



SHOP MANUAL

Manufacturer:

**Doosan Infracore Norway AS
N - 6440 Elnesvågen - NORWAY**

Printed in Norway

Dealer:

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Chapter 0

General instructions

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Foreword

The Shop Manual is prepared as an aid to performing quality repairs by giving the service personnel an understanding of the dump truck, and showing the correct way perform repairs and make judgements.

Make sure that you understand the manual and use it at every available opportunity. The manual will also serve as a useful guide to office personnel and other persons who are involved with the dump truck in one way or another.

How to use the SHOP MANUAL:

The main index give an view of the chapters index page no.

The manual is divided into the following chapters:

Chapter 1:	Engine	Chapter 6:	Electric system
Chapter 2:	Transmission	Chapter 7:	Front frame
Chapter 3:	Drive line	Chapter 8:	Rear frame
Chapter 4:	Lubrication	Chapter 9:	Option
Chapter 5:	Hydraulic system		

In the chapters index you will find the page no. for the description of each part.

Each part will describe: Structure and function:

This section explains how the components are built and how they work.

Testing and adjusting:

This section explains checks to be made before and after performing repairs, as well as adjustments to be done at the completion of the checks and repairs.

Disassembly and assembly:

This section describes how to remove, install, disassemble, repair and assemble components, and the work order. Special tools are listed at the end of each chapter. The special tools are an excellent aid in the work shop. By using special tools, the job will be easier to perform and in some cases a special tool is required to carry out the work. List of all special tools for the complete truck are listed in the "Special Tool Guide".

Maintenance standard:

This section gives the judgement standards when inspecting disassembled parts.

Troubleshooting:

When a fault is detected, this section is used as before the practical fault finding starts. A skilled and trained mechanic together with the Shop Manual is the best combination for troubleshooting when repair instruction is needed.

At the end of each chapters are the main Troubleshooting

This manual is valid for the serial nos. listed on the first page.

Distributing and updating:

Subscribed Shop Manuals will automatically be updated at revisions.

This manual is originally produced by Doosan Infracore Norway AS, 6440 Elnesvågen, Norway, and must not be reproduced, translated or made available to a third party, fully or partly, without our written permission.

NOTE !

Because of the different variants the parts and images which are contained in this book can be different from the current model of dump truck . For the spare parts please used the parts catalogue for current model.

Torque limit table

This tables indicates standard torque limits in Nm for the various screw and bolt qualities and dimensions. The torques are valid for screws on the outside of the components.

Quality class: Dimension	8.8 M (Nm)	10.9 M (Nm)	12.9 M (Nm)
M 8	24	33	40
M 10	47	65	79
M 12	81	114	136
M 14	128	181	217
M 16	197	277	333
M 18	275	386	463
M 20	385	541	649
M 22	518	728	874
M 24	665	935	1120
M 27	961	1350	1620
M 30	1310	1840	2210
M 33	1770	2480	2980
M 36	2280	3210	3850

Quality class: Dimension	8.8 M (Nm)	10.9 M (Nm)	12.9 M (Nm)
3/8" UNC	38	54	68
7/16" UNC	61	87	108
1/2" UNC	93	131	163
9/16" UNC	133	187	234
5/8" UNC	183	259	323
3/4" UNC	322	455	568
7/8" UNC	516	729	909
1" UNC	772	1090	1360
1 1/8" UNC	1090	1550	1930
1 1/4" UNC	1530	2160	2690
1 3/8" UNC	2020	2850	3550
1 1/2" UNC	2650	3750	4680

Quality class: Dimension	8.8 M (Nm)	10.9 M (Nm)	12.9 M (Nm)
M 8 x 1	25	35	42
M 10 x 1,25	48	68	81
M 10 x 1	49	70	84
M 12 x 1,5	83	117	140
M 12 x 1,25	85	120	144
M 14 x 1,5	135	190	288
M 16 x 1,5	204	287	344
M 18 x 1,5	294	413	496
M 20 x 1,5	408	574	688
M 22 x 1,5	546	768	921
M 24 x 2	696	979	1170
M 27 x 2	1000	1410	1690
M 30 x 2	1390	1950	2340
M 33 x 2	1860	2610	3130
M 36 x 2	2350	3310	3970

