20 x 2.5	155 - 189 N·m (114.3 - 139.3 lb ft)	130 - 158 N·m (95.9 - 116.5 lb ft)	334 - 412 N·m (246.3 - 303.9 lb ft)	285 - 343 N·m (210.2 - 253.0 lb ft)	598 - 736 N·m (441.1 - 542.8 lb ft)	500 - 618 N·m (368.8 - 455.8 lb ft)
M22 x 2.5	206 - 246 N·m (151.9 - 181.4 lb ft)	172 - 212 N·m (126.9 - 156.4 lb ft)	451 - 549 N·m (332.6 - 404.9 lb ft)	383 - 461 N·m (282.5 - 340.0 lb ft)	814 - 990 N·m (600.4 - 730.2 lb ft)	677 - 833 N·m (499.3 - 614.4 lb ft)
M24 x 3	265 - 323 N·m (195.5 - 238.2 lb ft)	206 - 264 N·m (151.9 - 194.7 lb ft)	568 - 706 N·m (418.9 - 520.7 lb ft)	471 - 569 N·m (347.4 - 419.7 lb ft)	1042 - 1278 N·m (768.5 - 942.6 lb ft)	843 - 1039 N·m (621.8 - 766.3 lb ft)
M27 x 3	392 - 470 N·m (289.1 - 346.7 lb ft)	314 - 392 N·m (231.6 - 289.1 lb ft)	843 - 1039 N·m (621.8 - 766.3 lb ft)	687 - 843 N·m (506.7 - 621.8 lb ft)	1533 - 1867 N·m (1130.7 - 1377.0 lb ft)	1233 - 1507 N·m (909.4 - 1111.5 lb ft)
M30 x 3.5	529 - 647 N·m (390.2 - 477.2 lb ft)	441 - 539 N·m (325.3 - 397.5 lb ft)	1158 - 1412 N·m (854.1 - 1041.4 lb ft)	971 - 1187 N·m (716.2 - 875.5 lb ft)	2065 - 2535 N·m (1523.1 - 1869.7 lb ft)	1744 - 2136 N·m (1286.3 - 1575.4 lb ft)
M33 x 3.5	716 - 872 N·m (528.1 - 643.2 lb ft)	598 - 736 N·m (441.1 - 542.8 lb ft)	1549 - 1903 N·m (1142.5 - 1403.6 lb ft)	1304 - 1598 N·m (961.8 - 1178.6 lb ft)	2796 - 3424 N·m (2062.2 - 2525.4 lb ft)	2345 - 2875 N·m (1729.6 - 2120.5 lb ft)
M36 x 4	932 - 1128 N·m (687.4 - 832.0 lb ft)	775 - 951 N·m (571.6 - 951 lb ft)	2000 - 2452 N·m (1475.1 - 1808.5 lb ft)	1677 - 2049 N·m (1236.9 - 1511.3 lb ft)	3608 - 4412 N·m (2661.1 - 3254.1 lb ft)	3027 - 3693 N·m (2232.6 - 2723.8 lb ft)

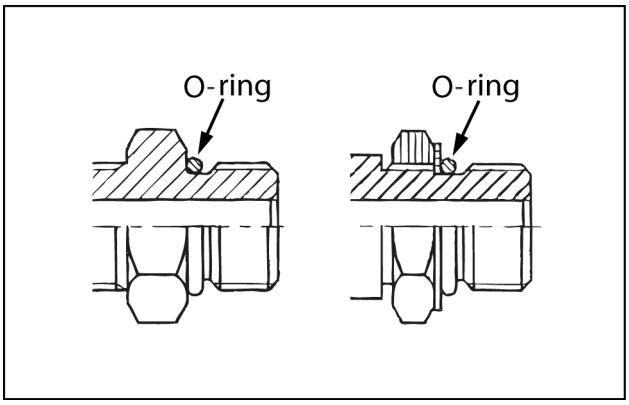
Tightening torques for metric fine threads (not plated)

