

# W50 - W60

# W70 - W80

## WHEEL LOADER

# Workshop Manual

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**THIS ALERT SYMBOL SIGNALS IMPORTANT MESSAGES INVOLVING YOUR SAFETY.**

**Read and heed carefully the safety instructions listed and follow the precautions recommended to avoid potential risks and to safeguard your health and your safety.**

**You will find this symbol in the text of this Manual referred to the following key words:**

**WARNING** - Cautions directed to avoid improper repair interventions involving potential consequences for the safety of the personnel performing the repairs.

**DANGER** - These warnings qualify specifically potential dangers for the safety of the operator or other persons directly or indirectly involved.

### IMPORTANT NOTICE

All maintenance and repair interventions explained in this Manual **must be performed exclusively by the Service Organisation of the Manufacturer**, observing strictly the instructions explained using, whenever necessary, the recommended specific tools.

Whoever performs the operations reported without following exactly the precautions is responsible on his own, for the damages that may result.

Neither the Factory nor any Organisations in its Distribution Network, including but not limited to national, regional or local distributors, are responsible for any liability arising from any damage resulting from defects caused by parts and/or components not approved by the Factory for use in maintaining and/or repairing products manufactured or merchandised by the Factory.

In any case, no warranty of any kind is made or shall be imposed with respect to products manufactured or merchandised by the Factory, when failures are caused by the use of parts and/or components not approved by the Factory.

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**SECTION 0**

**SAFETY INSTRUCTIONS**

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## FUNDAMENTAL SAFETY INSTRUCTIONS

### WARNINGS AND SYMBOLS

The following signs are used in the Workshop Manual to designate exceptionally important information:

	<b>Precautionary rules and measures designed to protect the operator and other persons from life-threatening hazards or injury and to prevent extensive damage to property.</b>
	<b>Information and precautionary measures designed to prevent damage to the machine and other property.</b>

### RISKS RESULTING FROM FAILURE TO OBSERVE THE SAFETY INSTRUCTIONS

	<p><b>This wheeled loader has been built in accordance with state-of-the-art standards and recognized safety regulations.</b></p> <p><b>Nevertheless, its use may constitute a risk if it is still operated despite a suspected or obvious defect or if it is inexpertly repaired.</b></p> <p><b>There is then a potential</b></p> <ul style="list-style-type: none"> <li>- risk to life and limb</li> <li>- risk of the machine and other assets being damaged.</li> </ul> <p><b>The wheeled loader must be stopped immediately if suspected or obvious damage represents a risk to the safety of the operator, of other persons at the deployment site, or of other assets.</b></p> <p><b>All components are carefully coordinated. Original parts must be used to ensure smooth running and a long service life.</b></p>
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### ORGANIZATIONAL MEASURES

The Operation and Maintenance Instruction Manual must always be at hand at the deployment site of the machine, e.g. in the container provided.

In addition to the Operation and Maintenance Instruction Manual, observe and instruct the user in all other generally applicable statutory and other mandatory regulations relevant to accident prevention and environmental protection.

These compulsory regulations may also deal, for example, with the handling of hazardous substances, the issuing/wearing of personal protective equipment, or traffic regulations.

The Operation and Maintenance Instruction Manual must be supplemented by instructions covering the duties involved in supervising and notifying special organizational features, such as job organization, working sequences or deployed personnel.

The personnel assigned to work on the machine must have read the operating instructions and in particular the Safety Instructions section before starting work. Reading the instructions after work has begun is too late. This applies especially to persons working only occasionally on the machine, e.g. during setting-up or servicing.

Check at least occasionally whether the work is being carried out in compliance with the Operation and Maintenance Instruction Manual and with attention being paid to risks and safety factors.

Long hair must be tied back or otherwise secured, garments must be close-fitting, and no jewellery including rings may be worn. Injury may result from such items being caught up in the machinery or catching on moving parts.

Use personal protective equipment wherever required by the circumstances or by law.

Observe all safety instructions and warnings attached to the machine.

See to it that safety instructions and warnings attached to the machine are always complete and perfectly legible.