Quality class: Dimension	8.8 M (Nm)	10.9 M (Nm)	12.9 M (Nm)
3/8" UNF	41	59	73
7/16" UNF	66	93	115
1/2" UNF	99	141	175
9/16" UNF	142	201	250
5/8" UNF	197	279	347
3/4" UNF	344	486	606
7/8" UNF	547	772	963
1" UNF	814	1150	1430
1 1/8" UNF	1170	1660	2060
1 1/4" UNF	1620	2290	2850
1 3/8" UNF	2170	3070	3820
1 1/2" UNF	2840	4000	5000

Bolt quality marking

Strength marking on screws consists of two numerals that may be separated by a point (.). The numerals indicate tensile and yield limits of material in N/mm².

- Numeral 1 denotes a hundredths of the tensile limit in N/mm².
- Numeral 1 x numeral 2 denotes a tenth of the yield limit in N/mm².

A bolt designated 8.8 thus has tensile limit 800 N/mm² and yield limit 640 N/mm².

Nut quality marking

The designation for nuts consists of one numeral. The numeral denotes that the nut is of equal strength to a bolt with the same first number.

A nut of strength class 8 is thus equally strong to a bolt of class 8.8.

Types of sealing-/locking compounds and lubricants

- Loctite 242/243: Middle strength (for locking of screws, bolts and nuts).
- Loctite 270/2701: High strength (for locking of screws, bolts and nuts).
- Loctite 603: High strength (for locking of bearings bushings, etc.).
- Loctite 638: Extra high strength (for locking of bearings, bushings, etc.).
- Loctite 574: Master gasket as floating gasket.
- Loctite 7063: For cleaning of surfaces prior to lubrication or glueing.
- Molycote 321R*: Anti-obstruction and running in lubricant.
- Würth 210/Loctite 8201: Anti-corrosion spray for electrical wires and components.

Safety in workshop

Purpose

This section is intended as general information about dangers of various types of workshop activities.

Follow the workshop manual

The workshop manual provides instructions about work methods and equipment that reduces the risk of accidents.

Mechanical skill

This is a very important factor. The Doosan-mechanic is skilled and well trained for his job. Without these qualities, risks are much greater and more difficult to anticipate.

Common sense

This characteristic should form the basis of activities in the workshop.

Negligence and carelessness cannot be allowed.

Work with a safety margin

Always expect that something can go wrong during the work.
Always work with a safety margin where there are risks.

Legislation and local rules

In most countries there are legislation and local practices that apply to safety at work. Follow them at all times.

Warnings (parts or packages)

Always read and follow warnings and instructions.

Do not trust your own knowledge of the risks. The properties of a part or the chemical composition of a product could have been changed during transit.

You have to know where the risks are

In this way you can avoid them. In many cases, risks are so obvious that you do not have to search for them, e.g. carbon monoxide - true it is invisible, but you know that it is lethal. Therefore protect yourself.

The hidden dangers

Dangers are found in all work environments and the most serious danger is in not being aware of them.

The three demands of safety

- * Knowledge: You have to know your job and also where the risks are.
- * Apprehension: You must be aware that you are exposed to risks, or at least to suspect that you are.
- * Caution: You have to protect yourself, do not take chances.

Incidents are warning signals

An incident is an unforeseen event without injury or damage.

The next time the consequence of the same event may be worse.

An incident demonstrates that there is a risk. Every incident must be taken as a warning signal - exactly as if there had been an accident or someone had been taken ill.

Look out

Do not trust others to point out the hazards. It is difficult to remember all pointers and exhortations. New and unexpected risks may also occur.

Therefore; **look out!**

As a guide, a number of examples follow. They are not to be regarded as a comprehensive listing.

Vibration

When using vibrating tools e.g. chisel hammer, impact drill, impact nut runner, grinder injuries may be sustained by transition of tool vibrations to the hands.



