

# SERVICE MANUAL

## E33C Mini Excavator

Part number 48139694

English  
March 2017





# **SERVICE MANUAL**

## **E33C Canopy - Tier IV final engine**

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# INTRODUCTION

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## INTRODUCTION

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## **Foreword - Important notice regarding equipment servicing**

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 CONSTRUCTION Sales and Service Networks.



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## 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 - General information**

### **Cleaning**

Clean the metal parts with cleaning solution that meets the standard and steam cleaning. (except for bearings)

After cleaning, dry well, and inject oil in all parts.

Also inject oil into the bearings after drying.

### **Inspection**

When disassembling parts, check all the parts.

If there are any worn or damaged parts, replace them.

Inspect carefully to prevent initial breakdowns.

### **Bearing**

Replace any loose bearings.

Air dry bearings before installing them.

### **Needle bearing**

When inserting needle bearings, be very careful not to damage them.

Apply grease to the section where the needle bearing will be inserted.

### **Gear**

Check that there is no wear and no damage.

### **Oil seal, O-ring, gasket**

Always install new oil seals, O-rings, and gaskets.

Apply grease to sections where oil seals and O-rings will be inserted.

### **Shaft**

Check that there is no wear and no damage.

Check the bearings and check for damaged oil seals on the shaft.

### **Service parts**

Install NEW HOLLAND CONSTRUCTION genuine service parts.

When placing an order, check the parts catalog. It contains the NEW HOLLAND CONSTRUCTION genuine part numbers.

Any breakdowns arising from the installation of non-genuine parts are not covered by the warranty.

### **Lubricants (fuel, hydraulic oil)**

Use the oil from the specified company or specified in the operator's manual or service Manual.

Any breakdowns arising from any fuel or hydraulic oil other than those specified are not covered by the warranty.

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## Safety rules - Personal safety

### Preliminary warnings to maintenance operation

#### WARNING

**Avoid injury!**

Shut off the engine, remove the key, and make sure all machine motion stops before you service the machine.

Failure to comply could result in death or serious injury.

W1128B

#### WARNING

Improper operation or service of this machine can result in an accident.

Assign a supervisor to direct worksite operations. Agree on all safety measures, procedures, and suitable hand signals.

Failure to comply could result in death or serious injury.

W0287A

#### CAUTION

**Pinch hazard!**

Always use suitable tools to align mating parts. **DO NOT** use your hand or fingers.

Failure to comply could result in minor or moderate injury.

C0044A

### Personal Protective Equipment (PPE)

#### WARNING

**Avoid injury!**

Use Personal Protective Equipment (PPE), including protective goggles, gloves, and safety footwear.

Failure to comply could result in death or serious injury.

W1036A

### Lifting operation

#### WARNING

**Crushing hazard!**

The lifting systems must be operated by qualified personnel who are aware of the correct procedures to follow. Make sure all lifting equipment is in good condition, and all hooks are equipped with safety latches.

Failure to comply could result in death or serious injury.

W0256A

#### WARNING

**Heavy objects!**

Lift and handle all heavy components using lifting equipment with adequate capacity. Always support units or parts with suitable slings or hooks. Make sure the work area is clear of all bystanders.

Failure to comply could result in death or serious injury.

W0398A

#### WARNING

Improper operation or service of this machine can result in an accident.

Raised equipment or machine movement without an operator can cause serious injury. Always do the following before performing any maintenance:

Park the machine on flat, level ground.

Lower the attachment to the ground.

Shut down the engine and remove the ignition key.

Lock the tracks.

Failure to comply could result in death or serious injury.

W0944D

**⚠ WARNING**

Tip-over hazard!  
Only raise the track as little as necessary.  
Failure to comply could result in death or serious injury.

W0276A

**Hydraulic system**

**⚠ WARNING**

Burn hazard!  
Before performing any service on the hydraulic system, you must allow it to cool. Hydraulic fluid temperature should not exceed 40 °C (104 °F).  
Failure to comply could result in death or serious injury.

W0241A

**⚠ WARNING**

Pressurized fluid can penetrate the skin and cause severe injuries.  
The grease in the cylinder is under high pressure. Never loosen the grease fitting adaptor completely in order to speed up the flow of grease.  
Failure to comply could result in death or serious injury.

W0261A

**⚠ WARNING**

Pressurized system!  
Before attempting any service procedure, it is your responsibility to know the number of accumulators on the machine, and the correct procedure for releasing the pressure of each accumulator.  
Failure to comply could result in death or serious injury.

W0136A

**Battery**

**⚠ 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

**⚠ WARNING**

Battery gas can explode!  
To prevent an explosion: 1. Always disconnect the negative (-) battery cable first. 2. Always connect the negative (-) battery cable last. 3. Do not short circuit the battery posts with metal objects. 4. Do not weld, grind, or smoke near a battery.  
Failure to comply could result in death or serious injury.

W0011A

**Fluids**

**⚠ WARNING**

Hazardous chemicals!  
Coolant can be toxic. Avoid contact with skin, eyes, and clothing. Antidotes:  
EXTERNAL - Rinse thoroughly with water. Remove soiled clothing.  
INTERNAL - Rinse the mouth with water. DO NOT induce vomiting. Seek immediate medical attention.  
EYES - Flush with water. Seek immediate medical attention.  
Failure to comply could result in death or serious injury.

W0282A

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**⚠ WARNING**

**Burn hazard!**

Hot coolant can spray and scald if you remove the radiator or deaeration tank cap while the system is hot. To remove the cap: allow the system to cool, turn the cap to the first notch, and wait for all pressure to release. Remove the cap only after all pressure has released.

Failure to comply could result in death or serious injury.

W0367A

**⚠ WARNING**

**Escaping fluid!**

Hydraulic fluid or diesel fuel leaking under pressure can penetrate the skin and cause infection or other injury. To prevent personal injury: Relieve all pressure before disconnecting fluid lines or performing work on the hydraulic system. Before applying pressure, make sure all connections are tight and all components are in good condition. Never use your hand to check for suspected leaks under pressure. Use a piece of cardboard or wood for this purpose. If injured by leaking fluid, see your doctor immediately.

Failure to comply could result in death or serious injury.

W0178A

**⚠ WARNING**

**Chemical hazard!**

When handling fuel, lubricants, and other service chemicals, follow the manufacturer's instructions. Wear Personal Protective Equipment (PPE) as instructed. Do not smoke or use open flame. Collect fluids in proper containers. Obey all local and environmental regulations when disposing of chemicals.

Failure to comply could result in death or serious injury.

W0371A

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## 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 CONSTRUCTION strongly recommends that you return all used batteries to a NEW HOLLAND CONSTRUCTION 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

## Torque - Standard torque settings

### BOLT AND NUT

Use following table for unspecified torque.

#### Coarse thread

| Bolt size  | Wrench | 8 t                                             | 10 t                                            |
|------------|--------|-------------------------------------------------|-------------------------------------------------|
| M6 x 1.0   | 10 mm  | 8.34 – 12.26 N·m (6.15 – 9.04 lb ft)            | 11.12 – 17.08 N·m (8.20 – 12.60 lb ft)          |
| M8 x 1.25  | 13 mm  | 19.66 – 29.42 N·m (14.50 – 21.70 lb ft)         | 26.44 – 40.27 N·m (19.50 – 29.70 lb ft)         |
| M10 x 1.5  | 17 mm  | 39.18 – 58.84 N·m (28.90 – 43.40 lb ft)         | 53.96 – 81.35 N·m (39.80 – 60.00 lb ft)         |
| M12 x 1.75 | 19 mm  | 72.54 – 109.82 N·m (53.50 – 81.00 lb ft)        | 96.13 – 154.56 N·m (70.90 – 114.00 lb ft)       |
| M14 x 2.0  | 22 mm  | 119.58 – 162.70 N·m (88.20 – 120.00 lb ft)      | 164.05 – 221.00 N·m (121.00 – 163.00 lb ft)     |
| M16 x 2.0  | 24 mm  | 183.04 – 246.76 N·m (135.00 – 182.00 lb ft)     | 246.76 – 334.89 N·m (182.00 – 247.00 lb ft)     |
| M18 x 2.5  | 27 mm  | 253.54 – 343.02 N·m (187.00 – 253.00 lb ft)     | 344.38 – 466.40 N·m (254.00 – 344.00 lb ft)     |
| M20 x 2.5  | 30 mm  | 355.22 – 479.96 N·m (262.00 – 354.00 lb ft)     | 482.67 – 653.50 N·m (356.00 – 482.00 lb ft)     |
| M22 x 2.5  | 32 mm  | 473.18 – 620.96 N·m (349.00 – 458.00 lb ft)     | 645.37 – 961.27 N·m (476.00 – 709.00 lb ft)     |
| M24 x 3.0  | 36 mm  | 612.83 – 828.40 N·m (452.00 – 611.00 lb ft)     | 833.83 – 1128.04 N·m (615.00 – 832.00 lb ft)    |
| M30 x 3.0  | 46 mm  | 1217.52 – 1645.96 N·m (898.00 – 1214.00 lb ft)  | 1658.17 – 2245.23 N·m (1223.00 – 1656.00 lb ft) |
| M36 x 4.0  | 55 mm  | 1709.69 – 2310.31 N·m (1261.00 – 1704.00 lb ft) | 2451.32 – 3039.74 N·m (1808.00 – 2242.00 lb ft) |