Classification	4.8T		7T		10.9T	
Nominal size	No lubrication	Oil lubrication	No lubrication	Oil lubrication	No lubrication	Oil lubrication
M8 x 1	10.2 - 12.4 N·m (7.5 - 9.1 lb ft)	8.5 - 10.5 N·m (6.3 - 7.7 lb ft)	22.5 - 26.5 N·m (16.6 - 19.5 lb ft)	18.6 - 22.6 N·m (13.7 - 16.7 lb ft)	40.2 - 48 N·m (29.6 - 35.4 lb ft)	33.4 - 41.2 N·m (24.6 - 30.4 lb ft)
M10 x 1.25	20.6 - 24.6 N·m (15.2 - 18.1 lb ft)	16.8 - 20.6 N·m (12.4 - 15.2 lb ft)	43.2 - 53 N·m (31.9 - 39.1 lb ft)	37.3 - 45.1 N·m (27.5 - 33.3 lb ft)	78.5 - 96.1 N·m (57.9 - 70.9 lb ft)	66.6 - 80.4 N·m (49.1 - 59.3 lb ft)
M12 x 1.25	35.3 - 43.1 N·m (26.0 - 31.8 lb ft)	30.4 - 36.2 N·m (22.4 - 26.7 lb ft)	76.5 - 94.1 N·m (56.4 - 69.4 lb ft)	64.7 - 78.5 N·m (47.7 - 57.9 lb ft)	138 - 170 N·m (101.8 - 125.4 lb ft)	116 - 142 N·m (85.6 - 104.7 lb ft)
M16 x 1.5	83.4 - 101 N·m (61.5 - 74.5 lb ft)	69.7 - 85.3 N·m (51.4 - 62.9 lb ft)	176 - 216 N·m (129.8 - 159.3 lb ft)	152 - 186 N·m (112.1 - 137.2 lb ft)	324 - 402 N·m (239.0 - 296.5 lb ft)	275 - 333 N·m (202.8 - 245.6 lb ft)
M20 x 1.5	167 - 205 N·m (123.2 - 151.2 lb ft)	139 - 171 N·m (102.5 - 126.1 lb ft)	363 - 441 N·m (267.7 - 325.3 lb ft)	304 - 362 N·m (224.2 - 267.0 lb ft)	657 - 795 N·m (484.6 - 586.4 lb ft)	549 - 667 N·m (404.92 - 491.95 lb ft)
M24 x 2	285 - 343 N·m (210.2 - 253.0 lb ft)	236 - 294 N·m (174.1 - 216.8 lb ft)	617 - 755 N·m (455.1 - 556.86 lb ft)	510 - 628 N·m (376.16 - 463.19 lb ft)	1122 - 1358 N·m (827.54 - 1001.61 lb ft)	932 - 1128 N·m (687.41 - 831.97 lb ft)
M30 x 2	578 - 696 N·m (426.31 - 513.34 lb ft)	481 - 579 N·m (354.77 - 427.05 lb ft)	1253 - 1527 N·m (924.17 - 1126.3 lb ft)	1039 - 1275 N·m (766.33 - 940.39 lb ft)	2245 - 2755 N·m (1655.83 - 2031.98 lb ft)	1874 - 2286 N·m (1382.19 - 1686.07 lb ft)
M33 x 2	765 - 941 N·m (564.24 - 694.05 lb ft)	636 - 776 N·m (469.09 - 572.35 lb ft)	1674 - 2046 N·m (1234.68 - 1509.05 lb ft)	1395 - 1705 N·m (1028.9 - 1257.54 lb ft)	3016 - 3684 N·m (2224.49 - 2717.18 lb ft)	2515 - 3065 N·m (1854.97 - 2260.63 lb ft)
M36 x 3	962 - 1178 N·m (709.53 - 868.85 lb ft)	804 - 980 N·m (593 - 722.81 lb ft)	2104 - 2556 N·m (1551.83 - 1885.21 lb ft)	1744 - 2136 N·m (1286.31 - 1575.4 lb ft)	3778 - 4622 N·m (2786.5 - 3409.01 lb ft)	3147 - 3853 N·m (2321.11 - 2841.83 lb ft)

Torque - Tightening torque for hose and fitting

Joint (O-ring type)

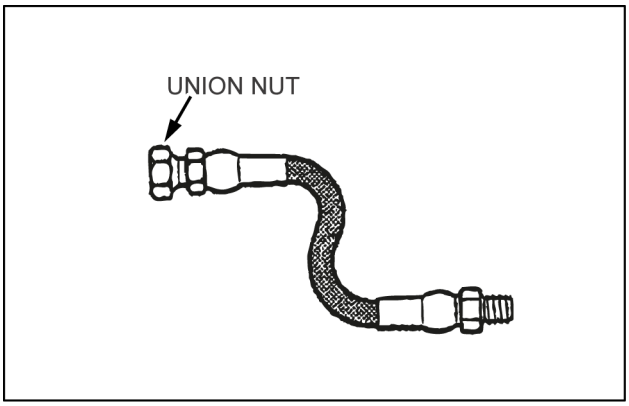
Size	Wrench	Tightening torque
PF 1/8	14 mm	15 - 19 N·m (11 - 14 lb ft)
PF 1/4	19 mm	34 - 38 N·m (25 - 28 lb ft)
PF 3/8	22 mm	69 - 79 N·m (51 - 58 lb ft)
PF 1/2	27 mm	98.2 - 117.8 N·m (72.4 - 86.9 lb ft)
PF 3/4	36 mm	152.2 - 171.8 N·m (112.3 - 126.7 lb ft)
PF 1	41 mm	245.2 - 264.8 N·m (180.9 - 195.3 lb ft)