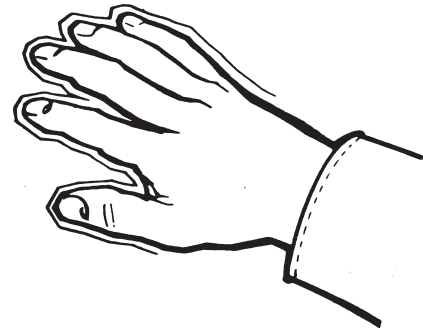
Risks

Vibrations may cause vascular spasms (prickling and pain) in the surface veins. The fingers turn white, cold and senseless. Also nerves, muscles, bones, sinews and joints may be injured.

The risk of injury is believed to increase by smoking and also by low temperatures e.g. if the tools are cold or if the hands are exposed to chilling air.

The injuries become apparent especially when the fingers are cold, often when not working.

Vibration injuries are curable if taken care of in time.



Protective measures

Use heavy gloves. Gloves provide some protection against vibrations and low temperatures.

Alternate between vibration-free and vibrating jobs to provide the body with a possibility to rest from vibrations.

By varying the work posture and grips, the body is not one-sidedly exposed to vibrations.

Avoid smoking before and during the work to help the blood circulation as much as possible.

If you notice any signs of vibration injury consult a doctor.



Protection against vibration

- Heavy gloves
- Alternate jobs
- Do not smoke before and during the work

Injurious noise

Rule of thumb:

Noise that is louder than 85 db (A) and that prevails for more than 8 hours is classed as injurious. (Some countries have other limits.) High frequency noise (high-pitched) is more injurious than low frequency noise (low-pitched) of the same amplitude.



Risks

Partial deafness, in difficult cases impaired hearing beyond cure.

It is impossible to train your tolerance to noise. You may believe that you are doing that if you notice less of the noise after some time.

**IN THAT CASE YOU ARE
REALLY IN DANGER !**

Probably your sense of hearing is already impaired.

Protective measures

With noise absorbers on roof and walls and screens between work places it is easier to limit the propagation of noise. Against injurious noise you have to protect yourself with ear muffs. Ear muffs must be tested and approved.



Protection against noise:

- Use ear muff

Organic solvent

Organic solvents are mixtures of organic liquids (different from e.g. water) that dissolve grease, paint, varnish, wax, oil, glue, rubber etc.

Examples:

- | | |
|----------------------|-------------------------------------|
| - Petroleum spirits | -Toluen |
| - Trichlore ethylene | -Thinner |
| - Petrol | -Alcohols |
| - Xylen | -Plastics and
appertaining glues |



Risks

Solvents release fumes. Fumes may cause dizziness, loss of balance, headache and nausea. Fumes may also irritate the windpipe.

Solvent exposure may also lead to injury to the central nervous system. This may result in insomnia, depressions, nervousness, poor memory and a general sense of feeling tired.

When solvents come in direct contact with the skin, it will become dry and cracked. The risk of skin allergies increases and, additionally, there is a risk of a solvent causing dermatitis.

Many solvents are flammable.



Protective measures

As a first measure, arrange for ventilation that prevents fumes from mixing with the air you breath. Note that the ventilation has to be fire-proof if a solvent is flammable.

If a problem cannot be resolved with ventilation it is necessary to wear either a face mask or breathing protector with filter against dust and organic fumes.

Never leave tins with paint or solvent uncovered.

Use solvent with low content of aromatics. This reduces the risk.

Ensure that solvents do not come into contact with the skin and do not use them as detergent.

Use plastic gloves when working. Gloves of certain materials can be penetrated by a solvent or even dissolved by such solvents.

Make certain.



Protection against organic solvents:

- Fireproof ventilation
- Face mask or breathing protection with filter
- Replace caps/lids
- Use as harmless solvents as possible
- Avoid contact with the skin
- Do not wash the skin with solvent
- Use gloves



Coolant

Risks

The cooling system is over-pressurized when the coolant is hot. Coolant that leaks or bursts out may cause scalding.

Coolant consists of water and corrosion inhibitor, and if necessary, anti-freeze. The anti-freeze may consist of ethylene glycol.

Ethylene glycol and corrosion inhibitor are injurious and dangerous to consume. Splashes in the eyes are dangerous and, in contact with the skin, such substances can penetrate and cause dermatitis.

Coolant may also consist of other mixtures that may imply other risks.



