

# Introduction and Safety in the Workshop

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## Introduction and Safety in the Workshop

### Section 1

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## INTRODUCTION

The purpose of this manual is to assist Dealers and Distributors in the efficient repair and maintenance of Massey Ferguson farm machinery. Carrying out the procedures as detailed, together with the use of special tools where appropriate, will enable the operations to be completed within the time stated in the Repair Time Schedule.

To assist with locating information, each section of the manual is preceded by a contents page listing the operations. Each instruction within an operation has a sequence number, and to complete the operation in the minimum time it is essential that these instructions are performed in numerical sequence commencing at 1, unless otherwise stated.

When applicable, these sequence numbers identify the components in the appropriate illustration. Where an operation requires the use of a special tool, the tool number is quoted under the operation heading and is repeated in, or following, the instruction involving its use.

### Indexing

For convenience the manual is divided into sections and parts, each page bearing a section and part number. The sections are subdivided into numbered operations. Example: 1-7A would be Operation 1 in Section 7, Part A. This simplifies cross referencing and enables the subject to be found easily.

### Definition of Terms

The operation descriptions generally used throughout the schedules may be defined as follows:

**Removal and Refitment** - Remove and refit an original part or assembly, or a new part or assembly which does not involve additional operations or time.

**Install** - Install a part or component not previously fitted e.g., accessories.

**Overhaul** - Remove a part or assembly, dismantle, inspect and recondition, re-assemble, and re-install making all necessary adjustments.

**Dis-assembly and Re-assembly** - The terms 'Dis-assembly' and 'Re-assembly' indicate the orderly taking apart of an assembly into individual parts and rebuilding it into the original assembly.

**Adjust** - Make the necessary adjustments to restore specified setting or performance.

**Check** - Ascertain if a setting or condition is within the limits of acceptability, either as defined in the manufacturer's specifications or, where a dimension is not specified, in the judgement of the mechanic. The checking of fixings, e.g. nuts and bolts, includes tightening to the specified torque figures listed in this Manual.

**Servicing** - All technical work undertaken to maintain the machine in working order.

## Special Tools

Where the use of a special tool is specified in an operation the tool number will be shown under the operation heading and also following the instruction requiring its use.

The use of the special tools mentioned in the text contributes to a safe, efficient and profitable repair. Some operations are impracticable without their use, for example, the refitment of the differential unit. Distributors and Dealers are therefore urged to check their tools against the list provided.

For further details, refer to the special tool catalogue for this range of tractors, Section 14 of this manual.

## Repairs and Replacements

When service parts are required it is essential that only genuine AGCO replacements are used.

Attention is particularly drawn to the following points concerning repairs and the fitting of replacement parts and accessories:

Safety features embodied in the tractor may be impaired if other than genuine parts are fitted.

In certain territories, legislation prohibits the fitting of parts not to the tractor manufacturer's specification. Torque wrench setting figures given in the Workshop Manual must be strictly adhered to. Locking devices where specified must be fitted. If the efficiency of a locking device is impaired during removal it must be renewed.

The tractor warranty may be invalidated by the fitting of other than genuine AGCO parts. All AGCO replacements have the full backing of the manufacturer's warranty. Massey Ferguson Dealers are obliged to supply only genuine service parts.

## Repair of the Tractor

*Follow these important points:*

**CLEAN THE TRACTOR AND DIAGNOSE THE FAULT BEFORE DIS-ASSEMBLY.**

If possible, make a complete diagnosis to determine the extent of the repair required. Take precautions, as necessary, to prevent dirt or other foreign material entering the hydraulic, fuel or air systems.

**DO NOT MIX PARTS.**

Make particular note of special parts which should not be interchanged.

**DURING DIS-ASSEMBLY, CLEAN PARTS THOROUGHLY AND INSPECT THEM FOR WEAR, DAMAGE, ETC.**

**LABEL PARTS. PROTECT PRECISION OR MACHINED SURFACES.**



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## Amendments

Under normal conditions revised pages are issued carrying the same number as the existing pages requiring amendment. The new pages are inserted in place of the existing ones. The old pages should then be destroyed.

The issue number is printed on the bottom of each page, e.g. Issue 1, 2 or 3 etc.

In some cases additional pages or completely new sections may be issued. These pages are to be inserted immediately following the page carrying the next lowest page number, or section number as appropriate.

Where new pages are required to be positioned between existing pages, the new page numbers will contain a

suffix letter - example: New page number 7A-16a. This page is inserted after existing page number 7A-16 and before page number 7A-17. Correspondingly a further new page numbered 7A-16b would be positioned after 7A-16a but before 7A-17.

To ensure that a record of amendments to this manual is readily available, the list of amendments will be re-issued with each set of revised pages, quoting the amendment number, date of issue and appropriate instructions.

**NOTE:** *Service Bulletins and Amendment Sheets are issued to Massey Ferguson Dealers only and are not for general circulation.*

| Amendment Status |       |      |         |
|------------------|-------|------|---------|
| Date             | Issue | Page | Remarks |
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# Introduction and Safety in the Workshop

## SAFETY ALERT SYMBOL AND TERMS



This safety alert symbol means **ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!**

The safety alert symbol identifies important safety messages on

machines, safety signs, in manuals, or elsewhere. When you see this symbol, be alert to the possibility of personal injury or death. Follow the instructions in the safety message.

## Why is SAFETY important to you?

**\* ACCIDENTS DISABLE and KILL \***

**\* ACCIDENTS are COSTLY \***

**\* ACCIDENTS can be AVOIDED \***

## SAFETY IN THE WORKSHOP

This safety section of your Workshop Service manual is intended to point out some of the basic safety situations which may be encountered during the normal repair operations of the tractor, and to suggest possible ways of dealing with these situations.

Additional precautions may be necessary, depending on the type of repair and the conditions at the work site or in the workshop. AGCO has no direct control over the repair procedures, operation, inspection, lubrication or general maintenance. Therefore it is **YOUR** responsibility to use good safety practices in these areas.

## SAFETY - A WORD TO THE MECHANIC

It is your responsibility to read and understand this safety section before carrying out repairs on AGCO equipment.

Remember that **YOU** are the key to safety. Good safety practices not only protect you, but also the people around you. Study the features in this section and the rest of the manual and make them a working part of your safety programme. Practice all other usual and customary safe working precautions, and above all – **REMEMBER – SAFETY IS YOUR RESPONSIBILITY. YOU CAN PREVENT SERIOUS INJURY OR DEATH.**

## SAFETY - DANGER, WARNING AND CAUTION

Whenever you see these signal words and symbol  used in this manual and on decals, you **MUST** take note of their instructions.



### Danger

The symbol and the word **DANGER** indicates an **imminently hazardous situation which, if not avoided, will result in DEATH OR VERY SERIOUS INJURY.**



### Warning

The symbol and the word **WARNING** indicates a **potentially hazardous situation. If the instructions or procedures are not correctly followed it could result in PERSONAL INJURY, OR LOSS OF LIFE.**



### Caution

The symbol and the word **CAUTION** is used to indicate a **potentially hazardous situation that, if not avoided, may result in MINOR OR MODERATE INJURY.**

**IMPORTANT:** The word **IMPORTANT** is used to identify **special instructions which, if not observed, could result in damage to, or destruction of the machine, process or its surroundings.**

**NOTE:** The word **NOTE** is used to indicate points of particular interest for more efficient and convenient repair or operation.

# Introduction and Safety in the Workshop

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## SAFETY DECALS



### Warning

**DO NOT remove or obscure Danger, Warning or Instruction Decals.**

Replace any Danger, Warning, Caution or Instruction Decals that are not readable, damaged or are missing.

## GENERAL

Practically all service work involves the need to drive a tractor. The Operator Instruction Book, supplied with each tractor or implement, contains detailed safety precautions relating to driving, operating and servicing. These precautions are as applicable to the service mechanic as they are to the operator, and should be read, understood and practised by all personnel.

Prior to undertaking any maintenance, repair, overhaul, dismantling or re-assembly operations, whether within a workshop facility or out 'in the field', consideration should be given to factors that may have an effect upon Safety, not only upon the mechanic carrying out the work, but also upon bystanders.

- DO NOT allow children or bystanders around or on the machine while it is being adjusted, serviced, repaired or operated.

## PERSONAL CONSIDERATIONS

### Clothing

- The wrong clothes or carelessness in dress can cause accidents. Check to see that you are suitably clothed. DO NOT wear loose clothing or long hair around equipment.

Some jobs require special protective equipment.

### Eye Protection

- The smallest eye injury may cause loss of vision. Injury can be avoided by wearing the proper eye protection when engaged in chiselling, grinding, discing, sanding, welding, painting etc.
- Wear safety goggles or safety glasses appropriate to the job in hand.

### Breathing Protection

- Fumes, dust and paint spray are unpleasant and harmful. These can be avoided by wearing respiratory protection.

### Hearing Protection

- Loud noise may damage your hearing and the greater the exposure the worse the damage. If you think the noise is excessive, wear ear protection.

### Hand Protection

- It is advisable to use a protective barrier cream before work to prevent irritation and skin contamination. After work clean your hands in soap and water. Solvents such as white spirit, paraffin, etc., may harm the skin.
- Wear gloves when ever possible to protect your hands. DO NOT wear rings or wrist watches when working on machinery, as they could catch on moving parts and cause serious injury.

### Foot Protection

- Substantial or protective footwear with reinforced toe-caps (safety shoes) will protect your feet from falling objects. Additionally, oil-resistant soles will help to avoid slipping.

### Special Clothing

- For certain work it may be necessary to wear flame or acid-resistant clothing.

## EQUIPMENT CONSIDERATIONS

### Machine Guards

- Before using any machine, check to ensure that the machine guards are in position and serviceable. These guards not only prevent parts of the body or clothing coming in contact with the moving parts of the machine, but also ward off objects that might fly off the machine and cause injury. Ensure that missing guards are replaced.

### Lifting Appliances

- Always ensure that lifting equipment, such as chains, slings, lifting brackets, hooks and eyes are thoroughly checked before use. If in doubt, select stronger equipment than is necessary.
- Never stand under a suspended load or raised implement.
- Avoid injury through incorrect handling of components. Make sure you are capable of lifting the object. If in doubt get help.

### Jacking

- Select a jack strong enough to carry the load.
- Stabilise the tractor and chock the wheels.
- Put support stands under the tractor. Lower the jack and let the tractor rest on the stands.
- DO NOT go under a tractor supported by a chain hoist or jack.

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## Compressed Air

- The pressure from a compressed air line is often as high as 7 bar (100 lbf/in<sup>2</sup>). It is perfectly safe if used correctly. Any misuse may cause injury.
- Never use compressed air to blow dust, filings, dirt etc., away from your work area unless the correct type of nozzle is fitted and eye protection is used.
- Compressed air is not a cleaning agent, it will only move dust, etc., from one place to another. Look around before using an air hose as bystanders may get grit into their eyes, ears or skin.
- Used approved air guns, wear safety goggles, and use proper shielding to protect others in the work area.
- Never point an air nozzle at a persons body.

## Hand Tools

- Many cuts, abrasions and injuries are caused by defective tools. Never use the wrong tool for the job, as this generally leads either to some injury, or to a poor job.
- Never use:—
  - A hammer with a loose head or split handle.
  - Spanners or wrenches with splayed or worn jaws.
  - Spanners or files as hammers; or drills, clevis pins or bolts as punches.
- Grind off mushroom heads from chisels. The sharp edges can tear your skin if the tool slips. And, when the tool is struck, chips could break off and fly into your eyes.
- Keep a handle on every file to prevent the tang from piercing your palm or wrist if the file should slip or catch.
- For removing or replacing hardened pins use a copper or brass drift rather than a hammer.
- For dismantling, overhauling and assembly of major components, always use Special Service Tools recommended.

These will reduce the work effort, labour time and repair cost.

- Always keep tools clean and in good working order.

## Electricity

- Electricity has become so familiar in day to day usage, that its potentially dangerous properties are often overlooked. Misuse of electrical equipment can endanger life.
- Before using any electrical equipment - particularly portable appliances - make a visual check to make sure that the cable is not worn or frayed and that the plugs, sockets, etc., are intact; make sure you know where the nearest isolating switch is located. Always use an earthed (grounded) 3 pin electrical cord.

## GENERAL CONSIDERATIONS

### Solvents

- Use only cleaning fluids and solvents that are known to be safe. Certain types of fluids can cause damage to components such as seals, etc., and can cause skin irritation. Solvent labels should be checked that they are suitable not only for the cleaning of components and individual parts, but also that they DO NOT affect the personal safety of the user.

### Housekeeping

- Many injuries result from tripping or slipping over or on, objects or material left lying around by a careless worker. Prevent these accidents from occurring. If you notice a hazard, don't ignore it - remove it.
- A clean, hazard-free place of work improves the surroundings and daily environment for everybody.
- Keep work organised and clean. Wipe up spills of any kind to minimise the possibility of a fall. Keep tools and parts off the floor to further reduce the possibility of tripping and causing serious injury.

### Fire

- Fire has no respect for persons or property. The destruction that fire can cause is not always fully realised. Everyone must be constantly on guard.
  - Extinguish matches, cigars, cigarettes, etc., before throwing them away.
  - Work cleanly, disposing of waste material into proper containers.
  - Locate the fire extinguishers and find out how to operate them.
  - DO NOT allow or use open flame near the fuel tank, fuel lines, battery, hydraulic hoses or component parts
- When using a gas torch, always keep a fully charged fire extinguisher within reach.
- In the event of fire:
  - DO NOT panic - warn those near and raise the alarm.

### First Aid

- In the type of work that mechanics are engaged in, dirt, grease, fine dust, etc. all settle upon the skin and clothing. If a cut, abrasion or burn is disregarded it may be found that an infection has formed within a short time. What appears at first to be trivial could become painful and injurious. It only takes a few minutes to have a fresh cut dressed, but it will take longer if you neglect it. Make sure you know where the First Aid box is located and that it is kept fully stocked at all times.

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## OPERATIONAL CONSIDERATIONS

- Stop the engine, if at all possible, before performing any service.
- Place a warning sign on self propelled equipment which, due for service or overhaul, would be dangerous to start. Disconnect the battery leads if leaving such a unit unattended and remove the key.
- DO NOT attempt to start the engine while standing beside the tractor or attempt to by-pass the safety start switch. Make a practise of checking that neutral start switches are functioning correctly.
- Avoid prolonged running of the engine in a closed building or in an area with inadequate ventilation as exhaust fumes are highly toxic.
- Always turn the radiator cap to the first stop to allow pressure in the system to dissipate when the coolant is hot.
- Never work beneath a tractor which is on soft ground. Always take the unit to an area which has a hard level working surface - concrete is preferred.
- If it is found necessary to raise the equipment for ease of servicing or repair, make sure that safe and stable supports are installed, beneath axle housings, casings, etc., before commencing work.
- Certain repair or overhaul procedures may necessitate 'Separating the tractor', either at the engine gearbox or gearbox/rear axle locations. These operations are simplified by the use of the Tractor Splitting Kit/Stand (Use the AGCO MF.3012 Tractor Splitting Track, also available, MF.3013 Cab Stands). Should this equipment not be available, then every consideration must be given to stability, balance and weight of the components, especially if a cab is installed.
- Use footsteps or working platforms when servicing those areas that are not within easy reach.
- Cleanliness of the tractor hydraulic system is essential for optimum performance. When carrying out service and repairs plug all hose ends and component connections to prevent dirt entry.
- Clean the exterior of all components before carrying out any form of repair. Dirt and abrasive dust can reduce the efficiency and working life of a component and lead to costly replacement. Use of high pressure washer or steam cleaner is recommended.
- Before loosening any hoses or tubes connecting implements to remote control valves, etc., switch off the engine, remove all pressure in the lines by operating levers several times. This will remove the danger of personal injury by oil pressure.
- Prior to pressure testing, make sure all hoses and connectors not only of the equipment, but also those of the test equipment, are in good condition and tightly sealed. Pressure readings must be taken with the gauges specified. The correct procedure should be rigidly observed to prevent damage to the system

or equipment, and to eliminate the possibility of personal injury.

- Hydraulic fluid escaping under pressure can have enough force to penetrate the human skin. To locate a leak under pressure, use a small piece of cardboard, never use your hands. If you are injected with hydraulic fluid seek medical help immediately.
- When equipment or implements are required to be attached to the hydraulic linkage, either for testing purposes or for transportation, the 'Position Control' should be used.
- Always lower equipment to the ground when leaving the tractor.
- If high lift attachments are installed on a tractor beware of overhead power, electric or telephone cables when travelling. Drop the attachment near to ground level to increase stability and minimise risks.
- DO NOT park or attempt to service the equipment on an incline. If unavoidable, take extra care and chock all wheels.
- Observe recommended precautions as indicated in this Service Manual when dismantling the air conditioning system as escaping refrigerant can cause frostbite.
- Prior to removing wheels and tyres from a tractor, check to determine whether additional ballast (liquid or weights) has been added. Seek assistance and use suitable equipment to support the weight of the wheel assembly. Store the wheels so that they cannot fall over and cause injury.
- When inflating tyres beware of over inflation - constantly check the pressure. Over inflation can cause tyres to burst and result in personal injury.

Heed these safety precautions, and the ones found in this manual, and you will protect yourself accordingly. Disregard them and you may become injured for life.

## SERVICING TECHNIQUES

### Service Safety

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all farm machinery as well as the personal safety of the individual doing the work.

This Service Manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will help assure that a thorough repair is successfully completed.

There are numerous variations in procedures, techniques, tools, and parts for servicing tractors, as well as in the skill of the individual doing the work. This Manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Anyone who departs from the instructions provided in this Manual must realise that one compromises their personal safety and the tractor's

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integrity by the choice of repair methods, tools and/or parts.

## Service Techniques

Clean the exterior of all components before carrying out any form of repair. Dirt and abrasive dust can reduce the efficient working life of a component and lead to costly replacement.

Time spent on the preparation and cleanliness of working surfaces will pay dividends in making the job easier and safer and will result in overhauled components being more reliable and efficient in operation.

Use cleaning fluids which are known to be safe. Certain types of fluid can cause damage to 'O' rings and cause skin irritation. Check the label on Solvents to ensure that they are suitable for the cleaning of components and also that they DO NOT risk the personal safety of the user.

Replace 'O' rings, seals or gaskets whenever they are disturbed. Never mix new and old seals or 'O' rings, regardless of condition. Always lubricate new seals and 'O' rings with hydraulic oil before installation.

When replacing component parts use the correct tool for the job.

## Hoses and Tubes

Always replace hoses and tubes if their ends are damaged.

When installing a new hose, loosely connect each end and make sure the hose takes up the designed position before tightening the connection. Clamps should be tightened sufficiently to hold the hose without crushing and to prevent chafing or contact with other parts.

Before removing hoses or tubes make sure they are identified so that they can be correctly re-assembled.

Be sure any hose which has been installed is not kinked or twisted after it is tightened.

## Bearings

Bearings which are considered suitable for further service should be cleaned in a suitable solvent and immersed in clean lubricating oil until required.

DO NOT spin bearings with compressed air. The centrifugal force could cause a ball or roller to fly outward with enough force to cause an injury.

Installation of a bearing can be classified in two ways: press fit on rotating parts such as shafts, and gears, and push fit into static locations such as reduction gear housings. Where possible, always install the bearing onto the rotating component first.

Always use pullers or a press to remove and/or install bearings, bushings and cylinder sleeves, etc. Use hammers, punches and chisels only when absolutely necessary and be sure to wear safety goggles.

## Shims

When shims are removed, tie them together and identify them as to location. Keep shims clean and flat until they are re-installed.

## Gaskets

Be sure the holes in the gasket correspond with the lubricant passages in the mating parts. If gaskets are to be made, select material of the proper type and thickness. Be sure to cut holes in the right places. Always renew gaskets prior to re-installation.

## Lip Type Seals

Lubricate the lips of the lip-type seals before installation. Use petroleum jelly. DO NOT use grease. Ensure that the oil seal is fitted the right way round, the lip of the seal is placed next to the lubricant that is sealed. Some seals have a second auxiliary lip, which is used to prevent the ingress of dirt to the seal lip.

If, during installation, the seal lip must pass over a shaft that has splines, a keyway, rough surface or a sharp edge, the lip can be easily damaged. Always use a seal protector, when one is provided.

## Use of Bolts in Blind Holes

Use bolts of the correct length. A bolt which is too long may 'bottom' before the head is tight against the part it is to hold. The threads can be damaged when a 'long' bolt is removed. If a bolt is too short, there may not be enough threads engaged to hold the part securely.

## Locking Devices

Lockwashers, tab washers or split pins are used to lock nuts and bolts.

Flat metal locks must be installed properly to be effective. Bend one end of the lock around the edge of the part. Bend the other end against one flat surface of the nut or bolt head. Always install new locks.

Always fit new split pins/cotter pins and bend the ends round so that they will not catch in clothing and help to prevent cuts.

## Cables and Wires

When removing or disconnecting a group of cables or wires, tag each one to assure proper re-assembly.

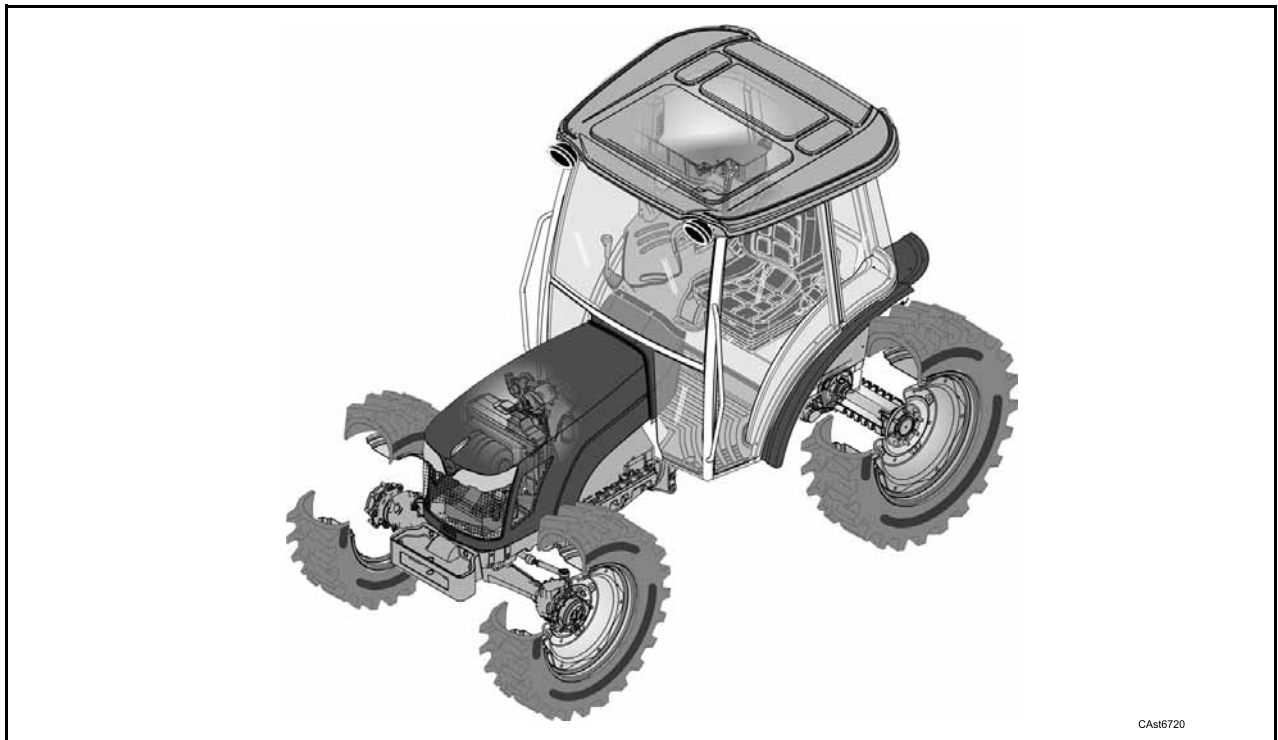
Always clip back wires and cable looms properly to prevent chafing, cable damage and possible damage by fire.



## 3600 Tractor

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### 3600 Tractor Section 2



## 3600 Tractor

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## General Information

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### General Information

#### Section 2

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# General Information

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## MANUAL USE

End users

- Installer
- User
- Maintenance operator

### Maintenance

CONSULT THIS MANUAL THOROUGHLY, as proper functioning and good efficiency of mechanical organs depends mostly on constant and correct routine maintenance ensuring product integrity and expected life duration.

In case of any damages or anomalies, quick intervention of trained operators can avoid future impairment and lengthen the working life.

### Repair

The disassembly/assembly procedures have been outlined for a total product overhauling. They have also been described in sequence through photographs with relevant explanation for specific interventions, thus obtaining a complete and safe guide for each and every phase of an operation.

Moreover, the attentive group inspection leads to a correct repair work estimation that could merely require dismounting only few components, and thus operating partially on the group.

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Agco Limited  
Abbey Park  
Stoneleigh, Kenilworth, CV8 2TQ England  
Tel. +44 (0) 24 7669 4400  
[www.agcocorp.com](http://www.agcocorp.com)

## AGREEMENTS AND DEFINITIONS

### Agreements

Illustrations like pictures, drawings and components in this manual are NOT in scale, because of limited space and editing limits, therefore they are NOT reliable to obtain values about size or weight.

Illustrations are supposed to point out the various handling sequences and phases of the tractor and its components.

### Definitions

Left side: it is the left side of the tractor considering the vehicle in running conditions.

Right side: it is the right side of the tractor considering the vehicle in running conditions.

### Typographic agreements

**NOTE:** The notes, pointed out externally to the text they refer, include important information.



### Warning

**Warning indications point out the procedures, whose partial or complete non-observance can damage the machine or the connected equipment.**



### Danger

**Danger indications point out the procedures, whose partial or complete non-observance can injure the operator.**

### Measurements

This manual indicates all measurements in International System (SI).

# General Information

## Symbology

| DESCRIPTION                                                      | SYMBOLS                                                                                                                                                                     |
|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| WARNING/DANGER                                                   |                                                                                          |
| REMOVE/INSTALL<br>seals-gaskets-filters                          |       |
| OIL FILLING OR OIL LEVEL/OIL DRAIN                               |       |
| LUBRICATION/GREASING                                             |                                                                                          |
| ADJUSTMENTS/MEASUREMENTS<br>tightening torques-preloads-backlash |                                                                                          |
| SPECIAL TOOLS                                                    |                                                                                        |
| SEALING/LOCKING FLUIDS<br>APPLICATION                            |                                                                                        |
| MARKING                                                          |                                                                                        |
| DISASSEMBLY/ASSEMBLY OF BULKY PARTS OR<br>SUBASSEMBLIES          |   |
| WARNING:<br>respect assembly orientation                         |                                                                                        |
| CLEANING CAREFULLY                                               |                                                                                        |
| APPLY HIGH PRESSURE FLUID                                        |                                                                                        |

# General Information

## GENERAL DESCRIPTION

All maintenance and repair operations described in this manual should be carried out exclusively by authorized workshops. All instructions detailed should be carefully observed and special equipment indicated should be used if necessary.

Everyone who carries out service operations described without carefully observing these prescriptions will be directly responsible for deriving damages.

### General

Clean the exterior of all components before carrying out any form of repair. Dirt and dust can reduce the efficient working life of a component and lead to costly replacement.

Time spent on the preparation and cleanliness of working surfaces will pay dividends in making the job easier and safer and will result in overhauled components being more reliable and efficient in operation. Use cleaning fluids which are known to be safe. Certain types of fluid can cause damage to O-Rings and cause skin irritation. Solvents should be checked that they are suitable for the cleaning of components and also that they do not risk the personal safety of the user.

Replace O-Rings, seals or gaskets whenever they are disturbed. Never mix new and old seals or O-Rings, regardless of condition. Always lubricate new seals and O-Rings with hydraulic oil before installation.

When replacing component parts, use the correct tool for the job.

### Hoses and Tubes

Always replace hoses and tubes if the cone end or the end connections on the hose are damaged.

When installing a new hose, loosely connect each end and make sure the hose takes up the designed position before tightening the connection. Clamps should be tightened sufficiently to hold the hose without crushing and to prevent chafing.

After hose replacement to a moving component, check that the hose does not foul by moving the component through the complete range of travel.

Be sure any hose which has been installed is not kinked or twisted.

Hose connections which are damaged, dented, crushed or leaking, restrict oil flow and the productivity of the components being served. Connectors which show signs of movement from the original swagged position have failed and will ultimately separate completely.

A hose with a chafed outer cover will allow water entry. Concealed corrosion of the wire reinforcement will subsequently occur along the hose length with resultant hose failure.

Ballooning of the hose indicates an internal leakage due to structural failure. This condition rapidly deteriorates and total hose failure soon occurs.

Kinked, crushed, stretched or deformed hoses generally suffer internal structural damage which can result in oil restriction, a reduction in the speed of operation and ultimate hose failure.

Free-moving, unsupported hoses must never be allowed to touch each other or related other surfaces. This causes chafing which reduces hose life.

### O-Ring Flat Face Seal Fittings

When repairing O-Ring face seal connectors, the following procedures should be observed.



## Warning

**Never disconnect or tighten a hose or tube that is under pressure, if in doubt, actuate the operating levers several times with the engine switched off prior to disconnecting a hose or tube.**

Release the fittings and separate the hose or tube assembly, then remove and discard the O-Ring seal from the fitting.

Dip a new O-Ring seal into clean hydraulic oil prior to installation. Install a new O-Ring into the fitting and, if necessary, retain in position using petroleum jelly.

Assemble the new hose or tube assembly and tighten the fitting finger tight, while holding the tube or hose assembly to prevent it from turning.

Use two suitable wrenches and tighten the fitting to the specified torque according to the size of the fitting.

To ensure a leak-free joint is obtained, it is important that the fittings are not over or under torqued.

### Shimming

At each adjustment, select adjusting shims, measure them individually using a micrometer and then sum up recorded values.

Do not rely on measuring the whole shimming set, which may be incorrect, or on rated value indicated for each shim.

### Rotating Shaft Seals

To correctly install rotating shaft seals, observe the following instructions:

- let the seal soak into the same oil as it will seal for at least half an hour before mounting;
- thoroughly clean the shaft and ensure that the shaft working surface is not damaged;
- place the sealing lip towards the fluid. In case of a hydrodynamic lip, consider the shaft rotation direction and orient grooves in order that they deviate the fluid towards the inner side of the seal;
- coat the sealing lip with a thin layer of lubricant (oil rather than grease) and fill with grease the gap between the sealing lip and the dust lip of double lip seals;

## General Information

- insert the seal into its seat and press it down using a flat punch. Do not tap the seal with a hammer or a drift;
- take care to insert the seal perpendicularly to its seat while you are pressing it. Once the seal is settled, ensure that it contacts the thrust element if required;
- to prevent damaging the sealing lip against the shaft, place a suitable protection during installation.

### O-Rings

Lubricate the O-Rings before inserting them into their seats. This will prevent the O-Rings from rolling over and twisting during mounting which will jeopardize sealing.

### Bearings

It is advisable to heat the bearings to 80 to 90 °C before mounting them on their shafts and cool them down before inserting them into their seats.

### Spring Pins

When mounting roll pin spring pins, ensure that the pin notch is oriented in the direction of the effort to stress the pin.

### Hardware Torque Values

Check the tightness of hardware periodically.

Use the following charts to determine the correct torque when checking, adjusting or replacing hardware on the tractor.

**IMPORTANT:** *Torque values listed are for general use only. Make sure fastener threads are clean and not damaged.*

**NOTE:** *A torque wrench is necessary to properly torque hardware.*

### Notes for Spare Parts

Only genuine parts guarantee same quality, life, safety as original components as they are the same as mounted in production. Only the genuine spare parts can offer this guarantee.

All spare parts orders should be complete with the following data:

- machine model (commercial name) and chassis number;
- engine type and number;
- part number of the ordered part, which can be found on the "Parts Book", which is the base for order processing.

### Notes for Equipment

Equipment which proposes and shows in this manual are as follows:

- studied and designed expressly for use on company machines;
- necessary to make a reliable repair;
- accurately built and strictly tested to offer efficient and long-lasting working means.
- We also remind the repair personnel that having these equipment means:
- work in optimal technical conditions;
- obtain best results;
- save time and effort;
- work more safely.

### Notices

Wear limits indicated for some details should be intended as advised, but not binding values. The words "front", "rear", "right hand", and "left hand" referred to the different parts should be intended as seen from the operator's seat oriented to the normal sense of movement of the machine.

### How to Move the Machine with the Battery Removed

Cables from the external power supply should be connected exclusively to the respective terminals of the Machine positive and negative cables using pliers in good condition which allow proper and steady contact.

Disconnect all services (lights, wind-shield wipers, etc.) before starting the Machine.

If it is necessary to check the machine electrical system, check it only with the power supply connected. At check end, disconnect all services and switch the power supply off before disconnecting the cables.

## General Information

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# General Specifications

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## General Specifications

### Section 2

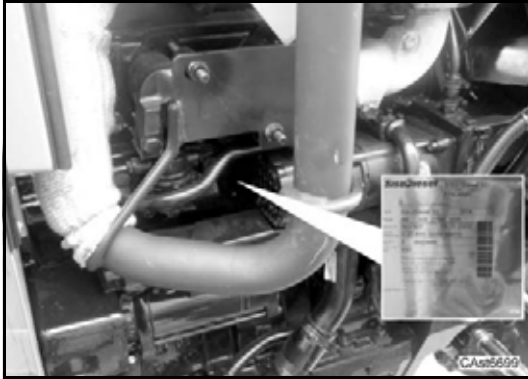
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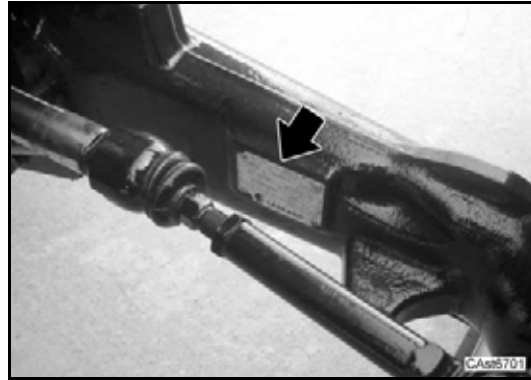


# General Specifications

## PRODUCT IDENTIFICATION



Engine



4WD front axle serial number

Each tractor is identified by means of tractor model and serial numbers. As a further identification, engine and chassis are provided with identification numbers.

To ensure prompt, efficient service when ordering parts or requesting repairs from authorized dealer, record these numbers in the spaces provided.