TULI12EXM0034AB 1

Hydraulic hose (30° flare type)

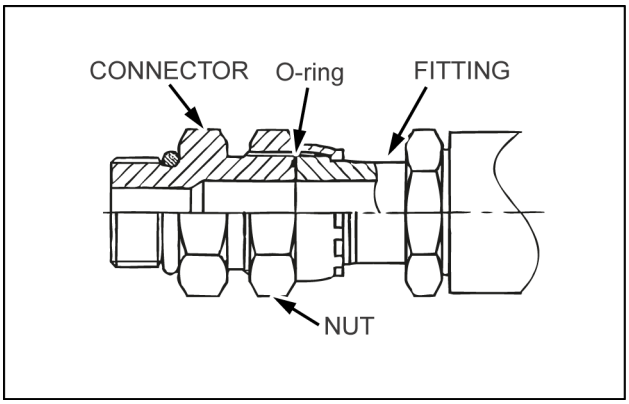
Size	Wrench	Tightening torque
PF 1/8	17 mm	13 - 17 N·m (10 - 13 lb ft)
PF 1/4	19 mm	24.1 - 33.9 N·m (18 - 25 lb ft)
PF 3/8	22 mm	44.1 - 53.9 N·m (32.5 - 39.8 lb ft)
PF 1/2	27 mm	73.1 - 82.9 N·m (53.9 - 61.1 lb ft)
PF 3/4	36 mm	108.2 - 127.8 N·m (79.8 - 94.3 lb ft)
PF 1	41 mm	122 - 152 N·m (90 - 112 lb ft)



TULI12EXM0035AB 2

Joint (ors type)

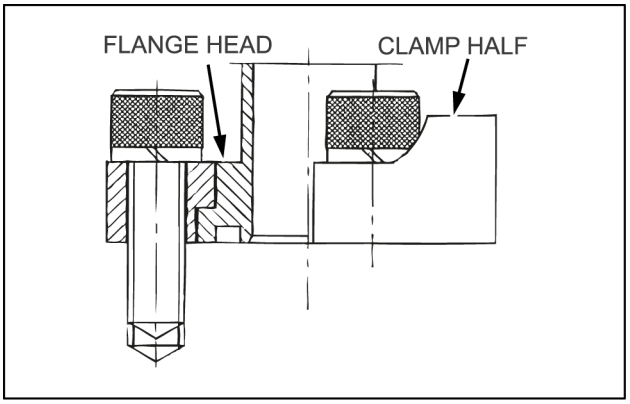
Unified screw size	Opposing flats	Tightening Torque
1-14 UNS	30, 32	123 - 151 N·m (91 - 111 lb ft)
1 3 / 16-12 UN	36	159 - 195 N·m (117 - 144 lb ft)
	41	185 - 227 N·m (136 - 167 lb ft)
1 7/16-12 UN	41	185 - 227 N·m (136 - 167 lb ft)
	46	185 - 227 N·m (136 - 167 lb ft)



TULI12EXM0036AB 3

Split flange

Tightening torque				
Size	Standard pressure series 20.6 MPa (2988.0 psi)	Bolt size	Hi pressure series 41.2 MPa (5976.1 psi)	Bolt size
PF 3/4	28.3 - 39.5 N·m (20.9 - 29.1 lb ft)	M10	33.9 - 45.1 N·m (25.0 - 33.3 lb ft)	M10
PF 1	36.8 - 48 N·m (27.1 - 35 lb ft)	M10	56.6 - 67.8 N·m (41.7 - 50.0 lb ft)	M12
PF1 1/4	48 - 62.2 N·m (35 - 45.9 lb ft)	M10	84.9 - 101.7 N·m (62.6 - 75.0 lb ft)	M14
PF1 1/2	62.2 - 79 N·m (45.9 - 58 lb ft)	M12	158 - 180 N·m (117 - 133 lb ft)	M16
PF 2	73.5 - 90.3 N·m (54.2 - 66.6 lb ft)	M12	271 - 293 N·m (200 - 216 lb ft)	M20