Protective measures

If possible, avoid working with coolant lines and containers when coolant is still hot.

First remove the filler cap carefully to release the overpressure. Hot steam and coolant may burst out.

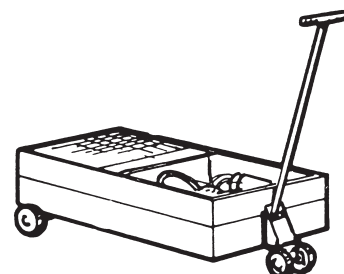
If there is a risk of splashing you must use rubber gloves and protective goggles. Change clothes if coolant has splashed on them. Contact with the skin may be dangerous.

Use special equipment for draining and filling e.g.a. cart with container and pump. It is not permitted to dump coolant in sewer systems or on the ground.



Protection against coolant

- Preferably wait until coolant has become cold
- Remove filler cap carefully
- Use rubber gloves and protective goggles
- Use special equipment for draining and filling



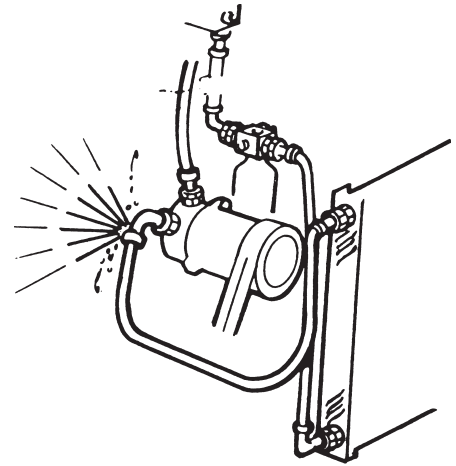
Refrigerant

Refrigerants are used in various thermal equipment e.g. air conditioning in vehicles.

Risks

Refrigeration equipment operates under pressure. A refrigerant that is leaking may cause frost-bite.

A refrigerant that is leaking and exposed to heat e.g. by a welding flame or cigarette becomes very dangerous to breath.

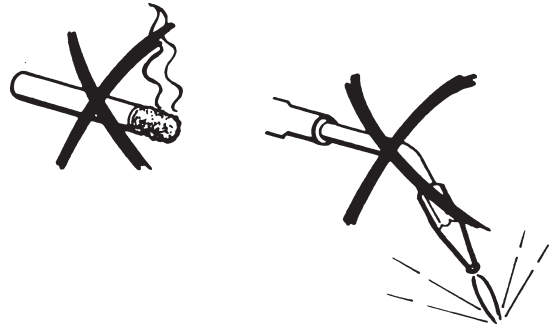


Protective measures

Always use special equipment when draining or filling refrigeration equipment. This reduces the risk of leakage.

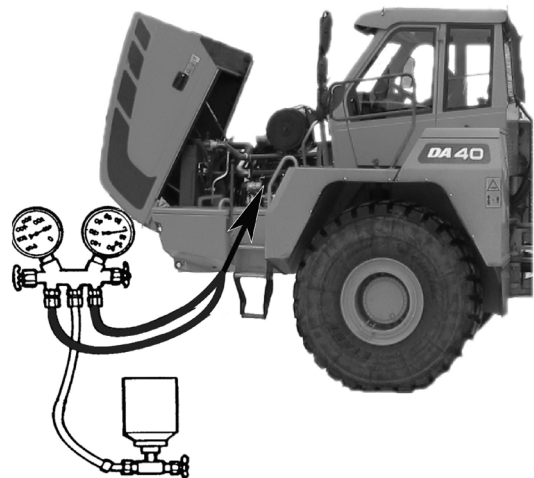
Do not loosen connections on refrigeration equipment without first draining the system or reducing the pressure.

Avoid welding and smoking when carrying out work that implies a risk of leakage. A leaking refrigerant is not noticed as the gas is practically odourless. The gas is heavier than air and therefore a portable air evacuator at floor level is suitable.