In the event of safety-relevant modifications or changes in the behaviour of the machine during operation, stop the machine immediately and report the malfunction to the competent authority/person.

Never make any modifications, additions or conversions which might affect safety without the supplier's approval. This also applies to the installation and adjustment of safety devices and valves as well as to welding work on load-bearing elements.

Spare parts must comply with the technical requirements specified by the manufacturer. Spare parts from original equipment manufacturers can be relied upon to do so.

Replace hydraulic hoses within stipulated and appropriate intervals, even if no safety-relevant defects have been detected.

Adhere to prescribed intervals or those specified in the Operation and Maintenance Instruction Manual for routine checks and inspections.

For the execution of maintenance work, tools and workshop equipment equal to the task on hand are absolutely indispensable.

The personnel must be familiar with the location and operation of fire extinguishers.

Observe all fire-warning and fire-fighting procedures.

## SELECTION AND QUALIFICATION OF PERSONNEL

Any work on / with the machine must be executed by reliable personnel only. Statutory minimum age limits must be observed.

Deploy only trained or instructed staff and set out clearly the individual responsibilities of the personnel for operation, set-up, maintenance and repair.

Make sure that only authorized personnel works on / with the machine.

Define the machine operator's responsibilities – also with regard to observing traffic regulations giving the operator the authority to refuse instructions by third parties that are contrary to safety.

Do not allow persons to be trained or instructed or persons taking part in a general training course to work on or with the machine without being permanently supervised by an experienced person.

Work on the electrical system and equipment of the machine must be carried out only by a skilled electrician or by instructed persons under the supervision and guidance of a skilled electrician and in accordance with electrical engineering rules and regulations.

Work on chassis, brake and steering systems must be performed only by skilled personnel specially trained for such work.

Work on the hydraulic system must be carried out only by personnel with special knowledge and experience of hydraulic equipment.

## OPERATION, SAFETY INSTRUCTIONS

### Standard operation

Avoid any operational mode that might be prejudicial to safety.

Before starting work, familiarize yourself with the surroundings and circumstances of the site, such as obstacles in the working and travelling area, the soil bearing capacity and any barriers separating the construction site from the public highway.

Take the necessary precautions to ensure that the machine is used only when in a safe and reliable state.

Operate the machine only if all protective and safety-oriented devices, e.g. removable safety devices, emergency shut-off equipment, sound-proofing elements and extractors, are in place and fully functional.

Check the machine at least once per working shift for obvious damage and defects. Report any changes (incl. changes in the machine's working behaviour) to the competent organization/person immediately. If necessary, stop the machine immediately and lock it.

In the event of malfunctions, stop the machine immediately and lock it. Have any defects rectified immediately.

Start the machine from the driver's seat only.

During start-up and shut-down procedures always watch the indicators in accordance with the Operation and Maintenance Instruction Manual.

Before setting the machine in motion, make sure that nobody is at risk.

Before starting work or travelling with the machine, check that the braking, steering, signalling and lighting systems are fully functional.

Before setting the machine in motion always check that the accessories have been safely stowed away.

When travelling on public roads, ways and places, always observe the valid traffic regulations and, if necessary, make sure beforehand that the machine is in a condition compatible with these regulations.

In conditions of poor visibility and after dark always switch on the lighting system.

Persons accompanying the driver must be seated on the passenger seats provided for this purpose.

When driving through underpasses or tunnels, over bridges or under overhead lines, always make sure that there is sufficient clearance.

Always keep at a distance from the edges of building pits and slopes.

Avoid any operation that might be a risk to machine stability.

Never travel across slopes; always keep the working equipment and the load close to the ground, especially when travelling downhill.

On sloping terrain always adapt your travelling speed to the prevailing ground conditions. Never change to a lower gear on a slope but always before reaching it.

Before leaving the driver's seat always secure the machine against inadvertent movement and unauthorized use. Shut off the engine.

## MAINTENANCE, SAFETY INSTRUCTIONS

Observe the adjusting, maintenance and inspection activities and intervals set out in the Operation and Maintenance Instruction Manual, including information on the replacement of parts and equipment. These activities may be executed by skilled personnel only.