TULI12EXM0037AB 4

Torque - Tightening torques for nuts and sleeves

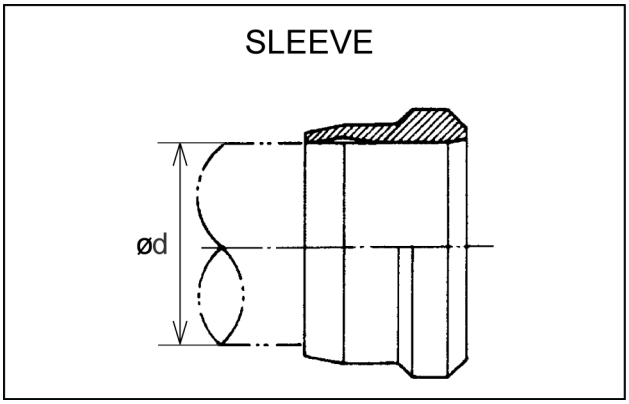
Table below indicates standard tightening torques applicable to cases where no particular note is given.

Overtightening or under tightening of nuts and sleeves in FLARELESS JOINT may develop oil leaks through pipe connections.

Always tighten nuts and sleeves to proper torques.

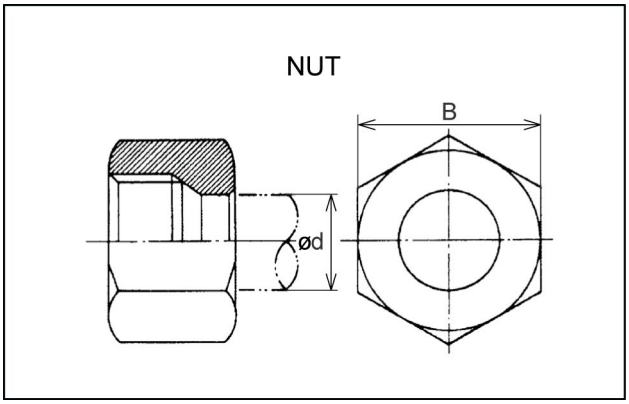
Manufac-turer's name	Working pressure	Tube size OD × thickness	Opposing flats (HEX)	Tightening torque
Nippon A.M.C	29.4 MPa (4264 psi)	ø 10 mm (0.394 in) × 1.5 mm (0.059 in)	19 mm	39.2 - 58.8 N·m (28.9 - 43.4 lb ft)
		ø 15 mm (0.591 in) × 2.0 mm (0.079 in)	27 mm	106 - 130 N·m (78.2 - 95.9 lb ft)
		ø 18 mm (0.709 in) × 2.5 mm (0.098 in)	32 mm	132 - 162 N·m (97.4 - 119.5 lb ft)
		ø 22 mm (0.866 in) × 3.0 mm (0.118 in)	36 mm	194 - 238 N·m (143.1 - 175.5 lb ft)
		ø 28 mm (1.102 in) × 4.0 mm (0.157 in)	41 mm	248 - 302 N·m (182.9 - 222.7 lb ft)
Ihara koatu	29.4 MPa (4264 psi)	ø 35 mm (1.378 in) × 5.0 mm (0.197 in)	55 mm	397 - 485 N·m (292.8 - 357.7 lb ft)

Tube size ød	Parts No.	
	Ihara Koatu	Nippon A.M.C.
6 mm (0.2 in)	ZF93S06000	–
8 mm (0.3 in)	ZF93S08000	–
10 mm (0.4 in)	ZF93S10000	ZA93S10000
12 mm (0.5 in)	ZF93S12000	–
15 mm (0.6 in)	ZF93S15000	ZA93S15000
18 mm (0.7 in)	ZF93S18000	ZA93S18000
22 mm (0.9 in)	ZF93S22000	ZA93S22000
28 mm (1.1 in)	ZF93S28000	ZA93S28000
32 mm (1.3 in)	ZF93S32000	–
35 mm (1.4 in)	ZF93S35000	ZA93S35000
38 mm (1.5 in)	ZF93S38000	–