Protection against refrigerant

- Use special equipment for draining and filling
- Drain system before loosening connections
- Avoid smoking and naked flame
- Use portable air ventilator



Air pollution

Examples:

- Carbon monoxide present in exhaust fumes
- Nitric oxide - present in exhaust fumes
- Welding fumes, especially fumes from galvanized or painted metals.
- Oil mist (e.g. in anti-corrosion treatment)
- Sulphuric acid mist (e.g. when charging batteries)
- Grinding dust and fumes formed when grinding and heating plastic, varnish, anti-corrosive, lubricants, paint etc.



Risks

Carbon monoxide reduces the ability of the blood to supply the brain and other parts of the body with oxygen.

Carbon monoxide poisoning = "Internal asphyxiation".

Nitric oxides and gases and the fumes from plastic, varnish, anti-corrosive, lubricants, paint etc may damage the lungs.

Oil mist from certain oils may cause skin problems such as blemishes, boils and eczema.

Sulphuric acid mist is erosive and may damage the windpipe.

Protective measures

Avoid running engines indoors. Immediately attach evacuation equipment to the exhaust pipe if an engine has to be kept running indoors. Also parking heaters admit exhaust fumes when in operation (portable air evacuator is suitable).

Use plastic gloves and breathing protection if there is a risk of oil mist (e.g. anti-corrosion treatment). Before starting work, treat un-protective skin with protective cream that does not dissolve in oil. Ensure that the ventilation is satisfactory where you weld, charge batteries or apply anti-corrosive, if necessary, also complemented with portable air evacuator.

When working with eroding substances (e.g. when battery charging) there must be a possibility for rinsing the eyes.



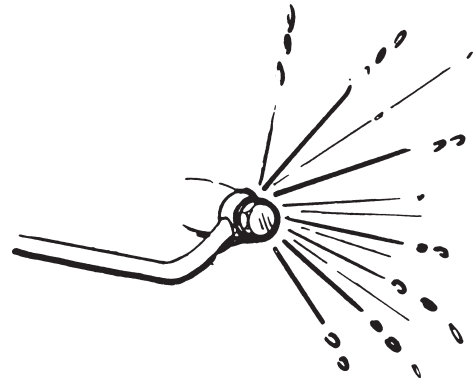
Protection against air pollution

- Ventilate properly. Use portable air evacuator when welding.
- Preferably avoid running engines indoors.
- Use evacuation equipment if engines have to be run indoors.
- Use plastic gloves and breathing protection if there is a risk of oil mist.
- Avoid contact with the skin.
- Ensure that there are facilities to rinse the eyes when working with eroding substances.

Liquid or gas under high pressure

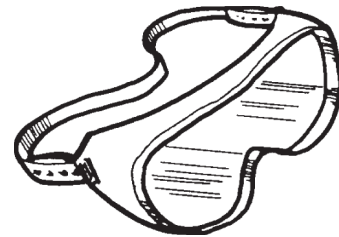
Pipes etc may become damaged when working and liquid or gas may burst out. Liquid or gas may also burst out when loosening a connection. High pressure may remain in the system even if a pump has stopped.

Gas containers for e.g. welding gases may explode if exposed to rough handling e.g. when an oxygen tube drops on a hard floor. Valves may become damaged and gas leak out if a gas tube falls.



Risks

- There are risks, for instance, when working with:
- Fuel system
- Power steering
- Trailing axle hoist
- Tipper
- Brake system
- Compressed air from the workshop compressed air system may also be risky.
For risks in rubber repair, see "Splinters, flying objects".



Dangerous - in what way?

- Spray can penetrate the skin and cause serious tissue injury
- Eyes may sustain serious injury
- Many substances may cause poisoning
- Air and other gases blown into the rectum may cause serious, sometimes fatal injuries
- Leak testing or test pressurizing with compressed air or other gas may cause explosion

Protective measure

Do not work with pressure in the system unnecessarily. First stop the pump and release remaining pressure carefully. Use goggles. Gloves are also to be preferred. Never use compressed air or other gas to blow dirt from the clothes. Use liquid for testing leaks (of e.g. oil cooler).