Brief operating personnel before beginning special operations and maintenance work, and appoint a person to supervise the activities.

In any work concerning the operation, conversion or adjustment of the machine and its safety-oriented devices or any work related to maintenance, inspection and repair, always observe the start-up and shut-down procedures set out in the Operation and Maintenance Instruction Manual and the information on maintenance work.

Ensure that the maintenance area is adequately secured.

If the machine is completely shut down for maintenance and repair work, it must be secured against inadvertent starting by:

- removing the ignition key and
- attaching a warning sign.

Carry out maintenance and repair work only if the machine is positioned on stable and level ground and has been secured against inadvertent movement and buckling.

To avoid the risk of accidents, individual parts and large assemblies being moved for replacement purposes should be carefully attached to lifting tackle and secured. Use only suitable and technically perfect lifting gear and suspension systems with adequate lifting capacity. Never work or stand under suspended loads.

The fastening of loads and the instructing of crane operators should be entrusted to experienced persons only. The marshaller giving the instructions must be within sight or sound of the operator.

For carrying out overhead assembly work always use specially designed or otherwise safety-oriented ladders and working platforms. Never use machine parts as a climbing aid.

Wear a safety harness when carrying out maintenance work at greater heights.

Keep all handles, steps, handrails, platforms, landings and ladders free from dirt, snow and ice.

Clean the machine, especially connections and threaded unions, of any traces of oil, fuel or preservatives before carrying out maintenance/repair work. Never use aggressive detergents. Use lint-free cleaning rags.

Before cleaning the machine with water, steam jet (high-pressure cleaning) or detergents, cover or tape up all openings which have to be protected against water, steam or detergent penetration for safety and functional reasons. Special care must be taken with electric motors and switchgear cabinets.

Ensure during cleaning of the machine that the temperature sensors of the fire-warning and fire-fighting systems do not come into contact with hot cleaning agents as this might activate the extinguishing system.

After cleaning, remove all covers and tapes applied for that purpose.

After cleaning, examine all fuel, lubricant, and hydraulic fluid lines for leaks, loose connections, chafe marks and damage. Any defects found must be rectified without delay.

Always tighten any screwed connections that have been loosened during maintenance and repair work. Any safety devices removed for set-up, maintenance or repair purposes must be refitted and checked immediately upon completion of the maintenance and repair work.

Ensure that all consumables and replaced parts are disposed of safely and with minimum environmental impact.

## WARNING OF SPECIAL DANGERS

### Electric energy

Use only original fuses with the specified current rating. Switch off the machine immediately if trouble occurs in the electrical system.

When working with the machine, maintain a safe distance from overhead electric lines. If work is to be carried out close to overhead lines, the working equipment must be kept well away from them. Caution: life-threatening danger! Check out the prescribed safety distances.

If your machine comes into contact with a live wire

- Do not leave the machine.
- Drive the machine out of the hazard zone and warn others against approaching and touching the machine.
- Have the live wire de-energized.
- Do not leave the machine until the damaged line has been de-energized with certainty.

The electrical equipment of machines is to be inspected and checked at regular intervals. Defects such as loose connections or scorched cables must be rectified immediately.

### Gas, dust, steam and smoke

Operate internal combustion engines and fuel-operated heating systems only on adequately ventilated premises. Before starting the machine on enclosed premises, make sure that there is sufficient ventilation.

Observe the regulations in force at the respective site.

Carry out welding, flame-cutting and grinding work on the machine only if this has been expressly authorized, as there may be a risk of explosion and fire.

Before carrying out welding, flame-cutting and grinding operations, clean the machine and its surroundings of dust and other inflammable substances and make sure that the premises are adequately ventilated. RISK OF EXPLOSION.

### Hydraulic and pneumatic equipment

Check all lines, hoses and screwed connections regularly for leaks and obvious damage. Repair damage immediately. Splashed oil may cause injury and fire.

Depressurize all system sections and pressure pipes (hydraulic system, compressed-air system) to be opened in accordance with the specific instructions for the unit concerned before carrying out any repair work.