#### Fine thread

| Bolt size  | Wrench | 8 t                                             | 10 t                                            |
|------------|--------|-------------------------------------------------|-------------------------------------------------|
| M 8 x 1.0  | 13 mm  | 21.56 – 33.35 N·m (15.90 – 24.60 lb ft)         | 29.42 – 43.12 N·m (21.70 – 31.80 lb ft)         |
| M10 x 1.2  | 17 mm  | 44.06 – 65.76 N·m (32.50 – 48.50 lb ft)         | 57.89 – 87.31 N·m (42.70 – 64.40 lb ft)         |
| M12 x 1.25 | 19 mm  | 76.47 – 113.75 N·m (56.40 – 83.90 lb ft)        | 103.99 – 157.27 N·m (76.70 – 116.00 lb ft)      |
| M14 x 1.5  | 22 mm  | 130.43 – 177.61 N·m (96.20 – 131.00 lb ft)      | 176.26 – 235.91 N·m (130.00 – 174.00 lb ft)     |
| M16 x 1.5  | 24 mm  | 195.24 – 264.38 N·m (144.00 – 195.00 lb ft)     | 260.32 – 352.51 N·m (192.00 – 260.00 lb ft)     |
| M18 x 1.5  | 27 mm  | 280.65 – 427.08 N·m (207.00 – 315.00 lb ft)     | 376.92 – 509.79 N·m (278.00 – 376.00 lb ft)     |
| M20 x 1.5  | 30 mm  | 391.83 – 530.12 N·m (289.00 – 391.00 lb ft)     | 523.35 – 707.74 N·m (386.00 – 522.00 lb ft)     |
| M22 x 1.5  | 32 mm  | 516.57 – 699.60 N·m (381.00 – 516.00 lb ft)     | 692.82 – 938.23 N·m (511.00 – 692.00 lb ft)     |
| M24 x 2.0  | 36 mm  | 665.71 – 901.62 N·m (491.00 – 665.00 lb ft)     | 892.13 – 1206.68 N·m (658.00 – 890.00 lb ft)    |
| M30 x 2.0  | 46 mm  | 1342.26 – 1815.44 N·m (990.00 – 1339.00 lb ft)  | 1781.54 – 2435.05 N·m (1314.00 – 1796.00 lb ft) |
| M36 x 3.0  | 55 mm  | 1884.59 – 2548.94 N·m (1390.00 – 1880.00 lb ft) | 2567.92 – 3473.61 N·m (1894.00 – 2562.00 lb ft) |

#### Pipe and hose (FLARE type)

| Thread size (PF) | Wrench | Torque                    |
|------------------|--------|---------------------------|
| 1/4"             | 19 mm  | 39.18 N·m (28.90 lb ft)   |
| 3/8"             | 22 mm  | 49.08 N·m (36.20 lb ft)   |
| 1/2"             | 27 mm  | 93.14 N·m (68.70 lb ft)   |
| 3/4"             | 36 mm  | 176.26 N·m (130.00 lb ft) |
| 1"               | 41 mm  | 206.08 N·m (152.00 lb ft) |
| 1-1/4"           | 50 mm  | 343.02 N·m (253.00 lb ft) |

#### Pipe and hose (ORFS type)

| Thread size (UNF) | Wrench | Torque                  |
|-------------------|--------|-------------------------|
| 9/16-18           | 19 mm  | 39.18 N·m (28.90 lb ft) |
| 11/16-16          | 22 mm  | 49.08 N·m (36.20 lb ft) |
| 13/16-16          | 27 mm  | 93.14 N·m (68.70 lb ft) |

## INTRODUCTION

| Thread size (UNF) | Wrench | Torque                    |
|-------------------|--------|---------------------------|
| 1-3/16-12         | 36 mm  | 176.26 N·m (130.00 lb ft) |
| 1-7/16-12         | 41 mm  | 206.08 N·m (152.00 lb ft) |
| 1-11/16-12        | 50 mm  | 343.02 N·m (253.00 lb ft) |

### Fitting

| Thread size | Wrench | Torque                    |
|-------------|--------|---------------------------|
| 1/4"        | 19 mm  | 39.18 N·m (28.90 lb ft)   |
| 3/8"        | 22 mm  | 49.08 N·m (36.20 lb ft)   |
| 1/2"        | 27 mm  | 93.14 N·m (68.70 lb ft)   |
| 3/4"        | 36 mm  | 176.26 N·m (130.00 lb ft) |
| 1"          | 41 mm  | 206.08 N·m (152.00 lb ft) |
| 1-1/4"      | 50 mm  | 343.02 N·m (253.00 lb ft) |



## Torque - Special torque settings

| Component          |                                       | Bolt size  | Torque setting                           |
|--------------------|---------------------------------------|------------|------------------------------------------|
| Engine             | Engine mounting bolt (engine–bracket) | M12 x 1.75 | 96.3 – 155.9 N·m (71.0 – 115.0 lb ft)    |
|                    |                                       | M12 x 1.75 | 117.7 – 137.21 N·m (86.8 – 101.20 lb ft) |
|                    | Engine mounting bolt (bracket-frame)  | M10 x 1.5  | 54.2 – 81.4 N·m (40.0 – 60.0 lb ft)      |
|                    | Radiator mounting bolt and nut        | M12 x 1.75 | 96.3 – 155.9 N·m (71.0 – 115.0 lb ft)    |
|                    | Coupling mounting bolt                | M12 x 1.75 | 72.3 – 110.2 N·m (53.3 – 81.3 lb ft)     |
| Hydraulic system   | Main pump mounting bolt               | M12 x 1.75 | 74.6 – 112.5 N·m (55.0 – 83.0 lb ft)     |
|                    | Main control valve mounting bolt      | M10 x 1.5  | 54.0 – 81.4 N·m (39.8 – 60.0 lb ft)      |
|                    | Fuel tank mounting bolt               | M6 x 1.0   | 8.3 – 12.3 N·m (6.2 – 9.0 lb ft)         |
|                    |                                       | M8 x 1.25  | 19.7 – 29.4 N·m (14.5 – 21.7 lb ft)      |
|                    |                                       | M12 x 1.75 | 96.3 – 155.9 N·m (71.0 – 115.0 lb ft)    |
|                    | Hydraulic oil tank mounting bolt      | M8 x 1.25  | 19.7 – 29.42 N·m (14.5 – 21.70 lb ft)    |
|                    |                                       | M12 x 1.75 | 96.3 – 155.9 N·m (71 – 115 lb ft)        |
|                    | Turning joint mounting bolt and nut   | M10 x 1.5  | 54.0 – 81.4 N·m (39.8 – 60.0 lb ft)      |
| Power train system | Swing motor mounting bolt             | M14 x 2.0  | 164.1 – 221 N·m (121 – 163 lb ft)        |
|                    | Swing bearing upper mounting bolt     | M12 x 1.75 | 115.9 – 155.2 N·m (85.5 – 114.5 lb ft)   |
|                    | Swing bearing lower mounting bolt     | M12 x 1.75 | 105.9 – 145.2 N·m (78.1 – 107.1 lb ft)   |
|                    | Travel motor mounting bolt            | M12 x 1.75 | 125.8 – 145.3 N·m (92.8 – 107.2 lb ft)   |
|                    | Sprocket mounting bolt                | M12 x 1.75 | 108.9 – 132.5 N·m (80.3 – 97.7 lb ft)    |
| Under-carriage     | Carrier roller mounting bolt and nut  | M12 x 1.75 | 108.9 – 132.5 N·m (80.3 – 97.7 lb ft)    |
|                    | Track roller mounting bolt            | M18 x 2.0  | 366.2 – 444.6 N·m (270.1 – 327.9 lb ft)  |
| Other systems      | Counterweight mounting bolt           | M20 x 2.5  | 482.8 – 653.4 N·m (356.1 – 481.9 lb ft)  |
|                    | Operator's seat mounting bolt         | M8 x 1.25  | 19.7 – 29.4 N·m (14.5 – 21.7 lb ft)      |

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## 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 CONSTRUCTION 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 CONSTRUCTION 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

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### 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.**

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### Special tools

The special tools that NEW HOLLAND CONSTRUCTION suggests and illustrate in this manual have been specifically researched and designed for use with NEW HOLLAND CONSTRUCTION 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