Protection against gas and liquid under pressure

- Use goggles and gloves
- Do not work with pressure in the system if not absolutely necessary
- Be careful when handling compressed air

Fire and explosion risks

Examples of flammable and explosive substances are:

- Oil
- Petrol
- Diesel fuel
- Organic solvents (varnish, plastic, detergents)
- Anti-corrosive
- Acetylene and other gas for welding and heating



Examples of reason for setting on fire:

- Welding, cutting
- Smoking
- Machine grinding
- Sparks caused by static electricity or electric equipment
- Heat generated in waste and rags soaked with certain types of oil and paint (linseed oil)
- Oxygen increases the risk of ignition. Containers, pipes and valves for oxygen therefore have to be free of oil and grease



Special cases:

- **Battery charging**

When charging batteries the water content in the battery acid is split into oxygen and hydrogen. This makes a gas mixture that is very explosive. The risk is especially acute when using an auxiliary battery or a speed charging unit.

- **Diesel fuel**

The flash point may have been lowered by mixing with petrol. Such a mixture is then explosive in normal room temperature. If diesel fuel is heated it is more explosive than petrol.



Protection against fire and explosion

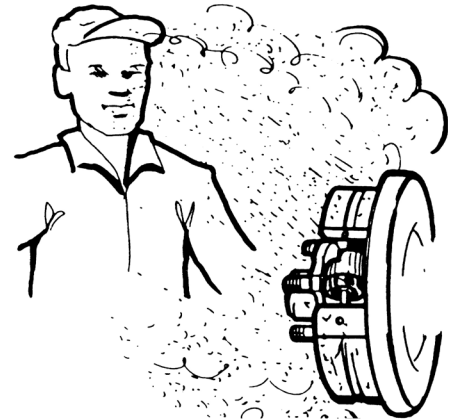
- Store dangerous substances in approved containers and ensure that it is closed.
- Keep ignition sources removed from or completely screened from the dangerous substances.
- Ventilation, evacuation.

Asbestos

The dust that is emitted by brake and clutch linings partly consists of asbestos fibres.

Risks

Asbestos dust that is inhaled may cause lung diseases and cancer in various organs. The risk of contracting lung cancer is considerably more acute for people who smoke. This risk remains many years after giving up smoking.



Protective measures

Bind the dust with water before starting to work with brakes and clutches.

Wash brake and clutch parts with water or clean with special vacuum cleaner.

Never blow with compressed air.

Use breathing protection with suitable dust filter. A simple paper mask does not suffice.

Protection against asbestos

- Clean with water or special vacuum cleaner
- Use breathing protection

Lead

The dust that is formed when grinding lead filler and certain paints that contains lead.

Risks

Lead may be absorbed by the blood by skin contact and cause poisoning.

Protection against lead

- Avoid contact with the skin and inhaling.
- Use gloves, breathing protection and face mask.



Jacked up vehicle or bodywork

Risks

Mechanical or hydraulic lifting equipment may topple and could also be lowered because of incorrect handling or interference.

Falling objects may also cause crushing.

Protective measures

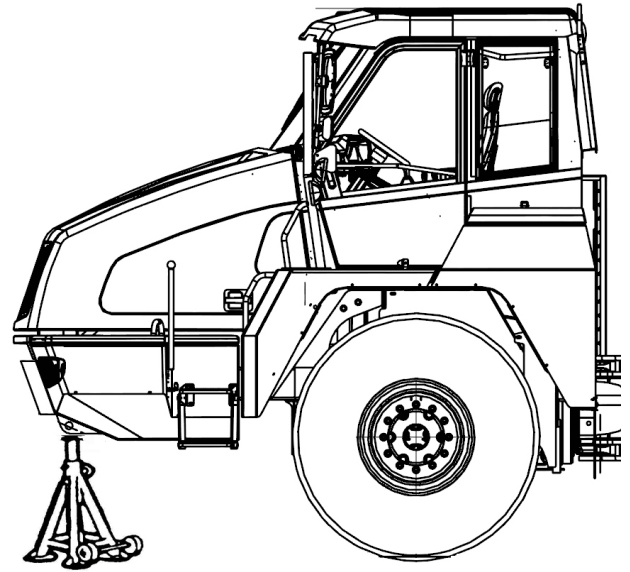
Do not crawl underneath a vehicle that is jacked up without stands.

Check that the supporting surface is firm and level and use stands.