Hydraulic and compressed-air lines must be laid and fitted properly. Ensure that no connections are interchanged. The fittings, lengths and quality of the hoses must comply with the technical requirements.

### Noise

During operation, all sound baffles of the machine must be closed.

Always wear the prescribed ear protectors.

### Oil, grease and other chemical substances

When handling oil, grease and other chemical substances, observe the product-related safety regulations.

Be careful when handling hot consumables (risk of burning or scalding).

**TRANSPORTING AND TOWING;  
RECOMMISSIONING**

The machine must be towed, loaded and transported only in accordance with the Operation and Maintenance Instruction Manual.

For towing the machine observe the prescribed transport position, admissible speed and route.

Use only appropriate means of transport and lifting gear of adequate capacity.

The recommissioning procedure must be strictly in accordance with the Operation and Maintenance Instruction Manual.

**REPAIRS, SAFETY INSTRUCTIONS****OPERATION AND MAINTENANCE INSTRUCTION MANUAL**

Never start repair work without having read and understood the Operation and Maintenance Instruction Manual.

Pay special attention to: "Fundamental Safety Instructions",

"Inspection and Servicing, Safety Instructions"

and all warning and instruction signs attached to the machine.

The descriptions of operational sequences are designed for experienced personnel only.

Always keep the Operation and Maintenance Instruction Manual with the machine.

**REPAIR PERSONNEL**

Repair personnel must have know-how and experience relevant to the repair of this or comparable machines.

Inexperienced personnel must be thoroughly trained by experienced repair personnel.

**BLOCKING THE PIVOT JOINT**

When carrying out repair work in the pivot range, block the pivot joint. Remove the block on completing work.

**PRETENSIONED UNITS**

Never open damaged pretensioned units but replace them as complete units.

Open them only in exceptional cases where the system and the working sequence are exactly known and the necessary special tools are available.

The Operation and Maintenance Instruction Manual contains no relevant information.

**DISMANTLING COMPONENTS**

Never dismantle components while the machine is still at operating temperature.

Oils, greases, brake fluid or coolant may have a high temperature and thus result in burning or scalding.

Wait for the machine to cool down.

Depressurize pipelines and hoses, cylinders, radiator, hydraulic tank, compressed air reservoir and other systems or units before starting work.

Replace defective components in good time to prevent greater damage.

Clean the defective component carefully before dismantling it. Mark dismantled components in the correct sequence to facilitate installation.

When dismantling the component, close exposed hose and pipe connections, open boreholes and housings with care to prevent dirt from penetrating.

## ACCUMULATORS

### Safety Instructions



#### NEVER REMOVE LEAD SEALS

Never change the rated pressure of pressure-reducing valves without the explicit authorization of the Service department.

Never remove lead seals from pressure-reducing valves and accumulators.

#### AFTER REPAIR WORK

To prevent corrosion, coat all bright metal machine components with a grease film.

On completing the work, reassemble all protective devices, covers, and sound- and vibration-insulation material.

Never start up the driving motor while work is being done on the machine.

Check the repaired components and all machine functions with a trial run.

Never release the machine for re-commissioning until it is fully functioning.



Accumulators are installed in the hydraulic system. These accumulators contain nitrogen under high initial pressure.

Even when the hydraulic pressure in the system is reduced, the nitrogen remains in the accumulator.

The accumulators are completely safe in operation. If incorrectly handled, however, there is a risk of explosion.

Therefore:

- Never handle accumulators mechanically, never weld or solder them.
- Testing and servicing work must be carried out by experts only.
- Prior to any testing and servicing work, depressurize the hydraulic part of the system.
- To dismantle the accumulator, always wear eye protection and working gloves.
- Fill accumulators with nitrogen only, never with compressed air or oxygen.
- Report any defects or damage to the machine owner without delay.
- Prior to re-commissioning, an inspection by a specialist or expert is essential if the accumulator has been damaged or if the admissible operating temperature or operating pressure has been exceeded.