TULI12EXN1144AA 1

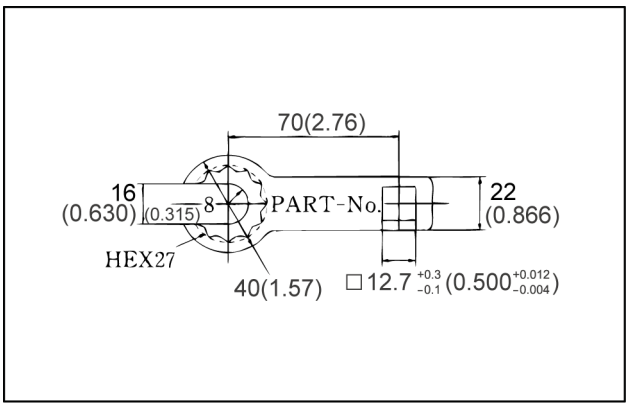
Tube size ød	Opposing flats (HEX)	Parts No.	
		Ihara Koatu	Nippon A.M.C.
6 mm (0.2 in)	14 mm (0.6 in)	ZF93N06000	–
8 mm (0.3 in)	17 mm (0.7 in)	ZF93N08000	–
10 mm (0.4 in)	19 mm (0.7 in)	ZF93N10000	ZA93N10000
12 mm (0.5 in)	22 mm (0.9 in)	ZF93N12000	–
15 mm (0.6 in)	27 mm (1.1 in)	ZF93N15000	ZA93N15000
18 mm (0.7 in)	32 mm (1.3 in)	ZF93N18000	ZA93N18000
22 mm (0.9 in)	36 mm (1.4 in)	ZF93N22000	ZA93N22000
28 mm (1.1 in)	41 mm (1.6 in)	ZF93N28000	ZA93N28000
32 mm (1.3 in)	50 mm (2.0 in)	ZF93N32000	–
35 mm (1.4 in)	55 mm (2.17 in)	ZF93N35000	ZA93N35000
38 mm (1.5 in)	60 mm (2.4 in)	ZF93N38000	–



TULI12EXN1145AA 2

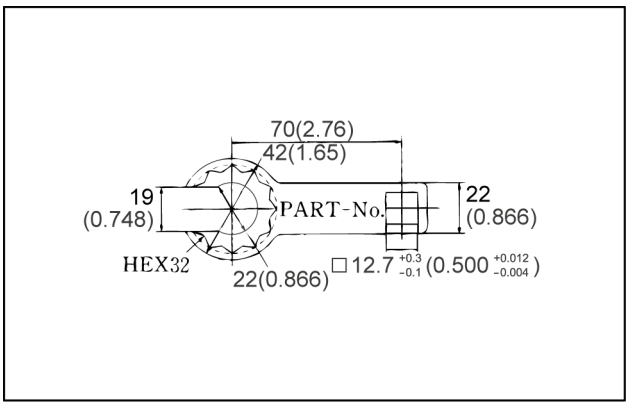
Special tools - Special spanner for tube