Machine model and serial number plate (located on there rear side of the vehicle adjacent to the linkage):

Dealer telephone number:

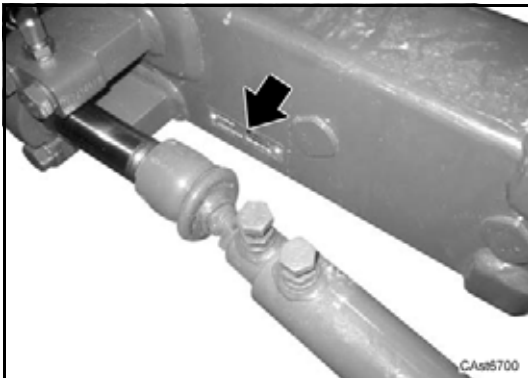
\_\_\_\_\_

Dealer fax number:

\_\_\_\_\_

Dealer e-mail address:

\_\_\_\_\_



2WD front axle serial number

Machine serial number (also located on right-hand side of front axle support):

\_\_\_\_\_

Engine serial number (located on the right side of engine block):

\_\_\_\_\_

Date of delivery:

\_\_\_\_\_

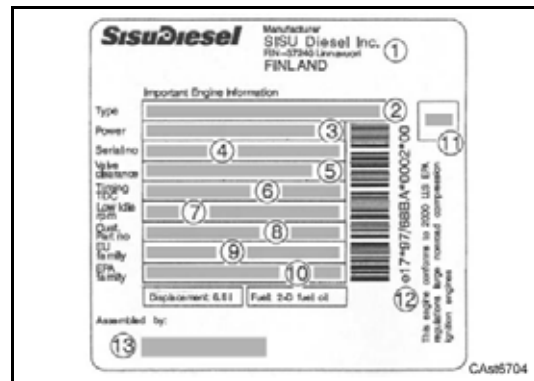
Dealer name and address:

\_\_\_\_\_

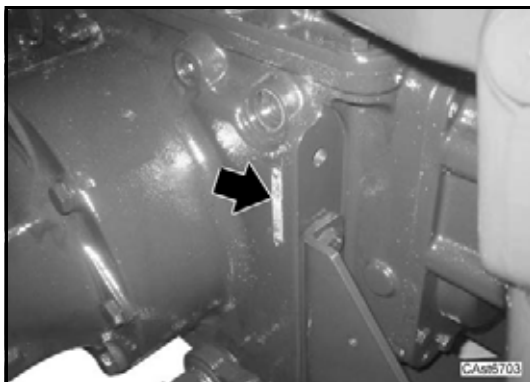
## General Specifications



Tractor serial number



Engine serial number - all versions -



Transmission serial number

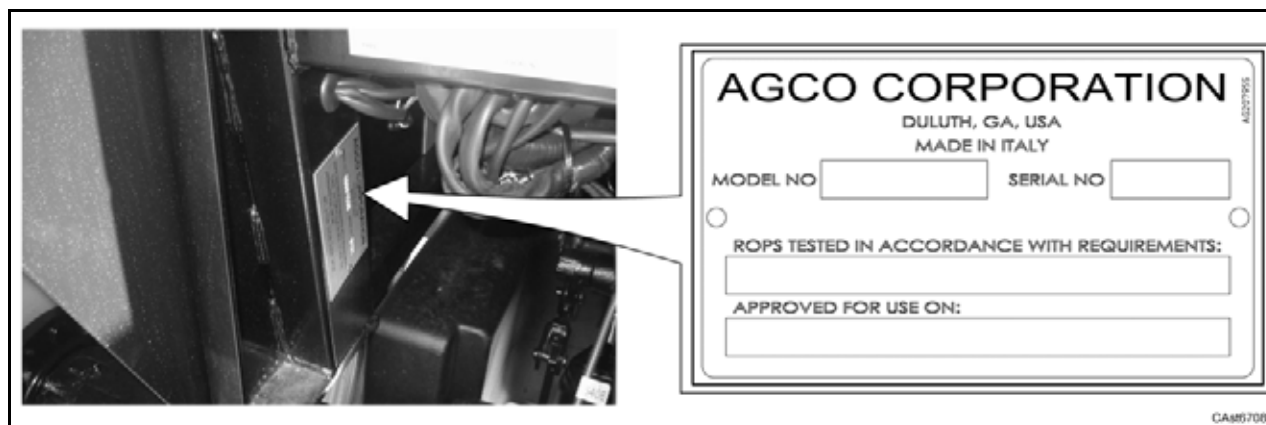
1. Engine manufacturer
2. Engine type
3. Engine power and rated speed
4. Serial number and date of production
5. Valve clearance
6. Injection timing (static)
7. Idling speed
8. Customer part number
9. 97/68/EC approval engine family code
10. EPA40 CFR 89 approval engine family code
11. Smoke value of approval
12. 97/68/EC approval number
13. Name of engine assembler

## General Specifications

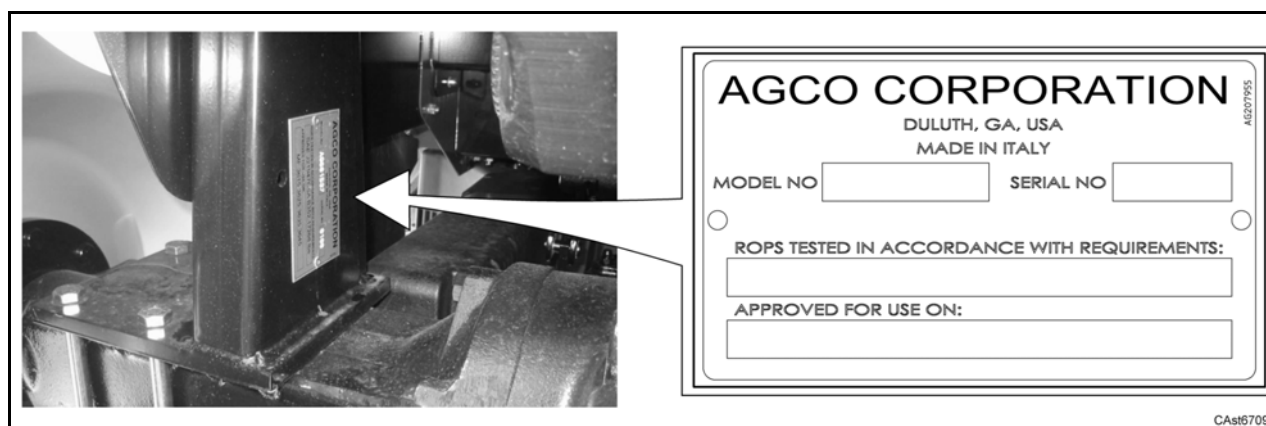
### CAB



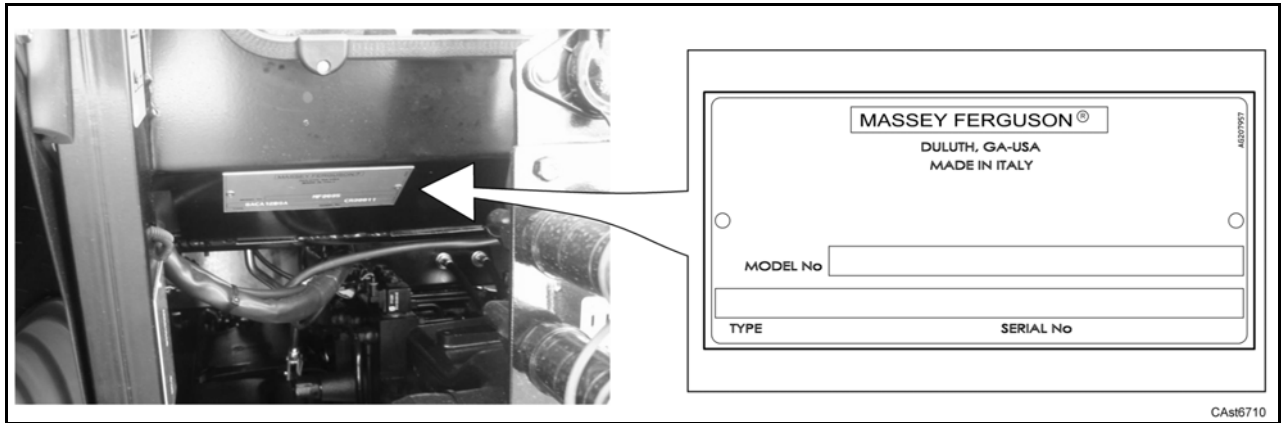
### PLATFORM TRACTORS



### PLATFORM TRACTORS



## General Specifications



# General Specifications

## GENERAL DESCRIPTION

| MACHINE | Tractor             |
|---------|---------------------|
| MODEL   | 3615/3625/3635/3645 |

| DESCRIPTION                                   | VALUES                              |
|-----------------------------------------------|-------------------------------------|
| Engine                                        |                                     |
| Engine type 3615                              | 33.380 DT                           |
| Engine type 3625                              | 33.379 DT                           |
| Engine type 3635                              | 33.378 DT                           |
| Engine type 3645                              | 33.377 DTA                          |
| Aspiration                                    | Turbocharged                        |
| PTO estimated power (kW (Hp))<br>3615         | 33.6 (45)                           |
| PTO estimated power (kW (Hp))<br>3625         | 41 (55)                             |
| PTO estimated power (kW (Hp))<br>3635         | 48.5 (65)                           |
| PTO estimated power (kW (Hp))<br>3645         | 55.9 (75)                           |
| Number of cylinders                           | 3                                   |
| Cylinder capacity (cm <sup>3</sup> )          | 3298                                |
| Bore (mm-inch)                                | 108-4.25                            |
| Stroke (mm-inch)                              | 120-4.72                            |
| Compression ratio                             | 18.5                                |
| System of cooling                             | Liquid cooled                       |
| Rated engine speed (rpm)                      | 2150                                |
| Maximum torque speed (rpm)                    | 1400                                |
| Air filter type                               | 8"                                  |
| Engine power at rated speed (kW (Hp))<br>3615 | 43 (57.6)                           |
| Engine power at rated speed (kW (Hp))<br>3625 | 51 (68.3)                           |
| Engine power at rated speed (kW (Hp))<br>3635 | 58 (77.7)                           |
| Engine power at rated speed (kW (Hp))<br>3645 | 68 (91.1)                           |
| Cycle                                         | Four stroke direct injection diesel |

## General Specifications

| TRANSMISSION |           |            |                 |            |              |
|--------------|-----------|------------|-----------------|------------|--------------|
| No. speed    | 2WD - 4WD | km/h (mph) | Reverser        | Speedshift | Differential |
| 8+8          | 2WD       | 30 (18.6)  | Synchro Reverse | -          | 2S           |
| 8+8          | 4WD       | 30 (18.6)  | Synchro Reverse | -          | 2S           |
| 8+8          | 2WD       | 30 (18.6)  | Synchro Reverse | -          | 4S           |
| 8+8          | 4WD       | 30 (18.6)  | Synchro Reverse | -          | 4S           |
| 12+12        | -         | 30 (18.6)  | Synchro Reverse | -          | 4S           |
| 12+12        | -         | 30 (18.6)  | Synchro Reverse | -          | 4S           |

| DESCRIPTION                        | VALUES                           |
|------------------------------------|----------------------------------|
| Steering system 2WD                |                                  |
| Maximum system pressure            | 190 bar (2755 psi)               |
| Flow for steering wheel revolution | 100 cc/rev                       |
| Steering system 4WD                |                                  |
| Maximum system pressure            | 190 bar (2755 psi)               |
| Flow for steering wheel revolution | 100 cc/rev                       |
| Air conditioning                   |                                  |
| Capacity of circuit                | 0.8 kg (28.22 oz)                |
| Type of refrigerant                | R134A                            |
| Brake system                       |                                  |
| Oil reservoir                      | 0.34 l (0.36 US qt)              |
| Front wheel drive                  |                                  |
| Final drive - each                 | 0.6 l (0.633 US qt)              |
| Axle housing                       | 5.5 l (5.8 US qt)                |
| Fuel tank                          |                                  |
| Cab/Platform                       | 108 l (28.53 US gal)             |
| Footstep                           | 83 l (21.92 US gal)              |
| Electrical system                  |                                  |
| Type                               | 12 V, negative ground            |
| Battery                            | 12 V, 105 Ah<br>675 cca (440cci) |
| Alternator                         | 80 A                             |
| Starting motor                     | 12 V - 3.0 kW                    |
| Bulb light specs                   |                                  |
| Headlight                          | 12 V - 35 kW                     |
| Rear work lamp bulb                | 35 kW                            |
| Tail lights                        | 12 V R21 W                       |
| Turn signal light                  | 12 V R5 W                        |
| Beacon light                       | 12 V R55 W                       |
| Cab working light                  | E1 - 26 W                        |
| License plate light                | 5 W                              |
| Brakes                             |                                  |
| Type                               | Oil immersed multi disc          |
| Number of brake unit               | 2                                |
| Outer diameter of disc             | 165 mm (6.496 in)                |
| Inner diameter of disc             | 110 mm (4.33 in)                 |

## General Specifications

| TIGHTENING TORQUES (lb·ft) (Nm) |                     |                        |
|---------------------------------|---------------------|------------------------|
| Front axle                      | Disc to axle flange | Rim on disc            |
| 2WD                             | 175 (129)           | -                      |
| 4WD                             | 300 (221)           | 190 a 230 (140 to 170) |
| Rear axle                       | Disc to axle flange | Rim on disc            |
| Flanged shaft                   | 500 (368)           | 300 (221)              |

### TARE WEIGHTS kg (lb)\*

|              |     |          | 3615        | 3625 | 3635 | 3645 |
|--------------|-----|----------|-------------|------|------|------|
| Front Axle   | 2WD | footstep | 980 (2161)  |      |      |      |
|              |     | platform | 1090 (2043) |      |      |      |
|              |     | cab      | 1210 (2668) |      |      |      |
|              | 4WD | footstep | 1130 (2492) |      |      |      |
|              |     | platform | 1240 (2734) |      |      |      |
|              |     | cab      | 1360 (2999) |      |      |      |
| Rear Axle    | 2WD | footstep | 1730 (3815) |      |      |      |
|              |     | platform | 1770 (3903) |      |      |      |
|              |     | cab      | 1930 (4526) |      |      |      |
|              | 4WD | footstep | 1700 (3748) |      |      |      |
|              |     | platform | 1740 (3837) |      |      |      |
|              |     | cab      | 1900 (4189) |      |      |      |
| Total Weight | 2WD | footstep | 2170 (4785) |      |      |      |
|              |     | platform | 2860 (6306) |      |      |      |
|              |     | cab      | 3140 (6924) |      |      |      |
|              | 4WD | footstep | 2830 (6240) |      |      |      |
|              |     | platform | 2980 (6571) |      |      |      |
|              |     | cab      | 3620 (7982) |      |      |      |

\*The tare weight (is the unladen weight of tractor in running order, excluding optional accessories but including coolant, oils, fuel, tools and driver) values shown are without the driver weight.

## General Specifications

### MAX PERMISSIBLE WEIGHTS kg (lb)

|              |     |          | 3615         | 3625 | 3635 | 3645         |
|--------------|-----|----------|--------------|------|------|--------------|
| Front Axle   | 2WD | footstep | 1800 (3969)  |      |      |              |
|              |     | platform |              |      |      |              |
|              |     | cab      |              |      |      |              |
|              | 4WD | footstep | 2000 (4851)  |      |      | 2500 (5512)  |
|              |     | platform |              |      |      |              |
|              |     | cab      |              |      |      |              |
| Rear Axle    | 2WD | footstep | 3000 (6615)  |      |      | 3200 (7056)  |
|              |     | platform |              |      |      |              |
|              |     | cab      |              |      |      |              |
|              | 4WD | footstep | 3000 (6615)  |      |      | 3200 (7056)  |
|              |     | platform |              |      |      |              |
|              |     | cab      |              |      |      |              |
| Total Weight | 2WD | footstep | 4400 (9702)  |      |      | 4600 (10143) |
|              |     | platform |              |      |      |              |
|              |     | cab      |              |      |      |              |
|              | 4WD | footstep | 4800 (10584) |      |      | 5100 (11245) |
|              |     | platform |              |      |      |              |
|              |     | cab      |              |      |      |              |
|              |     |          | Normal duty  |      |      | Heavy duty   |

### TARE WEIGHTS kg (lb)\*

|              |     |          | 3615        | 3625 | 3635 | 3645 |
|--------------|-----|----------|-------------|------|------|------|
| Front Axle   | 2WD | platform | 1090 (2403) |      |      |      |
|              |     | cab      | 1210 (2668) |      |      |      |
|              | 4WD | platform | 1240 (2734) |      |      |      |
|              |     | cab      | 1360 (2999) |      |      |      |
| Rear Axle    | 2WD | platform | 1770 (3903) |      |      |      |
|              |     | cab      | 1930 (4526) |      |      |      |
|              | 4WD | platform | 1740 (3837) |      |      |      |
|              |     | cab      | 1900 (4189) |      |      |      |
| Total Weight | 2WD | platform | 2860 (6306) |      |      |      |
|              |     | cab      | 3140 (6924) |      |      |      |
|              | 4WD | platform | 2980 (6571) |      |      |      |
|              |     | cab      | 3620 (7982) |      |      |      |

\*The tare weight (is the unladen weight of tractor in running order, excluding optional accessories but including coolant, oils, fuel, tools and driver) values shown are without the driver weight.



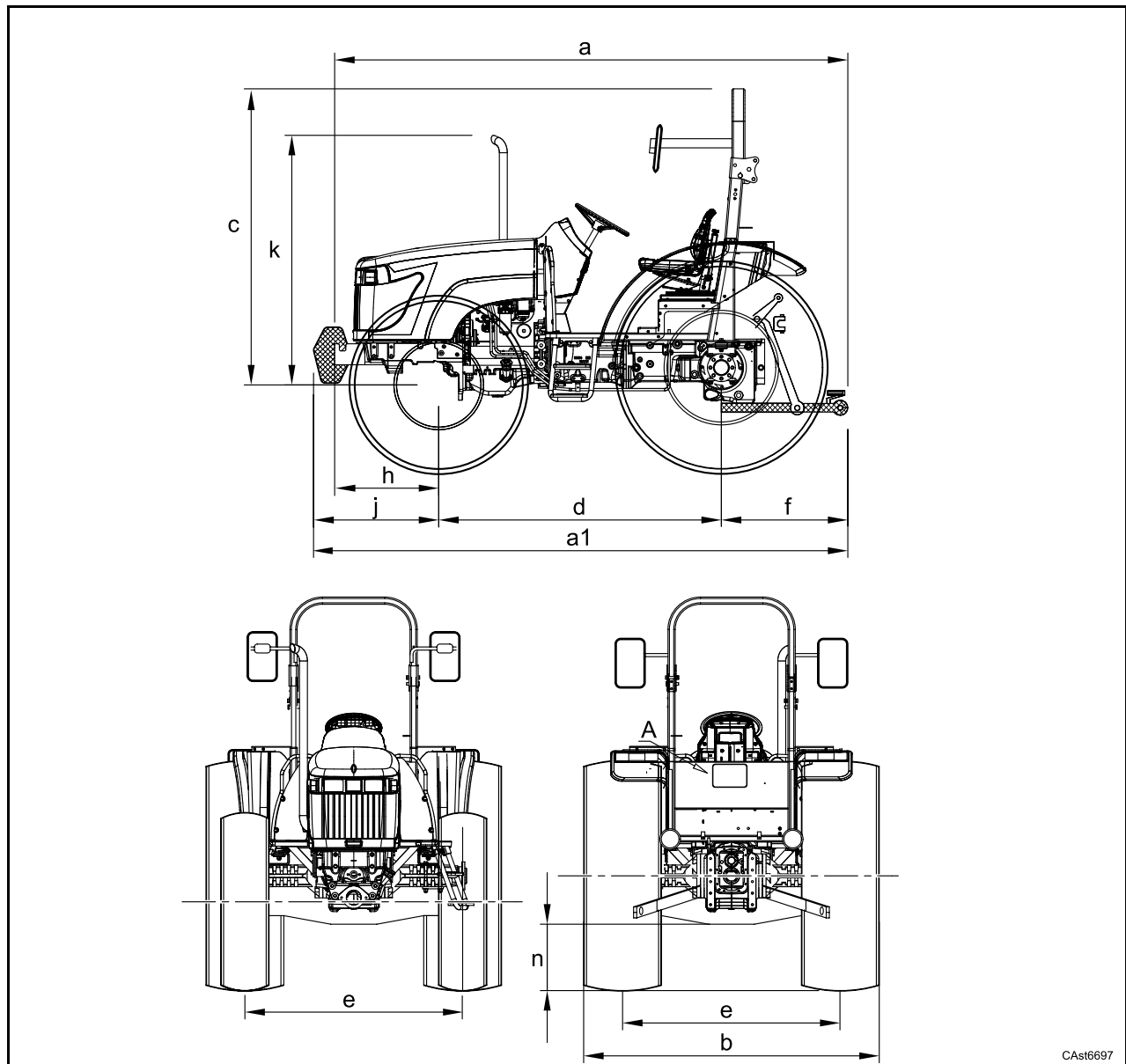
## General Specifications

### MAX PERMISSIBLE WEIGHTS kg (lb)

|              |     |          | 3615         | 3625 | 3635 | 3645         |
|--------------|-----|----------|--------------|------|------|--------------|
| Front Axle   | 2WD | platform | 1800 (3969)  |      |      |              |
|              |     | cab      |              |      |      |              |
|              | 4WD | platform | 2000 (4851)  |      |      | 2500 (5512)  |
|              |     | cab      |              |      |      |              |
| Rear Axle    | 2WD | platform | 3000 (6615)  |      |      | 3200 (7056)  |
|              |     | cab      |              |      |      |              |
|              | 4WD | platform | 3000 (6615)  |      |      | 3200 (7056)  |
|              |     | cab      |              |      |      |              |
| Total Weight | 2WD | platform | 4400 (9702)  |      |      | 4600 (10143) |
|              |     | cab      |              |      |      |              |
|              | 4WD | platform | 4800 (10584) |      |      | 5100 (11245) |
|              |     | cab      |              |      |      |              |
|              |     |          | Normal duty  |      |      | Heavy duty   |

# General Specifications

## DIMENSIONS WITH PLATFORM

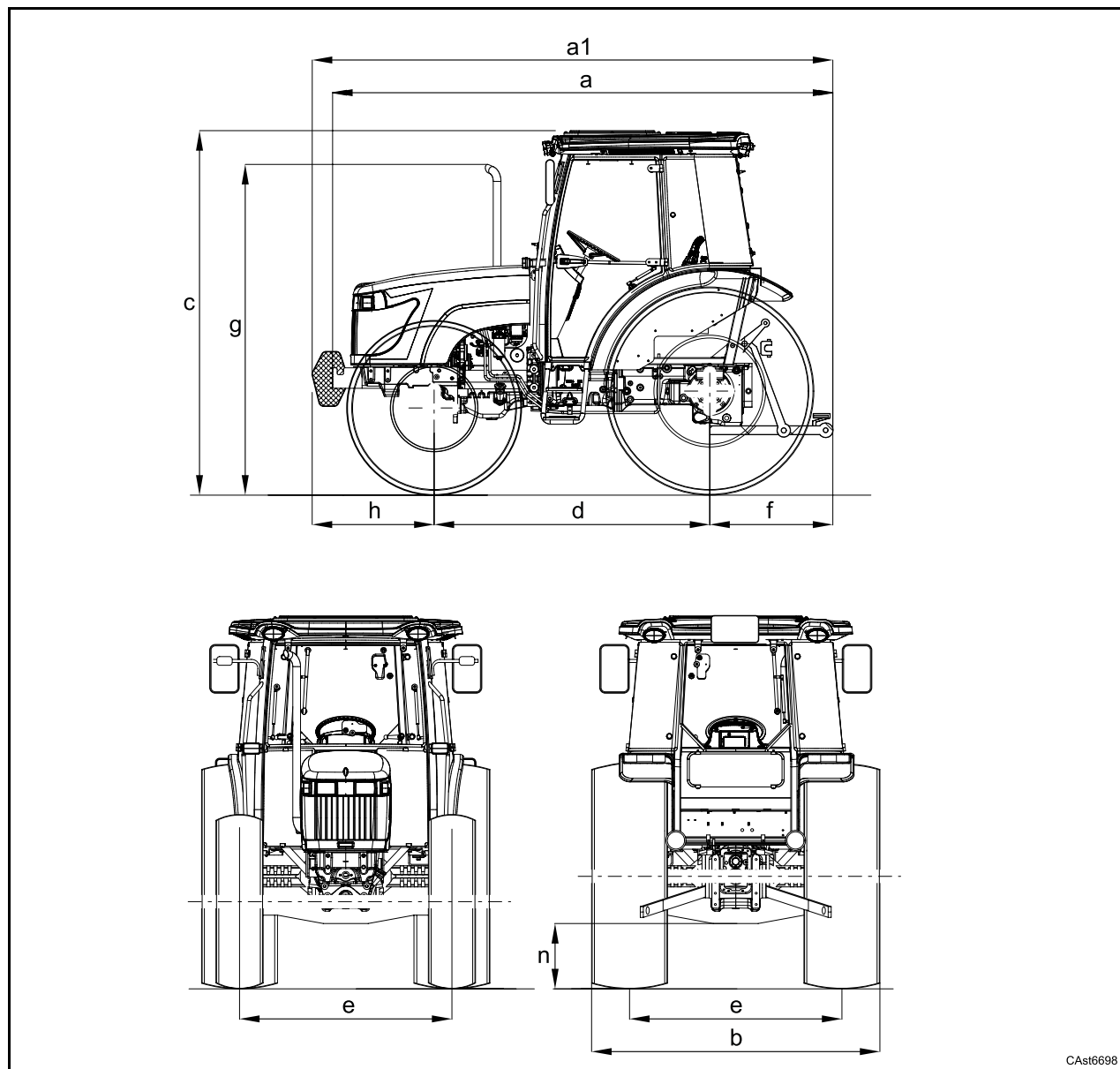


| Dimensions*             | 4WD       |             | 2WD       |             |
|-------------------------|-----------|-------------|-----------|-------------|
|                         | mm        | inch        | mm        | inch        |
| a                       | 3735      | 147.04      | 3735      | 147.04      |
| a1                      | 4030      | 158.66      | 4030      | 158.66      |
| b (max for circulation) | 2000      | 78.73       | 2000      | 78.73       |
| c                       | 2680      | 105.51      | 2680      | 105.51      |
| d                       | 2080      | 81.88       | 2050      | 80.70       |
| e (front)               | 1310-1938 | 51.57-76.29 | 1435-2068 | 56.49-81.47 |
| e (rear)                | 1198-1904 | 47.16-74.96 | 1198-1904 | 47.16-74.96 |
| f                       | 1075      | 42.32       | 1075      | 42.32       |
| g                       | 1075      | 42.32       | 1075      | 42.32       |
| h                       | 870       | 34.25       | 870       | 34.25       |
| n                       | 370       | 14.56       | 370       | 14.56       |

\* Measured in mm with a 16.9 R30 wheel

# General Specifications

## DIMENSIONS WITH CAB



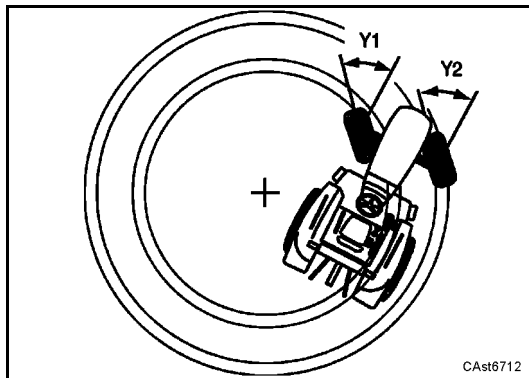
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| Dimensions*             | 4WD       |             | 2WD       |             |
|-------------------------|-----------|-------------|-----------|-------------|
|                         | mm        | inch        | mm        | inch        |
| a                       | 3735      | 147.04      | 3735      | 147.04      |
| a1                      | 4030      | 158.66      | 4030      | 158.66      |
| b (max for circulation) | 2000      | 78.73       | 2000      | 78.73       |
| c                       | 2570      | 101.18      | 2570      | 101.18      |
| d                       | 2080      | 81.88       | 2050      | 80.70       |
| e (front)               | 1310-1938 | 51.57-76.29 | 1435-2068 | 56.49-81.47 |
| e (rear)                | 1198-1904 | 47.16-74.96 | 1198-1904 | 47.16-74.96 |
| f                       | 1075      | 42.32       | 1075      | 42.32       |
| g                       | 2280      | 89.76       | 2280      | 89.76       |
| h                       | 870       | 34.25       | 870       | 34.25       |
| n                       | 370       | 14.56       | 370       | 14.56       |

\* Measured in mm with a 16.9 R30 wheel

# General Specifications

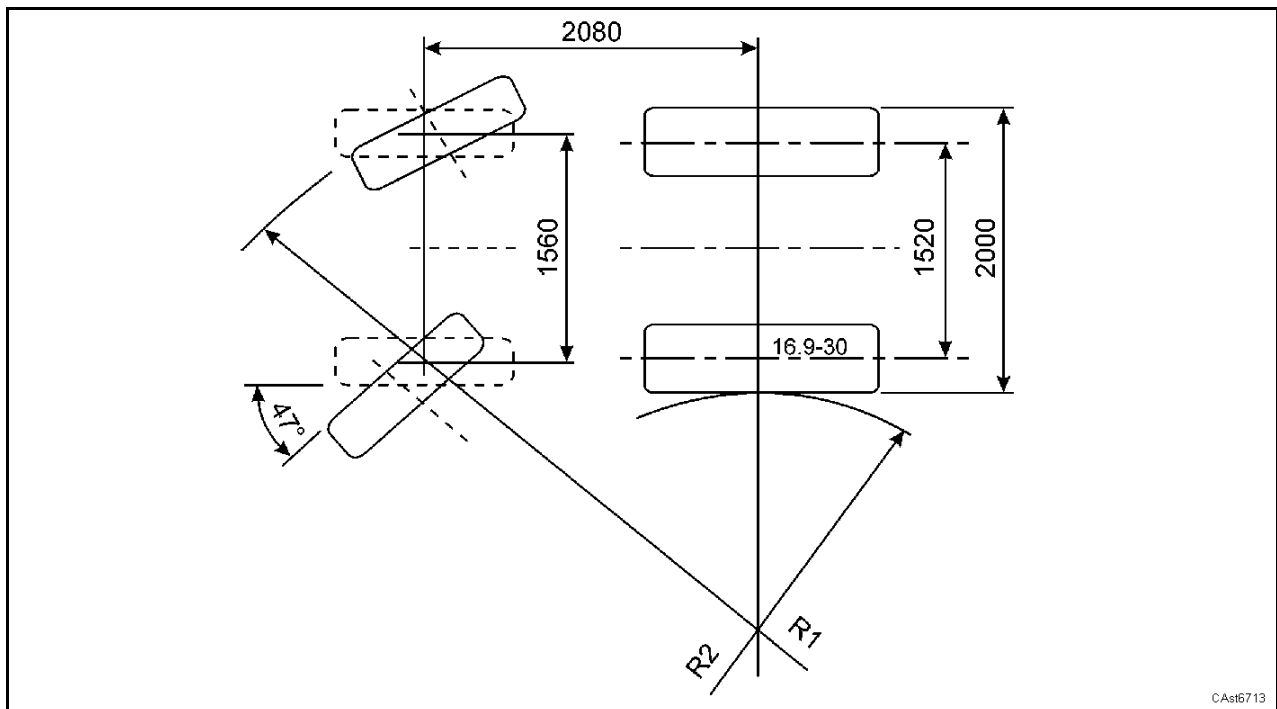
## STEERING ANGLE



Y1: inner  
 2WD=  $55^{\circ} 0-2^{\circ}$   
 4WD=  $55^{\circ} 0-2^{\circ}$

Y2: outer  
 2WD=  $40^{\circ}$   
 4WD=  $40^{\circ}$

## STEERING RADIUS



| Tyres             |            |     | 3615                                 | 3625 | 3635 | 3645 |
|-------------------|------------|-----|--------------------------------------|------|------|------|
| 16.9R30 - 7.50-16 | R2<br>(mm) | 2WD | 5400* - 4500**<br>212.59* - 177.16** |      |      |      |
| 16.9R30 - 11.2R24 | (inch)     | 4WD | 5300* - 4400**<br>208.66* - 173.22** |      |      |      |
| 16.9R30 - 7.50-16 | R1<br>(mm) | 2WD | 3725* - 3350**<br>146.65* - 131.88** |      |      |      |
| 16.9R30 - 11.2R24 | (inch)     | 4WD | 4350* - 3450**<br>171.25* - 135.82** |      |      |      |

\*without brakes

\*\*with brakes

# General Specifications

## TRAVEL SPEED

Travel speeds in km/h at rated engine speed of 215 rpm.

| A  | B  | C  |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| SYMBOL SNAIL (creeper range)                                                        | SYMBOL TORTOISE (field range)                                                       | SYMBOL HARE (road range)                                                              |

### 8+8 SYNCHRO REVERSE 30 KM/H 4WD

| Range Speeds                                                                          |    | Tyres index radius |        |        |        |        |        |        | Reverse |
|---------------------------------------------------------------------------------------|----|--------------------|--------|--------|--------|--------|--------|--------|---------|
|                                                                                       |    | (m)                | 0,600  | 0,650  | 0,675  | 0,700  | 0,725  | 0,750  | 0,750   |
|                                                                                       |    | (inch)             | 23.621 | 25.590 | 26.574 | 27.558 | 28.543 | 29.527 | 29.527  |
| B    | B1 | km/h               | 1,955  | 2,177  | 2,199  | 2,280  | 2,362  | 2,443  | 2,078   |
|                                                                                       |    | mph                | 1,214  | 1,315  | 1,366  | 1,416  | 1,467  | 1,518  | 1,291   |
|                                                                                       | B2 | km/h               | 2,852  | 3,090  | 3,209  | 3,327  | 3,446  | 3,565  | 3,031   |
|                                                                                       |    | mph                | 1,771  | 1,919  | 1,993  | 2,066  | 2,140  | 2,214  | 1,883   |
|                                                                                       | B3 | km/h               | 4,125  | 4,469  | 4,641  | 4,812  | 4,984  | 5,156  | 4,385   |
|                                                                                       |    | mph                | 2,562  | 2,776  | 2,883  | 2,989  | 3,096  | 3,202  | 2,724   |
|                                                                                       | B4 | km/h               | 5,972  | 6,470  | 6,719  | 6,968  | 7,216  | 7,465  | 6,348   |
|                                                                                       |    | mph                | 3,709  | 4,019  | 4,173  | 4,328  | 4,482  | 4,637  | 3,943   |
| C  | C1 | km/h               | 8,627  | 9,345  | 9,705  | 10,064 | 10,424 | 10,783 | 9,169   |
|                                                                                       |    | mph                | 5,358  | 5,804  | 6,028  | 6,251  | 6,475  | 6,698  | 5,695   |
|                                                                                       | C2 | km/h               | 12,588 | 13,637 | 14,161 | 14,686 | 15,210 | 15,735 | 13,380  |
|                                                                                       |    | mph                | 7,819  | 8,470  | 8,796  | 9,122  | 9,447  | 9,773  | 8,311   |
|                                                                                       | C3 | km/h               | 18,206 | 19,723 | 20,482 | 21,240 | 21,999 | 22,757 | 19,352  |
|                                                                                       |    | mph                | 11,308 | 12,250 | 12,722 | 13,193 | 13,664 | 14,135 | 12,020  |
|                                                                                       | C4 | km/h               | 26,359 | 28,555 | 29,654 | 30,752 | 31,850 | 32,948 | 28,017  |
|                                                                                       |    | mph                | 16,372 | 17,736 | 18,419 | 19,101 | 19,783 | 20,465 | 17,402  |