## Machine specifications

### Engine

|                                      |                                                   |
|--------------------------------------|---------------------------------------------------|
| Model                                | Yanmar 3TNV88F-ESHYB                              |
| Type                                 | 4-cycle vertical overhead valve, diesel fuel      |
| Cooling method                       | Water cooling                                     |
| Number of cylinders and arrangement  | 3 cylinders, in-line                              |
| Firing order                         | 1 - 3 - 2                                         |
| Combustion chamber type              | Direct injection type                             |
| Cylinder bore x stroke               | <b>88 mm (3.46 in) x 90 mm (3.54 in)</b>          |
| Piston displacement                  | <b>1642 cm<sup>3</sup> (100.2 in<sup>3</sup>)</b> |
| Compression ratio                    | 19.1 : 1                                          |
| Rated gross horse power ( SAE J1995) | <b>18.2 kW (24.7 Hp) at 2200 RPM</b>              |
| Maximum torque at <b>1200 RPM</b>    | <b>84.3 – 94.1 N·m (62.2 – 69.4 lb ft)</b>        |
| Engine oil quantity                  | <b>6.7 L (1.8 US gal)</b>                         |
| Dry weight                           | <b>172 kg (379 lb)</b>                            |
| High idling speed                    | <b>2280 – 2380 RPM</b>                            |
| Low idling speed                     | <b>1150 – 1250 RPM</b>                            |
| Rated fuel consumption               | 177 g/Hp·hr at 2200 RPM                           |
| Starting motor                       | <b>12 V, 2.3 kW</b>                               |
| Alternator                           | <b>12 V, 55 A</b>                                 |
| Battery                              | 1 x <b>12 V x 70 A·h ( 20 h rating)</b>           |

### Main pump

|                  |                                                           |
|------------------|-----------------------------------------------------------|
| Type             | Variable displacement tandem axis piston pumps            |
| Capacity         | <b>2 x 17 cm<sup>3</sup>/rev (1.0 in<sup>3</sup>/rev)</b> |
| Maximum pressure | <b>22553 kPa (3271 psi)</b>                               |
| Rated oil flow   | <b>2 x 37.4 L/min (9.9 US gpm)</b>                        |
| Rated speed      | <b>2200 RPM</b>                                           |

### Gear pump

|                  |                                                                     |
|------------------|---------------------------------------------------------------------|
| Type             | Fixed displacement gear pump single stage                           |
| Capacity         | <b>4.5 – 10.5 cm<sup>3</sup>/rev (0.3 – 0.6 in<sup>3</sup>/rev)</b> |
| Maximum pressure | <b>2944 – 20105 kPa (427 – 2916 psi)</b>                            |
| Rated oil flow   | <b>9.9 – 23.1 L/min (2.6 – 6.1 US gpm)</b>                          |

### Main control valve

|                                          |                                            |
|------------------------------------------|--------------------------------------------|
| Type                                     | Sectional, 10 spools (11 blocks)           |
| Operating method                         | Hydraulic pilot system                     |
| Main relief valve pressure : P1, P2 / P3 | <b>20105 – 22553 kPa (2916 – 3271 psi)</b> |
| Overload relief valve pressure           | <b>24518 kPa (3556 psi)</b>                |

**Swing motor**

|                        |                                                       |
|------------------------|-------------------------------------------------------|
| Type                   | Fixed displacement axial piston motor                 |
| Capacity               | <b>22 cm<sup>3</sup>/rev (1.3 in<sup>3</sup>/rev)</b> |
| Relief pressure        | <b>19616 kPa (2845 psi)</b>                           |
| Braking system         | Automatic, spring applied hydraulic released          |
| Braking torque         | <b>90.2 N·m (66.5 lb ft)</b>                          |
| Brake release pressure | <b>1958 – 6378 kPa (284 – 925 psi)</b>                |
| Reduction gear type    | 2 - stage planetary                                   |

**Travel motor**

|                        |                                              |
|------------------------|----------------------------------------------|
| Type                   | Variable displacement axial piston motor     |
| Relief pressure        | <b>22553 kPa (3271 psi)</b>                  |
| Reduction gear type    | 2-stage planetary                            |
| Braking system         | Automatic, spring applied hydraulic released |
| Brake release pressure | <b>1200 kPa (174 psi)</b>                    |
| Braking torque         | <b>38 N·m (28 lb ft)</b>                     |

**Remote control valve**

|                         |                        |                                                 |
|-------------------------|------------------------|-------------------------------------------------|
| Type                    | Pressure reducing type |                                                 |
| Operating pressure      | Minimum                | <b>490 kPa (71 psi)</b>                         |
|                         | Maximum                | <b>2013 kPa (292 psi)</b>                       |
| Single operation stroke | Lever                  | <b>637.42 – 833.58 kPa (92.45 – 120.90 psi)</b> |

**Cylinder**

|                     |                                       |                                                               |
|---------------------|---------------------------------------|---------------------------------------------------------------|
| Boom cylinder       | Bore diameter x Rod diameter x Stroke | <b>85 mm (3.3 in) x 45 mm (1.8 in) x 540 mm (21.3 in)</b>     |
|                     | Cushion                               | Extend only                                                   |
| Arm cylinder        | Bore diameter x Rod diameter x Stroke | <b>Ø 80 mm (3.1 in) x Ø 45 mm (1.8 in) x 585 mm (23.0 in)</b> |
|                     | Cushion                               | Extend and retract                                            |
| Bucket cylinder     | Bore diameter x Rod diameter x Stroke | <b>Ø 70 mm (2.8 in) x Ø 45 mm (1.8 in) x 510 mm (20.1 in)</b> |
|                     | Cushion                               | -                                                             |
| Boom swing cylinder | Bore diameter x Rod diameter x Stroke | <b>Ø 80 mm (3.1 in) x Ø 45 mm (1.8 in) x 400 mm (15.7 in)</b> |
|                     | Cushion                               | -                                                             |
| Dozer cylinder      | Bore diameter x Rod diameter x Stroke | <b>Ø 95 mm (3.7 in) x Ø 50 mm (2.0 in) x 152 mm (6.0 in)</b>  |
|                     | Cushion                               | -                                                             |

**NOTE:** discoloration of cylinder rod can occur when the friction reduction additive of lubrication oil spreads on the rod surface.

Discoloration does not cause any harmful effect on the cylinder performance.

**Types of shoes – Steel double grouser**

|                 |                           |
|-----------------|---------------------------|
| Shoe width      | <b>300 mm (11.8 in)</b>   |
| Ground pressure | <b>28.3 kPa (4.1 psi)</b> |
| Overall width   | <b>1550 mm (61.0 in)</b>  |

**Types of shoes – Rubber track**

|                 |                           |
|-----------------|---------------------------|
| Shoe width      | <b>300 mm (11.8 in)</b>   |
| Ground pressure | <b>27.6 kPa (4.0 psi)</b> |
| Overall width   | <b>1550 mm (61.0 in)</b>  |

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**Number of rollers and shoes on each side**

|              |    |
|--------------|----|
| Upper roller | 1  |
| Lower roller | 4  |
| Track shoes  | 44 |

## Weights

### Machine

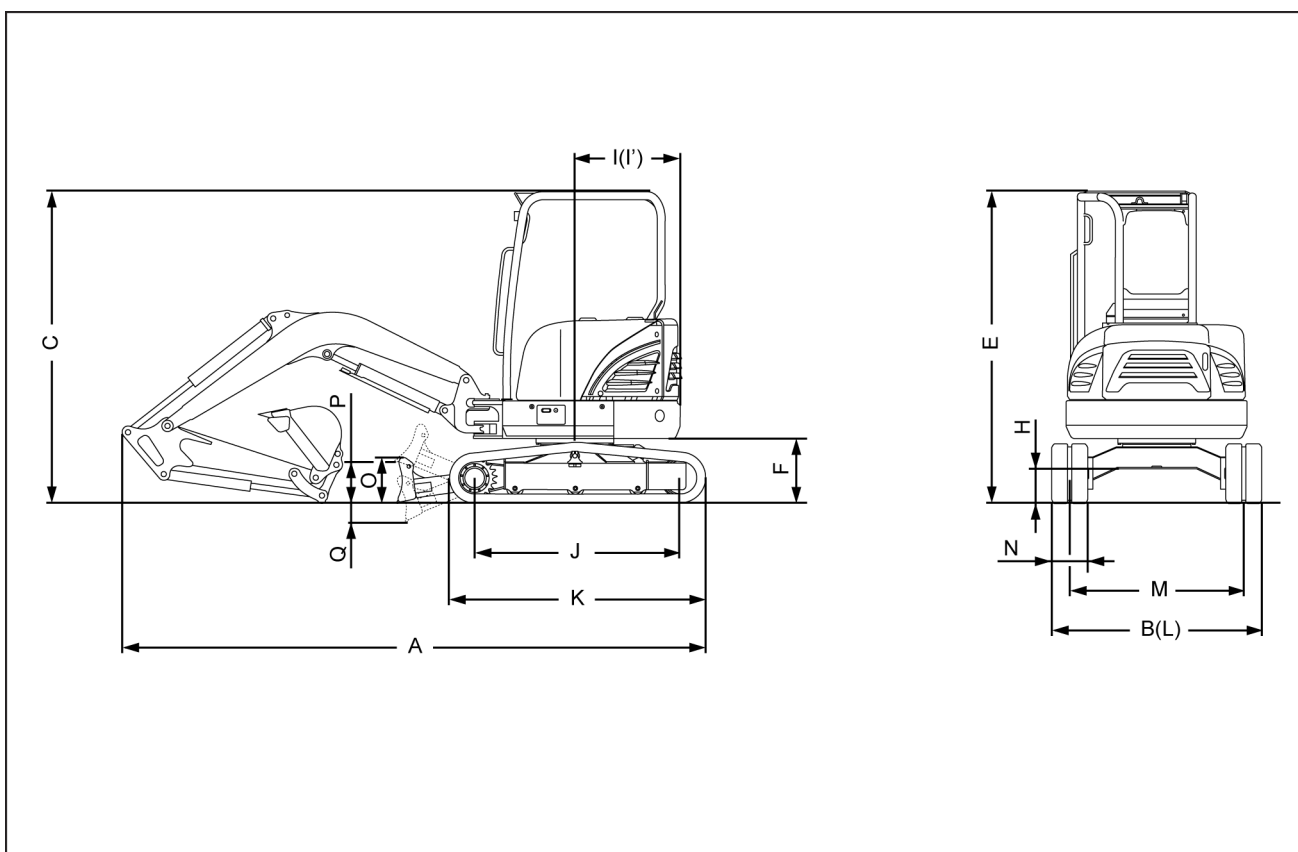
|                      |                          |
|----------------------|--------------------------|
| Operating weight (*) | <b>3220 kg (7099 lb)</b> |
|----------------------|--------------------------|