Never remove or paint over warning and information plates, rating plates or type identification markings. Replace illegible or damaged plates immediately.

**ENGINE****Engine, repair instructions**

Before working on the engine, read and observe: "Repair, safety instructions" and the Operation and Maintenance Instruction Manual for the engine.

Risk of injury from rotating or hot engine components.

Shut off the engine and wait for it to cool down.

Do repair work only if the machine is secured as described under "Securing the machine" in Operation and Maintenance Instruction Manual.

Check and replace V-belts only when the engine is stationary.

Repair work on the engine demands extensive know-how and special tools.

If in doubt, have the repair work carried out by the Service Dept. or by your local dealer.

**Assisted starting (with jumper cables), safety instructions****EXPLOSION HAZARD**

Battery gases contain hydrogen and are highly flammable. Keep potential ignition sources such as unshielded lights or lighted cigarettes away from the batteries.

Risk of injury from acid splashes and battery gases.

Never lean over the batteries when starting the machine from another vehicle.

Wear goggles.

Never use assisted starting if the batteries are defective or frozen.

Never connect batteries (battery assemblies) unless they have the same voltage.

Use only tested jumper cables with insulated terminal clips and an adequate lead diameter.

Ensure that the bodies of the supplying and receiving machines are not in contact. Otherwise a current flow could result from connecting the positive poles. Risk of short-circuiting.

Never use assisted starting involving overvoltage, e.g. two or three batteries connected in series or auxiliary devices generating higher voltages than 12V.

Never use welding generators or welding transformers as a source of current.

Position the jumper cables in such a way that they cannot be caught by rotating engine components.

Read and observe: "Inspection and Servicing, Safety Instructions", paying special attention to the section "Handling batteries".

**WELDING OPERATIONS****Welding Operations, safety instructions**

**Never perform welding operations unless you are qualified to do so.**

**Observe the accident prevention regulations.**

**Any work on receptacles that contain or have contained substances:**

- which are combustible or which encourage combustion,
- which are susceptible to explosion, or
- which may develop health-hazardous gases, vapours, mist or dust during welding operations,

**must be carried out only under expert supervision and only by experienced persons authorized to do such work.**

**Should you have any problems or queries, apply to the Service department.**



**Prior to any welding operations on the machine:**

- Disconnect the battery, first at the negative terminal and then at the positive terminal.
- Disconnect the positive terminal at the alternator.
- Protect the disconnected terminals and plugs from short-circuiting and soiling by covering them with foil or adhesive tape.

**Apply the welding current terminals very close to the welding point.**

**The welding current must not flow via the ball bearing slewing rim, via pin couplings or link joints of hydraulic cylinders.**

**On completion of the welding operation, restore all electrical connections.**

**When connecting the battery, first connect the positive terminal and then the negative terminal.**

# SECTION 1

## SERVICE DATA

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## 1.1 FOREWORD

The Technical Handbook "Service Data" contains details which are important to the service staff. Data included in other parts of the general documentation have been left aside. The set of documents for an CNH construction machine includes:

- Operation and Maintenance Instruction Manual
- Parts Catalog
- Dimension Table or Dimension Sheet "Techn. Data".

Workshop Manual and "Service Information" bulletins (si) are, furthermore, to be considered as supplements to the general documentation.

Data regarding auxiliary units for operating ancillary or special systems, as well as data on machines produced only in small numbers, have not been included.

Filling quantities are only approximate figures intended to help in stockholding the various fluids and agents. Each unit has appropriate checking systems, e.g. dipstick or checking screws, with which the exact filling level can be checked.