# General Specifications

## 12+12 SYNCHRO REVERSE 30 KM/H 4WD

| Range Speeds                                                                          |    | Tyres index radius |        |        |        |        |        |        | Reverse |
|---------------------------------------------------------------------------------------|----|--------------------|--------|--------|--------|--------|--------|--------|---------|
|                                                                                       |    | (m)                | 0,600  | 0,650  | 0,675  | 0,700  | 0,725  | 0,750  |         |
|                                                                                       |    | (inch)             | 23.621 | 25.590 | 26.574 | 27.558 | 28.543 | 29.527 |         |
| A    | A1 | km/h               | 0,426  | 0,462  | 0,480  | 0,498  | 0,515  | 0,533  | 0,453   |
|                                                                                       |    | mph                | 0.265  | 0.287  | 0.298  | 0.309  | 0.320  | 0.331  | 0.281   |
|                                                                                       | A2 | km/h               | 0,622  | 0,674  | 0,700  | 0,726  | 0,752  | 0,778  | 0,661   |
|                                                                                       |    | mph                | 0.386  | 0.419  | 0.435  | 0.451  | 0.467  | 0.483  | 0.411   |
|                                                                                       | A3 | km/h               | 0,900  | 0,975  | 1,012  | 1,050  | 1,087  | 1,125  | 0,957   |
|                                                                                       |    | mph                | 0.559  | 0.606  | 0.629  | 0.652  | 0.675  | 0.699  | 0.594   |
|                                                                                       | A4 | km/h               | 1,303  | 1,412  | 1,466  | 1,520  | 1,574  | 1,629  | 1,385   |
|                                                                                       |    | mph                | 0.809  | 0.877  | 0.911  | 0.944  | 0.978  | 1.012  | 0.860   |
| B  | B1 | km/h               | 1,955  | 2,177  | 2,199  | 2,280  | 2,362  | 2,443  | 2,078   |
|                                                                                       |    | mph                | 1.214  | 1.315  | 1.366  | 1.416  | 1.467  | 1.518  | 1.291   |
|                                                                                       | B2 | km/h               | 2,852  | 3,090  | 3,209  | 3,327  | 3,446  | 3,565  | 3,031   |
|                                                                                       |    | mph                | 1.771  | 1.919  | 1.993  | 2.066  | 2.140  | 2.214  | 1.883   |
|                                                                                       | B3 | km/h               | 4,125  | 4,469  | 4,641  | 4,812  | 4,984  | 5,156  | 4,385   |
|                                                                                       |    | mph                | 2.562  | 2.776  | 2.883  | 2.989  | 3.096  | 3.202  | 2.724   |
|                                                                                       | B4 | km/h               | 5,972  | 6,470  | 6,719  | 6,968  | 7,216  | 7,465  | 6,348   |
|                                                                                       |    | mph                | 3.709  | 4.019  | 4.173  | 4.328  | 4.482  | 4.637  | 3.943   |
| C  | C1 | km/h               | 8,627  | 9,345  | 9,705  | 10,064 | 10,424 | 10,783 | 9,169   |
|                                                                                       |    | mph                | 5.358  | 5.804  | 6.028  | 6.251  | 6.475  | 6.698  | 5.695   |
|                                                                                       | C2 | km/h               | 12,588 | 13,637 | 14,161 | 14,686 | 15,210 | 15,735 | 13,380  |
|                                                                                       |    | mph                | 7.819  | 6.470  | 8.796  | 9.122  | 9.447  | 9.773  | 8.311   |
|                                                                                       | C3 | km/h               | 18,206 | 19,723 | 20,482 | 21,240 | 21,999 | 22,757 | 19,352  |
|                                                                                       |    | mph                | 11.308 | 12.250 | 12.722 | 13.193 | 13.664 | 14.135 | 12.020  |
|                                                                                       | C4 | km/h               | 26,359 | 28,555 | 29,654 | 30,752 | 31,850 | 32,948 | 28,017  |
|                                                                                       |    | mph                | 16.372 | 17.736 | 18.419 | 19.101 | 19.783 | 20.465 | 17.402  |

# General Specifications

## 12+12 POWERSHUTTLE 30 KM/H 4WD

| Range Speeds                                                                          |    | Tyres index radius |        |        |        |        |        | Reverse |
|---------------------------------------------------------------------------------------|----|--------------------|--------|--------|--------|--------|--------|---------|
|                                                                                       |    | (m)                | 0,600  | 0,650  | 0,675  | 0,700  | 0,725  | 0,750   |
|                                                                                       |    | (inch)             | 23.621 | 25.590 | 26.574 | 27.558 | 28.543 | 29.527  |
| A    | A1 | km/h               | 0,426  | 0,462  | 0,480  | 0,498  | 0,515  | 0,533   |
|                                                                                       |    | mph                | 0.265  | 0.287  | 0.298  | 0.309  | 0.320  | 0.331   |
|                                                                                       | A2 | km/h               | 0,622  | 0,674  | 0,700  | 0,726  | 0,752  | 0,778   |
|                                                                                       |    | mph                | 0.386  | 0.419  | 0.435  | 0.451  | 0.467  | 0.483   |
|                                                                                       | A3 | km/h               | 0,900  | 0,975  | 1,012  | 1,050  | 1,087  | 1,125   |
|                                                                                       |    | mph                | 0.559  | 0.606  | 0.629  | 0.652  | 0.675  | 0.699   |
|                                                                                       | A4 | km/h               | 1,303  | 1,412  | 1,466  | 1,520  | 1,574  | 1,629   |
|                                                                                       |    | mph                | 0.809  | 0.877  | 0.911  | 0.944  | 0.978  | 1.012   |
| B    | B1 | km/h               | 1,955  | 2,177  | 2,199  | 2,280  | 2,362  | 2,443   |
|                                                                                       |    | mph                | 1.214  | 1.315  | 1.366  | 1.416  | 1.467  | 1.518   |
|                                                                                       | B2 | km/h               | 2,852  | 3,090  | 3,209  | 3,327  | 3,446  | 3,565   |
|                                                                                       |    | mph                | 1.771  | 1.919  | 1.993  | 2.066  | 2.140  | 2.214   |
|                                                                                       | B3 | km/h               | 4,125  | 4,469  | 4,641  | 4,812  | 4,984  | 5,156   |
|                                                                                       |    | mph                | 2.562  | 2.776  | 2.883  | 2.989  | 3.096  | 3.202   |
|                                                                                       | B4 | km/h               | 5,972  | 6,470  | 6,719  | 6,968  | 7,216  | 7,465   |
|                                                                                       |    | mph                | 3.709  | 4.019  | 4.173  | 4.328  | 4.482  | 4.637   |
| C  | C1 | km/h               | 8,627  | 9,345  | 9,705  | 10,064 | 10,424 | 10,783  |
|                                                                                       |    | mph                | 5.358  | 5.804  | 6.028  | 6.251  | 6.475  | 6.698   |
|                                                                                       | C2 | km/h               | 12,588 | 13,637 | 14,161 | 14,686 | 15,210 | 15,735  |
|                                                                                       |    | mph                | 7.819  | 8.470  | 8.796  | 9.122  | 9.447  | 9.773   |
|                                                                                       | C3 | km/h               | 18,206 | 19,723 | 20,482 | 21,240 | 21,999 | 22,757  |
|                                                                                       |    | mph                | 11.308 | 12.250 | 12.722 | 13.193 | 13.664 | 14.135  |
|                                                                                       | C4 | km/h               | 26,359 | 28,555 | 29,654 | 30,752 | 31,850 | 32,948  |
|                                                                                       |    | mph                | 16.372 | 17.736 | 18.419 | 19.101 | 19.783 | 20.465  |

## General Specifications

## 24+24 SYNCHRO REVERSE - SYNCRO SPLITTER 40 KM/H 4WD

| Range Speeds |      |      | Tyres index radius |        |        |        |        |        | Reverse |        |
|--------------|------|------|--------------------|--------|--------|--------|--------|--------|---------|--------|
|              |      |      | (m)                | 0,600  | 0,650  | 0,675  | 0,700  | 0,725  | 0,750   | 0,750  |
|              |      |      | (inch)             | 23.621 | 25.590 | 26.574 | 27.558 | 28.543 | 28.543  | 29.527 |
| LOW          | LoA1 | km/h | 0,458              | 0,496  | 0,515  | 0,534  | 0,553  | 0,572  | 0,617   |        |
|              |      | mph  | 0.285              | 0.308  | 0.320  | 0.332  | 0.344  | 0.355  | 0.383   |        |
|              | LoA2 | km/h | 0,668              | 0,723  | 0,751  | 0,779  | 0,807  | 0,835  | 0,901   |        |
|              |      | mph  | 0.415              | 0.449  | 0.467  | 0.484  | 0.501  | 0.519  | 0.560   |        |
|              | LoA3 | km/h | 0,966              | 1,046  | 1,087  | 1,127  | 1,167  | 1,207  | 1,303   |        |
|              |      | mph  | 0.600              | 0.650  | 0.675  | 0.700  | 0.725  | 0.750  | 0.810   |        |
|              | LoA4 | km/h | 1,398              | 1,515  | 1,573  | 1,631  | 1,690  | 1,748  | 1,887   |        |
|              |      | mph  | 0.869              | 0.941  | 0.977  | 1.013  | 1.050  | 1.086  | 1.173   |        |
|              | A    | km/h | 0,537              | 0,582  | 0,604  | 0,626  | 0,649  | 0,671  | 0,724   |        |
|              |      | mph  | 0.334              | 0.362  | 0.375  | 0.389  | 0.403  | 0.417  | 0.450   |        |
|              | HiA1 | km/h | 0,783              | 0,849  | 0,881  | 0,914  | 0,946  | 0,979  | 1,057   |        |
|              |      | mph  | 0.487              | 0.528  | 0.547  | 0.568  | 0.588  | 0.608  | 0.657   |        |
|              | HiA2 | km/h | 1,133              | 1,227  | 1,275  | 1,322  | 1,369  | 1,416  | 1,528   |        |
|              |      | mph  | 0.704              | 0.762  | 0.792  | 0.821  | 0.851  | 0.880  | 0.949   |        |
|              | HiA3 | km/h | 1,640              | 1,777  | 1,845  | 1,914  | 1,982  | 2,050  | 2,213   |        |
|              |      | mph  | 1.019              | 1.104  | 1.146  | 1.189  | 1.232  | 1.274  | 1.375   |        |
|              | HIGH | km/h |                    |        |        |        |        |        |         |        |
|              |      | mph  |                    |        |        |        |        |        |         |        |
| B            | LoB1 | km/h | km/h               | 2,098  | 2,272  | 2,360  | 2,447  | 2,535  | 2,622   |        |
|              |      | mph  | mph                | 1.304  | 1.412  | 1.466  | 1.520  | 1.575  | 1.629   |        |
|              | LoB2 | km/h | km/h               | 3,061  | 3,316  | 3,443  | 3,571  | 3,698  | 3,826   |        |
|              |      | mph  | mph                | 1.902  | 2.060  | 2.139  | 2.219  | 2.298  | 2.377   |        |
|              | LoB3 | km/h | km/h               | 4,427  | 4,796  | 4,980  | 5,165  | 5,349  | 5,534   |        |
|              |      | mph  | mph                | 2.751  | 2.980  | 3.094  | 3.209  | 3.324  | 3.439   |        |
|              | LoB4 | km/h | km/h               | 6,409  | 6,943  | 7,210  | 7,477  | 7,745  | 8,012   |        |
|              |      | mph  | mph                | 3.982  | 4.003  | 4.480  | 4.646  | 4.813  | 4.978   |        |
|              | B    | km/h | 2,460              | 2,665  | 2,768  | 2,870  | 2,973  | 3,075  | 3,319   |        |
|              |      | mph  | 1.529              | 1.656  | 1.720  | 1.783  | 1.847  | 1.911  | 2.062   |        |
|              | HiB1 | km/h | 3,590              | 3,889  | 4,039  | 4,188  | 4,338  | 4,488  | 4,843   |        |
|              |      | mph  | 2.231              | 2.417  | 2.510  | 2.602  | 2.696  | 2.798  | 3.009   |        |
|              | HiB2 | km/h | 5,192              | 5,625  | 5,841  | 6,058  | 6,274  | 6,491  | 7,005   |        |
|              |      | mph  | 3.226              | 3.495  | 3.629  | 3.764  | 3.898  | 4.033  | 4.353   |        |
|              | HiB3 | km/h | 7,518              | 8,144  | 8,457  | 8,771  | 9,084  | 9,397  | 10,142  |        |
|              |      | mph  | 4.671              | 5.060  | 5.255  | 5.450  | 5.645  | 5.839  | 6.302   |        |
|              | HiB4 | km/h | 9,258              | 10,029 | 10,415 | 10,801 | 11,187 | 11,572 | 12,490  |        |
|              |      | mph  | 5.753              | 6.232  | 6.472  | 6.711  | 6.951  | 7.191  | 7.761   |        |
|              | LoC1 | km/h | 13,509             | 14,635 | 15,197 | 15,760 | 16,323 | 16,886 | 18,225  |        |
|              |      | mph  | 8.394              | 9.094  | 9.443  | 9.793  | 10.143 | 10.493 | 11.324  |        |
|              | LoC2 | km/h | 19,538             | 21,167 | 21,981 | 22,795 | 23,609 | 24,243 | 26,360  |        |
|              |      | mph  | 12.140             | 13.153 | 13.658 | 14.164 | 14.670 | 15.064 | 16.379  |        |
|              | LoC3 | km/h | 28,288             | 30,645 | 31,824 | 33,002 | 34,181 | 35,360 | 38,164  |        |
|              |      | mph  | 17.577             | 19.042 | 19.775 | 20.506 | 21.239 | 21.972 | 23.714  |        |
|              | LoC4 | km/h | 10,859             | 11,764 | 12,216 | 12,669 | 13,121 | 13,574 | 14,650  |        |
|              |      | mph  | 6.747              | 7.310  | 7.591  | 7.872  | 8.153  | 8.434  | 9.103   |        |
|              | HiC1 | km/h | 15,845             | 17,165 | 17,826 | 18,486 | 19,146 | 18,806 | 21,377  |        |
|              |      | mph  | 9.846              | 10.666 | 11.077 | 11.077 | 11.897 | 11.686 | 13.283  |        |
|              | HiC2 | km/h | 22,197             | 24,827 | 25,782 | 26,737 | 27,692 | 28,646 | 30,918  |        |
|              |      | mph  | 13.793             | 15.427 | 16.020 | 16.614 | 17.207 | 17.800 | 19.212  |        |
|              | HiC3 | km/h | 33,180             | 35,945 | 37,327 | 38,710 | 40,092 | 41,475 | 44,764  |        |
|              |      | mph  | 20.617             | 22.335 | 23.159 | 24.053 | 24.912 | 25.771 | 27.815  |        |
|              | HiC4 | km/h |                    |        |        |        |        |        |         |        |
|              |      | mph  |                    |        |        |        |        |        |         |        |
|              | HIGH | km/h |                    |        |        |        |        |        |         |        |
|              |      | mph  |                    |        |        |        |        |        |         |        |



# General Specifications

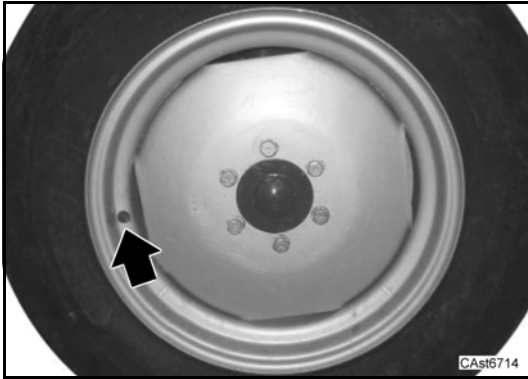
## 24+24 SYNCHRO REVERSE - POWER HI-LO 40 KM/H 4WD

| Range Speeds |                                                                                   |      | Tyres index radius |        |        |        |        |        | Reverse |        |
|--------------|-----------------------------------------------------------------------------------|------|--------------------|--------|--------|--------|--------|--------|---------|--------|
|              |                                                                                   |      | (m)                | 0,600  | 0,650  | 0,675  | 0,700  | 0,725  | 0,750   | 0,750  |
|              |                                                                                   |      | (inch)             | 23.621 | 25.590 | 26.574 | 27.558 | 28.543 | 28.543  | 29.527 |
| LOW          | LoA1                                                                              | km/h | 0,458              | 0,496  | 0,515  | 0,534  | 0,553  | 0,572  | 0,486   |        |
|              |                                                                                   | mph  | 0.285              | 0.308  | 0.320  | 0.332  | 0.344  | 0.355  | 0.302   |        |
|              | LoA2                                                                              | km/h | 0,668              | 0,723  | 0,751  | 0,779  | 0,807  | 0,835  | 0,710   |        |
|              |                                                                                   | mph  | 0.415              | 0.449  | 0.467  | 0.484  | 0.501  | 0.519  | 0.441   |        |
|              | LoA3                                                                              | km/h | 0,966              | 1,046  | 1,087  | 1,127  | 1,167  | 1,207  | 1,027   |        |
|              |                                                                                   | mph  | 0.600              | 0.650  | 0.675  | 0.700  | 0.725  | 0.750  | 0.638   |        |
|              | LoA4                                                                              | km/h | 1,398              | 1,515  | 1,573  | 1,631  | 1,690  | 1,748  | 1,486   |        |
|              |                                                                                   | mph  | 0.869              | 0.941  | 0.977  | 1.013  | 1.050  | 1.086  | 1.193   |        |
| A            |  | km/h | 0,537              | 0,582  | 0,604  | 0,626  | 0,649  | 0,671  | 0,571   |        |
|              |                                                                                   | mph  | 0.334              | 0.362  | 0.375  | 0.389  | 0.403  | 0.417  | 0.355   |        |
| HIGH         | HiA1                                                                              | km/h | 0,783              | 0,849  | 0,881  | 0,914  | 0,946  | 0,979  | 1,833   |        |
|              |                                                                                   | mph  | 0.487              | 0.528  | 0.547  | 0.568  | 0.588  | 0.608  | 0.518   |        |
|              | HiA2                                                                              | km/h | 1,133              | 1,227  | 1,275  | 1,322  | 1,369  | 1,416  | 1,204   |        |
|              |                                                                                   | mph  | 0.704              | 0.762  | 0.792  | 0.821  | 0.851  | 0.880  | 0.748   |        |
|              | HiA3                                                                              | km/h | 1,640              | 1,777  | 1,845  | 1,914  | 1,982  | 2,050  | 1,743   |        |
|              |                                                                                   | mph  | 1.019              | 1.104  | 1.146  | 1.189  | 1.232  | 1.274  | 1.083   |        |
|              | HiA4                                                                              | km/h | 2,098              | 2,272  | 2,360  | 2,447  | 2,535  | 2,615  | 2,230   |        |
|              |                                                                                   | mph  | 1.304              | 1.412  | 1.466  | 1.520  | 1.575  | 1.629  | 1.386   |        |
| B            | LoB1                                                                              | km/h | 3,061              | 3,316  | 3,443  | 3,571  | 3,698  | 3,825  | 3,253   |        |
|              |                                                                                   | mph  | 1.902              | 2.060  | 2.139  | 2.219  | 2.298  | 2.377  | 2.021   |        |
|              | LoB2                                                                              | km/h | 4,427              | 4,796  | 4,980  | 5,165  | 5,349  | 5,533  | 4,705   |        |
|              |                                                                                   | mph  | 2.751              | 2.980  | 3.094  | 3.209  | 3.324  | 3.439  | 2.924   |        |
|              | LoB3                                                                              | km/h | 6,409              | 6,943  | 7,210  | 7,477  | 7,745  | 8,012  | 6,813   |        |
|              |                                                                                   | mph  | 3.982              | 4.403  | 4.480  | 4.646  | 4.813  | 4.979  | 4.233   |        |
|              | LoB4                                                                              | km/h | 2,460              | 2,665  | 2,768  | 2,870  | 2,973  | 3,075  | 2,615   |        |
|              |                                                                                   | mph  | 1.529              | 1.656  | 1.720  | 1.783  | 1.847  | 1.911  | 1.625   |        |
| C            | HiB1                                                                              | km/h | 3,590              | 3,889  | 4,039  | 4,188  | 4,338  | 4,488  | 3,816   |        |
|              |                                                                                   | mph  | 2.231              | 2.417  | 2.510  | 2.602  | 2.696  | 2.798  | 2.371   |        |
|              | HiB2                                                                              | km/h | 5,192              | 5,625  | 5,841  | 6,058  | 6,274  | 6,491  | 5,519   |        |
|              |                                                                                   | mph  | 3.226              | 3.495  | 3.629  | 3.764  | 3.898  | 4.033  | 3.429   |        |
|              | HiB3                                                                              | km/h | 7,518              | 8,144  | 8,457  | 8,771  | 9,084  | 9,397  | 8,012   |        |
|              |                                                                                   | mph  | 4.671              | 5.060  | 5.255  | 5.450  | 5.645  | 5.839  | 5.012   |        |
|              | HiB4                                                                              | km/h | 9,258              | 10,029 | 10,415 | 10,801 | 11,187 | 11,572 | 9,840   |        |
|              |                                                                                   | mph  | 5.753              | 6.232  | 6.472  | 6.711  | 6.951  | 7.191  | 6.114   |        |
| LOW          | LoC1                                                                              | km/h | 13,509             | 14,635 | 15,197 | 15,760 | 16,323 | 16,886 | 14,359  |        |
|              |                                                                                   | mph  | 8.394              | 9.094  | 9.443  | 9.793  | 10.143 | 10.493 | 8.922   |        |
|              | LoC2                                                                              | km/h | 19,538             | 21,167 | 21,981 | 22,795 | 23,609 | 24,423 | 20,768  |        |
|              |                                                                                   | mph  | 12.140             | 13.153 | 13.658 | 14.164 | 14.670 | 15.176 | 12.905  |        |
|              | LoC3                                                                              | km/h | 28,288             | 30,645 | 31,824 | 33,002 | 34,181 | 35,360 | 30,583  |        |
|              |                                                                                   | mph  | 17.577             | 19.042 | 19.775 | 20.506 | 21.239 | 21.972 | 18.838  |        |
|              | LoC4                                                                              | km/h | 10,859             | 11,764 | 12,216 | 12,669 | 13,121 | 13,574 | 11,962  |        |
|              |                                                                                   | mph  | 6.747              | 7.310  | 7.591  | 7.872  | 8.153  | 8.434  | 7.418   |        |
| HIGH         | HiC1                                                                              | km/h | 15,845             | 17,165 | 17,826 | 18,486 | 19,146 | 18,806 | 23,292  |        |
|              |                                                                                   | mph  | 9.846              | 10.666 | 11.077 | 11.488 | 11.897 | 11.686 | 14.473  |        |
|              | HiC2                                                                              | km/h | 22,197             | 24,827 | 25,782 | 26,737 | 27,692 | 28,646 | 33,688  |        |
|              |                                                                                   | mph  | 13.793             | 15.427 | 16.020 | 16.614 | 17.207 | 17.800 | 20.933  |        |
|              | HiC3                                                                              | km/h | 33,180             | 35,945 | 37,327 | 38,710 | 40,092 | 41,475 | 48,774  |        |
|              |                                                                                   | mph  | 20.617             | 22.335 | 23.159 | 24.053 | 24.912 | 25.771 | 30.307  |        |
|              | HiC4                                                                              | km/h | 10,859             | 11,764 | 12,216 | 12,669 | 13,121 | 13,574 | 11,962  |        |
|              |                                                                                   | mph  | 6.747              | 7.310  | 7.591  | 7.872  | 8.153  | 8.434  | 7.418   |        |

## General Specifications

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### TYRE



#### Tyre pressure

Check the correct pressure of tyres:

##### *Rear wheels*

- All tyres: 1,6 bar (23.2 psi)

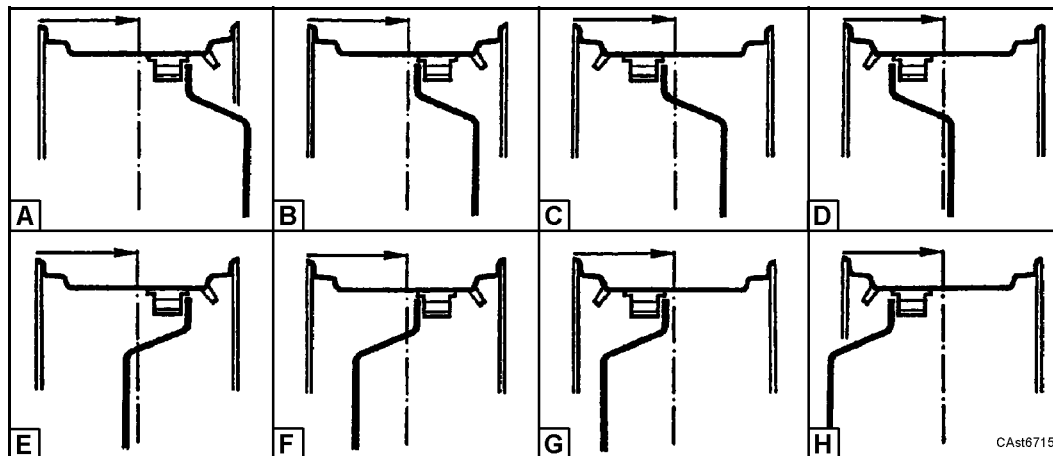
##### *Front wheels (two wheel drive)*

- Tyres 7.50-16: 2,8 bar (40.6 psi)
- Tyres 7.50-20: 2,8 bar (40.6 psi)
- Tyres 9.5L-15: 2,8 bar (40.6 psi)

##### *Front wheels (front wheel drive)*

- Tyres 9.50R24: 2,1 bar (30.4 psi)
- All other tyres: 1.6 bar (23.2 psi)

# General Specifications



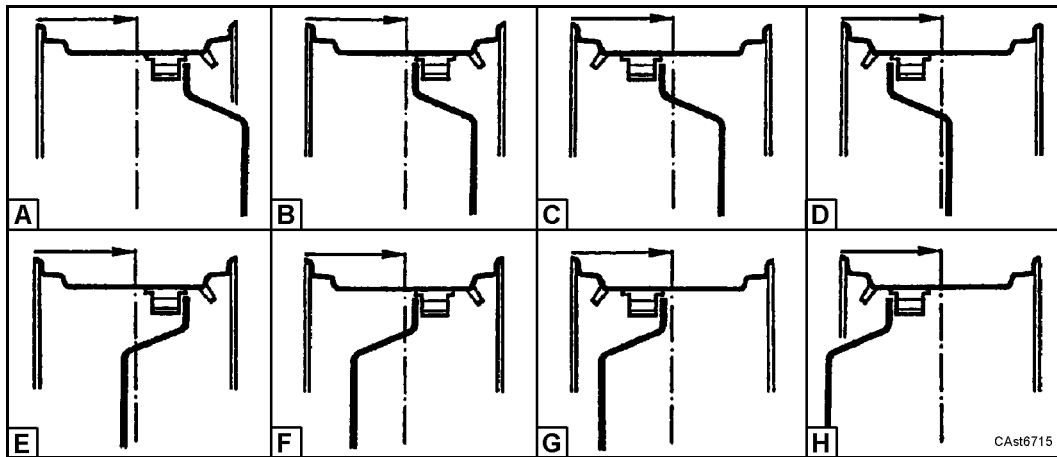
## FRONT WHEELS (US MARKET)

| Tyres      | A            | B            | C            | D            | E            | F            | G            | H            |
|------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 260/80 R20 | 1402 mm      | 1492 mm      | 1540 mm      | 1630 mm      | 1666 mm      | 1756 mm      | 1804 mm      | 1894 mm      |
|            | (55,19 inch) | (58,73 inch) | (60,62 inch) | (64,17 inch) | (65,59 inch) | (69,13 inch) | (71,02 inch) | (74,56 inch) |
| 11.2 R20   | 1334 mm      | 1424 mm      | 1608 mm      | 1698 mm      | 1598 mm      | 1688 mm      | 1872 mm      | 1962 mm      |
|            | (52,52 inch) | (56,06 inch) | (63,30 inch) | (66,85 inch) | (62,91 inch) | (66,45 inch) | (73,70 inch) | (77,24 inch) |
| 12.4 R20   | 1334 mm      | 1424 mm      | 1608 mm      | 1698 mm      | 1598 mm      | 1688 mm      | 1872 mm      | 1962 mm      |
|            | (52,51 inch) | (56,06 inch) | (63,30 inch) | (66,85 inch) | (62,91 inch) | (66,45 inch) | (73,70 inch) | (77,24 inch) |
| 9.5 R24    | 1386,6 mm    | 1496 mm      | 1500 mm      | 1609.4 mm    | 1686.6 mm    | 1796 mm      | 1800 mm      | 1909.4 mm    |
|            | (54,59 inch) | (58,90 inch) | (59,06 inch) | (63,36 inch) | (66,40 inch) | (70,71 inch) | (70,87 inch) | (75,17 inch) |
| 11.2 R24   | 1384 mm      | 1474 mm      | 1522 mm      | 1612 mm      | 1684 mm      | 1774 mm      | 1822 mm      | 1912 mm      |
|            | (54,48 inch) | (58,03 inch) | (59,92 inch) | (63,46 inch) | (66,29 inch) | (69,84 inch) | (71,73 inch) | (75,27 inch) |
| 12.4 R24   | 1384 mm      | 1474 mm      | 1522 mm      | 1612 mm      | 1684 mm      | 1774 mm      | 1822 mm      | 1912 mm      |
|            | (54,48 inch) | (58,03 inch) | (59,92 inch) | (63,46 inch) | (66,29 inch) | (69,84 inch) | (71,73 inch) | (75,27 inch) |

## FRONT WHEELS (EAME MARKET)

| Tyres      | A            | B            | C            | D            | E            | F            | G            | H            |
|------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 11.2 R24   | 1384 mm      | 1474 mm      | 1522 mm      | 1612 mm      | 1684 mm      | 1774 mm      | 1822 mm      | 1912 mm      |
|            | (54,48 inch) | (58,03 inch) | (59,92 inch) | (63,46 inch) | (66,29 inch) | (69,84 inch) | (71,73 inch) | (75,27 inch) |
| 360/70 R20 | 1334 mm      | 1424 mm      | 1608 mm      | 1698 mm      | 1598 mm      | 1688 mm      | 1872 mm      | 1962 mm      |
|            | (52,51 inch) | (56,06 inch) | (63,30 inch) | (66,85 inch) | (62,91 inch) | (66,45 inch) | (73,70 inch) | (77,24 inch) |
| 12.4 R24   | 1384 mm      | 1474 mm      | 1522 mm      | 1612 mm      | 1684 mm      | 1774 mm      | 1822 mm      | 1912 mm      |
|            | (54,48 inch) | (58,03 inch) | (59,92 inch) | (63,46 inch) | (66,29 inch) | (69,84 inch) | (71,73 inch) | (75,27 inch) |

# General Specifications



## REAR WHEELS (US MARKET)

| Tyres                    | A | B | C            | D            | E            | F            | G            | H            |
|--------------------------|---|---|--------------|--------------|--------------|--------------|--------------|--------------|
| 13.6 R28<br>(340/85 R28) | - | - | 1420 mm      | 1524 mm      | 1582 mm      | 1686 mm      | 1820 mm      | 1924 mm      |
|                          |   |   | (55,91 inch) | (60,00 inch) | (62,28 inch) | (66,38 inch) | (71,65 inch) | (75,75 inch) |
| 14.9 R28<br>(380/85 R28) | - | - | 1420 mm      | 1524 mm      | 1582 mm      | 1686 mm      | 1820 mm      | 1924 mm      |
|                          |   |   | (55,91 inch) | (60,00 inch) | (62,28 inch) | (66,38 inch) | (71,65 inch) | (75,75 inch) |
| 16.9 R24                 | - | - | -            | 1491,6 mm    | 1612 mm      | 1705,6 mm    | 1798 mm      | 1891,6 mm    |
|                          |   |   |              | (58,72 inch) | (63,46 inch) | (67,15 inch) | (70,79 inch) | (74,47 inch) |
| 16.9 R28 GY              | - | - | -            | 1518 mm      | 1588 mm      | 1692 mm      | 1814 mm      | 1918 mm      |
|                          |   |   |              | (59,76 inch) | (62,52 inch) | (66,61 inch) | (71,42 inch) | (75,51 inch) |
| 16.9 R30<br>(420/85 R30) | - | - | -            | 1506 mm      | 1600 mm      | 1704 mm      | 1802 mm      | 1906 mm      |
|                          |   |   |              | (59,29 inch) | (62,99 inch) | (67,09 inch) | (70,94 inch) | (75,04 inch) |
| 18.4 R26                 | - | - | -            | 1506 mm      | 1600 mm      | 1704 mm      | 1802 mm      | 1906 mm      |
|                          |   |   |              | (59,29 inch) | (62,99 inch) | (67,09 inch) | (70,94 inch) | (75,04 inch) |
| 18.4 R30                 | - | - | -            | 1506 mm      | 1600 mm      | 1704 mm      | 1802 mm      | 1906 mm      |
|                          |   |   |              | (59,29 inch) | (62,99 inch) | (67,09 inch) | (70,94 inch) | (75,04 inch) |
| 13.6 R38                 | - | - | 1436 mm      | 1506 mm      | 1602 mm      | 1672 mm      | 1836 mm      | 1906 mm      |
|                          |   |   | (56,53 inch) | (59,29 inch) | (63,07 inch) | (65,82 inch) | (78,28 inch) | (75,04 inch) |

## REAR WHEELS (EAME MARKET)

| Tyres                    | A | B | C            | D            | E            | F            | G            | H            |
|--------------------------|---|---|--------------|--------------|--------------|--------------|--------------|--------------|
| 12.4 R36                 | - | - | 1384 mm      | 1484 mm      | 1620 mm      | 1720 mm      | 1800 mm      | 1900 mm      |
|                          |   |   | (54,48 inch) | (58,42 inch) | (63,77 inch) | (67,71 inch) | (70,86 inch) | (74,70 inch) |
| 16.9 R30                 | - | - | -            | 1504 mm      | 1598 mm      | 1702 mm      | 1800 mm      | 1904 mm      |
|                          |   |   |              | (59,21 inch) | (62,91 inch) | (67,00 inch) | (70,86 inch) | (74,96 inch) |
| 540/65 R30               | - | - | -            | -            | 1598 mm      | 1702 mm      | 1800 mm      | 1904 mm      |
|                          |   |   |              |              | (62,91 inch) | (67,00 inch) | (70,86 inch) | (74,96 inch) |
| 420/70 R30               | - | - | -            | 1504 mm      | 1598 mm      | 1702 mm      | 1800 mm      | 1904 mm      |
|                          |   |   |              | (59,21 inch) | (62,91 inch) | (67,00 inch) | (70,86 inch) | (74,96 inch) |
| 16.9 R30<br>(420/85 R30) | - | - | -            | 1504 mm      | 1598 mm      | 1702 mm      | 1800 mm      | 1904 mm      |
|                          |   |   |              | (59,21 inch) | (62,91 inch) | (67,00 inch) | (70,86 inch) | (74,96 inch) |
| 480/70 R30               | - | - | -            | 1504 mm      | 1598 mm      | 1702 mm      | 1800 mm      | 1904 mm      |
|                          |   |   |              | (59,21 inch) | (62,91 inch) | (67,00 inch) | (70,86 inch) | (74,96 inch) |

# General Specifications

## TYRE COMBINATION (US MARKET)

| Tractor model    | 3615 | 3625 | 3635 | 3645 |                  |                  |                  |  |
|------------------|------|------|------|------|------------------|------------------|------------------|--|
|                  |      |      |      |      | Front tyres 2WD  |                  | Front tyres 4WD  |  |
| Rear tyres       |      |      |      |      |                  |                  |                  |  |
| 13.6-28 6PR      | X    | X    |      |      | 7.50-16 6PR (F2) |                  | 260/80-20        |  |
| 14.9-28 6PR (R1) | X    | X    |      |      |                  | 9.5L-15 6PR (F2) | 11.2-20          |  |
| 16.9-24 6PR (R1) | X    | X    | X    | X    |                  | 9.5L-15 6PR (F2) | 11.2-20          |  |
| 16.9-28 6PR (R1) | X    | X    | X    | X    |                  | 9.5L-15 6PR (F2) | 12.4-20          |  |
| 16.9-30 6PR (R1) |      |      | X    | X    |                  | 9.5L-15 6PR (F2) | 11.2-24 6PR (R1) |  |
| 18.4-26 6PR (R1) |      |      | X    | X    |                  | 9.5L-15 6PR (F2) | 12.4-20          |  |
| 18.4-30 6PR (R1) |      |      | X    | X    |                  | 9.5L-15 6PR (F2) | 12.4-24 6PR (R1) |  |
| 13.6-38 6PR (R1) |      |      | X    | X    |                  |                  | 12.4-24 6PR (R1) |  |

## TYRE COMBINATION (EAME MARKET)

| Tractor model | 3615 | 3625 | 3635 | 3645 |                 |  |                 |  |
|---------------|------|------|------|------|-----------------|--|-----------------|--|
|               |      |      |      |      | Front tyres 2WD |  | Front tyres 4WD |  |
| Rear tyres    |      |      |      |      |                 |  |                 |  |
| 12.4 R36      | X    | X    | X    | X    | 7.50-16         |  | 320/70 R24      |  |
| 480/70 R30    | X    | X    | X    | X    | 7.50-16         |  | 320/70 R24      |  |
| 420/70 R30    | X    | X    | X    | X    | 7.50-16         |  | 320/70 R24      |  |
| 540/65 R30    | X    | X    | X    | X    | 7.50-16         |  | 320/70 R24      |  |
| 16.9-30       | X    | X    | X    | X    | 7.50-16         |  | 11.2-24         |  |

## General Specifications

### BATTERY

Voltage: 12 V

Capacity (20 h): 100 Ah

Discharge current: 675 A

Weight with electrolyte: 25 kg

### DESCRIPTION AND OPERATION

All models feature one or two 12 volt, negative ground, "maintenance free" lead calcium (Pb-Ca) type battery, of six cell construction.