Applicable tube diameter	Part No.	HEX
15 mm (0.591 in)	2421T160	27 mm



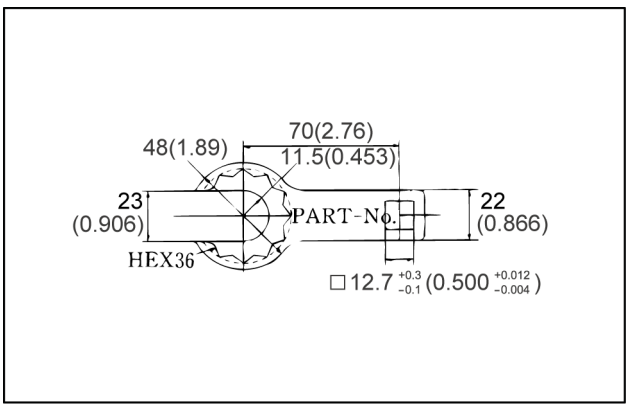
TULI12EXM0049AA 1

Applicable tube diameter	Part No.	HEX
18 mm (0.709 in)	2421T138	32 mm



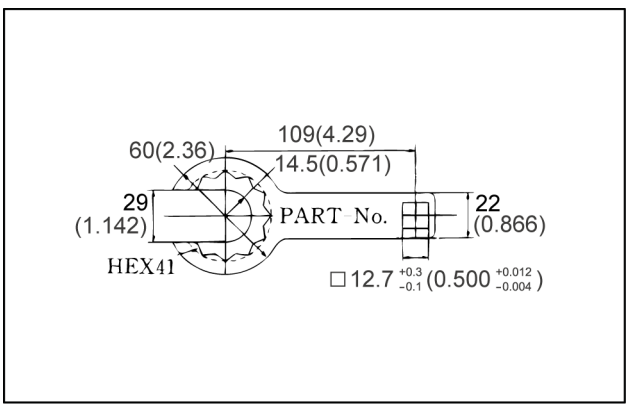
TULI12EXM0050AA 2

Applicable tube diameter	Part No.	HEX
22 mm (0.866 in)	2421T130	36 mm



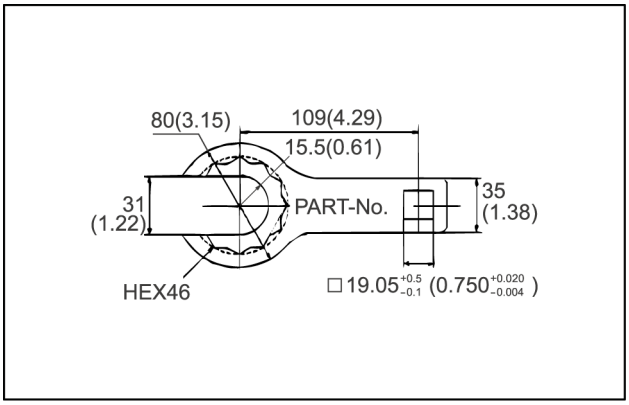
TULI12EXM0051AA 3

Applicable tube diameter	Part No.	HEX
28 mm (1.102 in)	2421T115	41 mm



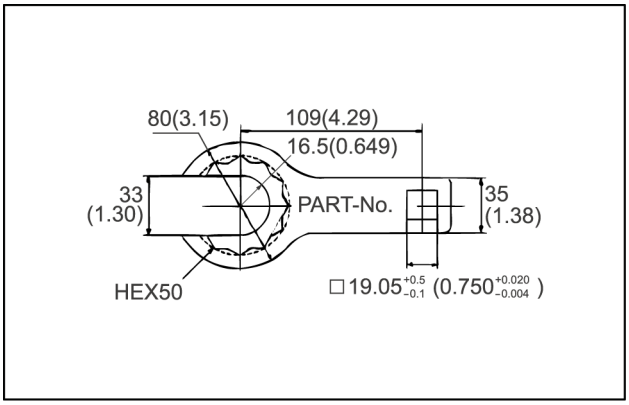
TULI12EXM0052AA 4

Applicable tube diameter	Part No.	HEX
28 mm (1.102 in)	2421T231	46 mm



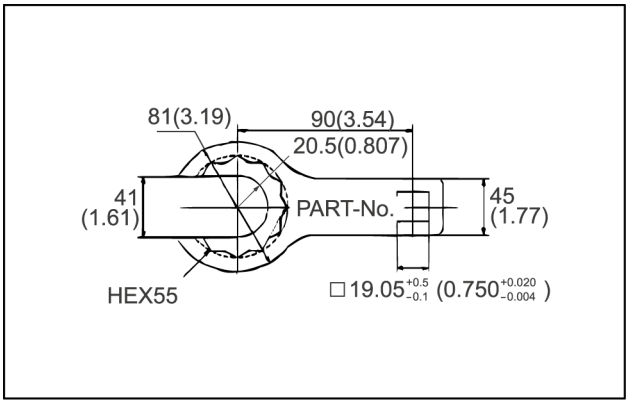
TULI12EXM0053AA 5

Applicable tube diameter	Part No.	HEX
32 mm (1.260 in)	2421T232	50 mm



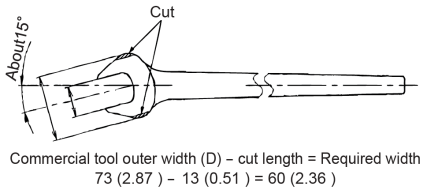
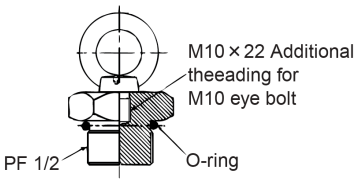
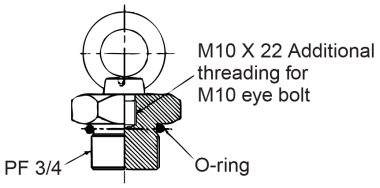
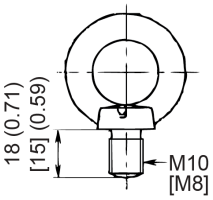
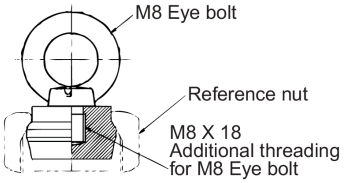
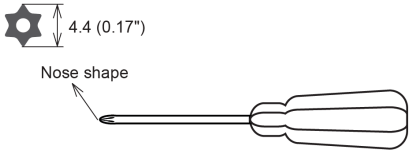
TULI12EXM0054AA 6

Applicable tube diameter	Part No.	HEX
35 mm (1.378 in)	2421T314	55 mm



TULI12EXM0055AA 7

Special tools

No.	Tools name	Tools No.	Shape	Use
1	Spanner Nominal **B : 32**	**ZT12A32000**		Swing motor A, B port
2	Plug **PF 1/2**	**ZE72X08000**		For slinging the pump
3	Plug **PF 3/4**	**ZE72X12000**		For slinging the swing motor
4	Eye bolt **M10 x 18** [**M8 x 15**]	**ZS91C01000** **[ZS91C00800]**		For slinging the swing & Flare hose
5	Plug (Nominal tube dia. 22) Reference Eye bolt Nut	**ZF83P22000** **ZS91C00800** **ZF93N22000**		Flare hose
6	Torx driver (with tamper proof) **T25** (for **M5**)			For instrument R.H cover