**The Part Nos. given in the sections are not to be used when ordering spare parts. They are only intended to identify the component being referred to. When ordering spare parts, use only the Part Nos. given in the Parts catalog or the internal microfilms.**



**Anyone involved with commissioning, operating, inspecting and servicing the CNH construction machine must read through and acquaint himself with the Operation and Maintenance Instructions Manual - and especially the Section SAFETY INSTRUCTIONS - before starting work.**

## 1.2 SI- AND ADDITIONAL UNITS

### 1.2.1 QUANTITIES OF SPACE AND MASS

Quantity	Symbol	Unit			Conversion		Explanation Remark
		old	new		For exact calculation	For rough calculation (appr. 2% inexact)	
			SI - Units	Selection of additional units			
Length	l	mm, cm, dm, m, km	m	mm, km			
Area	A	mm <sup>2</sup> , cm <sup>2</sup> , dm <sup>2</sup> , m <sup>2</sup>	m <sup>2</sup>	mm <sup>2</sup> , cm <sup>2</sup>			
Volume	V, Vn	mm <sup>3</sup> , cm <sup>3</sup> , dm <sup>3</sup> , m <sup>3</sup> , l	m <sup>3</sup>	mm <sup>3</sup> , cm <sup>3</sup> , dm <sup>3</sup> , l			
Mass	m	mg, g, kg, Mg=t, (kg <sub>f</sub> s <sup>2</sup> /m)	kg	mg, g, Mg, t			
Density	r	g/cm <sup>3</sup> , kg/dm <sup>3</sup> , (kg <sub>f</sub> s <sup>2</sup> /m <sup>4</sup> )	kg/m <sup>3</sup>	g/cm <sup>3</sup> , kg/dm <sup>3</sup>			
Inertia moment	J	kg m <sup>2</sup> (kg <sub>f</sub> m s <sup>2</sup> )	kg m <sup>2</sup>	Mg m <sup>2</sup>	1 kg <sub>f</sub> m s <sup>2</sup> = 9.81 kg m <sup>2</sup>	1 kg <sub>f</sub> m s <sup>2</sup> = 10 kg m <sup>2</sup>	
Specific volume	v	m <sup>3</sup> /kg, m <sup>3</sup> /t	m <sup>3</sup> /kg	m <sup>3</sup> /Mg			

## 1.2.2 TIME RELATED QUANTITIES

Quantity	Symbol	Unit			Conversion		Explanation Remark
		old	new		For exact calculation	For rough calculation (appr. 2% inexact)	
			SI - Units	Selection of additional units			
Time	t	s, min, h, d = day	s	ms, min, h, d			
Frequency	f	Hz	Hz				1 Hz = 1/s
Rate of revolutions	n	rev/min	1/s	1/min			s = min/60
Speed	v	m/s, km/h	m/s	km/h			
Acceleration	a	m/s <sup>2</sup>	m/s <sup>2</sup>				
Volume flow	V	m <sup>3</sup> /s, m <sup>3</sup> /min, m <sup>3</sup> /h	m <sup>3</sup> /s	m <sup>3</sup> /min, l/h			
Mass flow	m	kg/s, kg/min, kg/h	kg/s				
Heat flow	Φ	kcal/h	W	kW, MW	1 kcal/h = 1.163 W	1 kcal/h = 1.2 W	1 W = 1 J/s = 1 Nm/s
Specific fuel and oil consumption	b, b <sub>s</sub>	kg/CVh g/CVh	kg/J	g/kWh	1 g/CVh = 1.359 g/kWh	1 g/CVh = 1.36 g/kWh	