**IMPORTANT:** "Maintenance Free" means that under normal charging conditions the battery does not lose water from the electrolyte. Conditions that may cause water loss include prolonged charging above 14.4 volts where gassing occurs as it approaches full charge. This can be caused by a faulty charging system or boost/recovery charging equipment.

The battery has four major functions:

- To provide a source of current for starting, lighting and instrumentation.
- To help control the voltage in the electrical system.
- To furnish current when the electrical demands exceed the alternator output.
- To support quiescent loads from radio and micro processor memory.

The battery is constructed in such a manner that each cell contains positive and negative plates placed alternatively next to each other. Each positive plate is separated from a negative plate by a non conducting porous envelope separator. If any of the positive plates should make contact with negative plates within a cell, the cell will short circuit and suffer irreparable damage. All of the positive plates are welded to a bus-bar, forming a positive terminal and all of the negative plates are welded to a similar bus-bar forming a negative terminal.

Each positive plate is composed of a lead grid with lead peroxide pasted into the grid openings.

The negative plates are composed of a lead grid with spongy lead pasted into the grid openings.

The plates are submerged in a liquid electrolyte solution of diluted sulphuric acid.

### BATTERY REPLACEMENT

Use the ignition switch key to open the battery box and then remove the tool box.



#### Warning

**A spark or flame can cause the hydrogen in a battery to explode. To prevent any risk of explosion, observe the following instructions:**

- Place the battery master switch key in the OFF position (disconnected).
- When disconnecting the battery cables, always disconnect the negative cable (-) first.
- When reconnecting the battery cables, always connect the negative (-) cable last.
- Never short-circuit the battery terminals with metal objects.
- Do not weld, grind or smoke near a battery.



#### Warning

**Batteries produce explosive gases. Keep away any flame, spark or cigarettes. Always provide good ventilation when charging a battery or using a battery in an enclosed space. Always protect your eyes when working near a battery.**



#### Warning

**Before carrying out any welding on the machine or repair work on the electrical circuit, disconnect the battery and disconnect the B+ and D+ wires on the alternator. When reconnecting, check the wire markings.**



#### Warning

**Always store batteries in a safe place, out of the reach of children.**



#### Warning

**Never touch the battery terminals with your hands. This can induce a state of electrolysis and impair the main organs of the body.**

# General Specifications

## MAINTENANCE

### SPECIFIC GRAVITY

The specific gravity of the battery electrolyte indicates the state of charge.

Fully charged the specific gravity of the electrolyte is 1.280 minimum at 25 °C (77 °F).

Alternatively the approximate state of charge can be measured by using an accurate digital volt meter(+/- 0.01V) as follows:

Less than 10.5 V Battery unserviceable\*

Less than 11.8 V Battery discharged

Less than 12.3 V Battery 1/2 charged

Better than 12.6 V Battery fully charged

\* See note under tests for possible recovery of a mildly sulphated battery.

Battery voltage to be taken with the battery unloaded and:

A. After the battery has rested unloaded for at least 4 hours.

B. If the vehicle has recently run or battery has recently been charged, switch on head lamps for 2 minutes.

When a battery discharges, sulphuric acid in the electrolyte combines chemically with the plates and this action lowers the specific gravity of the solution.

A battery hydrometer will determine the specific gravity of the electrolyte in a cell and the amount of unused sulphuric acid in the solution is a measure of the degree of charge of that cell.

The lower the temperature at which a battery is required to operate, the more necessary it is that the battery is maintained in a fully charged condition. For example a battery with a low specific gravity of 1.225 at 27 °C will operate the starting motor at warm ambient temperatures but may not, due to lower battery efficiency at a low temperature. Table shows the effect of temperature on the efficiency of a typical battery.

| Temperature | Efficiency of a fully charged battery temperature |
|-------------|---------------------------------------------------|
| 25.0 °C     | 100%                                              |
| -4.5 °C     | 82%                                               |
| -24.0 °C    | 64%                                               |
| -27.5 °C    | 58%                                               |
| -31.0 °C    | 50%                                               |
| -34.5 °C    | 40%                                               |
| -37.5 °C    | 33%                                               |

Maximum battery life will be obtained if the correct care and periodic inspection is given. It is important that output capacity should not be exceeded by constant and excessive overloading and that charging requirements are maintained.

## SERVICING



### Warning

**Battery electrolyte causes severe burns. The battery contains sulphuric acid. Avoid any contact with the skin, eyes or clothing.**

**Antidote:**

**EXTERNAL: rinse well with water, removing any soiled clothing.**

**INTERNAL: avoid vomiting. Drink water to rinse your mouth. Consult a doctor.**

**EYES: rinse abundantly with water for 15 minutes and consult a doctor.**

Battery terminal tightness check Every 250 hours

Electrolyte level inspection Every 1000 hours

When servicing a battery the following steps should be observed:

- Maintain the electrolyte to the recommended level of 6 mm above the plates. If this is not observed the acid will reach a high concentration that will damage the separators and impair the performance of the plates.
- Use only distilled or de-mineralized water, do not overfill and never use tap water or water from a rain barrel or other source.
- Always keep the battery at least 75% charged otherwise the plates will become sulphated and loss of efficiency will result with possible damage from freezing at low temperatures.
- Avoid overcharging the battery as excessive charging will create high internal heat that will cause plate grid deterioration and produce water loss.
- When fast charging ensure the battery temperature does not exceed 50 °C.
- Do not add sulphuric acid to a cell unless the electrolyte has been lost through spilling. Before replenishing ensure the solution is at the correct specific gravity. A slow charge is the only method to be employed to fully charge a battery. A high rate charger can be used to quickly boost the battery capacity but this must be followed by a slow charge rate to bring the battery to full capacity.

# General Specifications

## DRY CHARGED

- Remove the battery cell vent plugs.
- Fill each cell to the recommended level with electrolyte of 1.260 specific gravity.

Dry charged batteries must be prepared for service as follows:



### Warning

**The electrolyte must be diluted sulphuric acid preferably at a temperature of 21-32 °C.**

- After filling, allow the battery to stand for 15 minutes then re-check the electrolyte level and top up if necessary.
- Charge the battery for 4 hours at a rate of 5-8 amperes and check that all cells are gassing freely.
- Install the battery cell vent plugs.

## CHARGING THE BATTERY

Before charging a battery:

- Thoroughly clean the battery casing and cell covers with dilute ammonia or hot water and clean the terminals.
- Check the level of the electrolyte in each cell and, if below plates, add distilled water to bring above plate level.

## NORMAL (TOP-UP) CHARGING

- With a slow charger use a rate of 3 to 6 amperes for the time necessary to bring the battery to full charge. This may take 36 hours or more if the battery is heavily discharged. A severely sulphated battery might not accept a charge. When the battery is fully charged the cells will gas freely and the specific gravity will remain constant. Remove the charger after three consecutive hydrometer readings taken at hourly intervals indicate that the specific gravity has stopped rising.
- When using a fast or high rate of charge carefully follow the manufacturers instructions. High rate charging raises the temperature of the electrolyte and unless the charger is equipped with an automatic time or temperature device, the electrolyte temperature could exceed 50 °C, which may cause violent battery gassing and damage to internal components.
- Re-check the level of electrolyte in each cell and add distilled water as necessary.



### Warning

**When a battery is being charged an explosive gas is produced. Do not smoke or use an exposed flame when checking the electrolyte level and ensure the charger is switched off before connecting or disconnecting to avoid sparks which could ignite the gas.**

## RECHARGING DEEPLY DISCHARGED

The recommended method to recharge a maintenance free Pb-Ca battery is to use a constant voltage charger. For deeply discharged batteries a 48 hours charging period at 16 volts is recommended, with current limitation, (47.5 A for 95 Ah).

This system is self regulating: high current is delivered at the beginning (when battery voltage is low), lower and lower current is then absorbed when battery reaches full charge (and its voltage is high).

If only constant current chargers are available it is recommended to use the current levels and times. If the battery is only 50% discharged use one half of the time listed (slow charge programs). For other states of discharge reduce proportionally the time of charge. Whenever possible use the slowest charge program to increase the battery's life.

If when charging the battery, violent gassing or spewing of electrolyte occurs, or the battery case feels hot (50 °C or greater), reduce or temporarily halt charging to avoid damaging the battery.

## TESTS

Before commencing battery tests check the battery for clogged vents, corrosion, raised vent plugs or a cracked case.

- Test equipment required:
- Hydrometer.
- Battery starter tester (High rate discharge tester).
- Thermometer.
- Battery Charger.



# General Specifications

## SPECIFIC GRAVITY

This test will determine the state of battery charge.

1. With the float in the vertical position take the reading.
2. Adjust the hydrometer reading for electrolyte temperature variations by subtracting 4 points (0.004 specific gravity) for every 5.5 °C below the temperature at which the hydrometer is calibrated and by adding 4 points (0.004 specific gravity) for every 5.5 °C above this temperature.

The following examples are calculated using a hydrometer calibrated at 30 °C.

*Example 1:*

Temperature below 30 °C

Electrolyte temperature 19 °C

Hydrometer reading 1.270

Subtract  $(11.0 / 5.5) \times 0.0040.008$

Corrected specific gravity 1.262

*Example 2:*

Temperature above 30 °C

Electrolyte temperature 40 °C

Hydrometer reading 1.220

Add  $(10.0 / 5.5) \times 0.0040.007$

Corrected specific gravity 1.227

1. Use the following table to determine the state of charge.

| State of charge | Correct specific gravity @ 15 °C | Correct specific gravity @ 25 °C | Average battery voltage |
|-----------------|----------------------------------|----------------------------------|-------------------------|
| 100%            | 1.295                            | 1.287                            | 2.76                    |
| 75%             | 1.253                            | 1.246                            | 12.52                   |
| 50%             | 1.217                            | 1.210                            | 12.30                   |
| 25%             | 1.177                            | 1.170                            | 12.06                   |
| Discharged      | 1.137                            | 1.130                            | 11.84                   |

**NOTE:** Specific gravity should not vary more than 0.025 points between cells.

2. If the specific gravity is 1.280 or more the battery is fully charged and in good operating condition.
3. Should the corrected specific gravity be below 1.280, charge the battery and inspect the charging system to determine the cause of the low battery charge.

**NOTE:** If distilled water has recently been added the battery should be recharged for a short period otherwise accurate hydrometer readings will not be obtained.

If the battery has been charged under static conditions, denser electrolyte will accumulate at the bottom of the cells. The battery should be shaken periodically to mix the electrolyte, this will improve the charge rate and provide a more accurate hydrometer reading when tested.

## PERFORMANCE TEST

The performance test is to determine if the battery has adequate capacity to turn the engine. The voltage reading obtained is used to determine the battery condition. Prior to testing, ensure the electrolyte level is correct and the open circuit voltage is 12.5 V or more. The battery may be tested on or off the tractor.

1. Set the current control switch of the battery starter tester (high rate discharge tester) to the "off" position and the voltage selector switch equal to, or slightly higher than, the rated battery voltage. Connect the tester positive leads to the battery positive terminal and the negative leads to the negative battery terminal.
2. Turn the current control knob until the ammeter reading is half the CCA rating of the battery and take the voltage reading.
3. If the reading is 9.6 volts or more after 15 seconds, the battery has an acceptable output capacity and will readily accept a normal charge.
4. If however the reading is below 9.6 volts, the battery is considered unsatisfactory for service and should be test charged as described below.



## Caution

*Do not leave the high discharge load on the battery for periods longer than 15 seconds.*

## General Specifications

### TEST CHARGING

This test is designed only for batteries that have failed the previous capacity test.

1. Attach the battery starter (high rate discharge tester) positive leads to the battery positive terminal and the negative leads to the battery negative terminal.
2. Connect the battery charger positive lead to the battery positive terminal and the negative lead to the battery negative terminal.
3. Turn the charger timer past a "3 minutes" charge indication and then back to the "3 minutes" mark.
4. Set the charging rate as close as possible to 40 amperes.
5. After 3 minutes at this fast charge take the voltmeter reading.
  - If the total voltage is over 15.5 volts the battery is unsatisfactory and is probably sulphated or worn out and should be replaced.

**NOTE:** A mildly sulphated battery can be recovered by using a multiple battery type charger, with an open circuit upper voltage limit of 50 volts.

Owing to the high resistance of a sulphated battery, it will primarily require a high voltage setting to overcome the resistance of the sulphation initially there may be no visible acceptance of the charge.

After a few minutes of inactivity a small charge will be apparent, followed by a rapid increase in the charge rate. The charge rate must not exceed 14.0 amperes or the electrolyte temperature 50 °C.

When the ampere rate has established, reset the volts until the charge rate is a steady 5 amperes.

Continue at this rate until the electrolyte specific gravity stops rising at approximately 1.275 - 1.280 at 20 °C (68 °F), this can take up to 48 hours of charging. Stand the battery for 24 hours and then conduct the capacity test detailed previously.

- If the total voltage is under 15.5 volts, test the specific gravity of each cell and re-charge the battery to the following scale:

| Specific gravity | Fast charge up to: |
|------------------|--------------------|
| 1.150 or less    | 60 minutes         |
| 1.151 to 1.175   | 45 minutes         |
| 1.176 to 1.200   | 30 minutes         |
| 1.201 to 1.225   | 15 minutes         |
|                  | (Slow charge only) |

**NOTE:** When battery problems are experienced the fan belt tension and the complete charging system should be checked.

### COMMON CAUSES OF BATTERY FAILURES

- Internal open circuit.
- Internal short circuit.
- Loss of electrolyte.
- Separation of active materials from grids.
- Accumulation of sulphate crystals too large to disperse.

These failures are normally caused by the following:

- Failure of inter cell components.
- Excessive crystal growth may puncture the separators and cause short circuits.
- Excessive over charging (charging system malfunction, boost/recovery techniques with high voltage, operation in very high temperatures).
- Freezing of electrolyte. A fully charged battery does not freeze until -65 °C.  
A 50% charged battery freezes between -17 °C and -27 °C.  
Fully discharged electrolyte freezes at -3 °C to -11 °C. Excessively high boost charging and gassing will also cause separation of active materials from the grids. Separation destroys the chemical function of the battery.
- Crystal growth occurs whenever batteries are left discharged. High temperatures and extended discharged periods increase this condition.

At room temperature after one week the battery is unlikely to recover on the vehicle.

Recharge will require a higher constant voltage.

After 3 weeks the battery will have suffered permanent degradation and the procedure detailed previously for charging a "Deeply Discharged" battery should be followed.

When fully charged, batteries have a long shelf life.

The lead calcium type battery self discharges at 3% per month. This means that it will take 16 months to lower to 50% charged. On the tractor the quiescent load is about 50 mA. To predict rundown on a static vehicle this should be added as approximately 8 Ah per week.

It is worth stressing that when cranking, if a battery starts to fade, it is beneficial to stop and allow two minutes for the battery to recover. The recovery time should be increased as the temperature decreases.

# General Specifications

## Emergency starting through another battery



### Danger

**Operate the starting motor only from the operator's seat. If the key switch is by-passed the engine may be started inadvertently with the transmission in gear and cause personal injury.**

**NOTE:** *The auxiliary battery may be on another tractor. In any case, it is essential that it has the same rated voltage and the same number of elements as the discharged battery.*

- Make sure the two vehicles are not in contact.
- Disconnect all battery-fed equipment through the proper controlling devices.
- Shift transmission levers into neutral position.
- Make sure the discharged battery is properly grounded, that the terminals are well tightened and the electrolyte level is correct.

Proceed in the following manner:

1. Connect both batteries as shown.

**NOTE:** *If the auxiliary battery is on another tractor, it is first necessary to start this tractor and to set it to 1/4th speed.*

2. Start the tractor by means of the ignition key and follow the regular engine starting procedure. If the engine does not fire the first time, repeat this operation after 15-20 seconds up to a maximum of 3-4 times. Should the engine not start, determine the cause and correct.

## Battery connection using suitable cables

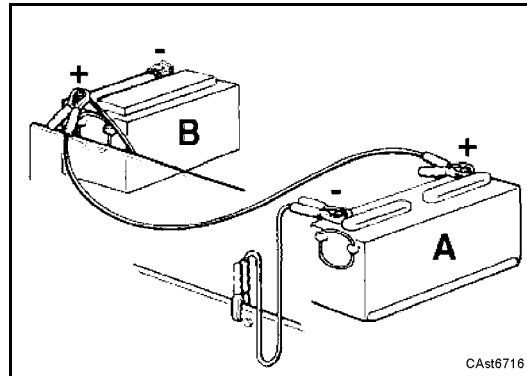
Battery connection for auxiliary battery not mounted in another tractor.



### Warning

**Wear eye protection when charging or boosting battery.**

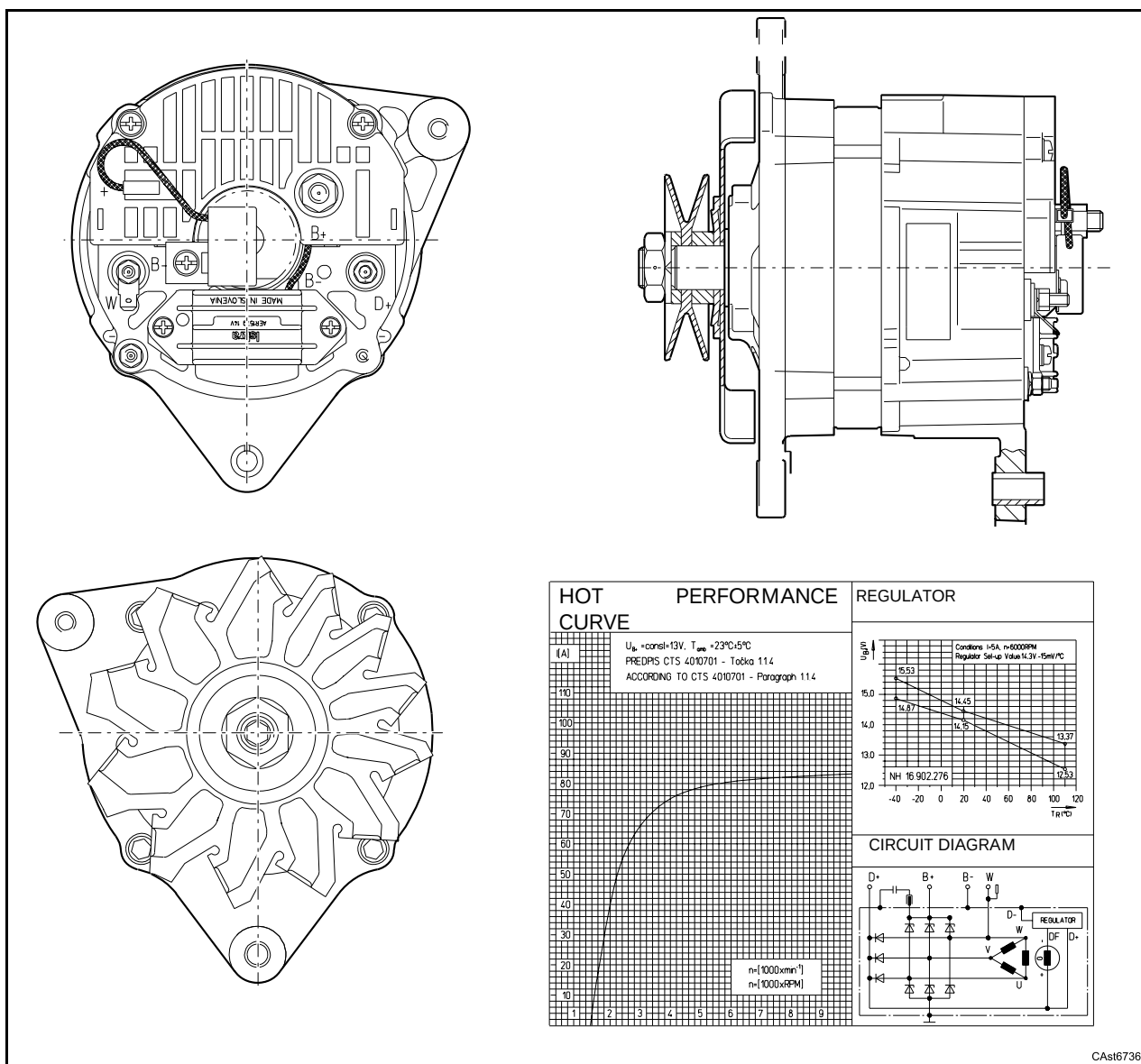
**IMPORTANT:** *Make sure to connect the battery terminals correctly to prevent short circuit.*



(A) Auxiliary battery

(B) Discharged battery

# General Specifications



# General Specifications

---

## ALTERNATOR

ManufacturerISKRA

Rated voltage14 V

PolarityNegative terminal grounded

Current 80 A

Minimum charging speed $\leq$ 1350 rpm

Maximum speed12000/13000 rpm

Operating temperature-40 °C to 110 °C

Direction of rotationClockwise seen from  
the pulley side

Regulated voltage at 6000 rpm  
with 5 A at 20 °C14.2 - 14.8 V

Maximum load that can be applied  
at terminal L12 V, 3.4 W x 6

Weight4.7 kg

# General Specifications

## GENERAL MAINTENANCE TABLE

| Component                         | Description                                                                                                | Every  |       |       |       |        |        |
|-----------------------------------|------------------------------------------------------------------------------------------------------------|--------|-------|-------|-------|--------|--------|
|                                   |                                                                                                            | 10 h * | 100 h | 250 h | 500 h | 1000 h | 2000 h |
| Engine                            | Check oil level; clean crankcase vent tube                                                                 | •      |       |       |       |        |        |
| Fuel filter                       | Drain water and sediment                                                                                   | •      |       |       |       |        |        |
| Cooling system                    | Check coolant level                                                                                        | •      |       |       |       |        |        |
| Transmission and hydraulic system | Check oil level                                                                                            | •      |       |       |       |        |        |
| Air cleaner dump valve            | Clean out dust, if necessary                                                                               | •      |       |       |       |        |        |
| Lights                            | Check lights are functioning properly                                                                      | •      |       |       |       |        |        |
| Front axle and front wheels       | Lubricate bearings (only necessary when operating in extremely wet and muddy conditions)                   | •      |       |       |       |        |        |
| Front wheel drive axle            | Lubricate front axle and drive shaft (only necessary when operating in extremely wet and muddy conditions) | •      |       |       |       |        |        |
| Rear axle bearings                | Lubricate (only necessary when operating in extremely wet and muddy conditions)                            | •      |       |       |       |        |        |
| Three-point hitch                 | Lubricate (only necessary when operating in extremely wet and muddy conditions)                            | •      |       |       |       |        |        |
| Cab                               | Remove and clean the cab air filter                                                                        | •      |       |       |       |        |        |
| Fuel system                       | Check for fuel leaks                                                                                       |        | •     |       |       |        |        |
| Engine oil filter                 | Check oil filter rubber sleeves                                                                            |        | •     |       |       |        |        |
| Wheel and tyres                   | Check torque of wheel bolts                                                                                |        | •     |       |       |        |        |
| Wheel and tyres                   | Check tyre pressure                                                                                        |        | •     |       |       |        |        |
| Grease point                      | Grease all other nipples                                                                                   |        | •     |       |       |        |        |
| Transmission                      | Check transmission oil level                                                                               |        | •     |       |       |        |        |
| Clutch                            | Adjust the clutch pedal cable (not for POWERSHUTTLE TRACTORS)                                              |        | •     |       |       |        |        |
| Engine                            | Drain and refill with fresh oil                                                                            |        |       | •     |       |        |        |
| Engine                            | Replace oil filter                                                                                         |        |       | •     |       |        |        |
| Transmission/hydraulic oil filter | Replace high pressure filter element; check oil level                                                      |        |       | •     |       |        |        |
| Brake system                      | Check brake actuating fluid level                                                                          |        |       | •     |       |        |        |
| Parking brake and foot brake      | Check free play                                                                                            |        |       | •     |       |        |        |
| Wheels                            | Check tightness of rim and disk hardware                                                                   |        |       | •     |       |        |        |
| Steering system                   | Lubricate tie rod ends                                                                                     |        |       | •     |       |        |        |
| Front axle and front wheels       | Lubricate bearings                                                                                         |        |       | •     |       |        |        |
| Front wheel drive axle            | Check oil level in axle housing and final drives; lubricate front axle and drive shaft                     |        |       | •     |       |        |        |
| Outer rear axle bearings          | Lubricate                                                                                                  |        |       | •     |       |        |        |
| Electrical system                 | Check alternator/fan belt                                                                                  |        |       | •     |       |        |        |
| Neutral start circuit             | Check that circuit functions correctly                                                                     |        |       | •     |       |        |        |
| Battery                           | Check the battery, smear the terminals with petroleum jelly                                                |        |       | •     |       |        |        |
| Fuel filter                       | Replace filter elements - primary and secondary                                                            |        |       |       | •     |        |        |
| Fuel tank                         | Drain residue                                                                                              |        |       |       | •     |        |        |

## General Specifications

| Component                                                 | Description                                                                          | Every  |       |       |       |        |        |
|-----------------------------------------------------------|--------------------------------------------------------------------------------------|--------|-------|-------|-------|--------|--------|
|                                                           |                                                                                      | 10 h * | 100 h | 250 h | 500 h | 1000 h | 2000 h |
| Three-point hitch                                         | Lubricate                                                                            |        |       |       | •     |        |        |
| Air intake hoses                                          | Check connections for leaks                                                          |        |       |       | •     |        |        |
| Components of drawbar                                     | Check the components for wear and replace them, if necessary. Check drawbar hardware |        |       |       | •     |        |        |
| Fuel system                                               | Clean the fuel supply pump screen                                                    |        |       |       | •     |        |        |
| Cab                                                       | Check air conditioning belt tension                                                  |        |       |       | •     |        |        |
| Engine air cleaner filter and cab air filter              | Replace air cleaner filter and cab air filter                                        |        |       |       |       | •      |        |
| Steering                                                  | Check the front wheel alignment (2WD)                                                |        |       |       |       | •      |        |
| Front axle                                                | Replace oil in differential and planetaries                                          |        |       |       |       | •      |        |
| Front wheel bearings (tractors without front wheel drive) | Have bearings cleaned, lubricated and adjusted by your dealer                        |        |       |       |       | •      |        |
| Transmission                                              | Change the transmission/hydraulic oil                                                |        |       |       |       | •      |        |
| Transmission                                              | Change the oil suction strainer                                                      |        |       |       |       | •      |        |
| Cooling system                                            | Drain, flush and refill the engine cooling system                                    |        |       |       |       |        | •      |

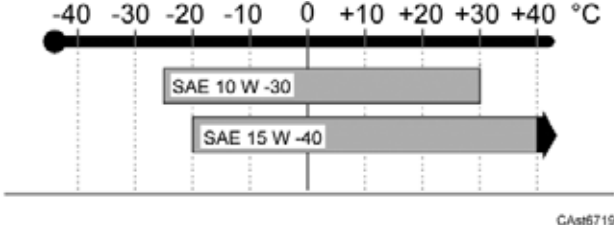
\* flexible maintenance times vary according to individual conditions of operation. You must establish times for servicing flexible items. An average interval time for checking these items is at each fuel fill.

## General Specifications

| As required                                                  |                                                                |
|--------------------------------------------------------------|----------------------------------------------------------------|
| Component                                                    | Description                                                    |
| Injection nozzles and pump                                   | Have these checked by your dealer                              |
| Radiator                                                     | Clean                                                          |
| Cooling system                                               | Check coolant level                                            |
| Fuel system                                                  | Check fuel filter, bleed system                                |
| Engine air cleaner and cab air filters                       | Clean the air filter and cab air filters                       |
| Air conditioning system                                      | Have system checked and serviced by your dealer                |
| Front wheel bearings<br>(tractors without front wheel drive) | Have bearings cleaned, lubricated and adjusted by your dealer  |
| Brakes                                                       | Have these checked by your dealer                              |
| Tyres                                                        | Check tyre pressure                                            |
| Lubricating points                                           | Lubricate, if tractor has been washed with high-pressure water |
| Electrical system                                            | Replace alternator/fan belt                                    |
| Fuses                                                        | Replace                                                        |
| Hand throttle                                                | Adjust resistance                                              |
| Digital display                                              | Program setting (if equipped)                                  |



# General Specifications

| Point of lubrication          |                    | Capacity<br>L<br>(U.S. gals) | Specifications                                                                                                                                                              |
|-------------------------------|--------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Engine</b>                 |                    | 10,5<br>(2.77)               |  <p>POWERLUBE MULTIGUARD® 10 W30 AND 15W40 WITH API CH-4 OR HIGHER RATING.</p>            |
| <b>Brakes</b>                 |                    | 0,5<br>(.013)                | POWER FLUID 411<br>DEXRON III®<br>SAE GRADE: 5W20                                                                                                                           |
| <b>TRANSMISSION</b>           |                    |                              |                                                                                                                                                                             |
| <b>12+12</b>                  | <b>2WD</b>         | 37 - (9,77)                  | PERMATRAN® 821XL                                                                                                                                                            |
|                               | <b>4WD</b>         | 39 - (10,30)                 | SAE GRADE: 10W20                                                                                                                                                            |
| <b>12+12<br/>POWERSHUTTLE</b> | <b>2WD</b>         | 36 - (9,51)                  | PERMATRAN® 821XL                                                                                                                                                            |
|                               | <b>4WD</b>         | 38 - (10,03)                 | SAE GRADE: 10W20                                                                                                                                                            |
| <b>FRONT AXLE</b>             |                    |                              |                                                                                                                                                                             |
| <b>Axle housing</b>           | <b>5,5</b>         |                              | PERMATRAN® 821XL<br>SAE GRADE: 10W20                                                                                                                                        |
| <b>Final drives - each</b>    | <b>0,5</b>         |                              | PERMATRAN® 821XL<br>SAE GRADE: 10W20                                                                                                                                        |
| <b>Various joints</b>         | <b>/</b>           |                              | MULTI PURPOSE LITHIUM GREASE                                                                                                                                                |
| <b>Coolant</b>                | <b>OOS<br/>OOS</b> | 10<br>(2.64)                 |  <p>50/50 mix ethylene antifreeze/water glycol<br/>never use only water as coolant!</p> |
|                               | <b>CAB<br/>CAB</b> | 11<br>(2.90)                 |                                                                                                                                                                             |

# Disassembly and Assembly Operations

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## Disassembly and Assembly Operations

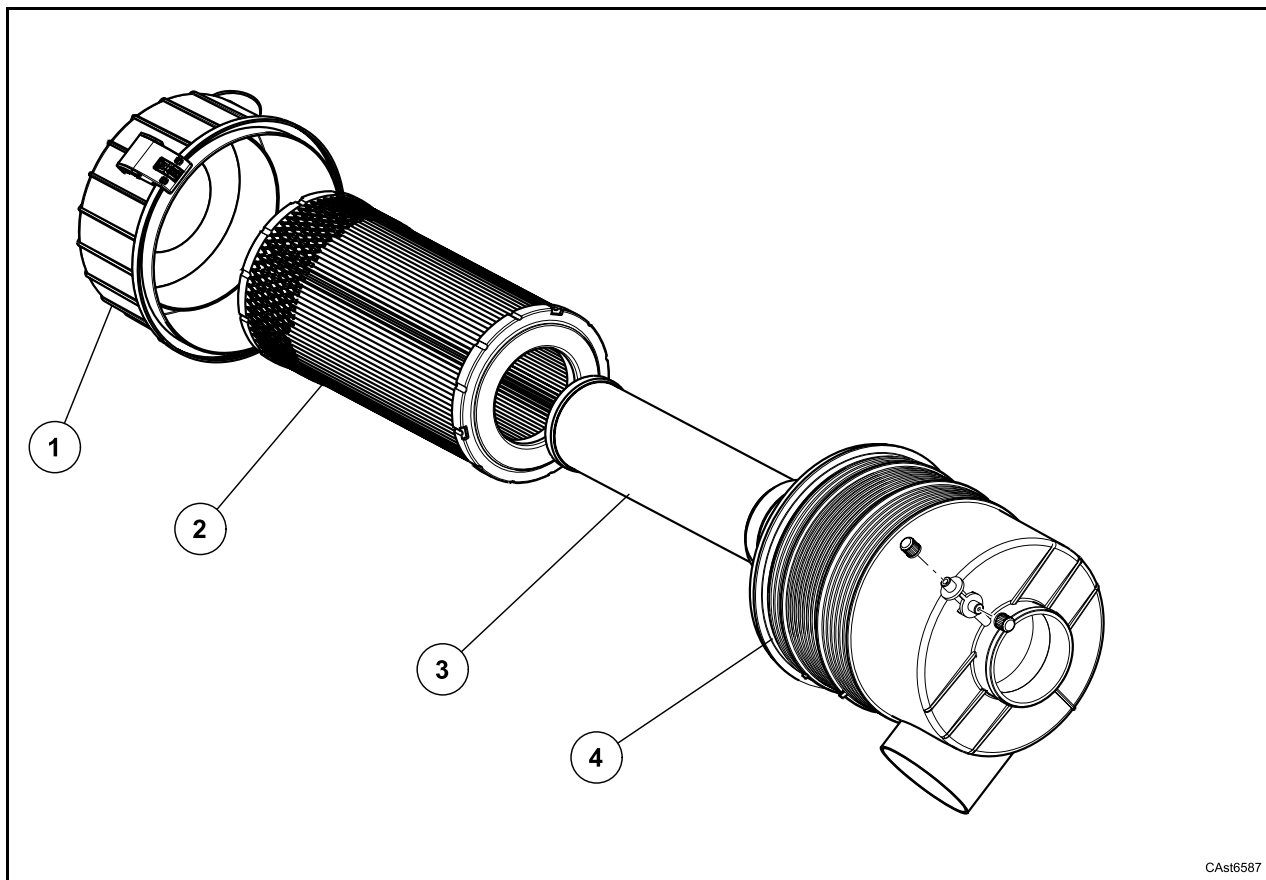
### Section 2

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# Disassembly and Assembly Operations

## AIR FILTER

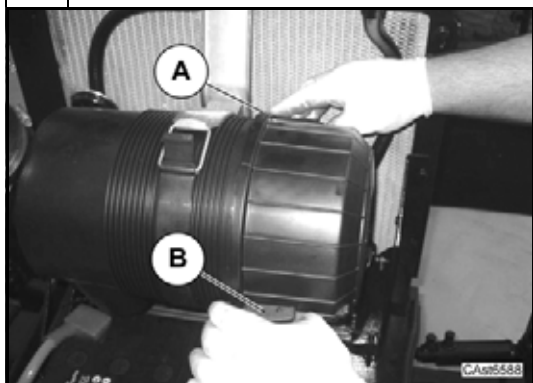


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### Disassembly

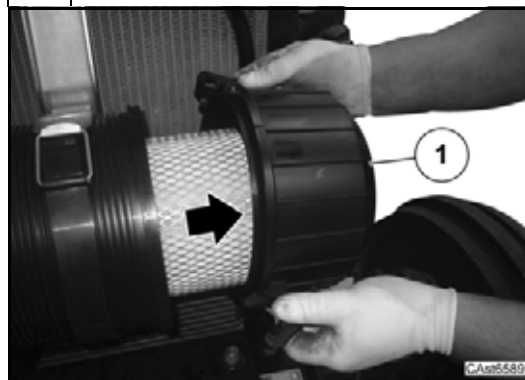
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Loosen clamps (A) and (B).