Basic instructions - Application of screw locking compound and sealing compound

For general use

Service	Manufacturer		Features
Screw locking compound	**LOCTITE® 242**	**Three-Bond 1360K**	Low strength
	LOCTITE® 262	**Three-Bond 1374**	Middle strength
	LOCTITE® 271	**Three-Bond 1305**	High strength
Sealing compound	**LOCTITE® 515**	**Three-Bond 1215**	Sealing

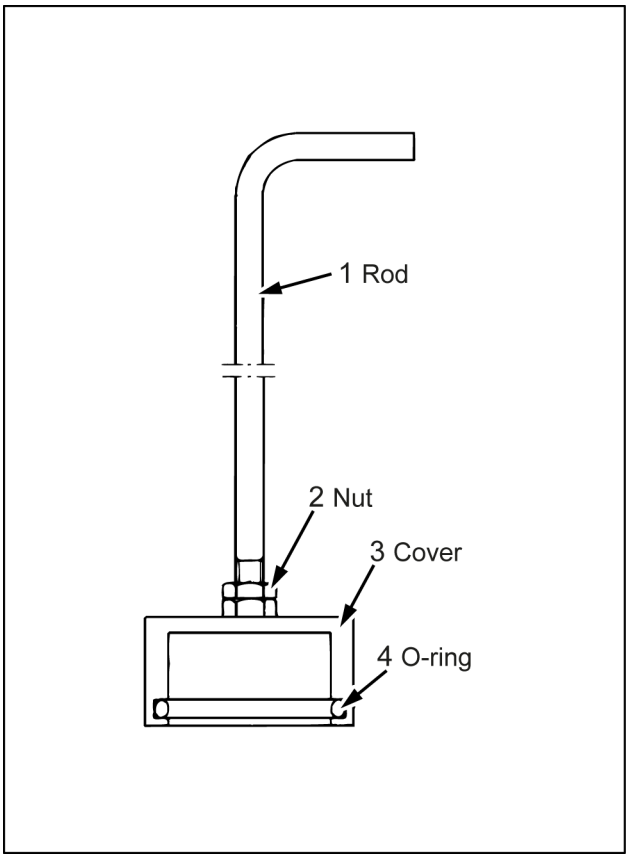
For specific location

No.	Use	Manufac-turer	Name	Equivalent	Applicable
1.	Sealing compound & adhesive	Three-bond	**Three-Bond 1901**	Manufacturer: Loctite Anti-seizure	Cylinder
			Three-Bond 1215 gray	**Loctite 5699**	Swing motor
			Three-Bond 1211white	**Loctite 5301J**	Swing motor
			Three-Bond 1303B	**Loctite 211**	Main pump
		Loctite	**LOCTITE® 222**	**Three-bond 1344N**	Main pump
			LOCTITE® 277	**Three-bond 1307N**	Pilot valve
		Loctite	**Parmatex 98D**	**Three-Bond 1121**	Hydraulic oil tank: Hose
		Sumitomo Chemical co., Ltd.	**Cyano bond PO-1**		Swing bearing : Seal
		Shell Petroleum	**Shell alvania EP2**	New **Molyknock grease 2**	Swing bearing grease bath

Special tools - Suction stopper

Components

No.	Name	Parts no.	Qty.
	Suction stopper assy.	**24100P978F4**	
1	Rod	**2420T4660D1**	1
2	Nut	**ZN16C08007**	1
3	Cover	**2414T2123D4**	1
4	O-ring	**45Z91D8**	1