Before starting to work under a jacked up body or other bodywork it has to be supported with a stay as well as the normal latches.

Protection against sinking or falling vehicle/ components

- Use safe stands, check that the supporting surface is suitable.
- Use reliable stays and secure in the normal manner.



Heavy units

Risks

Lifting heavy objects may cause back injuries.

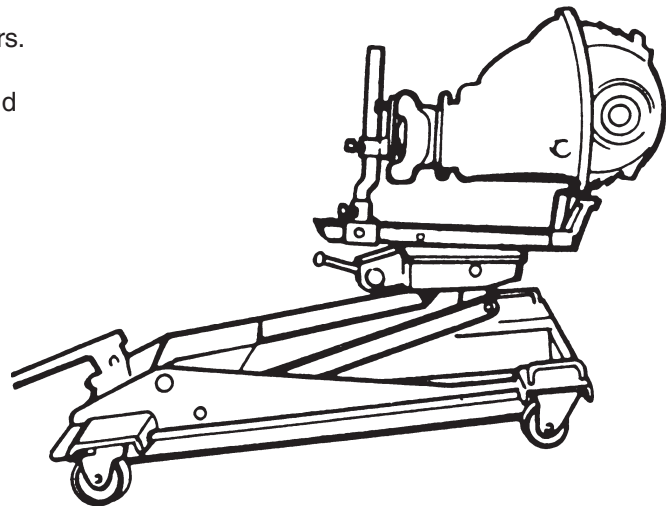
Dropping a unit or letting it fall from a lifting device may cause both injury and damage.

Example:

- When lifting a unit (gearbox, central gear) away from a vehicle it may drop from the jack.
- Unsuitable lifting straps may break or cause unit to slip.
- A unit that is set up on a stand may pivot round the shaft of the stand. By, for instance, removing the planetary box from a gearbox the point for stable balance is changed and this may cause the unit to pivot.

Protective measures

- Use lifting equipment.
- Ask for help, if needed.
- Use jack with special fixture for lifting out central gears.
- Use special equipment for handling wheels, brake and springs.
- Use purpose adapted lifting straps and lever blocks for lifting engines.
- Use stand with automatic locking (self-locking screw or brakes).



Protection against damage and injury in handling heavy units

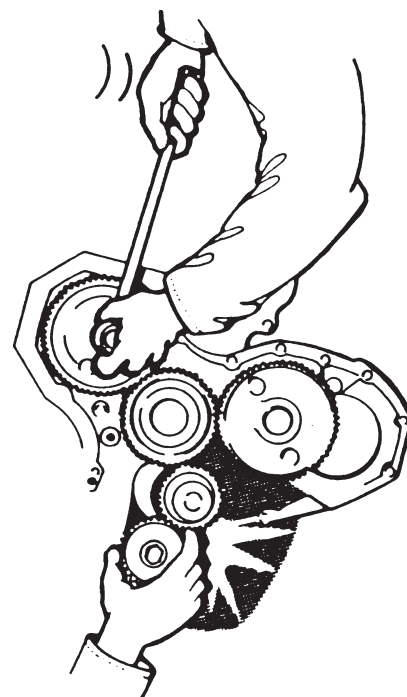
- Use lifting equipment.
- Keep in mind the balance of the unit on a stand.
- Ask for help, when needed.
- If you have to lift:
 - Object near body
 - Bend your knees, not your back
 - Do not twist your body when lifting.

More than one person working with the same object

If more than one person is working on the same vehicle, involuntary movements could injure another person.

Example:

- By turning a wheel on a drive axle, parts of another drive wheel may be caused to turn and injure somebody who is working with e.g. the hub reduction gear.
- Working with the suspension equipment of axles (springs, shock-absorber) may cause parts on the opposite side to start moving.
- Manoeuvring from the driver's seat (tipper, trailing axle hoist, loader) may cause parts to start moving, thereby causing serious injury.



Protect others who work on the same vehicle

- Be aware of the risks.
- Warn those who work on the same vehicle or in its vicinity.
- Do not start working with more than one drive wheel at the same time until the half shaft has been removed.

Involuntary start of electric motors etc.

Protective measures

Remove the negative (-) cable from the battery.