## 1.2.3 QUANTITIES OF FORCE, ENERGY AND POWER

Quantity	Symbol	Unit			Conversion		Explanation Remark
		old	new		For exact calculation	For rough calculation (appr. 2% inexact)	
			SI - Units	Selection of additional units			
Force	F	(dyne, gf)	N (Newton)	MN, kN, mN	1 kg <sub>f</sub> = 1 kg x 9.81 m/s <sup>2</sup> = 9.81 N	1 kg <sub>f</sub> = 10 N	1 N = 1 kg x 1 m/s <sup>2</sup> = 1 kg m/s <sup>2</sup>
Pressure (of Fluids)	P, Pi, P <sub>e</sub> , P <sub>ü</sub> , P <sub>u</sub>	(kg <sub>f</sub> /cm <sup>2</sup> , at, atm) (mWS, Torr) (mmHg)	N/m <sup>2</sup> Pa (Pascal)	bar, mbar	1 kg <sub>f</sub> /cm <sup>2</sup> = 0.981 bar 1 atm = 1.013 bar 1 mWS = 0.098 bar	1 kg <sub>f</sub> /cm <sup>2</sup> = 1 bar 1 mWS = 0.1 bar	1 N/m <sup>2</sup> = 1 Pa 1 Pa = 10 <sup>-5</sup> bar 1 bar = 10 <sup>5</sup> N/m <sup>2</sup>
Mechanical stress	s, t	(kg <sub>f</sub> /cm <sup>2</sup> ) (kg <sub>f</sub> /mm <sup>2</sup> )	N/m <sup>2</sup> , Pa	N/mm <sup>2</sup>	1 kg <sub>f</sub> /mm <sup>2</sup> = 9.81 N/mm <sup>2</sup> 1 kg <sub>f</sub> /cm <sup>2</sup> = 9.81 N/cm <sup>2</sup>	1 kg <sub>f</sub> /mm <sup>2</sup> = 10 N/mm <sup>2</sup> 1 kg <sub>f</sub> /cm <sup>2</sup> = 10 N/cm <sup>2</sup>	1 N/m <sup>2</sup> = 1Pa
Energy	W	(kg <sub>f</sub> m)	J (Joule)	MJ, kJ, kW h	1 kg <sub>f</sub> m = 9.81 J	1 kg <sub>f</sub> m = 10 J	3.6 MJ = 1 kWh 1 J = 1 Nm = 1 Ws
Heat capacity	Q	(cal, erg)	J (Joule)	MJ, kJ, kW h	1 kcal = 4.19 kJ		3.6 MJ = 1 kWh 1J = 1 Nm = 1 Ws
Power	P	(CV), W	W	kW, MW	1 CV = 0.735499 kW 1 kW = 1.359622 CV	1 CV = 0.74 kW 1 kW = 1.36 CV	1 W = 1J/s = 1 Nm/s
Torque, bending moment	M	(kg <sub>f</sub> m)	Nm	Ncm	1 kg <sub>f</sub> m = 9.81 Nm	1 kg <sub>f</sub> m = 10 Nm	

### 1.3 CONVERSIONS TABLES

#### 1.3.1 CONVERSION FOR UNITS OF LEGTH

Length	in	ft	yd	mi	UK n mile	cm	m
1 inch	1	0.0833	0.0278			2.54	0.0254
1 foot	12	1	0.3333	0.00019	0.00016	30.48	0.3048
1 yard	36	3	1	0.00057	0.00049	91.44	0.9144
1 statute mile	63360	5280	1760	1	0.86842		1609.3
1 UK nautic mile	72960	6080	2026.7	1.15151	1		1853.2
1 cm	0.3937	0.0328	0.0109			1	0.01
1 m	39.370	3.2808	1.0936	0.00062	0.00054	100	1

Length



25.4 mm = 1 in

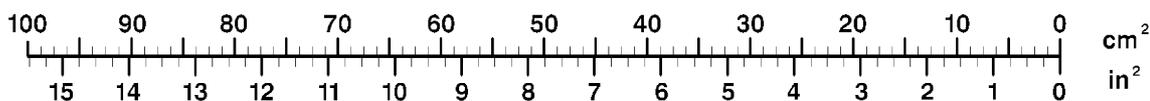
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#### 1.3.2 CONVERSION FOR UNITS OF AREA

Area	sq in	sq ft	sq yd	sq mi	acre	cm <sup>2</sup>	m <sup>2</sup>	km <sup>2</sup>
1 square inch	1	0.0069				6.4516		
1 square foot	144	1	0.1111			929.03	0.0929	
1 square yard	1296	9	1		0.00021	8361.3	0.8361	
1 square mile				1	640			2.58999
1 acre		43560	4840	0.00156	1		4046.9	0.004047
1 cm <sup>2</sup>	0.1550					1	0.0001	
1 m <sup>2</sup>	1550.0	10.764	1.1960			10000	1	
1 km <sup>2</sup>				0.3861	247.105			

Area

6.452 cm<sup>2</sup> = 1 in<sup>2</sup>



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