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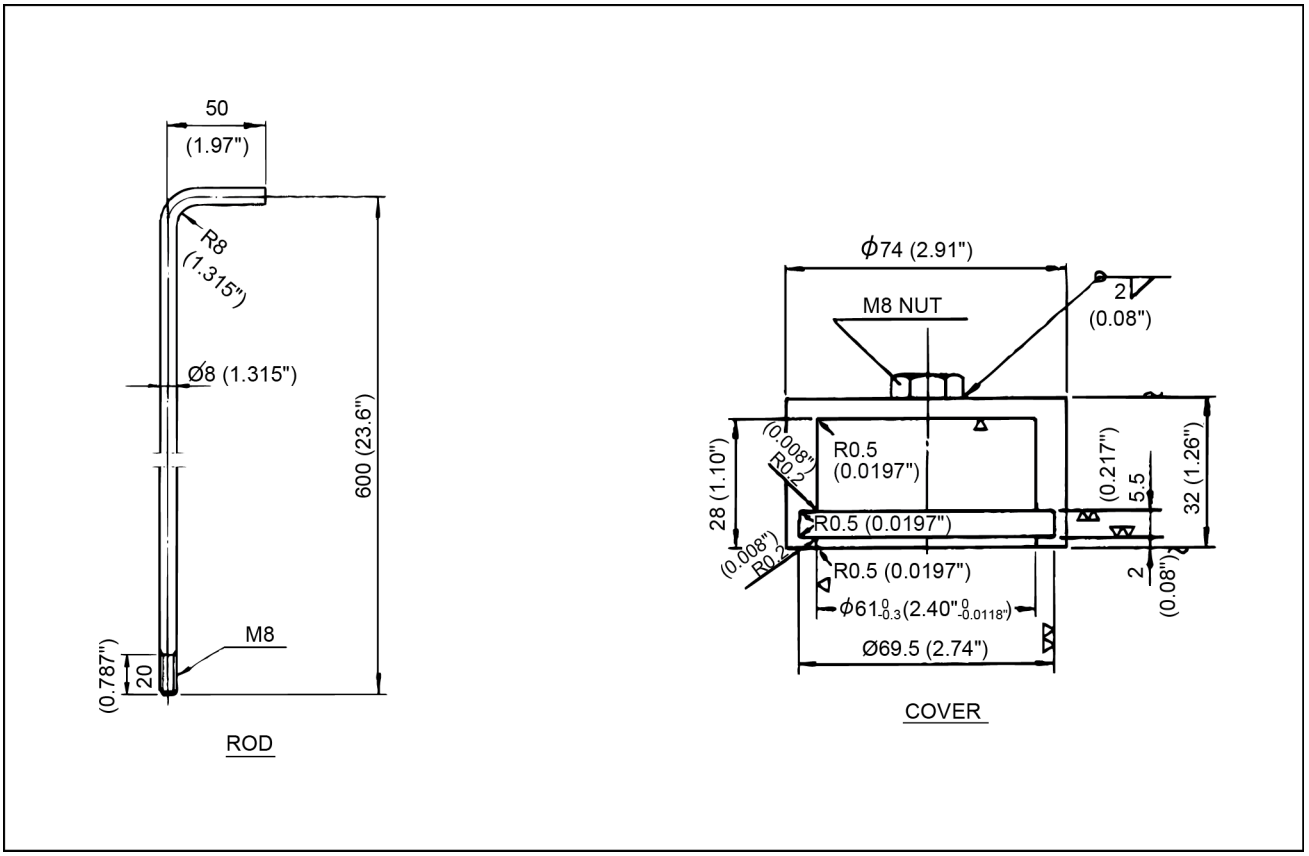
Dimension



SMIL13CEX1680FA 2

Basic instructions - How to use maintenance standards and precautions

Application

1. When the machine is new:
   Confirm that the performances are in accordance with standard specifications as compared to the performance standards.
2. At specific self inspection: (Rule by country)
   Use the data for the criterion, for the purpose of correction, adjustment and replacement.
3. When performances are deteriorated:
   Determine whether it is caused by a fault or end of service life after long hours of operation, to be used for safety and economical considerations.
4. When main components are replaced:
   For example, use data to restore performances of pumps and others.

Terminology

Standard values

1. Values to be used to condition or assemble a new machine. Where special notes are not given, these values represent standard specifications (machine with standard attachments and standard shoes).

Reference values for remedy

2. Values at which readjustment is required. In order to ensure performance and safety it is strictly prohibited to use the machine over the specified values.

Service limit

3. This is the limit value at which reconditioning is impossible without replacement of parts. If the value is expected to exceed the service limit before next inspection and correction are performed, replace the parts immediately. The operation over the specified values causes increase of damage and requires the down time of machine, and also causes safety problems.

Cautions to be exercised at judgment

Evaluation of measured data

Disagreement of measuring conditions, variations of data peculiar to a new machine, and measuring errors are to be evaluated. Determine generally at what levels measured values are located, instead of determining whether or not values fall within or run out of the reference values.

Determining correction, adjustment or replacement

Machine performances deteriorate with time as parts wear and some deteriorated performances may be restored to new levels. Therefore, determine correction, adjustment or replacement, depending upon the operating hours, kind of work and circumstances in which the machine is placed, and condition the machine performances to its most desirable levels.

Other cautions to be exercised

Parts liable to degrade

1. Rubber products, such as, hydraulic hoses,
   O-rings, and oil seals deteriorate with time: replace them at regular intervals or at overhauls.