If power is needed from the electric system, connect a line fuse (8A) between the battery terminal and the cable clamp.

This precaution also reduces the risk of burns and fires caused by battery power.

Windscreen wipers

Even if the wipers have been turned off with the switch there is voltage to the wiper motor (for the return stroke to parking position). Only a slight turn of the motor is needed to start it.

Risk of injuring the fingers.

Protective measures

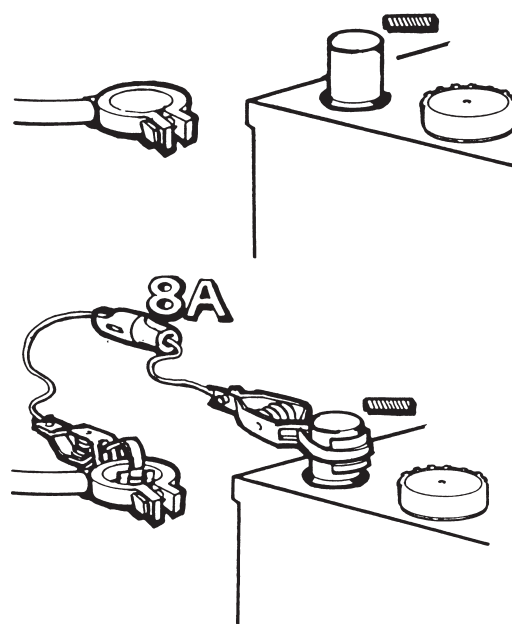
Do not loosen wiper motor before being sure that the power is disconnected.

Other electric equipment

Disconnecting the batteries is a good safety precaution against involuntary connections.

Protection against involuntary connection of electric equipment

- Be aware of the risks.
- Disconnect the batteries when it is justified.



Rotating parts

Examples:

- Cooling fan
- Belts
- Injection pump coupling
- Propeller shaft
- Drilling machines, lathes and other machines with rotating parts.

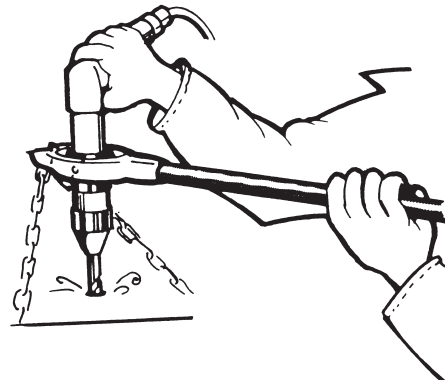
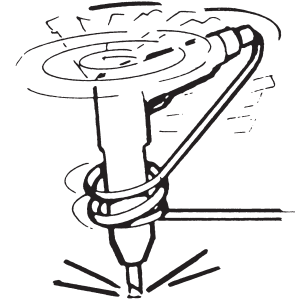
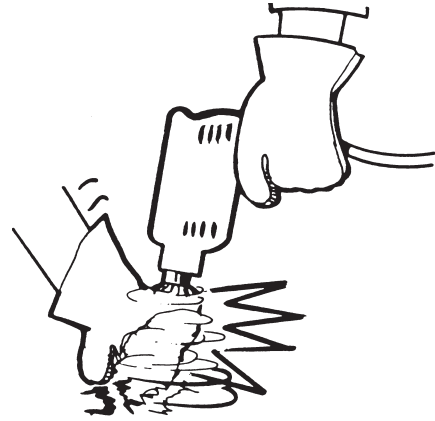
Risks

Rotating parts may cause injury when touched by e.g. inserting the fingers in the cooling fan.

Rotating parts may also cause a serious accident by catching clothes, gloves or long hair.

Even a completely smooth shaft may be dangerous.

When drilling large holes with a hand drilling machine, it can be turned out of your hands and begin to spin around. It may carry on spinning until its cable is torn off.



Protection against injuries from rotating parts

- Never use gloves when drilling.
- Never wear loosely hanging scarf or tie.
- Do not wear clothes with wide sleeves or trouser legs.
- Ensure that your clothes are intact.
- Collect loose hair under a hair net.
- Do not wear rings or bracelets.
- Use hand drilling machine with long lever when suitable.