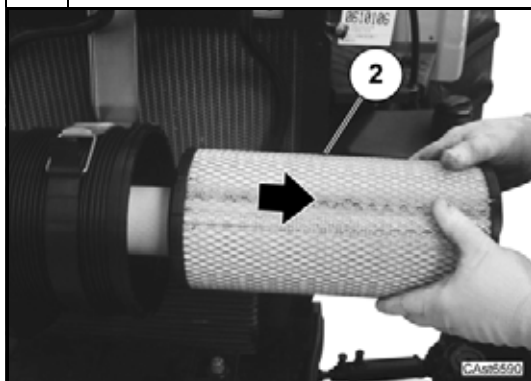
2.



Remove the cover (1).

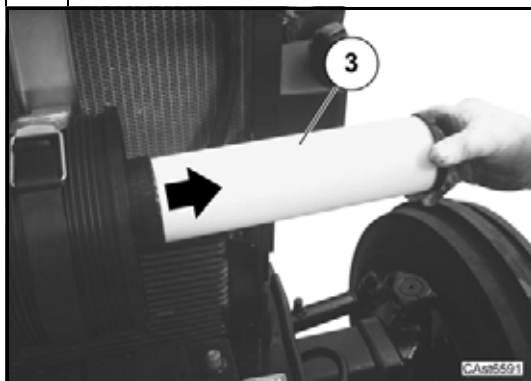
## Disassembly and Assembly Operations

3.



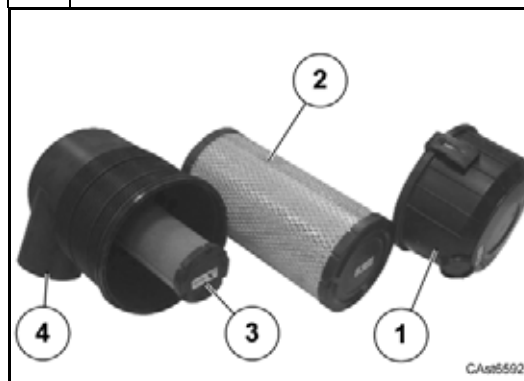
Remove the primary filter element (2).

4.



Remove the secondary filter element (3).

5.



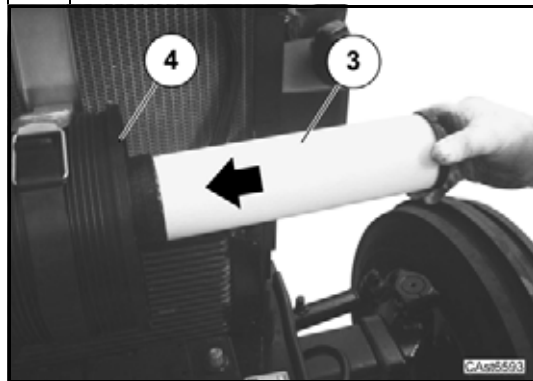
Clean and check all filter elements for wear or damages.  
Replace parts if necessary.

# Disassembly and Assembly Operations

## Assembly

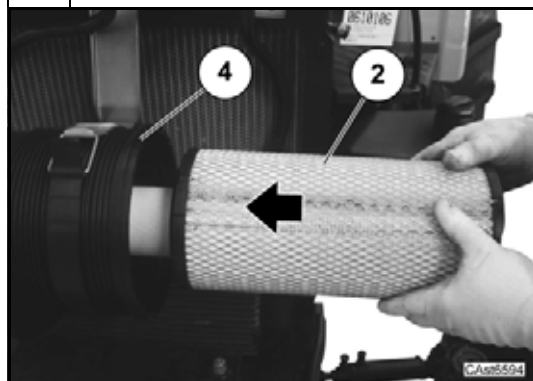
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



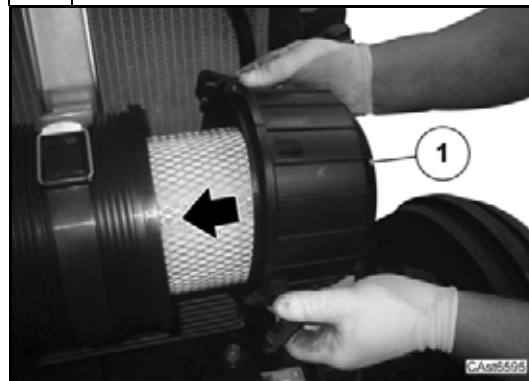
Insert secondary filter element (3) in the housing (4).

2.



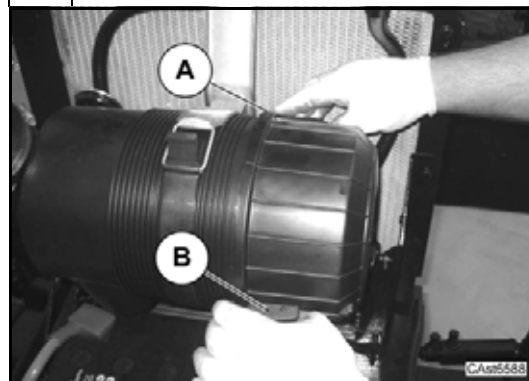
Insert the primary filter element (2) in the housing (4).

3.



Assemble the cover (1).

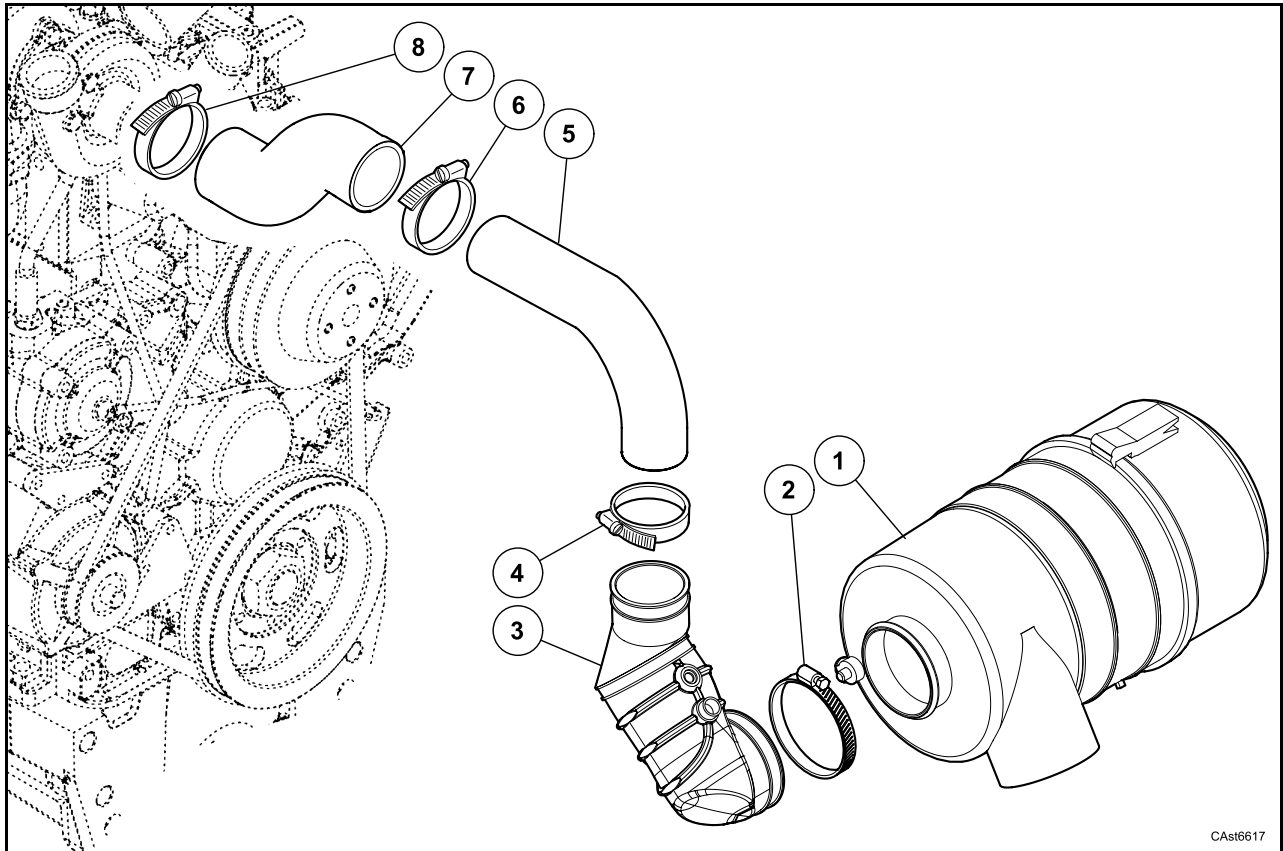
4.



Close the clamps (A) and (B).

# Disassembly and Assembly Operations

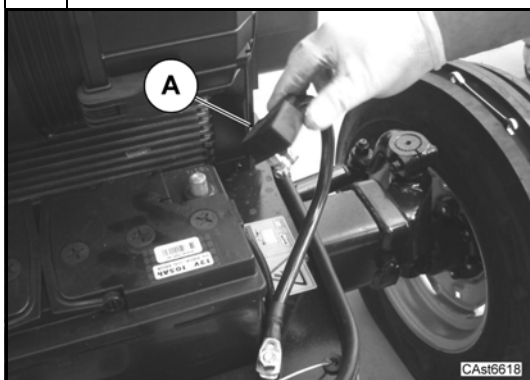
## AIR FILTER LINE



### Disassembly

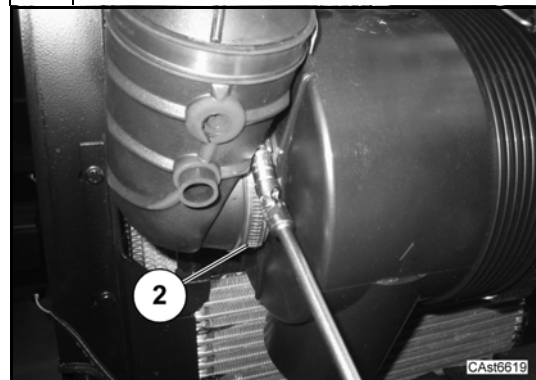
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Open the rubber cap and remove the negative cable (A) from the battery.

2.

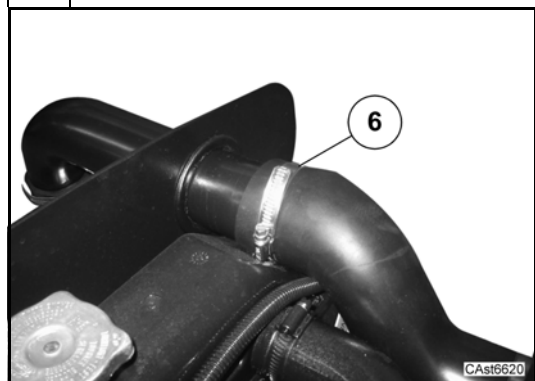


Loosen without removing clamp (2).

## Disassembly and Assembly Operations

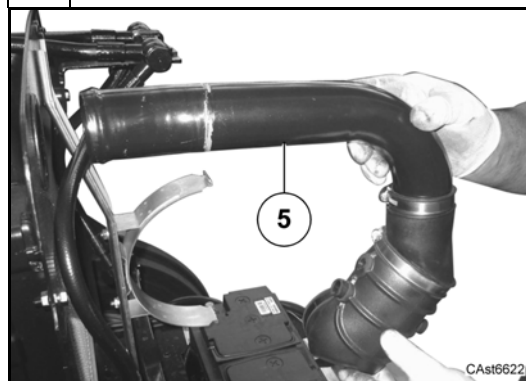
---

3.



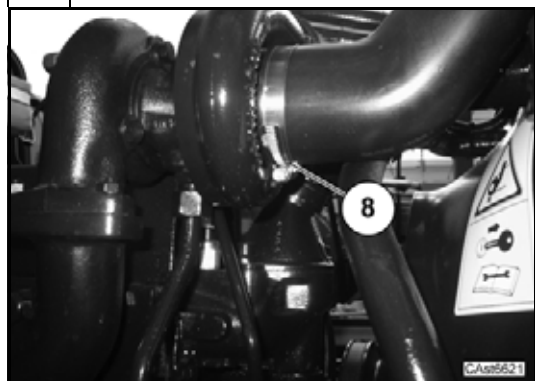
Loosen the clamp (6).

5.



Remove the pipe (5).

4.



Loosen the clamp (8).

6.



Remove the hose (7).

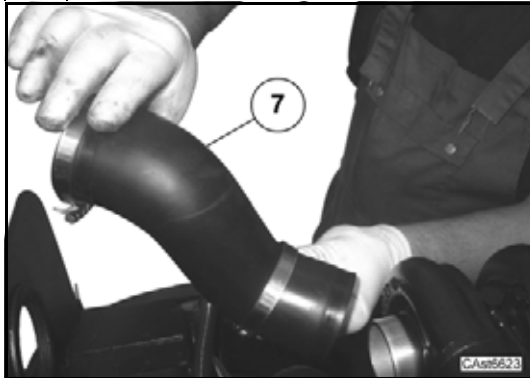


# Disassembly and Assembly Operations

## Assembly

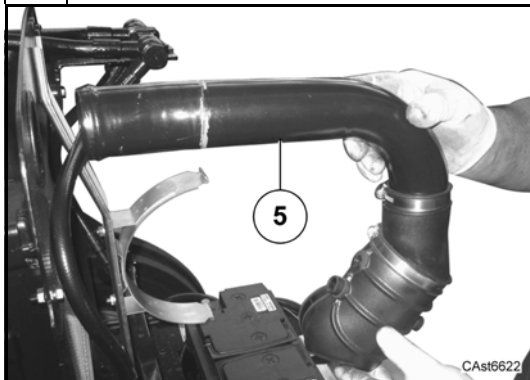
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



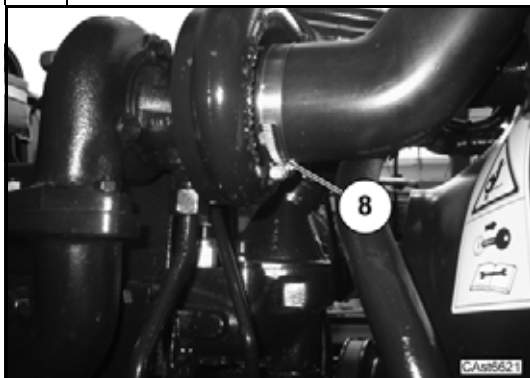
Assemble the sleeve (7).

2.



Assemble the pipe (5).

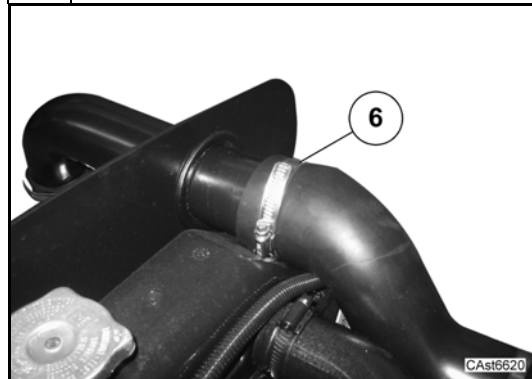
3.



Tighten the clamp (8).

Torque wrench setting 3 Nm (2.21 lb·ft).

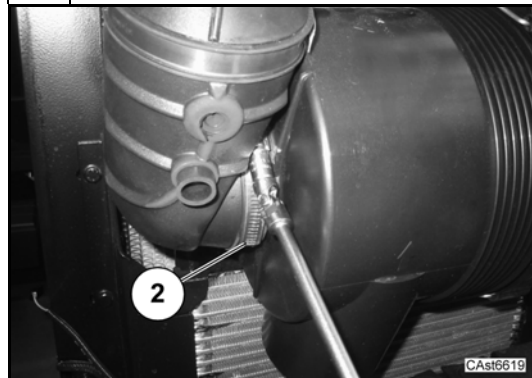
4.



Tighten the clamp (6).

Torque wrench setting 3 Nm (2.21 lb·ft).

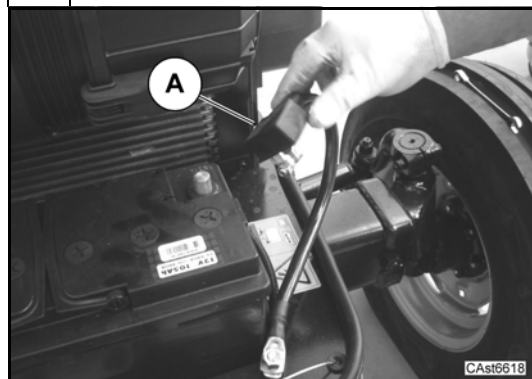
5.



Tighten the clamp (2).

Torque wrench setting 3 Nm (2.21 lb·ft).

6.

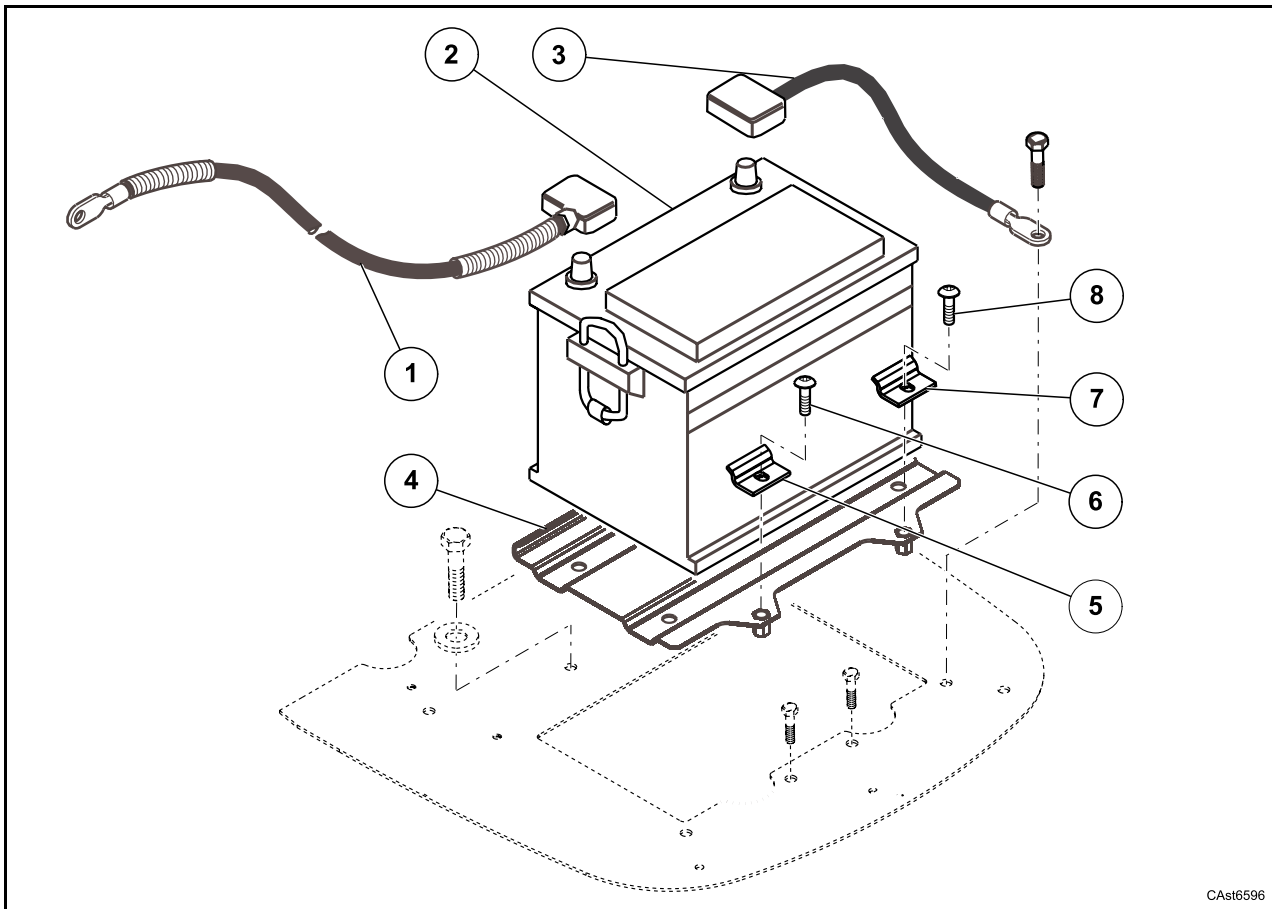


Connect cable (A) to battery negative pole. Close the rubber cap.



# Disassembly and Assembly Operations

## BATTERY

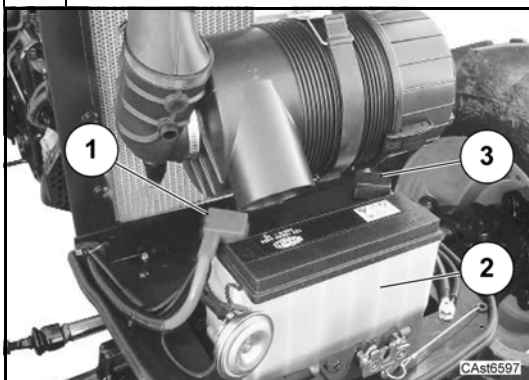


CAst6596

### Disassembly

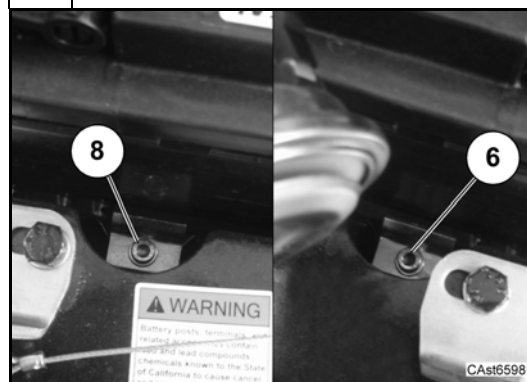
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Open the rubber cap, remove the positive (1) and the negative (3) connections from the battery (2).

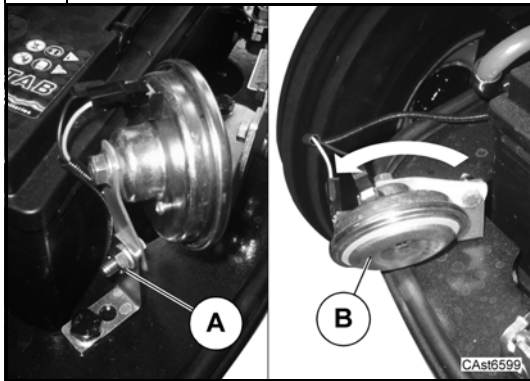
2.



Loosen the bolts (6) and (8).

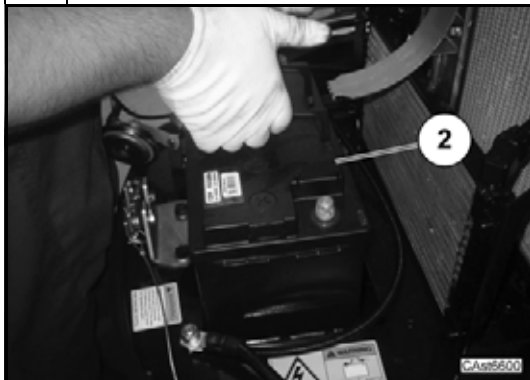
# Disassembly and Assembly Operations

3.



For an easy disassembly of the battery (2), unscrew nut (A) and rotate horn (B) to the front of the tractor.

4.



Remove the battery (2).

## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



## Warning

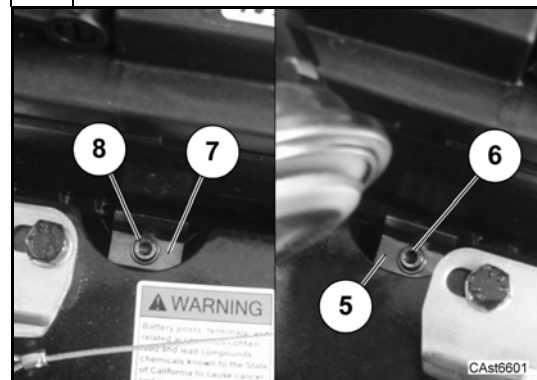
**Pay close attention to the symbols marked on the battery.**

Battery specifications

- 12 V, 100 Ah
- 675 CCA (440 cei)

Assemble the battery (2) on the support (4).

2.

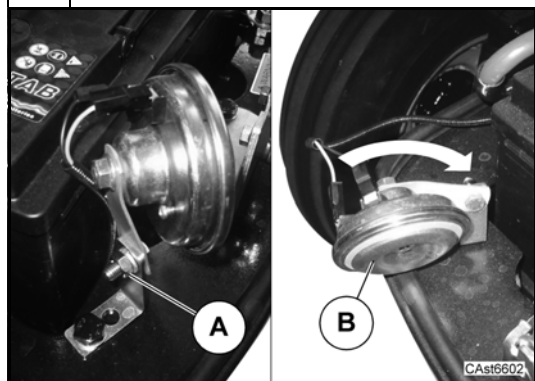


Lock the battery (2) tightening bolt (6) on the little bracket (5) and bolt (8) on the little bracket (7).

## Disassembly and Assembly Operations

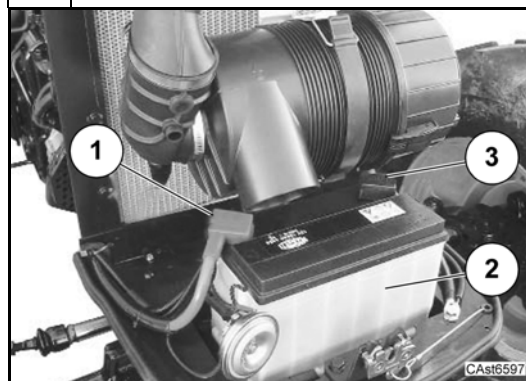
---

3.



Reposition the horn (B) and screw up in the nut (A).

4.

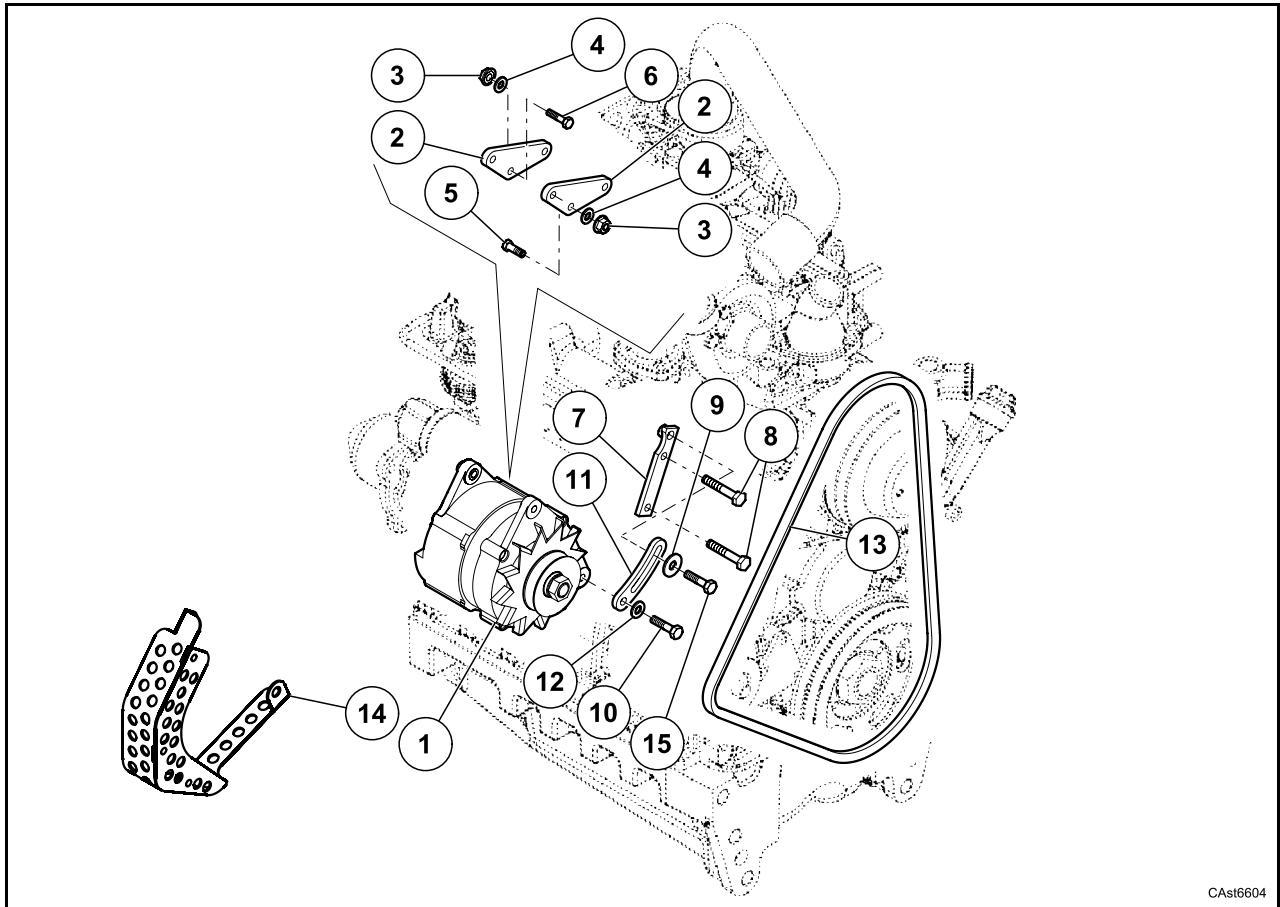


Assemble the positive (1) and negative (3) cables on the relevant battery poles (2).

Close the rubber cap.

# Disassembly and Assembly Operations

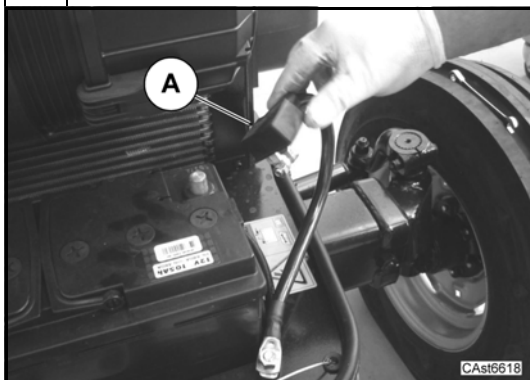
## ALTERNATOR



### Disassembly

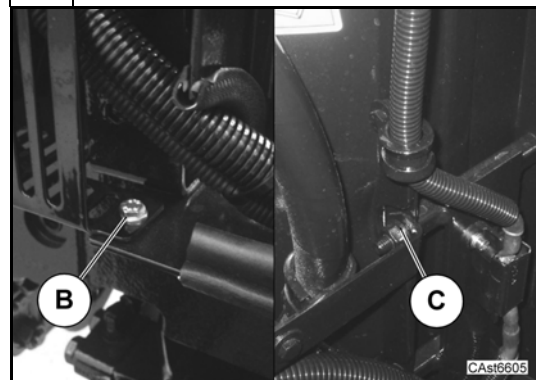
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Open the rubber cap and remove the negative (A) from the battery.

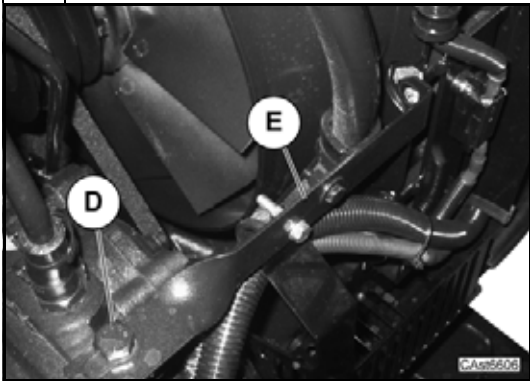
2.



Remove bolt (B) and nut (C).

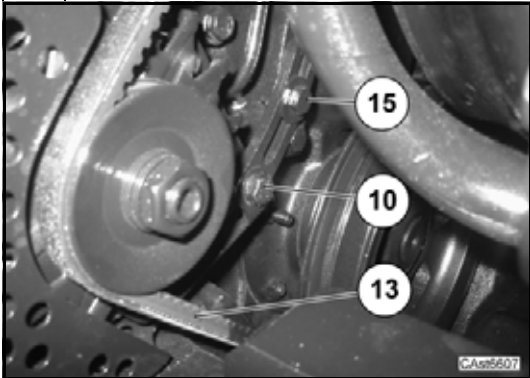
# Disassembly and Assembly Operations

3.



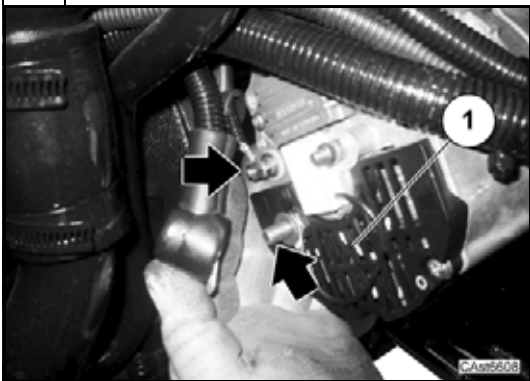
Remove bolt (D) and disassemble the right protection (E).

4.



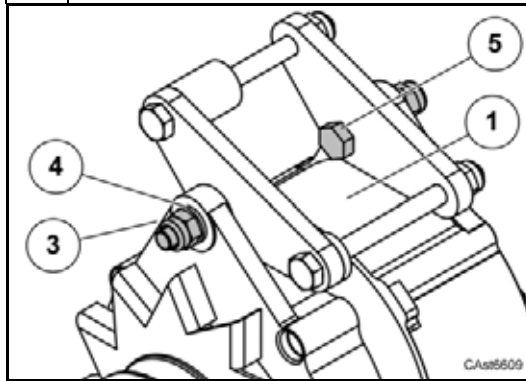
Loosen bolt (15), remove bolt (10) and washer (12) for reducing the fan belt (13) tension.