### Components

|                                                                                                                                                  |                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| Upperstructure assembly                                                                                                                          | <b>1460 kg (3218.7 lb)</b> |
| Main frame weld assembly                                                                                                                         | <b>345 kg (760.6 lb)</b>   |
| Engine assembly                                                                                                                                  | <b>172 kg (379.2 lb)</b>   |
| Main pump assembly                                                                                                                               | <b>19 kg (42 lb)</b>       |
| Main control valve assembly                                                                                                                      | <b>25 kg (55 lb)</b>       |
| Swing motor assembly                                                                                                                             | <b>40 kg (88.2 lb)</b>     |
| Hydraulic oil tank assembly                                                                                                                      | <b>50 kg (110 lb)</b>      |
| Fuel tank assembly                                                                                                                               | <b>30 kg (66 lb)</b>       |
| Boom swing post                                                                                                                                  | <b>80 kg (176.4 lb)</b>    |
| Counterweight                                                                                                                                    | <b>220 kg (485.0 lb)</b>   |
| Cab assembly                                                                                                                                     | <b>210 kg (463 lb)</b>     |
| Canopy assembly                                                                                                                                  | <b>100 kg (220.5 lb)</b>   |
| Lower chassis assembly                                                                                                                           | <b>1150 kg (2535.3 lb)</b> |
| Track frame weld assembly                                                                                                                        | <b>345 kg (760.6 lb)</b>   |
| Swing bearing                                                                                                                                    | <b>50 kg (110.2 lb)</b>    |
| Travel motor assembly                                                                                                                            | <b>40 kg (88.2 lb)</b>     |
| Turning joint                                                                                                                                    | <b>15 kg (33.1 lb)</b>     |
| Track recoil spring                                                                                                                              | <b>33.3 kg (73.4 lb)</b>   |
| Idler                                                                                                                                            | <b>22.4 kg (49.4 lb)</b>   |
| Carrier roller                                                                                                                                   | <b>7 kg (15.4 lb)</b>      |
| Track roller                                                                                                                                     | <b>11.5 kg (25.4 lb)</b>   |
| Sprocket                                                                                                                                         | <b>7 kg (15 lb)</b>        |
| Rubber track ( <b>300 mm (11.8 in)</b> )                                                                                                         | <b>160 kg (352.7 lb)</b>   |
| Dozer blade assembly                                                                                                                             | <b>135 kg (297.6 lb)</b>   |
| Front attachment assembly<br>( <b>2.38 m (93.701 in)</b> boom,<br><b>1.3 m (51.181 in)</b> arm,<br><b>0.09 m³ (0.118 yd³)</b> SAE heaped bucket) | <b>485 kg (1069.2 lb)</b>  |
| <b>2.38 m (93.701 in)</b> boom assembly                                                                                                          | <b>140 kg (308.6 lb)</b>   |
| <b>1.3 m (51.181 in)</b> arm assembly                                                                                                            | <b>80 kg (176.4 lb)</b>    |
| <b>0.09 m³ (0.118 yd³)</b> SAE heaped bucket                                                                                                     | <b>80 kg (176.4 lb)</b>    |
| Boom cylinder assembly                                                                                                                           | <b>40 kg (88.2 lb)</b>     |
| Arm cylinder assembly                                                                                                                            | <b>40 kg (88.2 lb)</b>     |
| Bucket cylinder assembly                                                                                                                         | <b>30 kg (66.1 lb)</b>     |
| Bucket control link assembly                                                                                                                     | <b>20 kg (44 lb)</b>       |
| Dozer cylinder assembly                                                                                                                          | <b>30 kg (66.1 lb)</b>     |
| Boom swing cylinder assembly                                                                                                                     | <b>30 kg (66.1 lb)</b>     |

(\*) Canopy, boom, arm, bucket, lubricant, coolant, full fuel and hydraulic oil, without quick coupler system, rubber track. Weight tolerance:  $\pm 3\%$ .

## Dimensions



SMIL16MEX1545FA 1

|                                                             |                           |
|-------------------------------------------------------------|---------------------------|
| <b>(A)</b> Overall length                                   | <b>4640 mm (182.7 in)</b> |
| <b>(B)</b> Overall width, with <b>300 mm (11.8 in)</b> shoe | <b>1550 mm (61.0 in)</b>  |
| <b>(C)</b> Overall height                                   | <b>2500 mm (98.4 in)</b>  |
| <b>(E)</b> Overall height of cab                            | <b>2500 mm (98.4 in)</b>  |
| <b>(F)</b> Ground clearance of counterweight                | <b>540 mm (21.3 in)</b>   |
| <b>(H)</b> Minimum ground clearance                         | <b>290 mm (11.4 in)</b>   |
| <b>(I)</b> Rear-end distance                                | <b>775 mm (30.5 in)</b>   |
| <b>(I')</b> Rear-end swing radius                           | <b>775 mm (30.5 in)</b>   |
| <b>(J)</b> Distance between tumblers                        | <b>1700 mm (66.9 in)</b>  |
| <b>(K)</b> Undercarriage length                             | <b>2130 mm (83.9 in)</b>  |
| <b>(L)</b> Undercarriage width                              | <b>1550 mm (61.0 in)</b>  |
| <b>(M)</b> Track gauge                                      | <b>1250 mm (49.2 in)</b>  |
| <b>(N)</b> Track shoe width, standard                       | <b>300 mm (11.8 in)</b>   |
| <b>(O)</b> Height of blade                                  | <b>330 mm (13.0 in)</b>   |
| <b>(P)</b> Ground clearance of blade up                     | <b>400 mm (15.7 in)</b>   |
| <b>(Q)</b> Depth of blade down                              | <b>435 mm (17.1 in)</b>   |

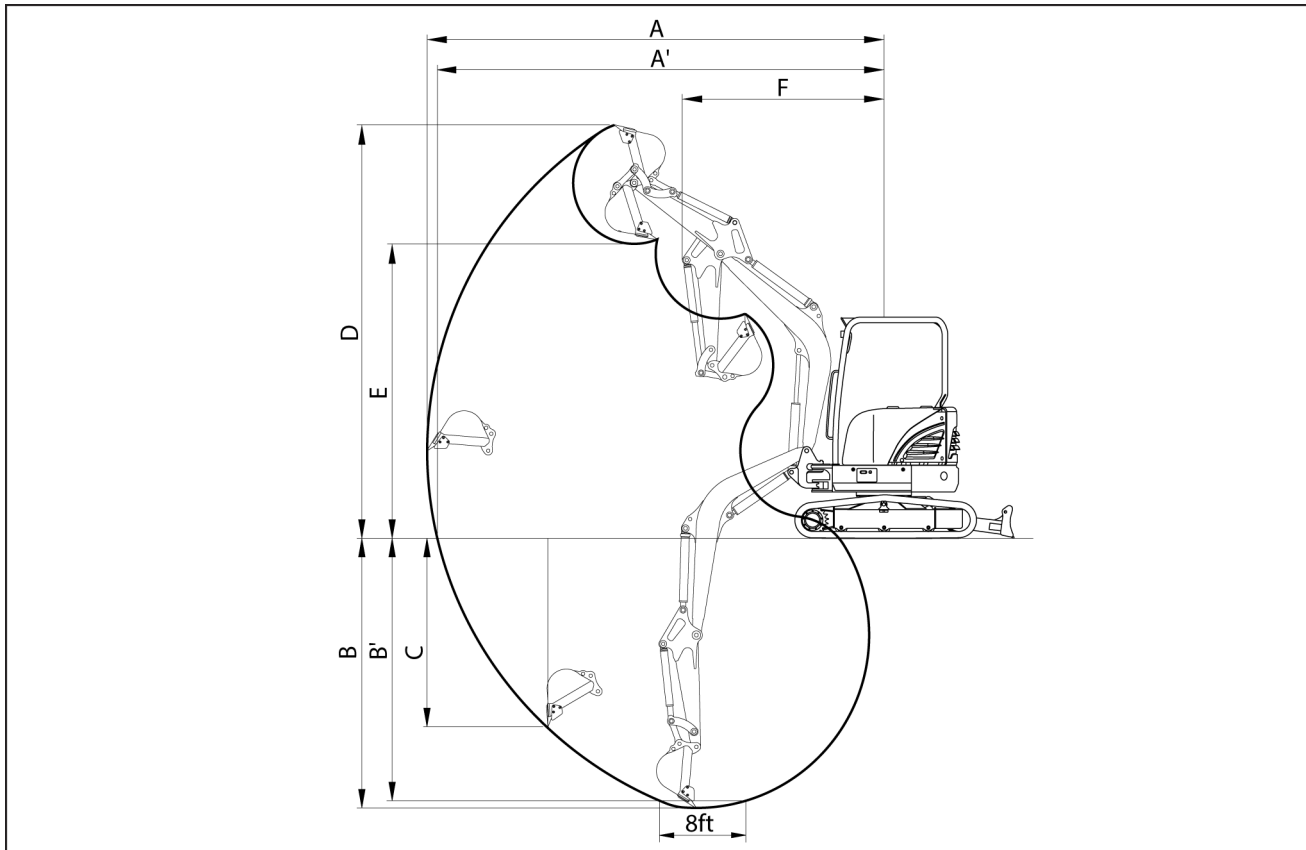
Boom length: **2.38 m (93.701 in)**

Arm length: **1.3 m (51.181 in)**

With boom swing post



## Working range



SMIL16MEX2310FA 2

|                                                |     |                            |
|------------------------------------------------|-----|----------------------------|
| <b>(A)</b> Maximum digging reach               |     | <b>5180 mm (203.9 in)</b>  |
| <b>(A')</b> Maximum digging reach on ground    |     | <b>5060 mm (199.2 in)</b>  |
| <b>(B)</b> Maximum digging depth               |     | <b>3035 mm (119.5 in)</b>  |
| <b>(B')</b> Maximum digging depth (8ft level)  |     | <b>2555 mm (100.6 in)</b>  |
| <b>(C)</b> Maximum vertical wall digging depth |     | <b>2030 mm (79.9 in)</b>   |
| <b>(D)</b> Maximum digging height              |     | <b>4650 mm (183.1 in)</b>  |
| <b>(E)</b> Maximum dumping height              |     | <b>3275 mm (128.9 in)</b>  |
| <b>(F)</b> Minimum swing radius                |     | <b>2290 mm (90.2 in)</b>   |
| Boom swing radius (left-hand/right-hand)       |     | <b>75° / 50°</b>           |
| Bucket digging force                           | SAE | <b>27.4 kN (6159.8 lb)</b> |
|                                                | ISO | <b>30.7 kN (6901.6 lb)</b> |
| Arm crowd force                                | SAE | <b>18.9 kN (4248.9 lb)</b> |
|                                                | ISO | <b>19.5 kN (4383.8 lb)</b> |

Boom length: **2.38 m (93.701 in)**

Arm length: **1.3 m (51.181 in)**

With boom swing post

## Conversion factors

### Unit conversion rate

| Gravitational unit    | - X →<br>← ÷ -       | SI unit           |
|-----------------------|----------------------|-------------------|
| kgf                   | 9.807                | N                 |
| lbf                   | 4.448                | N                 |
| kgf•cm                | 0.0981               | N•m               |
| lbf•ft                | 1.356                | N•m               |
| lbf•in                | 0.113                | N•m               |
| kgf/cm <sup>2</sup>   | 0.0981               | MPa               |
| atm                   | 0.1013               | MPa               |
| lbf/in <sup>2</sup>   | 0.0069               | MPa               |
| mm Hg                 | 133.3                | Pa                |
| in Hg                 | 3386                 | Pa                |
| kgf•m/s               | 0.00981              | kW                |
| lbf•ft/s              | 0.00136              | kW                |
| PS                    | 0.7355               | kW                |
| HP                    | 0.746                | kW                |
| kgf•m                 | 9.807                | J                 |
| kcal                  | 4186                 | J                 |
| kgf•s/cm <sup>2</sup> | 98067                | Pa•s              |
| cP                    | 0.001                | Pa•s              |
| P                     | 0.1                  | Pa•s              |
| cSt                   | 1 x 10 <sup>-6</sup> | m <sup>2</sup> /s |
| St                    | 0.0001               | m <sup>2</sup> /s |

### Length

#### Millimeters to inches

| mm | In.    | mm | In.    | mm | In.    | mm  | In.    |
|----|--------|----|--------|----|--------|-----|--------|
| 1  | 0.0394 | 26 | 1.0236 | 51 | 2.0079 | 76  | 2.9921 |
| 2  | 0.0787 | 27 | 1.0630 | 52 | 2.0472 | 77  | 3.0315 |
| 3  | 0.1181 | 28 | 1.1024 | 53 | 2.0866 | 78  | 3.0709 |
| 4  | 0.1575 | 29 | 1.1417 | 54 | 2.1260 | 79  | 3.1102 |
| 5  | 0.1969 | 30 | 1.1811 | 55 | 2.1654 | 80  | 3.1496 |
| 6  | 0.2362 | 31 | 1.2205 | 56 | 2.2047 | 81  | 3.1890 |
| 7  | 0.2756 | 32 | 1.2598 | 57 | 2.2441 | 82  | 3.2283 |
| 8  | 0.3150 | 33 | 1.2992 | 58 | 2.2835 | 83  | 3.2677 |
| 9  | 0.3543 | 34 | 1.3386 | 59 | 2.3228 | 84  | 3.3071 |
| 10 | 0.3937 | 35 | 1.3780 | 60 | 2.3622 | 85  | 3.3465 |
| 11 | 0.4331 | 36 | 1.4173 | 61 | 2.4016 | 86  | 3.3858 |
| 12 | 0.4724 | 37 | 1.4567 | 62 | 2.4409 | 87  | 3.4252 |
| 13 | 0.5118 | 38 | 1.4961 | 63 | 2.4803 | 88  | 3.4646 |
| 14 | 0.5512 | 39 | 1.5354 | 64 | 2.5197 | 89  | 3.5039 |
| 15 | 0.5906 | 40 | 1.5748 | 65 | 2.5591 | 90  | 3.5433 |
| 16 | 0.6299 | 41 | 1.6142 | 66 | 2.5984 | 91  | 3.5827 |
| 17 | 0.6693 | 42 | 1.6535 | 67 | 2.6378 | 92  | 3.6220 |
| 18 | 0.7087 | 43 | 1.6929 | 68 | 2.6772 | 93  | 3.6614 |
| 19 | 0.7480 | 44 | 1.7323 | 69 | 2.7165 | 94  | 3.7008 |
| 20 | 0.7874 | 45 | 1.7717 | 70 | 2.7559 | 95  | 3.7402 |
| 21 | 0.8268 | 46 | 1.8110 | 71 | 2.7953 | 96  | 3.7795 |
| 22 | 0.8661 | 47 | 1.8504 | 72 | 2.8346 | 97  | 3.8189 |
| 23 | 0.9055 | 48 | 1.8898 | 73 | 2.8740 | 98  | 3.8583 |
| 24 | 0.9449 | 49 | 1.9291 | 74 | 2.9134 | 99  | 3.8976 |
| 25 | 0.9843 | 50 | 1.9685 | 75 | 2.9528 | 100 | 3.9370 |