5.



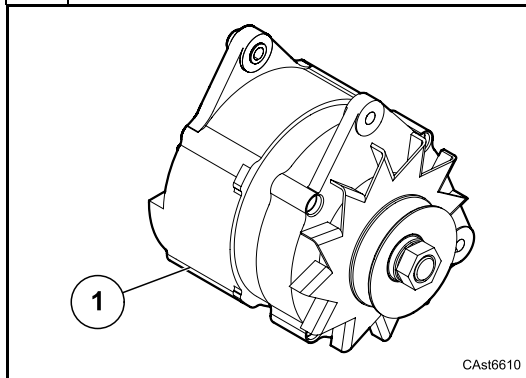
Remove all electrical connections to the alternator (1).

6.



To complete the disassembly of the alternator (1), remove the nut (3), the washer (4) and bolts (5) and (6).

7.



Check alternator (1) for wear or damage, replace it if necessary.

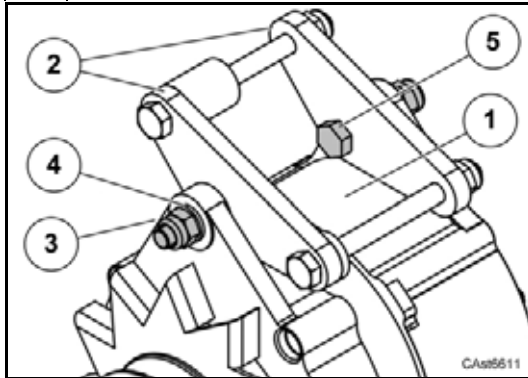


# Disassembly and Assembly Operations

## Assembly

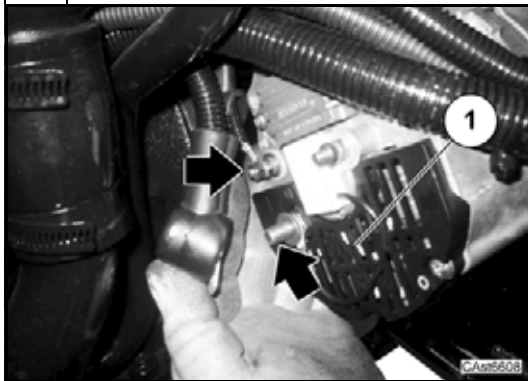
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



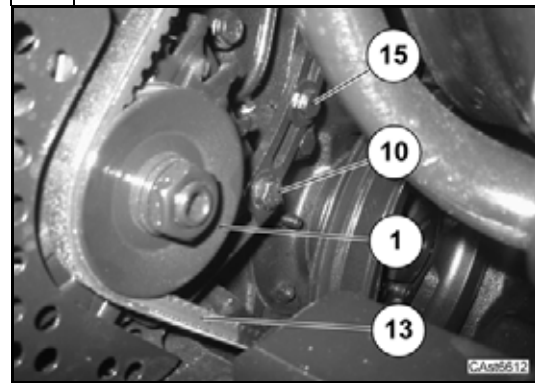
Assemble the alternator (1) on supports (2).  
Screw up bolts (5) and (6), washers (4) and nuts (3).

2.



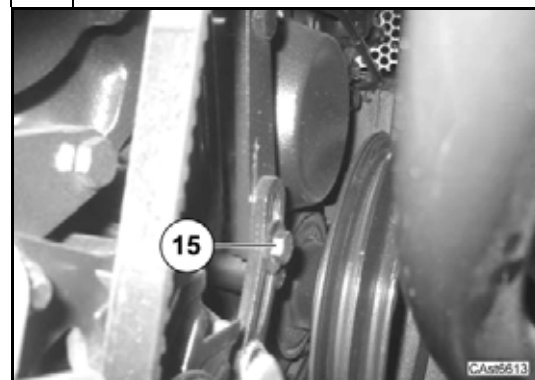
Restore electrical connections on the alternator (1).

3.



Insert belt (13) on the alternator (1).  
Screw up washer (12) and bolt (10).  
Torque wrench setting 12 Nm (8.85 lb·ft).  
Tension the belt and screw up washer (9) and bolt (15).  
Refer to: next step  
Torque wrench setting 26.6 Nm (18.14 lb·ft)

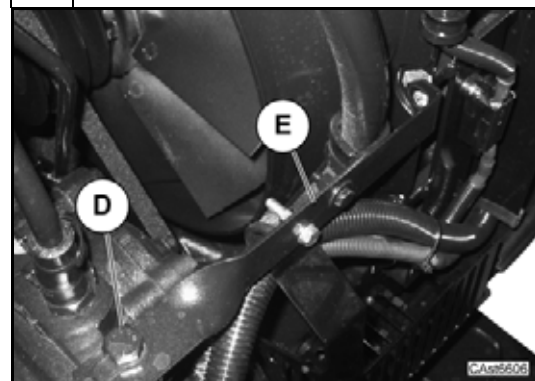
4.



Adjust belt tension by slightly loosening bolt (15).  
Pull the alternator until the belt tension is correct.  
Tighten cap bolt.

**IMPORTANT:** Replace belt if worn or damaged.

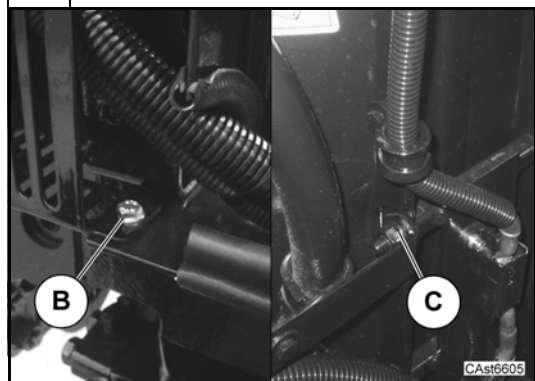
5.



Assemble the right protection (E). Screw up bolt (D).

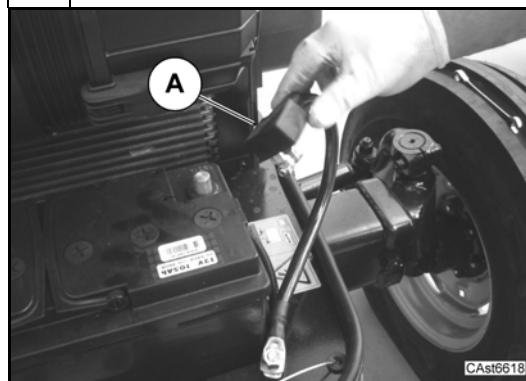
## Disassembly and Assembly Operations

6.

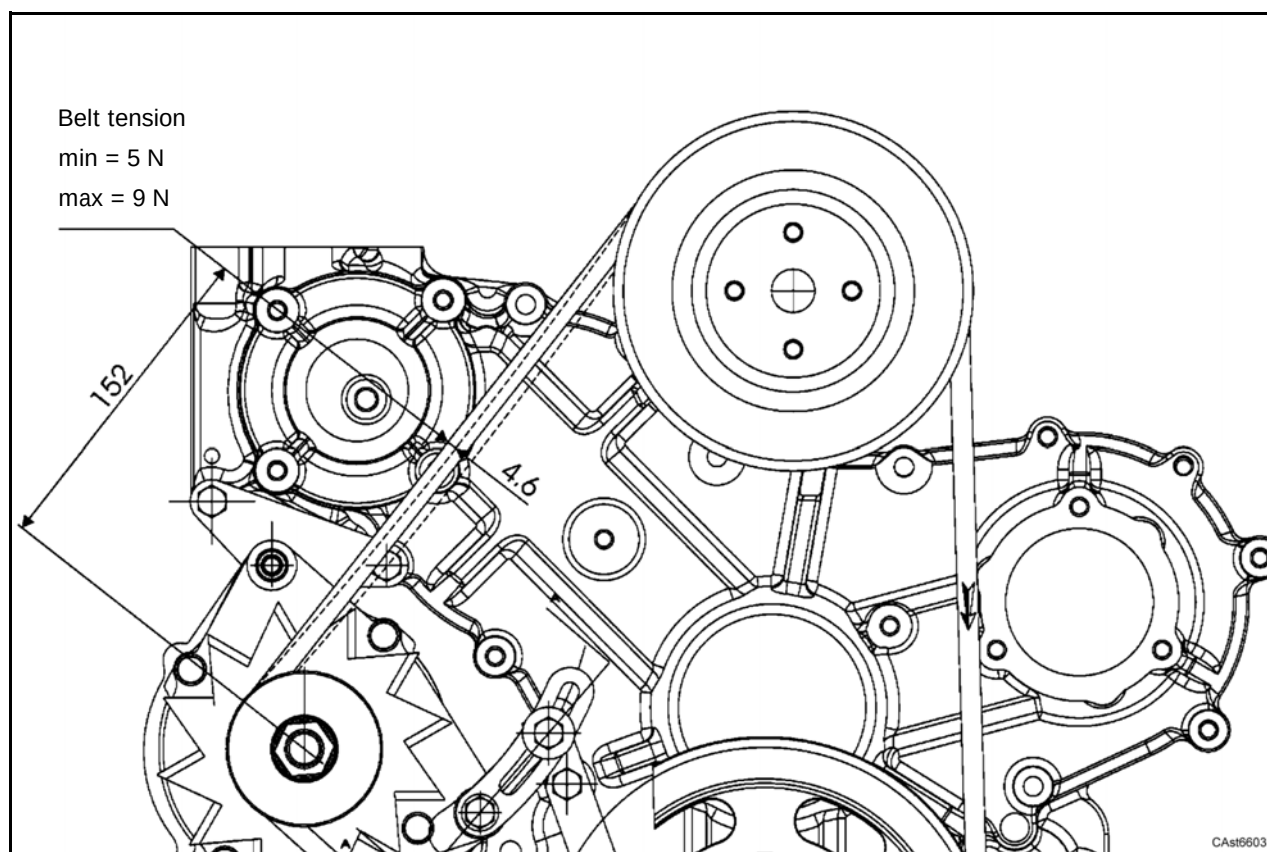


Screw up bolt (B) and nut (C).

7.

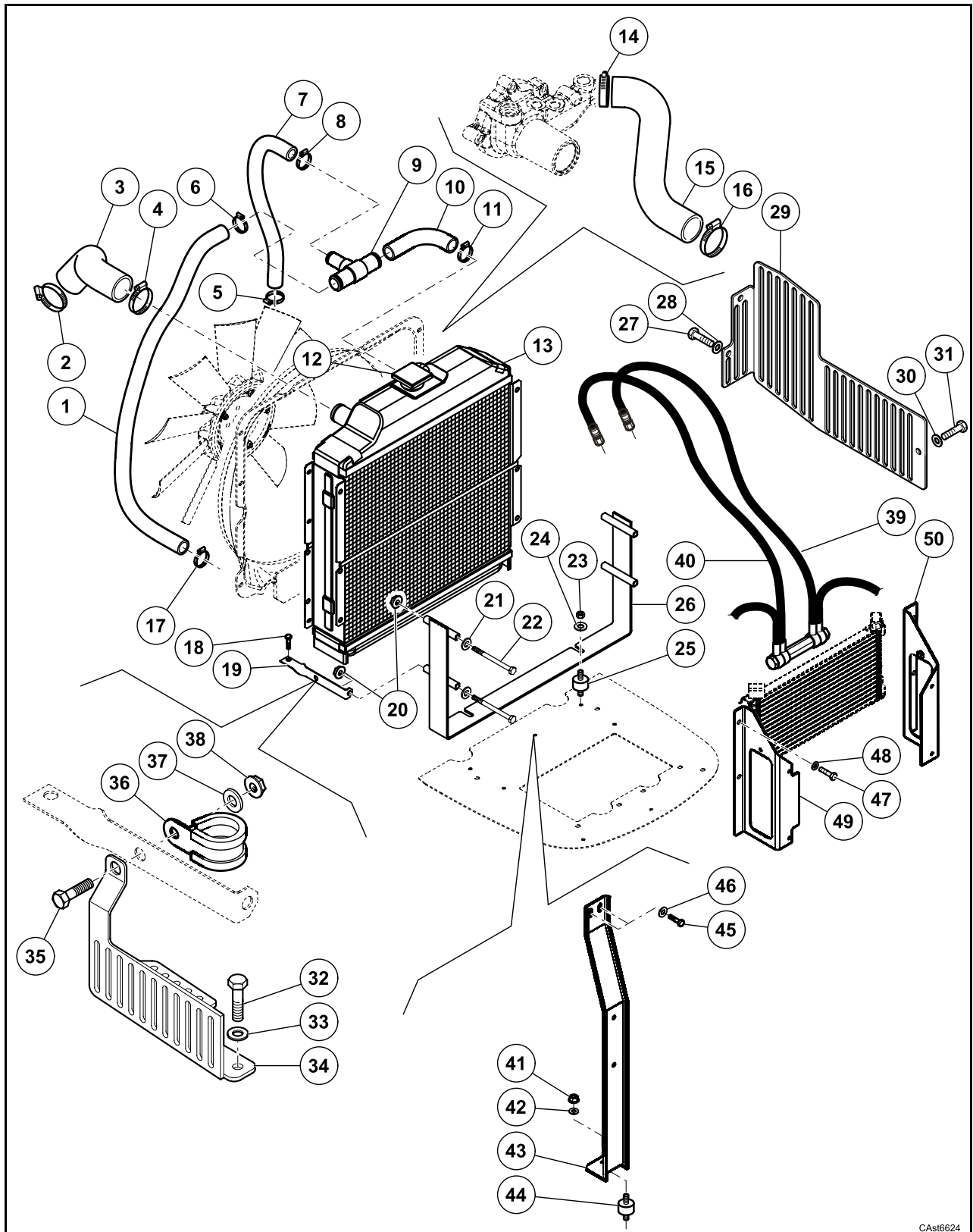


Connect cable (A) to battery negative pole.  
Assemble the rubber cap.



# Disassembly and Assembly Operations

## RADIATOR



CAst6624

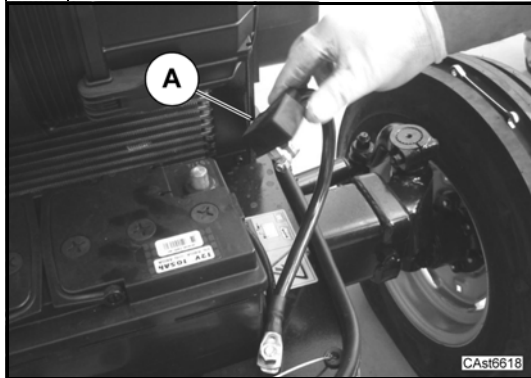


# Disassembly and Assembly Operations

## Disassembly

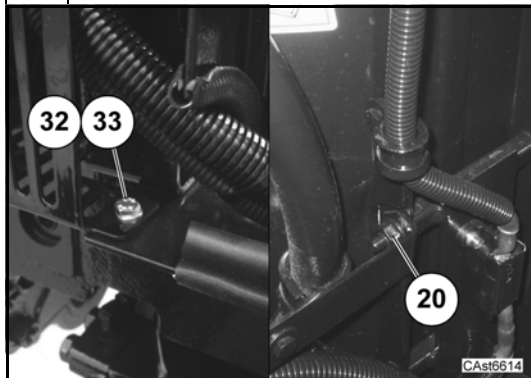
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Open the rubber cap and remove the negative (A) from the battery.

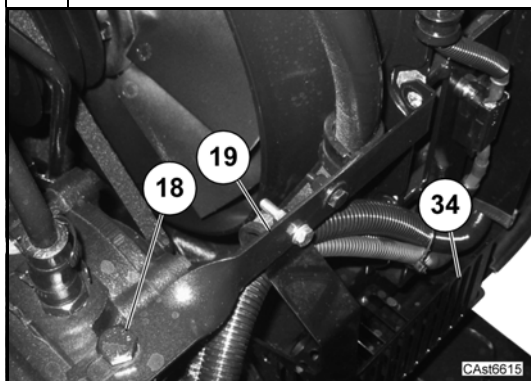
2.



Remove bolt (32) and washer (33).

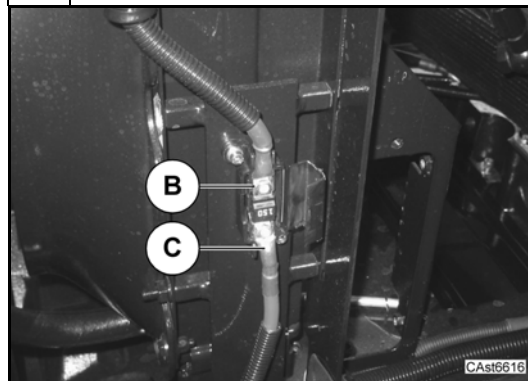
Unscrew nut (20).

3.



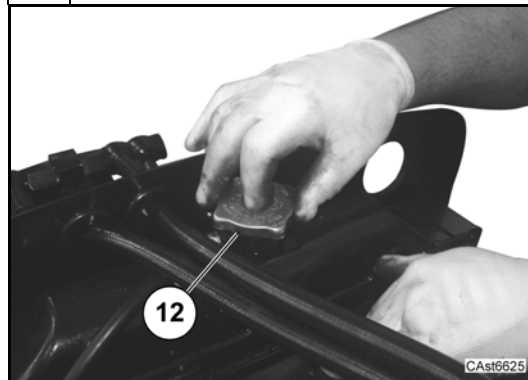
Unscrew bolt (18) and remove the right protections (34) and (19).

4.



Disconnect the maxi fuse (150 A) loosening bolts (B) and (C).

5.



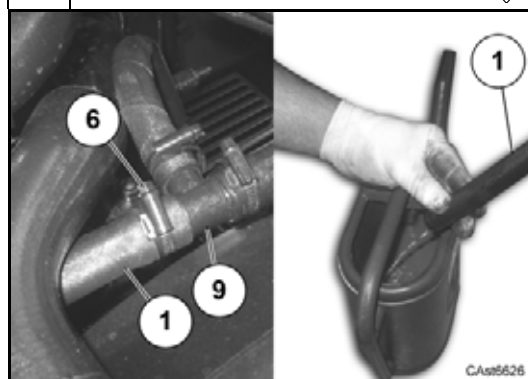
Loosen and remove radiator cap (12).



## Warning

**If the engine is hot, gradually loosen the plug and remove it in order to release the pressure from the circuit.**

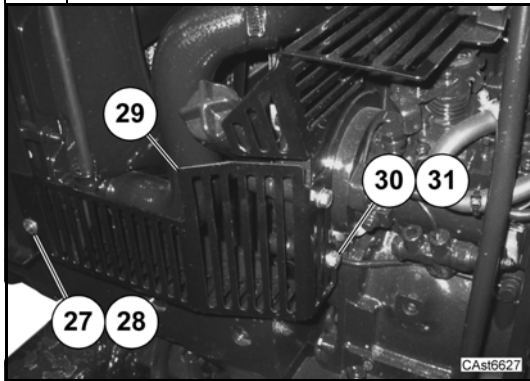
6.



Loosen clamp (6) and drain the liquid into a clean container through hose (1).

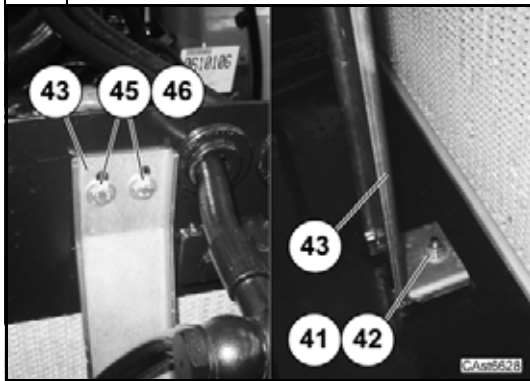
# Disassembly and Assembly Operations

7.



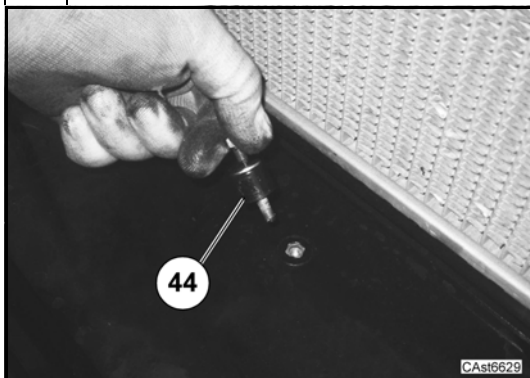
Unscrew bolt (27) and washer (28).  
Unscrew bolts (31) and washers (30).  
Remove the left protection (29).

8.



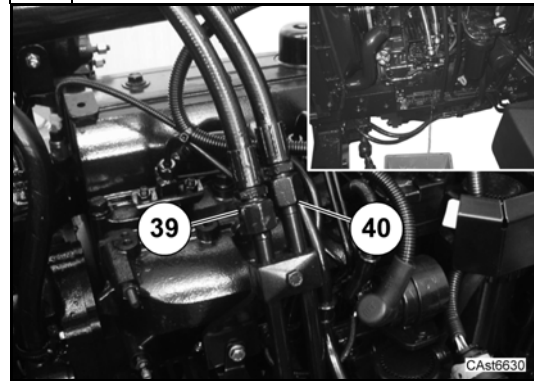
Unscrew screws (45) and washers (46).  
Unscrew nut (41) and washer (42).  
Remove the air filter support (43).

9.



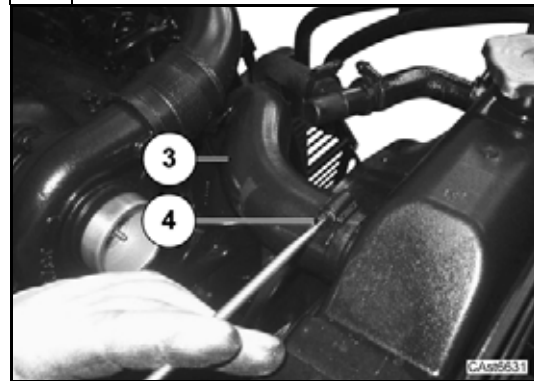
Loosen and remove the anti-vibration rubber (44).

10.



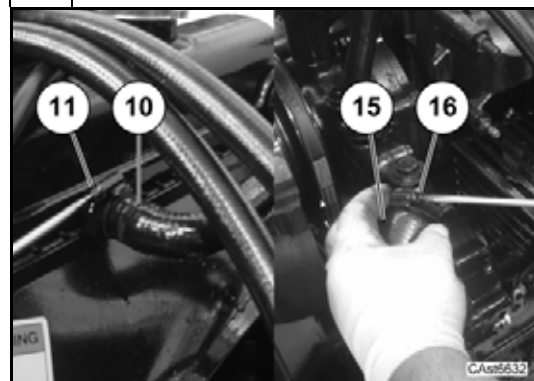
Place a suitable and clean container under the tractor to collect oil (if present).  
Disconnect the hydraulic oil lines (39) and (40).

11.



Loosen clamp (4) and remove the sleeve (3).

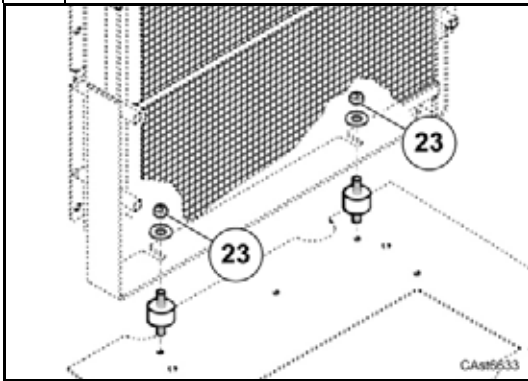
12.



Loosen clamp (11) and remove hose (10).  
Loosen clamp (16) and remove hose (15).

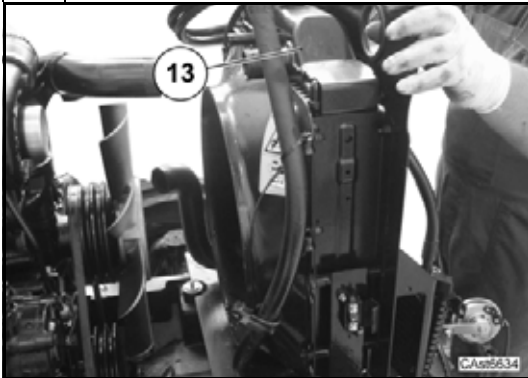
# Disassembly and Assembly Operations

13.



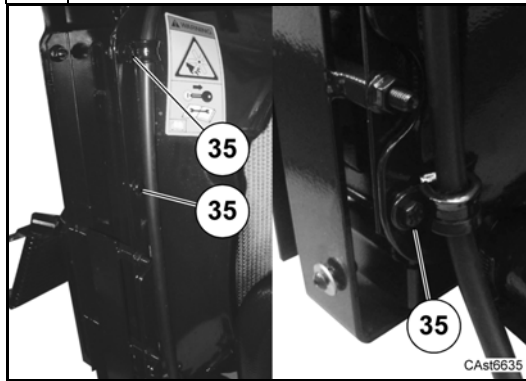
Loosen without removing nut (23).

14.



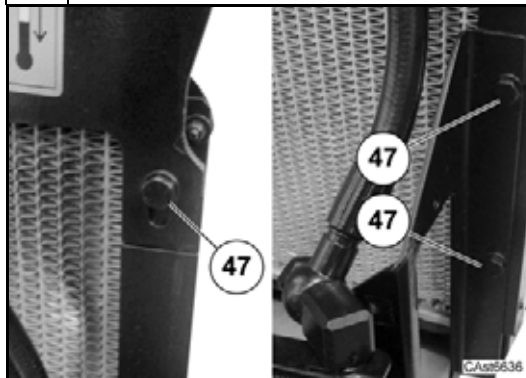
Remove radiator (13) and radiator support (26).

15.



To separate shroud from the radiator remove 6 bolts (35) from both sides.

16.



To complete the disassembly of the radiator remove 5 remaining bolts (47) (2 on right side + 3 on left side).

Check and inspect radiator for wear or damages, clean it using compressed air.

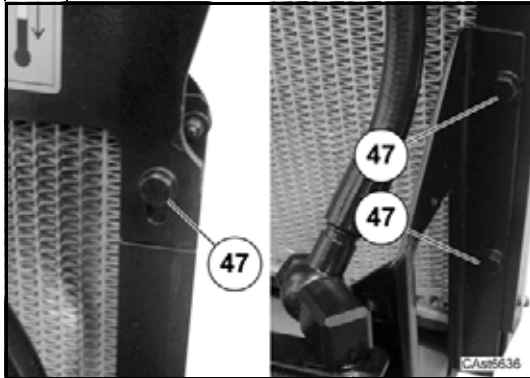
Repair as necessary.

# Disassembly and Assembly Operations

## Assembly

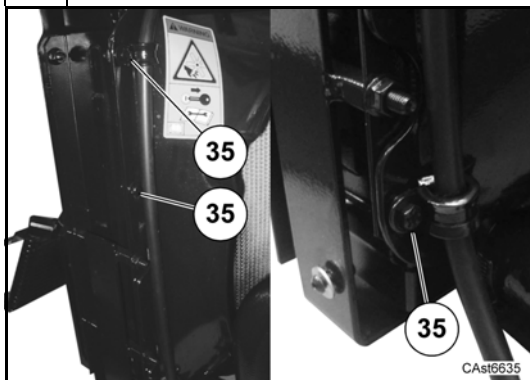
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



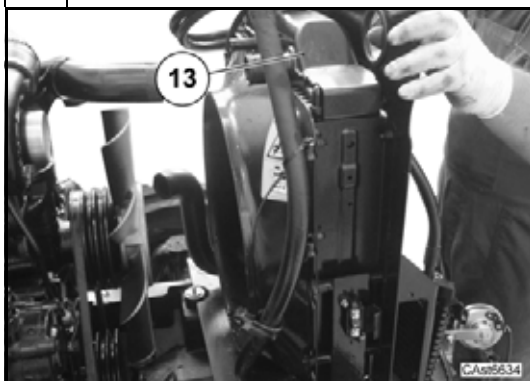
Assemble radiator (13) on supports (49) and (50).  
Tighten washers (49) and bolts (47).

2.



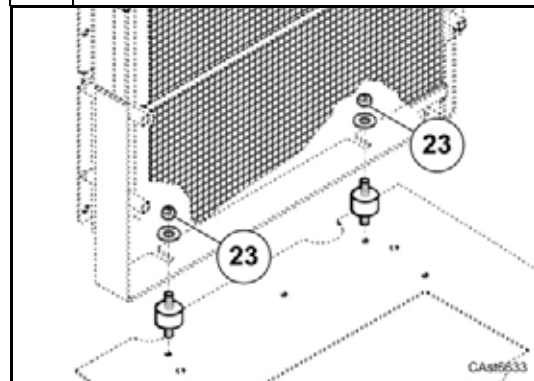
Assemble the shroud on radiator and tighten the 6 bolts (35).

3.



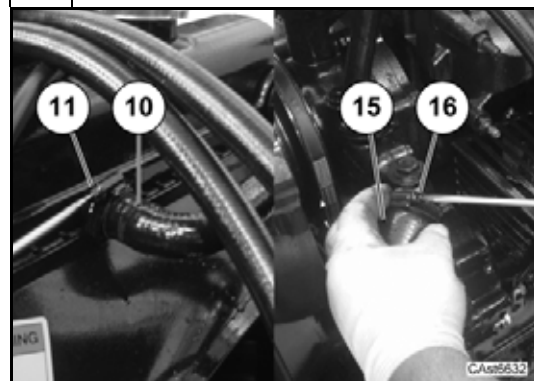
Fit the radiator assembly (13) to the tractor.

4.



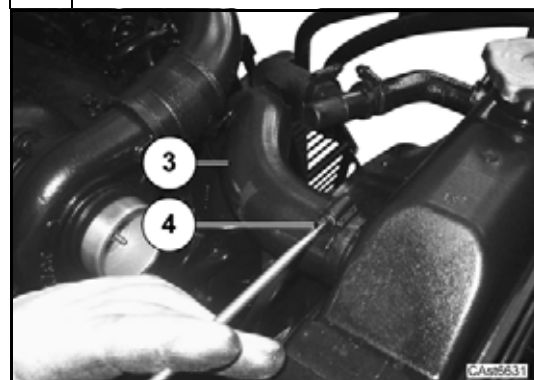
Screw up nuts (23).

5.



Assemble hose (10) and tighten clamp (11).  
Assemble hose (15) and tighten clamp (16).

6.

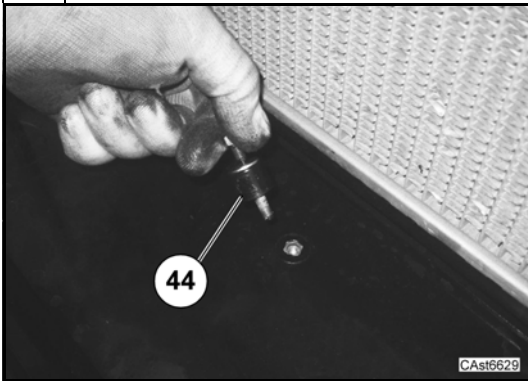


Assemble the sleeve (3) and tighten clamp (4).



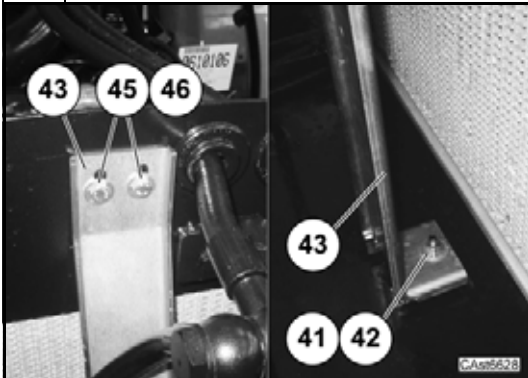
# Disassembly and Assembly Operations

7.



Assemble the anti-vibration rubber (44).

8.



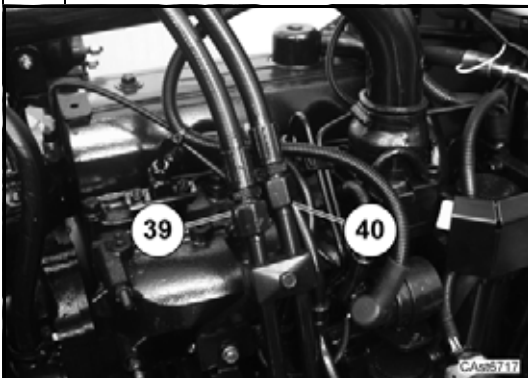
Assemble washer (42) and bolt up nut (41).

Torque wrench setting 12 Nm (8.85 lb-ft).

Assemble washers (46) and screw up bolts (45).

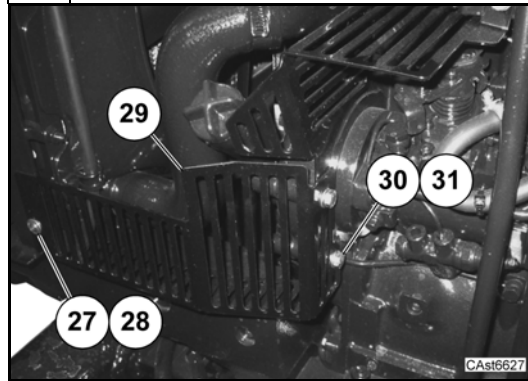
Torque wrench setting 10 Nm (7.37 lb-ft).

9.



Connect the hydraulic oil lines (39) and (40).

10.

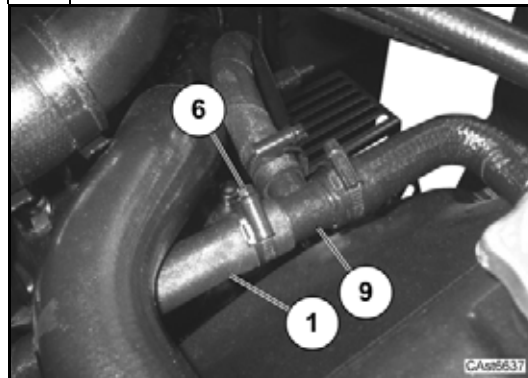


Assemble the left protection (29).

Screw up bolts (31) and washers (30).

Screw up bolt (27) and washer (28).

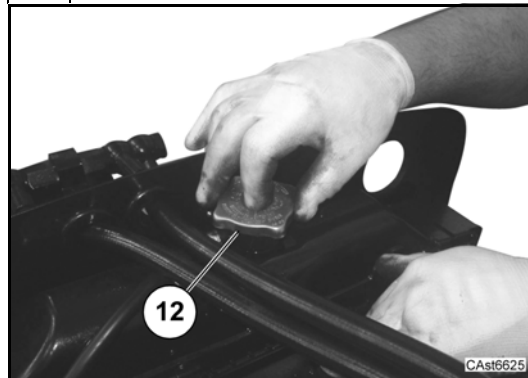
11.



Assemble hose (1) on connector (9).

Tighten clamp (6).

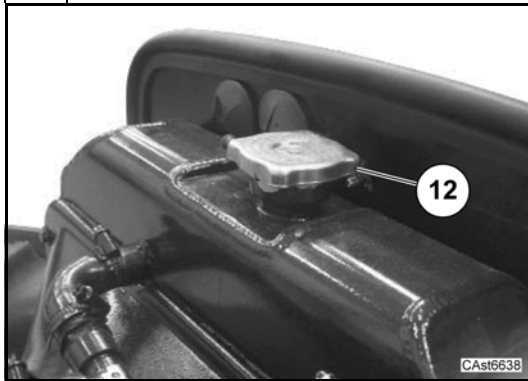
12.



Fill radiator (see next sequence) and close cap (12).

# Disassembly and Assembly Operations

13.



Check the coolant level in the header tank.



## Warning

**Wait for cooling system to cool before opening the radiator cap. Use a cloth to protect your hands and slowly loosen the cap to the first notch and wait for the pressure to dissipate. Then, remove the cap.**

DO NOT use an antifreeze solution for more than two years or with 2000 hours of operation.

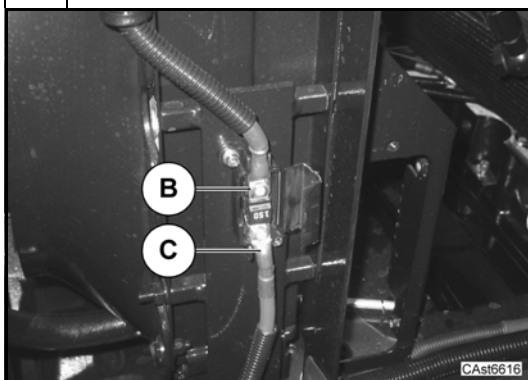
The heat generated by the diesel engine causes a natural change in the inhibitors of the coolant which results in loss of corrosion protection.

The loss of the inhibitors may cause water pump cavitation and cylinder block erosion.

1. To check the coolant level first remove the cap (12).
2. Top up with antifreeze solution using a mixture of 50% water and 50% heavy duty glycol ethylene antifreeze.

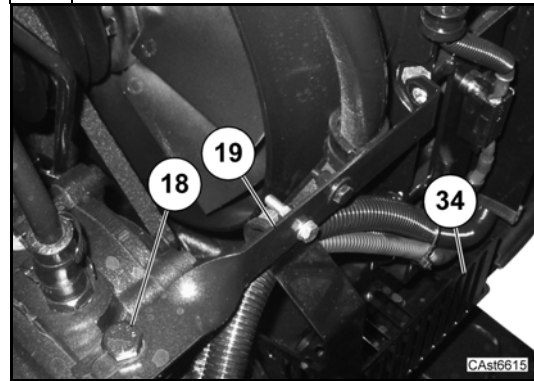
**IMPORTANT:** NEVER use water alone as a coolant. Damage from corrosion can be the result.

14.



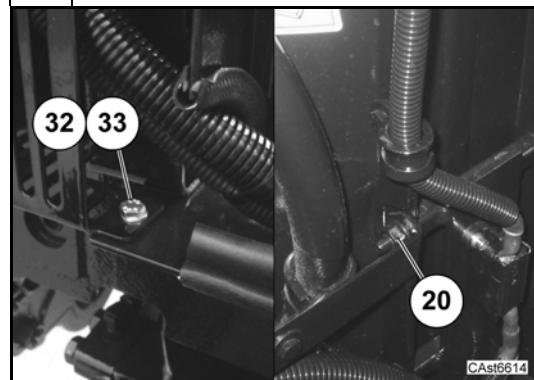
Connect the maxi fuse (150A) tightening bolts (B) and (C).

15.



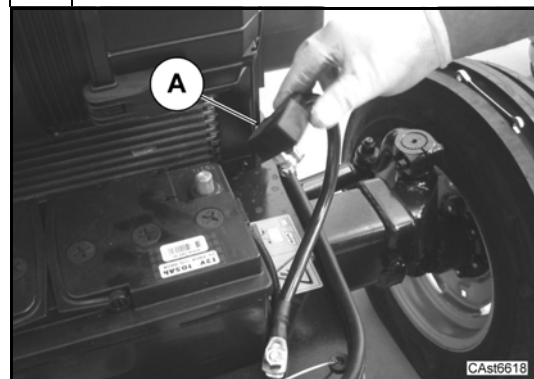
Assemble right protections (34) and (19).  
Screw up bolt (18).

16.



Screw up nut (20).  
Assemble washer (33) and screw up bolt (32).

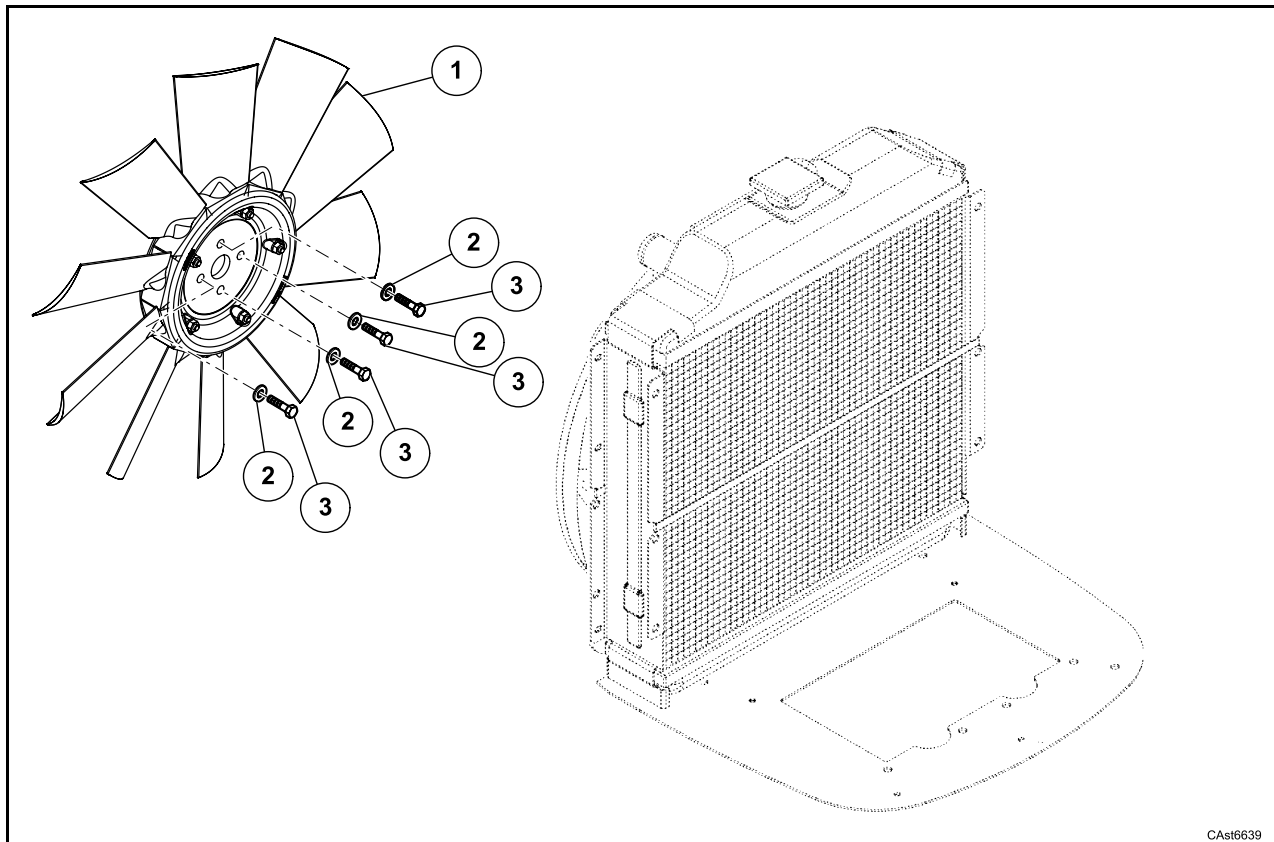
17.



Connect cable (A) to battery negative pole.  
Close the rubber cap.

# Disassembly and Assembly Operations

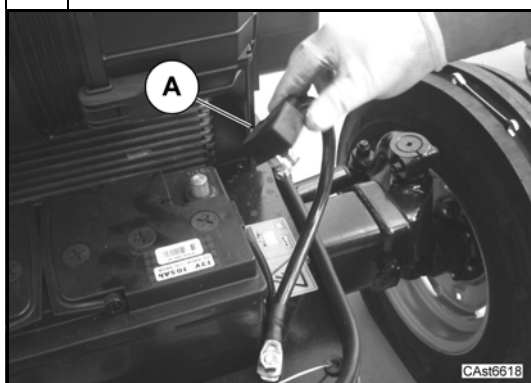
## FAN



### Disassembly

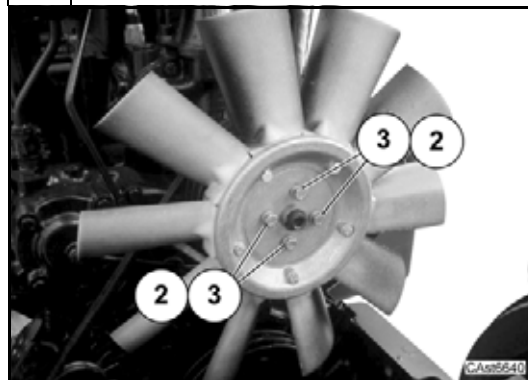
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Open the rubber cap and remove negative (A) from the battery.

2.



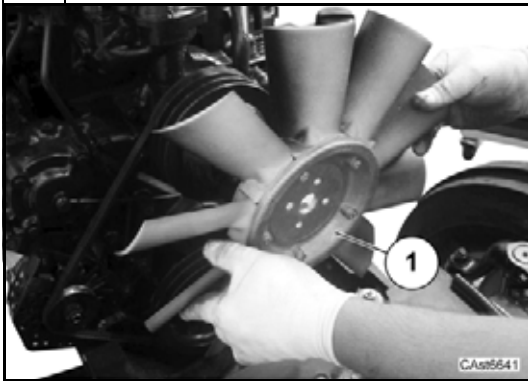
To gain access to the fan:

- remove air filter (see D.9)
- remove oil cooler (if equipped) (see D.12)
- remove intercooler (if equipped).
- remove air conditioning condenser (if equipped).
- remove radiator (see D.5)

Remove four bolts (3) and four washers (2).

## Disassembly and Assembly Operations

3.

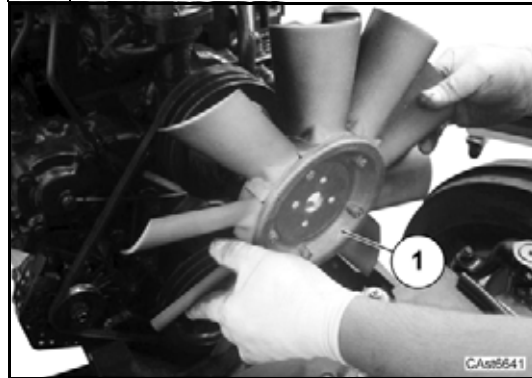


Remove fan (1).

### Assembly

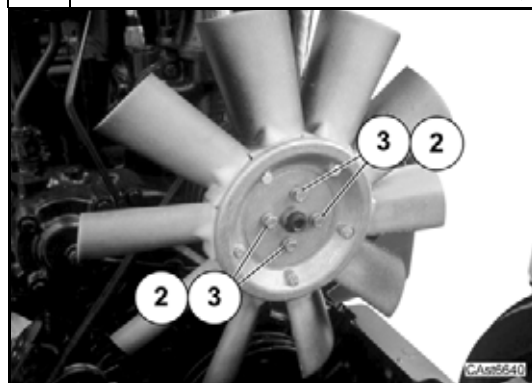
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Assemble fan (1).

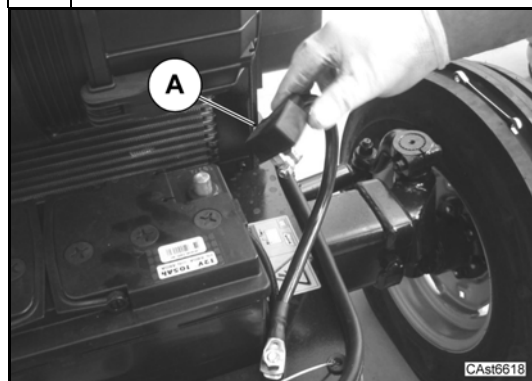
2.



Assemble the four washers (2) and tighten the four bolts (3).

Torque wrench setting 28 Nm (20.65 lb·ft).

3.



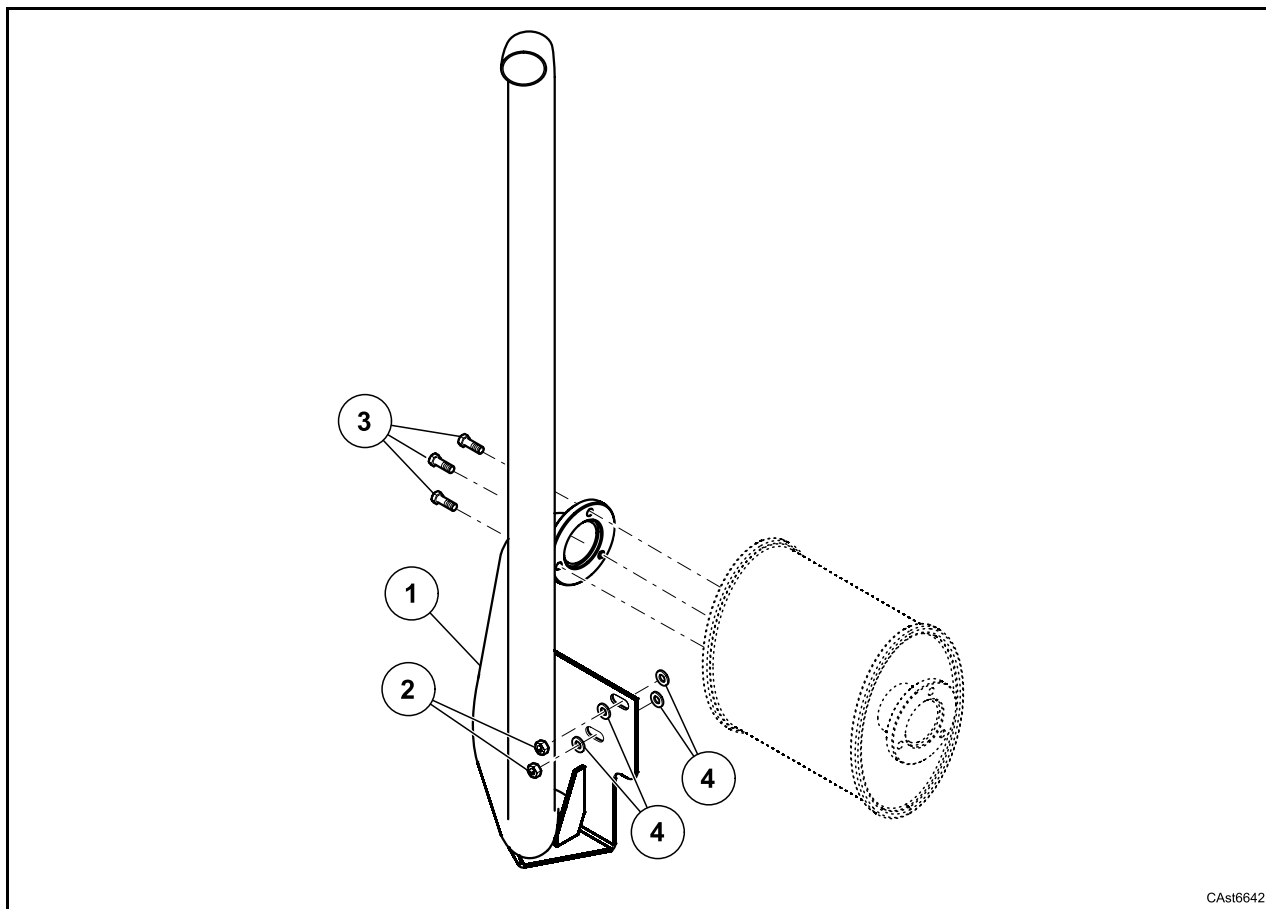
Connect cable (A) to battery negative pole.

Close the rubber cap.



# Disassembly and Assembly Operations

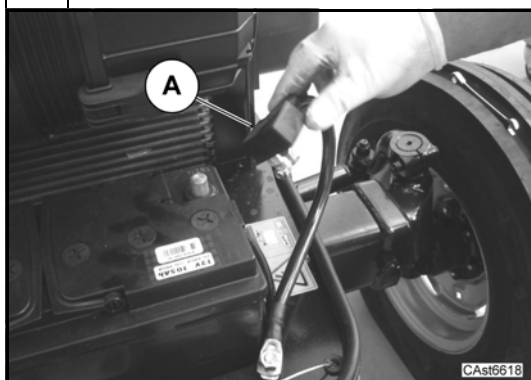
## EXHAUST PIPE



### Disassembly

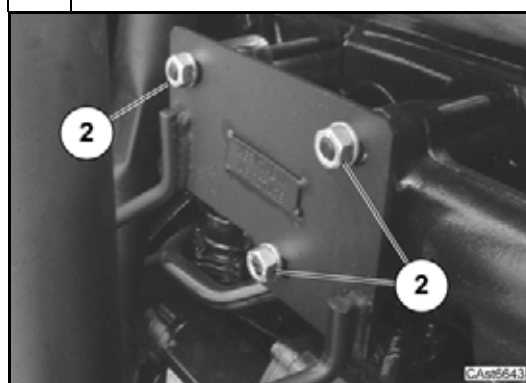
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Open the rubber cap and remove the negative (A) from the battery.

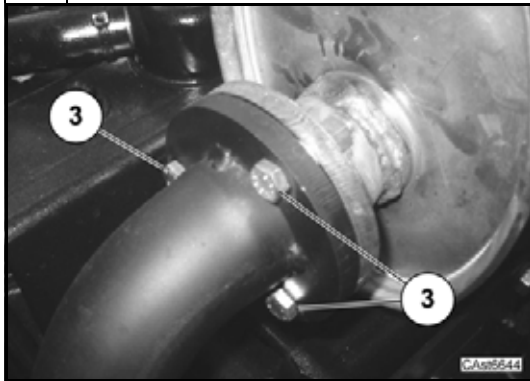
2.



Remove nuts (2).

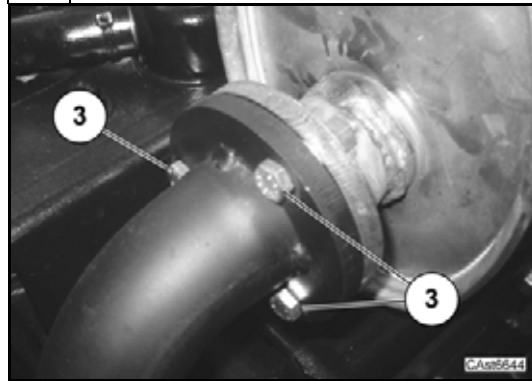
# Disassembly and Assembly Operations

3.



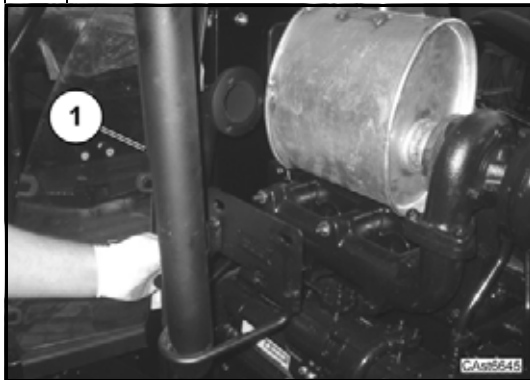
Remove bolts (3).

2.



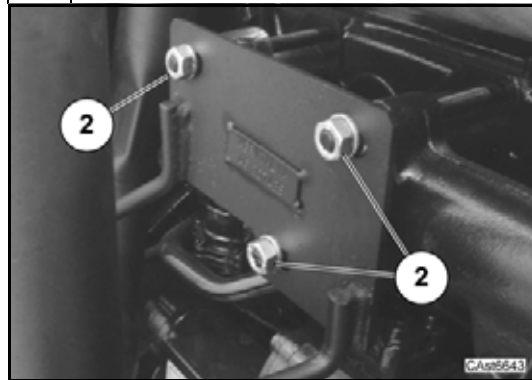
Screw up bolts (3).

4.



Remove the vertical exhaust pipe (1).

3.

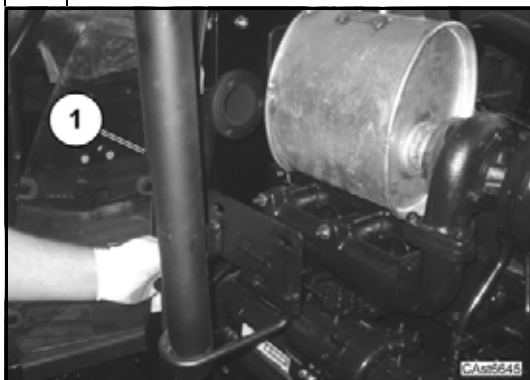


Screw up nuts (2).

## Assembly

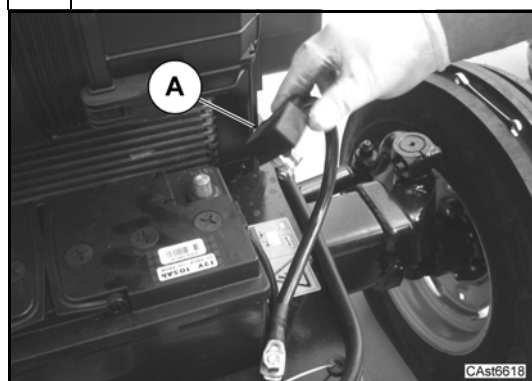
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Assemble the vertical exhaust pipe (1).

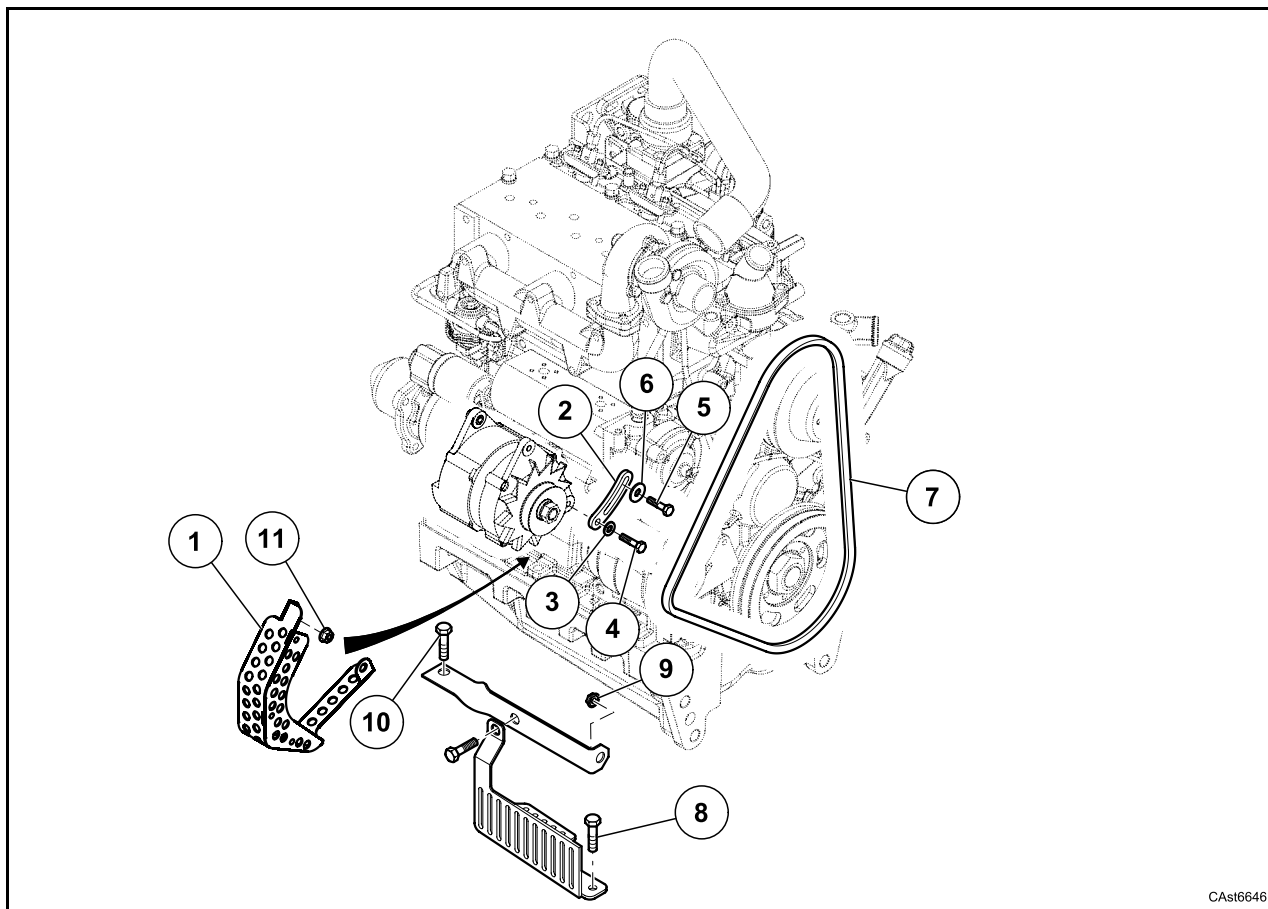
4.



Connect cable (A) to battery negative pole.  
Close the rubber cap.

# Disassembly and Assembly Operations

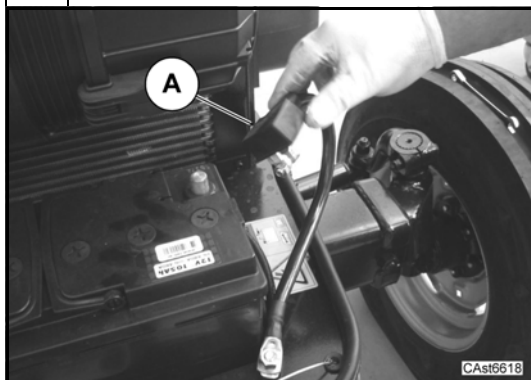
## FAN BELT



### Disassembly

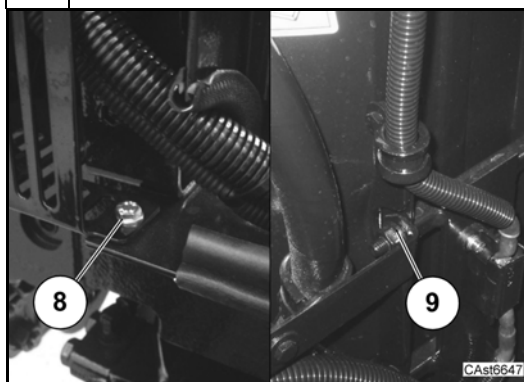
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Open the rubber cap and remove the negative (A) from the battery.

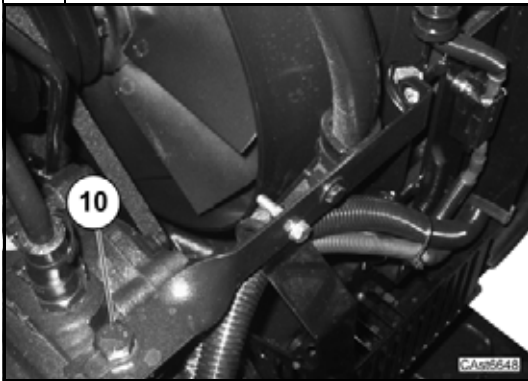
2.



Remove bolt (8) and nut (9).

# Disassembly and Assembly Operations

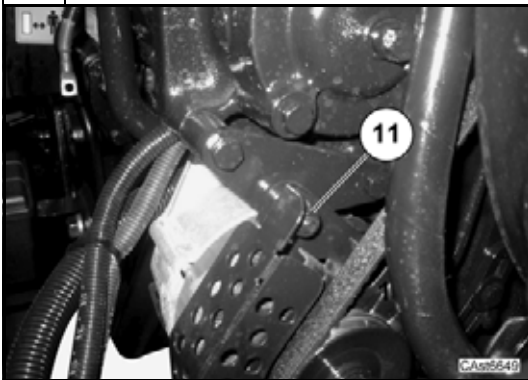
3.



Remove bolt (10).

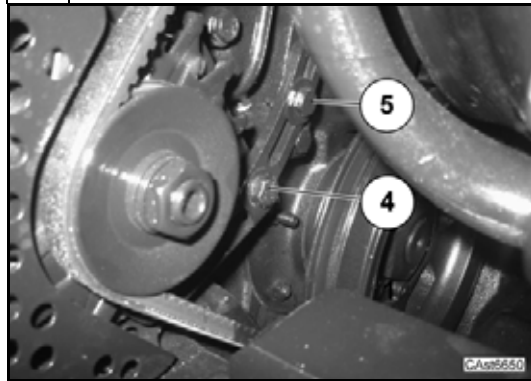
Disassemble the right protection.

4.



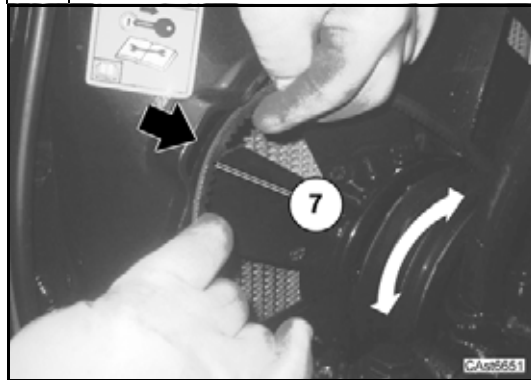
Loosen without removing nut (11).

5.



Loosen bolts (5) and (4) for reducing the fan belt tension.

6.



Rotating the engine fan, remove belt (7) through the opening of the radiator shroud.

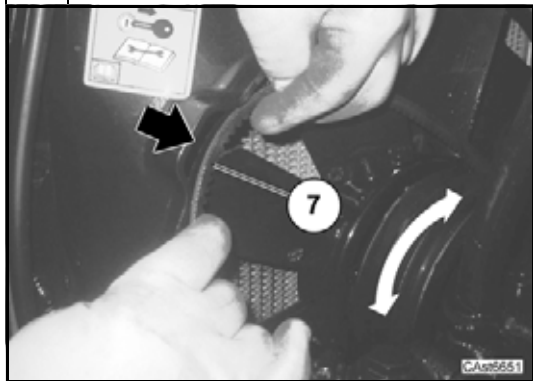
Check if the fan belt is worn or damaged, replace it if necessary.

# Disassembly and Assembly Operations

## Assembly

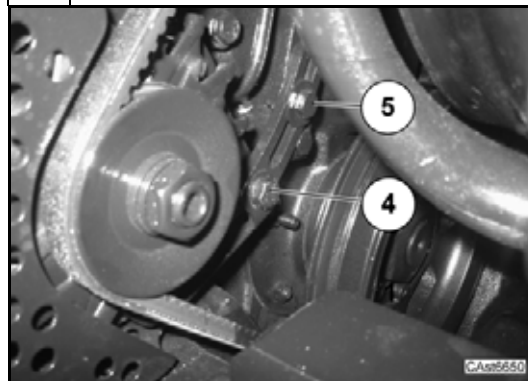
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Assemble the fan belt (7) through the opening of the radiator shroud.

2.



Assemble the fan belt (7) on the alternator.

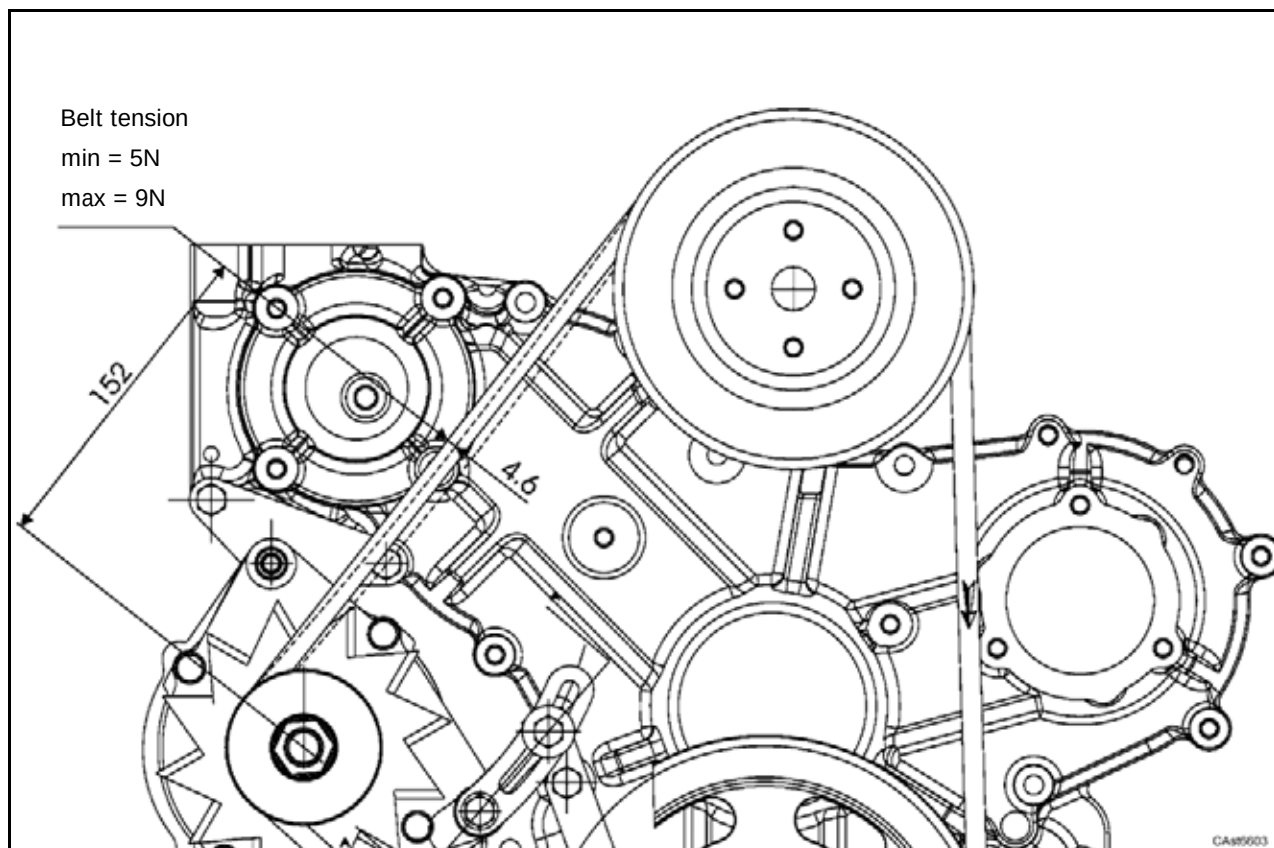
Tension the fan belt (7) handling on the alternator.

Tighten bolt (4).

Torque wrench setting 12 Nm (8.85 lb·ft).

Tighten bolt (5).

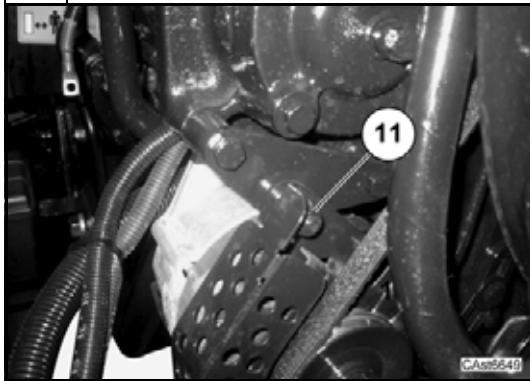
Torque wrench setting 24.6 Nm (18.14 lb·ft).