# INTRODUCTION

## Inches to millimeters

| in.   | mm     | in.   | mm      | in.   | mm      | in.   | mm      |
|-------|--------|-------|---------|-------|---------|-------|---------|
| 1/64  | 0.3969 | 17/64 | 6.7469  | 33/64 | 13.0969 | 49/64 | 19.4469 |
| 1/32  | 0.7938 | 9/32  | 7.1438  | 17/32 | 13.4938 | 25/32 | 19.8438 |
| 3/64  | 1.1906 | 19/64 | 7.5406  | 35/64 | 13.8906 | 51/64 | 20.2406 |
| 1/16  | 1.5875 | 5/16  | 7.9375  | 9/16  | 14.2875 | 13/16 | 20.6375 |
| 5/64  | 1.9844 | 21/64 | 8.3344  | 37/64 | 14.6844 | 53/64 | 21.0344 |
| 3/32  | 2.3813 | 11/32 | 8.7313  | 19/32 | 15.0813 | 27/32 | 21.4313 |
| 7/64  | 2.7781 | 23/64 | 9.1281  | 39/64 | 15.4781 | 55/64 | 21.8281 |
| 1/8   | 3.1750 | 3/8   | 9.5250  | 5/8   | 15.8750 | 7/8   | 22.2250 |
| 9/64  | 3.5719 | 25/64 | 9.9218  | 41/64 | 16.2719 | 57/64 | 22.6219 |
| 5/32  | 3.9688 | 13/32 | 10.3188 | 21/32 | 16.6688 | 29/32 | 23.0188 |
| 11/64 | 4.3656 | 27/64 | 10.7156 | 43/64 | 17.0656 | 59/64 | 23.4156 |
| 3/16  | 4.7625 | 7/16  | 11.1125 | 11/16 | 17.4625 | 15/16 | 23.8125 |
| 13/64 | 5.1594 | 29/64 | 11.5094 | 45/64 | 17.8594 | 61/64 | 24.2094 |
| 7/32  | 5.5563 | 15/32 | 11.9063 | 23/32 | 18.2563 | 31/32 | 24.6063 |
| 15/64 | 5.9531 | 31/64 | 12.3031 | 47/64 | 18.6531 | 63/64 | 25.0031 |
| 1/4   | 6.3500 | 1/2   | 12.7000 | 3/4   | 19.0500 | 1     | 25.4000 |

## Feet to meters

| ft.  | 0      | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | ft.  |
|------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
|      | m      | m      | m      | m      | m      | m      | m      | m      | m      | m      |      |
| ---- |        | 0.305  | 0.610  | 0.914  | 1.219  | 1.524  | 1.829  | 2.134  | 2.438  | 2.743  | ---- |
| 10   | 3.048  | 3.353  | 3.658  | 3.962  | 4.267  | 4.572  | 4.877  | 5.182  | 5.486  | 5.791  | 10   |
| 20   | 6.096  | 6.401  | 6.706  | 7.010  | 7.315  | 7.620  | 7.925  | 8.230  | 8.534  | 8.839  | 20   |
| 30   | 9.144  | 9.449  | 9.754  | 10.058 | 10.363 | 10.668 | 10.973 | 11.278 | 11.582 | 11.887 | 30   |
| 40   | 12.192 | 12.497 | 12.802 | 13.106 | 13.411 | 13.716 | 14.021 | 14.326 | 14.630 | 14.935 | 40   |
| 50   | 15.24  | 15.545 | 15.850 | 16.154 | 16.459 | 16.764 | 17.069 | 17.374 | 17.678 | 17.983 | 50   |
| 60   | 18.288 | 18.593 | 18.898 | 19.202 | 19.507 | 19.812 | 20.117 | 20.422 | 20.726 | 21.031 | 60   |
| 70   | 21.336 | 21.641 | 21.946 | 22.250 | 22.555 | 22.860 | 23.165 | 23.470 | 23.774 | 24.079 | 70   |
| 80   | 24.384 | 24.689 | 24.994 | 25.298 | 25.603 | 25.908 | 26.213 | 26.518 | 26.822 | 27.127 | 80   |
| 90   | 27.432 | 27.737 | 28.042 | 28.346 | 28.651 | 28.956 | 29.261 | 29.566 | 29.870 | 30.175 | 90   |
| 100  | 30.480 | 30.785 | 31.090 | 31.394 | 31.699 | 32.004 | 32.309 | 32.614 | 32.918 | 33.223 | 100  |

## Meters to feet

| m    | 0       | 1       | 2       | 3       | 4        | 5       | 6        | 7       | 8       | 9       | m    |
|------|---------|---------|---------|---------|----------|---------|----------|---------|---------|---------|------|
|      | ft.     | ft.     | ft.     | ft.     | ft.      | ft.     | ft.      | ft.     | ft.     | ft.     |      |
| ---- |         | 3.2808  | 6.5617  | 9.8425  | 13.1234  | 16.4042 | 19.685   | 22.9659 | 26.2467 | 29.5276 | ---- |
| 10   | 32.8084 | 36.0892 | 39.3701 | 42.6509 | 45.9318  | 49.2126 | 52.4934  | 55.7743 | 59.0551 | 62.3360 | 10   |
| 20   | 65.6168 | 68.8976 | 72.1785 | 75.4593 | 78.7402  | 82.0210 | 85.3018  | 88.5827 | 91.8635 | 95.1444 | 20   |
| 30   | 98.4252 | 101.706 | 104.986 | 108.267 | 111.5486 | 114.829 | 118.1102 | 121.391 | 124.671 | 127.952 | 30   |
| 40   | 131.233 | 134.514 | 137.795 | 141.076 | 144.357  | 147.637 | 150.918  | 154.199 | 157.480 | 160.761 | 40   |
| 50   | 164.042 | 167.322 | 170.603 | 173.884 | 177.165  | 180.446 | 183.727  | 187.007 | 190.288 | 193.569 | 50   |
| 60   | 196.850 | 200.131 | 203.412 | 206.692 | 209.973  | 213.254 | 216.535  | 219.816 | 223.097 | 226.378 | 60   |
| 70   | 229.658 | 232.939 | 236.220 | 239.501 | 242.782  | 246.063 | 249.343  | 252.624 | 255.905 | 259.186 | 70   |
| 80   | 262.467 | 265.748 | 269.028 | 272.309 | 275.590  | 278.871 | 282.152  | 285.433 | 288.713 | 291.994 | 80   |
| 90   | 295.275 | 298.556 | 301.837 | 305.118 | 308.399  | 311.679 | 314.960  | 318.241 | 321.522 | 324.803 | 90   |
| 100  | 328.084 | 331.364 | 334.645 | 337.926 | 341.207  | 344.488 | 347.769  | 351.049 | 354.330 | 357.611 | 100  |

## INTRODUCTION

### Miles to kilometers

| miles | 0       | 1       | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9       | miles |
|-------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-------|
|       | km      | km      | km      | km      | km      | km      | km      | km      | km      | km      |       |
| ----  |         | 1.609   | 3.219   | 4.828   | 6.437   | 8.047   | 9.656   | 11.265  | 12.875  | 14.484  | ----  |
| 10    | 16.093  | 17.703  | 19.312  | 20.921  | 22.531  | 24.140  | 25.750  | 27.359  | 28.968  | 30.578  | 10    |
| 20    | 32.187  | 33.796  | 35.406  | 37.015  | 38.624  | 40.234  | 41.843  | 43.452  | 45.062  | 46.671  | 20    |
| 30    | 48.280  | 49.890  | 51.499  | 53.108  | 54.718  | 56.327  | 57.936  | 59.546  | 61.155  | 62.764  | 30    |
| 40    | 64.374  | 65.983  | 67.592  | 69.202  | 70.811  | 72.420  | 74.030  | 75.639  | 77.249  | 78.858  | 40    |
| 50    | 80.467  | 82.077  | 83.686  | 85.295  | 86.905  | 88.514  | 90.123  | 91.733  | 93.342  | 94.951  | 50    |
| 60    | 96.561  | 98.170  | 99.779  | 101.39  | 102.998 | 104.607 | 106.217 | 107.826 | 109.435 | 111.045 | 60    |
| 70    | 112.654 | 114.263 | 115.873 | 117.482 | 119.091 | 120.701 | 122.310 | 123.919 | 125.529 | 127.138 | 70    |
| 80    | 128.748 | 130.357 | 131.966 | 133.576 | 135.185 | 136.794 | 138.404 | 140.013 | 141.622 | 143.232 | 80    |
| 90    | 144.841 | 146.450 | 148.060 | 149.669 | 151.278 | 152.888 | 154.497 | 156.106 | 157.716 | 159.325 | 90    |
| 100   | 160.934 | 162.544 | 164.153 | 165.762 | 167.372 | 168.981 | 170.590 | 172.200 | 173.809 | 175.418 | 100   |

### Kilometers to miles

| km   | 0      | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | km   |
|------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
|      | miles  | miles  | miles  | miles  | miles  | miles  | miles  | miles  | miles  | miles  |      |
| ---- |        | 0.621  | 1.243  | 1.864  | 2.485  | 3.107  | 3.728  | 4.350  | 4.971  | 5.592  | ---- |
| 10   | 6.214  | 6.835  | 7.456  | 8.078  | 8.699  | 9.321  | 9.942  | 10.563 | 11.185 | 11.806 | 10   |
| 20   | 12.427 | 13.049 | 13.670 | 14.292 | 14.913 | 15.534 | 16.156 | 16.777 | 17.398 | 18.020 | 20   |
| 30   | 18.641 | 19.263 | 19.884 | 20.505 | 21.127 | 21.748 | 22.369 | 22.991 | 23.612 | 24.233 | 30   |
| 40   | 24.855 | 25.476 | 26.098 | 26.719 | 27.340 | 27.962 | 28.583 | 29.204 | 29.826 | 30.447 | 40   |
| 50   | 31.069 | 31.690 | 32.311 | 32.933 | 33.554 | 34.175 | 34.797 | 35.418 | 36.040 | 36.661 | 50   |
| 60   | 37.282 | 37.904 | 38.525 | 39.146 | 39.768 | 40.389 | 41.010 | 41.632 | 42.253 | 42.875 | 60   |
| 70   | 43.496 | 44.117 | 44.739 | 45.360 | 45.981 | 46.603 | 47.224 | 47.846 | 48.467 | 49.088 | 70   |
| 80   | 49.710 | 50.331 | 50.952 | 51.574 | 52.195 | 52.817 | 53.438 | 54.059 | 54.681 | 55.302 | 80   |
| 90   | 55.923 | 56.545 | 57.166 | 57.788 | 58.409 | 59.03  | 59.652 | 60.273 | 60.894 | 61.516 | 90   |
| 100  | 62.137 | 62.758 | 63.380 | 64.001 | 64.623 | 65.244 | 65.865 | 66.487 | 67.108 | 67.729 | 100  |

## Area

### Square inches to square centimeters

| in <sup>2</sup> | 0               | 1               | 2               | 3               | 4               | 5               | 6               | 7               | 8               | 9               | in <sup>2</sup> |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                 | cm <sup>2</sup> | cm <sup>2</sup> | cm <sup>2</sup> | cm <sup>2</sup> | cm <sup>2</sup> | cm <sup>2</sup> | cm <sup>2</sup> | cm <sup>2</sup> | cm <sup>2</sup> | cm <sup>2</sup> |                 |
| ----            |                 | 6.452           | 12.903          | 19.355          | 25.806          | 32.258          | 38.710          | 45.161          | 51.613          | 58.065          | ----            |
| 10              | 64.516          | 70.968          | 77.419          | 83.871          | 90.323          | 96.774          | 103.226         | 109.677         | 116.129         | 122.581         | 10              |
| 20              | 129.032         | 135.484         | 141.935         | 148.387         | 154.839         | 161.290         | 167.742         | 174.194         | 180.645         | 187.097         | 20              |
| 30              | 193.548         | 200.000         | 206.452         | 212.903         | 219.355         | 225.806         | 232.258         | 238.710         | 245.161         | 251.613         | 30              |
| 40              | 258.065         | 264.516         | 270.968         | 277.419         | 283.871         | 290.323         | 296.774         | 303.226         | 309.677         | 316.129         | 40              |
| 50              | 322.581         | 329.032         | 335.484         | 341.935         | 348.387         | 354.839         | 361.290         | 367.742         | 374.194         | 380.645         | 50              |
| 60              | 387.097         | 393.548         | 400.000         | 406.452         | 412.903         | 419.355         | 425.806         | 432.258         | 438.710         | 445.161         | 60              |
| 70              | 451.613         | 458.065         | 464.516         | 470.968         | 477.419         | 483.871         | 490.323         | 496.774         | 503.226         | 509.677         | 70              |
| 80              | 516.129         | 522.581         | 529.032         | 535.484         | 541.935         | 548.387         | 554.839         | 561.290         | 567.742         | 574.194         | 80              |
| 90              | 580.645         | 587.097         | 593.548         | 600.000         | 606.452         | 612.903         | 619.355         | 625.806         | 632.258         | 638.710         | 90              |
| 100             | 645.161         | 651.613         | 658.065         | 664.516         | 670.968         | 677.419         | 683.871         | 690.323         | 696.774         | 703.226         | 100             |

# INTRODUCTION

## Square centimeters to square inches

| cm <sup>2</sup> | 0               | 1               | 2               | 3               | 4               | 5               | 6               | 7               | 8               | 9               | cm <sup>2</sup> |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                 | in <sup>2</sup> | in <sup>2</sup> | in <sup>2</sup> | in <sup>2</sup> | in <sup>2</sup> | in <sup>2</sup> | in <sup>2</sup> | in <sup>2</sup> | in <sup>2</sup> | in <sup>2</sup> |                 |
| ----            |                 | 0.155           | 0.310           | 0.465           | 0.620           | 0.775           | 0.930           | 1.085           | 1.240           | 1.395           | ----            |
| 10              | 1.550           | 1.705           | 1.860           | 2.015           | 2.170           | 2.325           | 2.480           | 2.635           | 2.790           | 2.945           | 10              |
| 20              | 3.100           | 3.255           | 3.410           | 3.565           | 3.720           | 3.875           | 4.030           | 4.185           | 4.340           | 4.495           | 20              |
| 30              | 4.650           | 4.805           | 4.960           | 5.115           | 5.270           | 5.425           | 5.580           | 5.735           | 5.890           | 6.045           | 30              |
| 40              | 6.200           | 6.355           | 6.510           | 6.665           | 6.820           | 6.975           | 7.130           | 7.285           | 7.440           | 7.595           | 40              |
| 50              | 7.750           | 7.905           | 8.060           | 8.215           | 8.370           | 8.525           | 8.680           | 8.835           | 8.990           | 9.145           | 50              |
| 60              | 9.300           | 9.455           | 9.610           | 9.765           | 9.920           | 10.075          | 10.230          | 10.385          | 10.540          | 10.695          | 60              |
| 70              | 10.850          | 11.005          | 11.160          | 11.315          | 11.470          | 11.625          | 11.780          | 11.935          | 12.090          | 12.245          | 70              |
| 80              | 12.400          | 12.555          | 12.710          | 12.865          | 13.020          | 13.175          | 13.330          | 13.485          | 13.640          | 13.795          | 80              |
| 90              | 13.950          | 14.105          | 14.260          | 14.415          | 14.570          | 14.725          | 14.880          | 15.035          | 15.190          | 15.345          | 90              |
| 100             | 15.500          | 15.655          | 15.810          | 15.965          | 16.120          | 16.275          | 16.430          | 16.585          | 16.740          | 16.895          | 100             |

## Volume

### Cubic inches to cubic centimeters

| in <sup>3</sup> | 0                         | 1                         | 2                         | 3                         | 4                         | 5                         | 6                         | 7                         | 8                         | 9                         | in <sup>3</sup> |
|-----------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|-----------------|
|                 | cm <sup>3</sup><br>( cc ) | cm <sup>3</sup><br>( cc ) | cm <sup>3</sup><br>( cc ) | cm <sup>3</sup><br>( cc ) | cm <sup>3</sup><br>( cc ) | cm <sup>3</sup><br>( cc ) | cm <sup>3</sup><br>( cc ) | cm <sup>3</sup><br>( cc ) | cm <sup>3</sup><br>( cc ) | cm <sup>3</sup><br>( cc ) |                 |
| ----            |                           | 16.387                    | 32.774                    | 49.161                    | 65.548                    | 81.936                    | 98.323                    | 114.710                   | 131.097                   | 147.484                   | ----            |
| 10              | 163.871                   | 180.258                   | 196.645                   | 213.032                   | 229.419                   | 245.807                   | 262.194                   | 278.581                   | 294.968                   | 311.355                   | 10              |
| 20              | 327.742                   | 344.129                   | 360.516                   | 376.903                   | 393.290                   | 409.678                   | 426.065                   | 442.452                   | 458.839                   | 475.226                   | 20              |
| 30              | 491.613                   | 508.000                   | 524.387                   | 540.774                   | 557.161                   | 573.549                   | 589.936                   | 606.323                   | 622.710                   | 639.097                   | 30              |
| 40              | 655.484                   | 671.871                   | 688.258                   | 704.645                   | 721.033                   | 737.420                   | 753.807                   | 770.194                   | 786.581                   | 802.968                   | 40              |
| 50              | 819.355                   | 835.742                   | 852.129                   | 868.516                   | 884.904                   | 901.291                   | 917.678                   | 934.065                   | 950.452                   | 966.839                   | 50              |
| 60              | 983.226                   | 999.613                   | 0                         | 7                         | 5                         | 2                         | 9                         | 6                         | 1114.323                  | 0                         | 60              |
| 70              | 1147.09                   | 1163.48                   | 1179.87                   | 1196.25                   | 1212.64                   | 1229.03                   | 1245.42                   | 1261.80                   | 1278.19                   | 1294.58                   | 70              |
|                 | 7                         | 4                         | 1                         | 8                         | 6                         | 3                         | 0                         | 7                         | 4                         | 1                         |                 |
| 80              | 1310.96                   | 1327.35                   | 1343.74                   | 1360.13                   | 1376.51                   | 1392.90                   | 1409.29                   | 1425.67                   | 1442.06                   | 1458.45                   | 80              |
|                 | 8                         | 5                         | 2                         | 0                         | 7                         | 4                         | 1                         | 8                         | 5                         | 2                         |                 |
| 90              | 1474.83                   | 1491.22                   | 1507.61                   | 1524.00                   | 1540.38                   | 1556.77                   | 1573.16                   | 1589.54                   | 1605.93                   | 1622.32                   | 90              |
|                 | 9                         | 6                         | 3                         | 1                         | 8                         | 5                         | 2                         | 9                         | 6                         | 3                         |                 |
| 100             | 1638.71                   | 1655.09                   | 1671.48                   | 1687.87                   | 1704.25                   | 1720.64                   | 1737.03                   | 1753.42                   | 1769.80                   | 1786.19                   | 100             |
|                 | 0                         | 7                         | 4                         | 2                         | 9                         | 6                         | 3                         | 0                         | 7                         | 4                         |                 |

### Cubic centimeters to cubic inches

| cm <sup>3</sup><br>( cc ) | 0               | 1               | 2               | 3               | 4               | 5               | 6               | 7               | 8               | 9               | cm <sup>3</sup><br>( cc ) |
|---------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|---------------------------|
|                           | in <sup>3</sup> | in <sup>3</sup> | in <sup>3</sup> | in <sup>3</sup> | in <sup>3</sup> | in <sup>3</sup> | in <sup>3</sup> | in <sup>3</sup> | in <sup>3</sup> | in <sup>3</sup> |                           |
| ----                      |                 | 0.0610          | 0.1220          | 0.1831          | 0.2441          | 0.3051          | 0.3661          | 0.4272          | 0.4882          | 0.5492          | ----                      |
| 10                        | 0.6102          | 0.6713          | 0.7323          | 0.7933          | 0.8543          | 0.9154          | 0.9764          | 1.0374          | 1.0984          | 1.1594          | 10                        |
| 20                        | 1.2205          | 1.2815          | 1.3425          | 1.4035          | 1.4646          | 1.5256          | 1.5866          | 1.6476          | 1.7087          | 1.7697          | 20                        |
| 30                        | 1.8307          | 1.8917          | 1.9528          | 2.0138          | 2.0748          | 2.1358          | 2.1968          | 2.2579          | 2.3189          | 2.3799          | 30                        |
| 40                        | 2.4409          | 2.5020          | 2.5630          | 2.6240          | 2.6850          | 2.7461          | 2.8071          | 2.8681          | 2.9291          | 2.9902          | 40                        |
| 50                        | 3.0512          | 3.1122          | 3.1732          | 3.2343          | 3.2953          | 3.3563          | 3.4173          | 3.4784          | 3.5394          | 3.6004          | 50                        |
| 60                        | 3.6614          | 3.7224          | 3.7835          | 3.8445          | 3.9055          | 3.9665          | 4.0276          | 4.0886          | 4.1496          | 4.2106          | 60                        |
| 70                        | 4.2717          | 4.3327          | 4.3937          | 4.4547          | 4.5157          | 4.5768          | 4.6378          | 4.6988          | 4.7598          | 4.8209          | 70                        |
| 80                        | 4.8819          | 4.9429          | 5.0039          | 5.0650          | 5.1260          | 5.1870          | 5.2480          | 5.3091          | 5.3701          | 5.4311          | 80                        |
| 90                        | 5.4921          | 5.5531          | 5.6142          | 5.6752          | 5.7362          | 5.7972          | 5.8583          | 5.9193          | 5.9803          | 6.0413          | 90                        |
| 100                       | 6.1024          | 6.1634          | 6.2244          | 6.2854          | 6.3465          | 6.4075          | 6.4685          | 6.5295          | 6.5905          | 6.6516          | 100                       |

Product: New Holland E33C Mini Excavator Service Repair Manual

Full Download: <https://www.arepairmanual.com/downloads/new-holland-e33c-mini-excavator-service-repair-manual/>[i-excavator-service-repair-manual/](https://www.arepairmanual.com/downloads/new-holland-e33c-mini-excavator-service-repair-manual/)**Gallons (U.S) to liters**

| U.S.-gal. | 0       | 1       | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9       | U.S.-gal. |
|-----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-----------|
|           | liters  | liters  | liters  | liters  | liters  | liters  | liters  | liters  | liters  | liters  |           |
| ----      |         | 3.7853  | 7.5707  | 11.3560 | 15.1413 | 18.9266 | 22.7120 | 26.4973 | 30.2826 | 34.0680 | ----      |
| 10        | 37.8533 | 41.6386 | 45.4239 | 49.2093 | 52.9946 | 56.7799 | 60.5653 | 64.3506 | 68.1359 | 71.9213 | 10        |
| 20        | 75.7066 | 79.4919 | 83.2772 | 87.0626 | 90.8479 | 94.6332 | 98.4186 | 102.203 | 105.989 | 109.774 | 20        |
| 30        | 113.559 | 117.345 | 121.130 | 124.915 | 128.701 | 132.486 | 136.271 | 140.057 | 143.842 | 147.627 | 30        |
|           | 9       | 2       | 5       | 9       | 2       | 5       | 8       | 2       | 5       | 8       |           |
| 40        | 151.413 | 155.198 | 158.983 | 162.769 | 166.554 | 170.339 | 174.125 | 177.910 | 181.695 | 185.481 | 40        |
|           | 2       | 5       | 8       | 1       | 5       | 8       | 1       | 5       | 8       | 1       |           |
| 50        | 189.266 | 193.051 | 196.837 | 200.622 | 204.407 | 208.193 | 211.978 | 215.763 | 219.549 | 223.334 | 50        |
|           | 5       | 8       | 1       | 4       | 8       | 1       | 4       | 8       | 1       | 4       |           |
| 60        | 227.119 | 230.905 | 234.690 | 238.475 | 242.261 | 246.046 | 249.831 | 253.617 | 257.402 | 261.187 | 60        |
|           | 7       | 1       | 4       | 7       | 1       | 4       | 7       | 0       | 4       | 7       |           |
| 70        | 264.973 | 268.758 | 272.543 | 276.329 | 280.114 | 283.899 | 287.685 | 291.470 | 295.255 | 299.041 | 70        |
|           | 0       | 4       | 7       | 0       | 3       | 7       | 0       | 3       | 7       | 0       |           |
| 80        | 302.826 | 306.611 | 310.397 | 314.182 | 317.967 | 321.753 | 325.538 | 329.323 | 333.109 | 336.894 | 80        |
|           | 3       | 6       | 0       | 3       | 6       | 0       | 3       | 6       | 0       | 3       |           |
| 90        | 340.679 | 344.464 | 348.250 | 352.035 | 355.820 | 359.606 | 363.391 | 367.176 | 370.962 | 374.747 | 90        |
|           | 6       | 9       | 3       | 6       | 9       | 3       | 6       | 9       | 2       | 6       |           |
| 100       | 378.532 | 382.318 | 386.103 | 389.888 | 393.674 | 397.459 | 401.244 | 405.030 | 408.815 | 412.600 | 100       |
|           | 9       | 2       | 6       | 9       | 2       | 5       | 9       | 2       | 5       | 9       |           |

**Liters to gallons (U.S)**

| liters | 0        | 1        | 2        | 3        | 4        | 5        | 6        | 7        | 8        | 9        | liters |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------|
|        | U.S.gal. | U.S.gal. | U.S.gal. | U.S.gal. | U.S.gal. | U.S.gal. | U.S.gal. | U.S.gal. | U.S.gal. | U.S.gal. |        |
| ----   |          | 0.2642   | 0.5284   | 0.7925   | 1.0567   | 1.3209   | 1.5851   | 1.8492   | 2.1134   | 2.3776   | ----   |
| 10     | 2.6418   | 2.9060   | 3.1701   | 3.4343   | 3.6985   | 3.9627   | 4.2268   | 4.4910   | 4.7552   | 5.0194   | 10     |
| 20     | 5.2836   | 5.5477   | 5.8119   | 6.0761   | 6.3403   | 6.6044   | 6.8686   | 7.1328   | 7.3970   | 7.6612   | 20     |
| 30     | 7.9253   | 8.1895   | 8.4537   | 8.7179   | 8.9820   | 9.2462   | 9.5104   | 9.7746   | 10.0388  | 10.3029  | 30     |
| 40     | 10.5671  | 10.8313  | 11.0955  | 11.3596  | 11.6238  | 11.8880  | 12.1522  | 12.4164  | 12.6805  | 12.9447  | 40     |
| 50     | 13.2089  | 13.4731  | 13.7372  | 14.0014  | 14.2656  | 14.5298  | 14.7940  | 15.0581  | 15.3223  | 15.5865  | 50     |
| 60     | 15.8507  | 16.1148  | 16.3790  | 16.6432  | 16.9074  | 17.1716  | 17.4357  | 17.6999  | 17.9641  | 18.2283  | 60     |
| 70     | 18.4924  | 18.7566  | 19.0208  | 19.2850  | 19.5492  | 19.8133  | 20.0775  | 20.3417  | 20.6059  | 20.8700  | 70     |
| 80     | 21.1342  | 21.3984  | 21.6626  | 21.9268  | 22.1909  | 22.4551  | 22.7193  | 22.9835  | 23.2476  | 23.5118  | 80     |
| 90     | 23.7760  | 24.0402  | 24.3044  | 24.5685  | 24.8327  | 25.0969  | 25.3611  | 25.6252  | 25.8894  | 26.1536  | 90     |
| 100    | 26.4178  | 26.6820  | 26.9461  | 27.2103  | 27.4745  | 27.7387  | 28.0028  | 28.2670  | 28.5312  | 28.7954  | 100    |

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