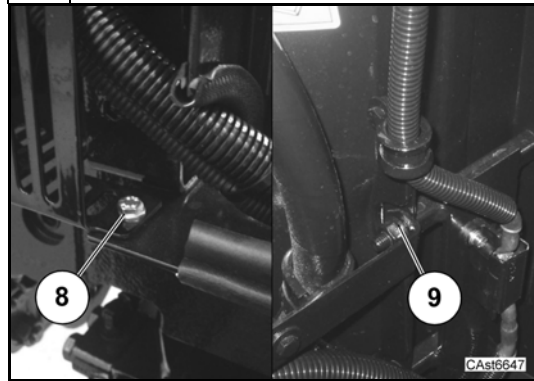
## Disassembly and Assembly Operations

3.



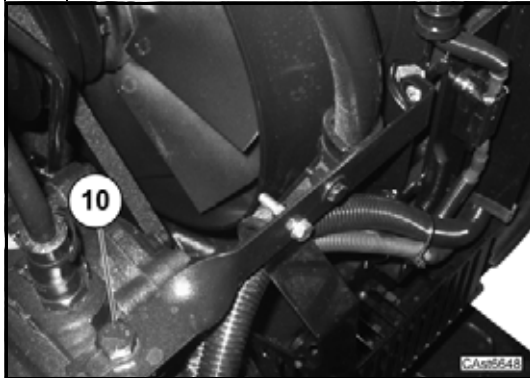
Tighten nut (11).

5.



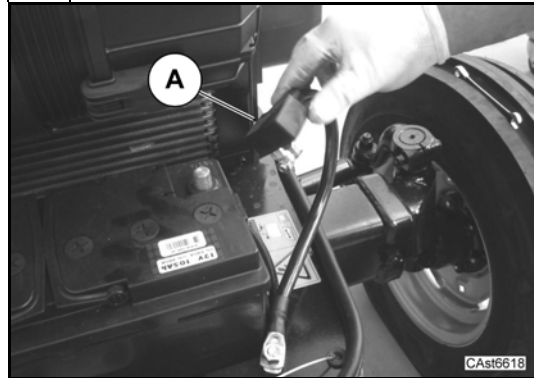
Screw up bolt (8) and nut (9).

4.



Assemble the right protection.  
Screw up bolt (10).

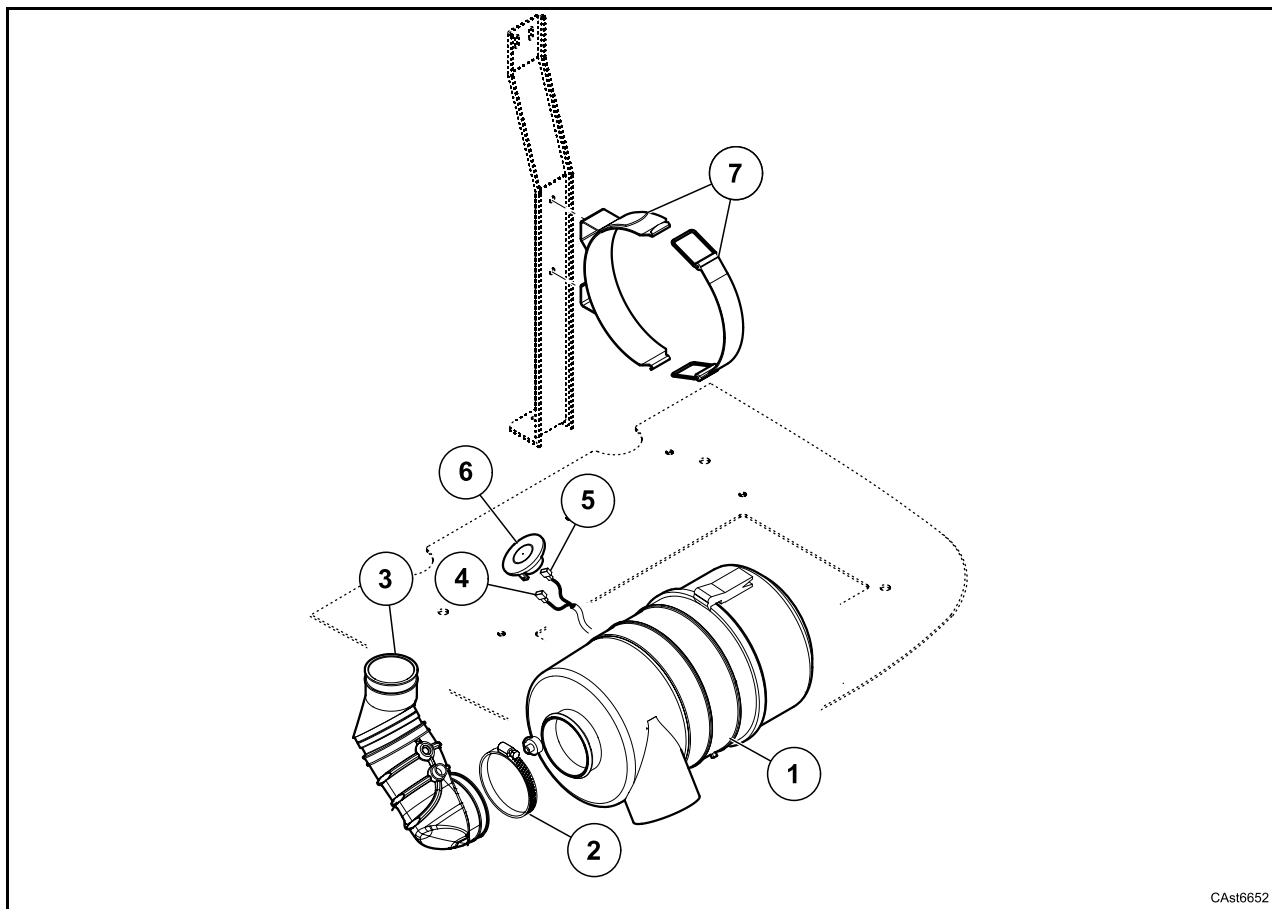
6.



Connect the negative cable (A) to the battery.  
Close the rubber cap.

# Disassembly and Assembly Operations

## AIR FILTER ASSY REPLACEMENT

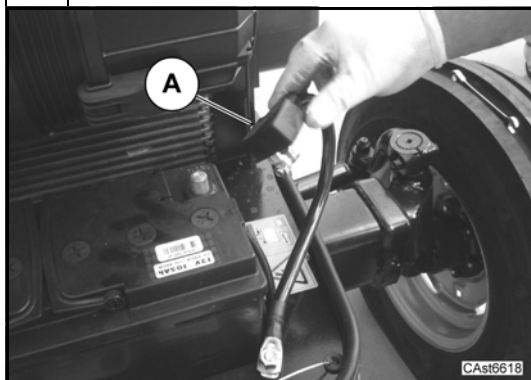


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### Disassembly

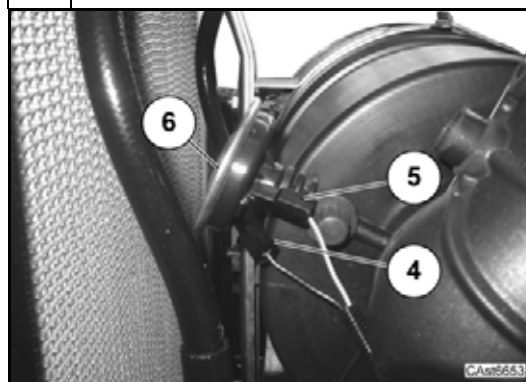
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Open the rubber cap and remove the negative (A) from the battery.

2.

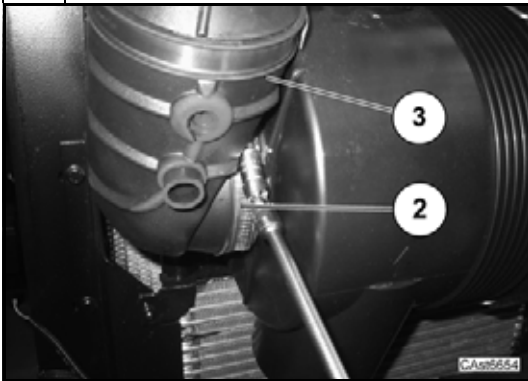


Remove connections (4) and (5) from the air filter sensor (6).



# Disassembly and Assembly Operations

3.



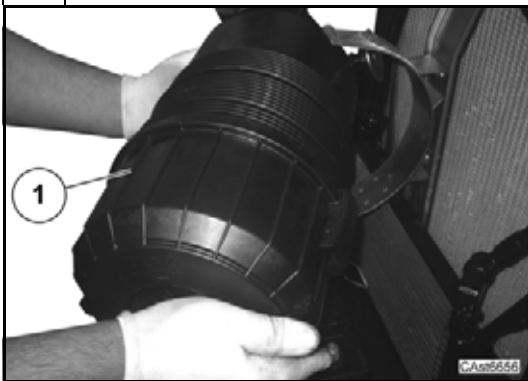
Loosen (without removing) clamp (2) and detach the sleeve (3).

4.



Remove clamp (7).

5.

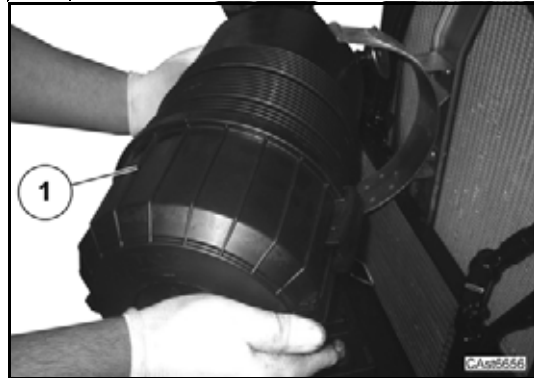


Remove the air filter (1).

## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



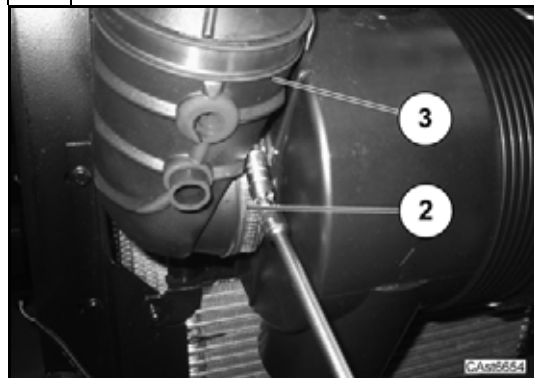
Insert the air filter (1) into its seat.

2.



Assemble and tighten the clamp (7).

3.

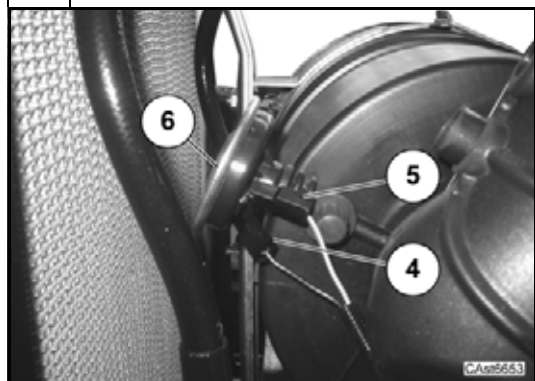


Assemble sleeve (3) and tighten clamp (2).

## Disassembly and Assembly Operations

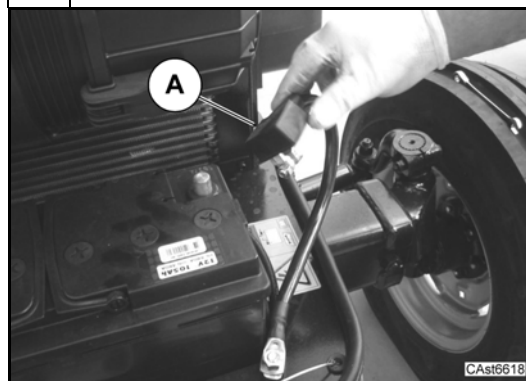
---

4.



Restore connections (4) and (5) on the air filter sensor (6).

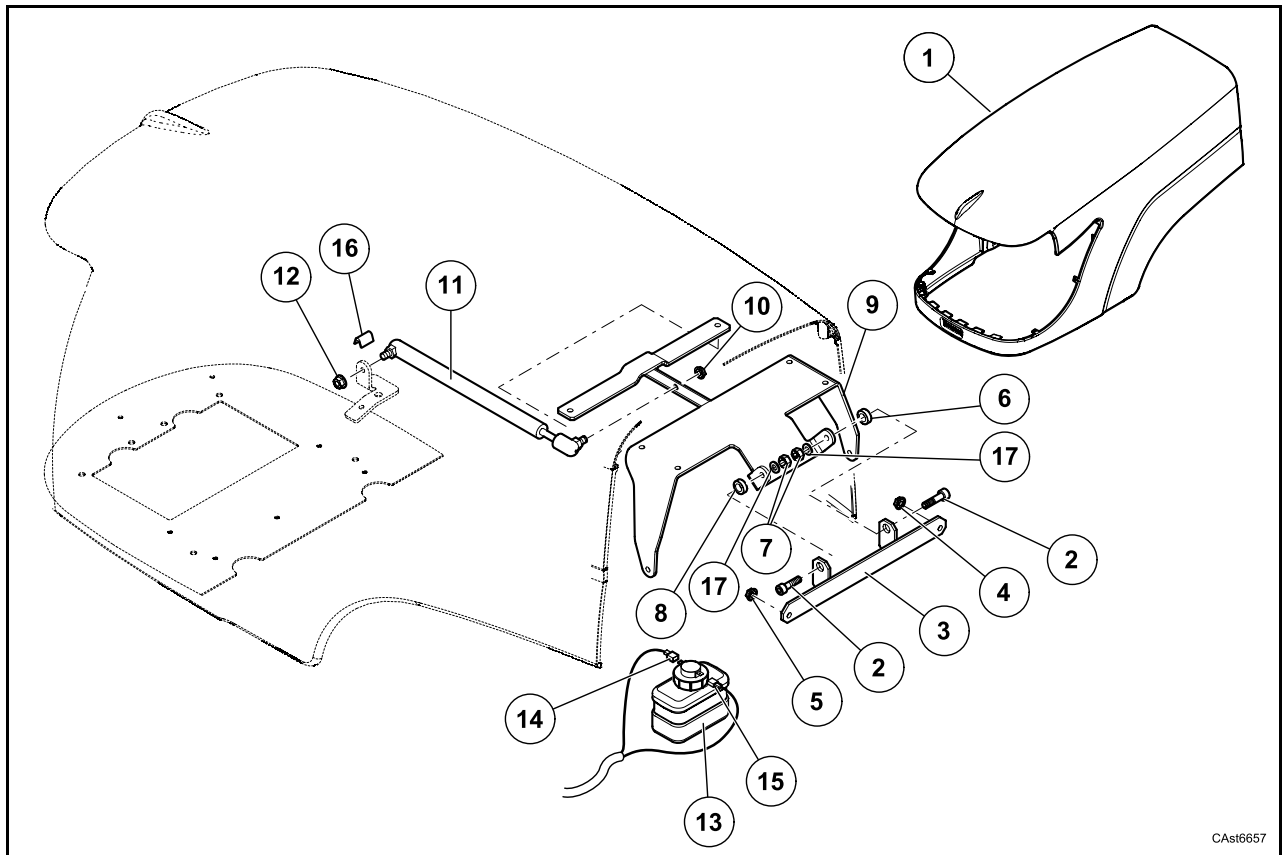
5.



Connect cable (A) to battery negative pole.  
Close the rubber cap.

# Disassembly and Assembly Operations

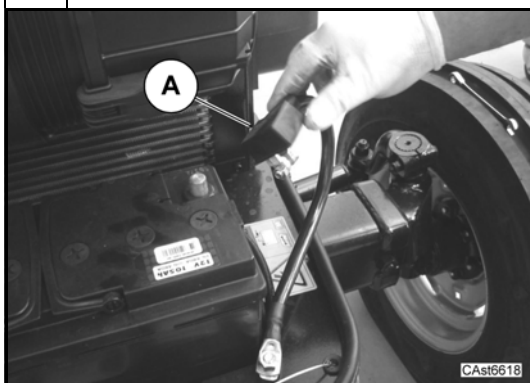
## BONNET



### Disassembly

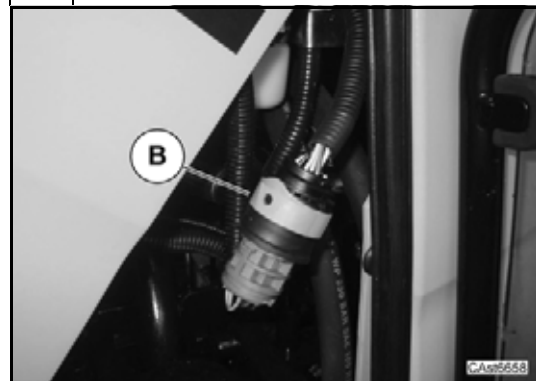
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Open the rubber cap and remove the negative (A) from the battery.

2.



Disconnect connector (B).

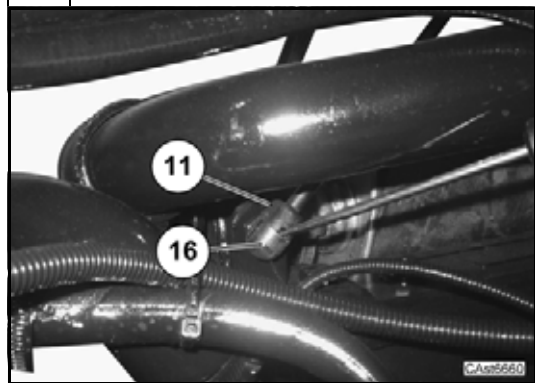
# Disassembly and Assembly Operations

3.



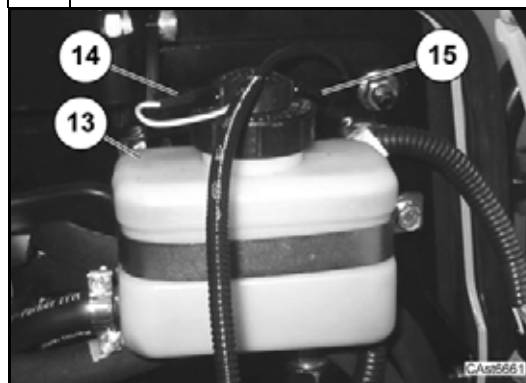
Remove nuts (4) and (5).

4.



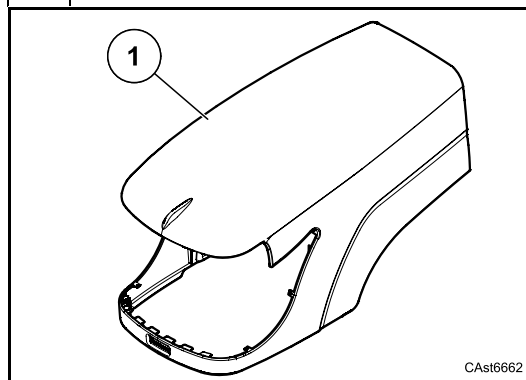
Remove clip (16) to unlock the gas spring (11).

5.



For an easy disassembly of the bonnet it is recommended to remove connectors (14) and (15) from the brake oil reservoir (13).

6.



Remove the bonnet (1) (the aid of a second person is needed) paying attention not to hit the brake oil reservoir (13).

# Disassembly and Assembly Operations

## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

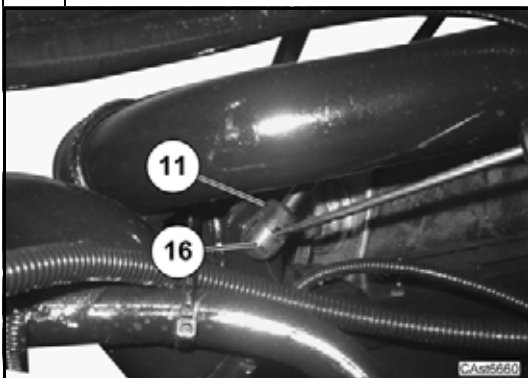
1.



Assemble the bonnet on the tractor paying attention to the brake oil reservoir (13).

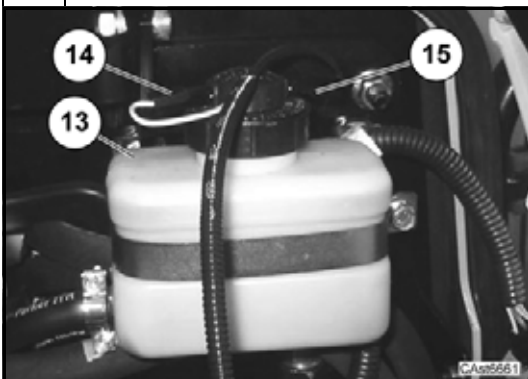
Screw up nuts (4) and (5).

2.



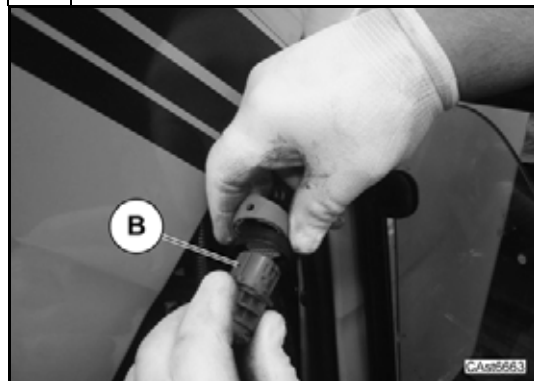
Insert the gas spring (11) into its seat and lock it with the clip (16).

3.



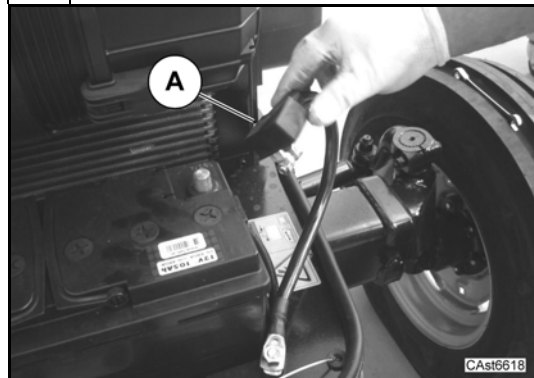
Restore connections (14) and (15) on the brake oil reservoir (13).

4.



Assemble connector (B).

5.

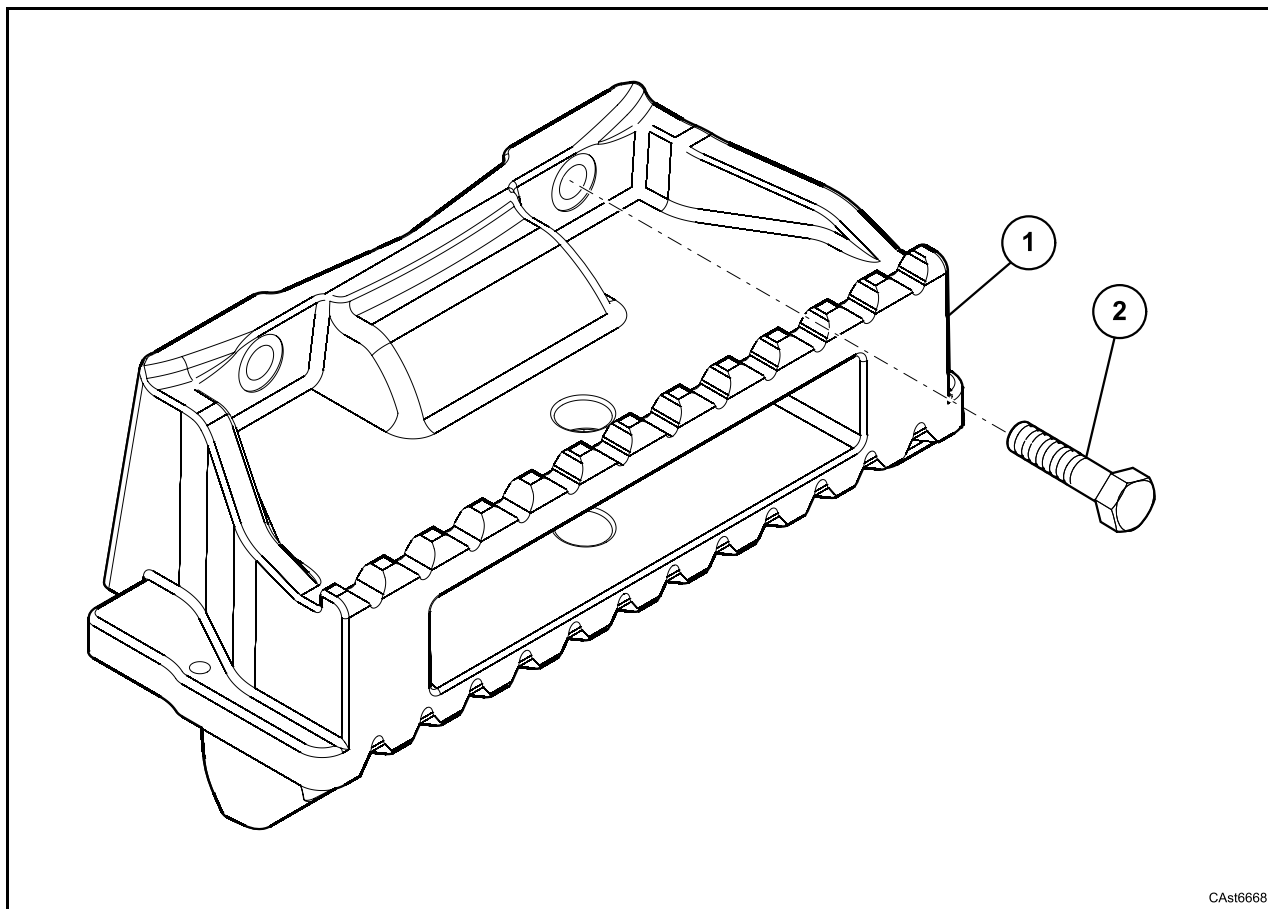


Connect cable (A) to battery negative pole.

Close the rubber cap.

# Disassembly and Assembly Operations

## FRONT WEIGHT

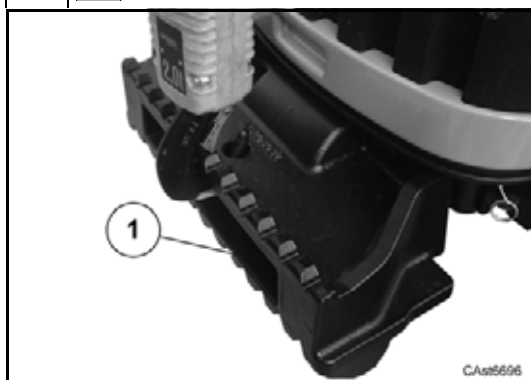


CAst6668

### Disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

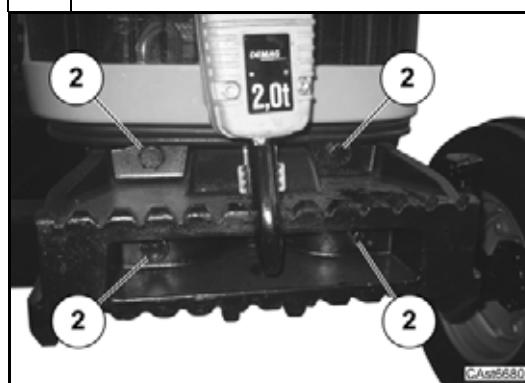
1.



Secure the front weight (1) to a lifting hoist.

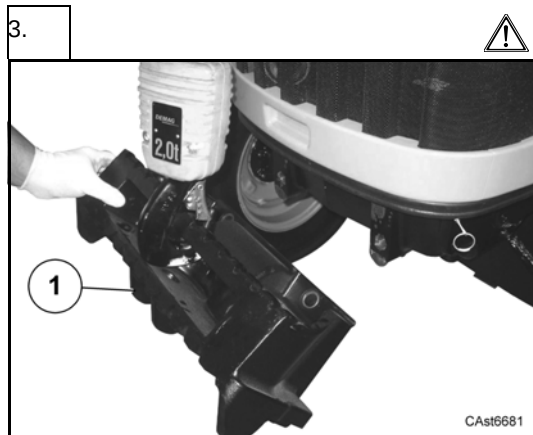
**NOTE:** Basic weight (1) = 81 kg (178 lb).

2.



Remove the four bolts (2).

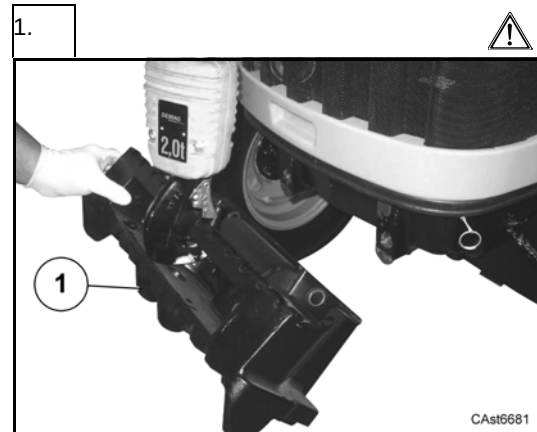
# Disassembly and Assembly Operations



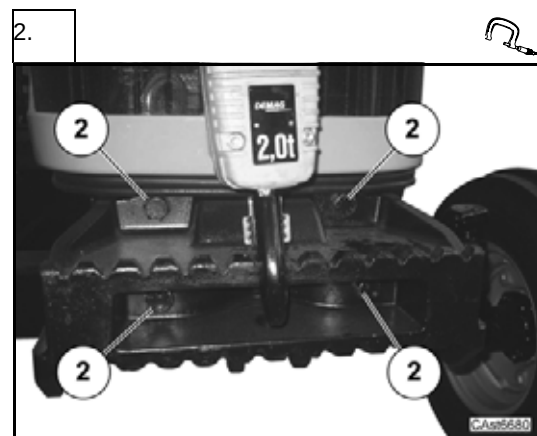
Remove the front weight (1).

## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.



Lift the front weight (1) with a suitable lifting hoist and assemble it on the tractor.



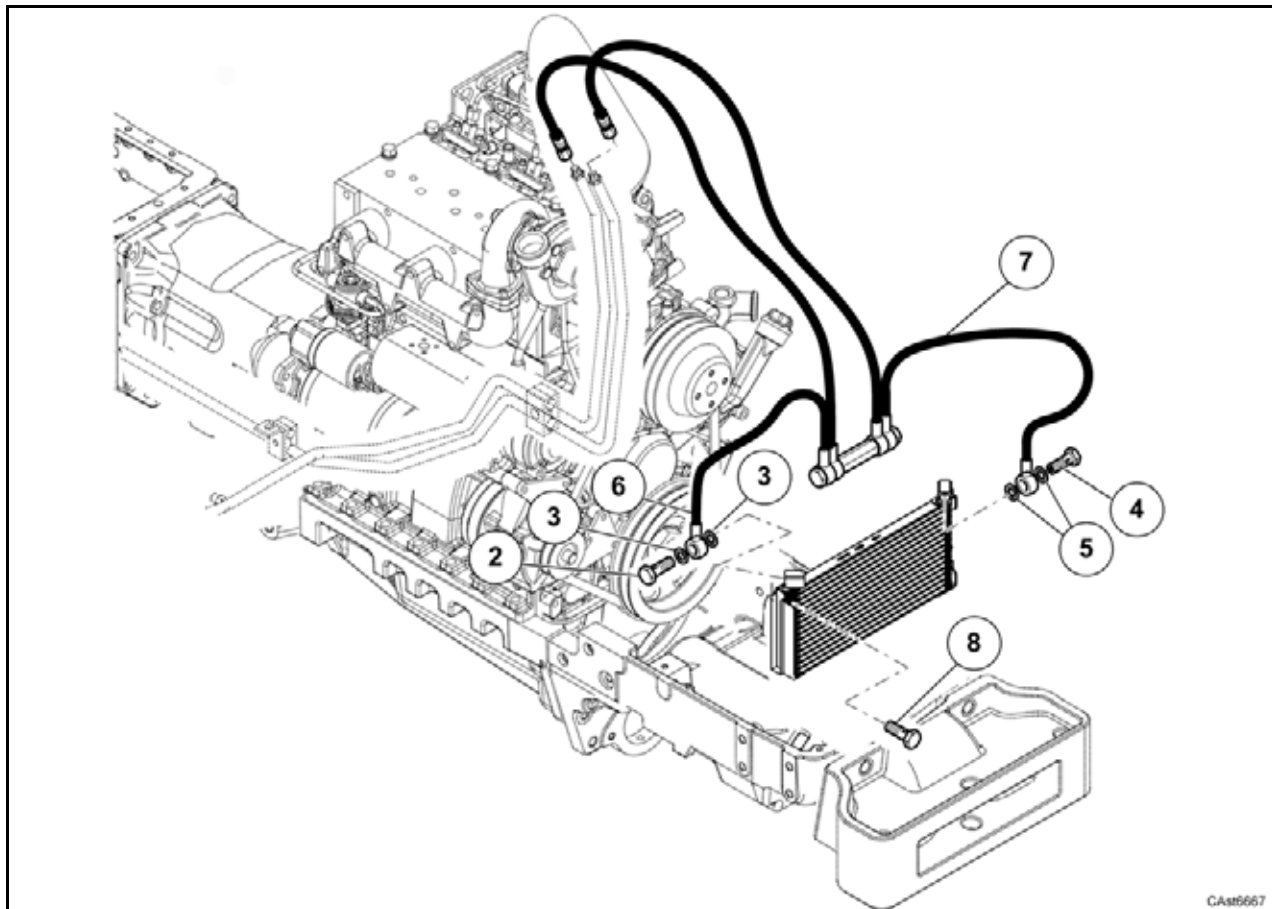
Tighten the four bolts (2).

Torque wrench setting 350 Nm (258.14 lb-ft).



# Disassembly and Assembly Operations

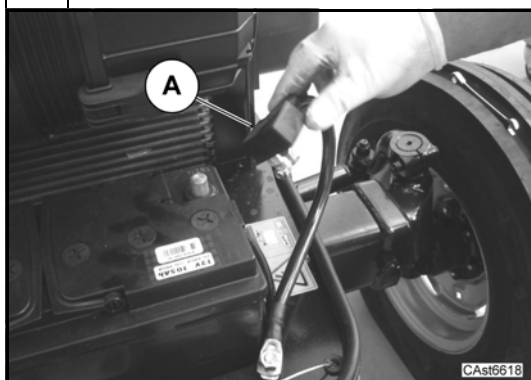
## OIL COOLER



### Disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

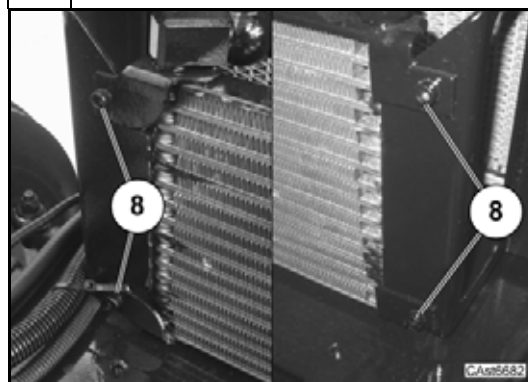
1.



Open the rubber cap and remove the negative (A) from the battery. Remove the air filter.

Refer to: section D.9.

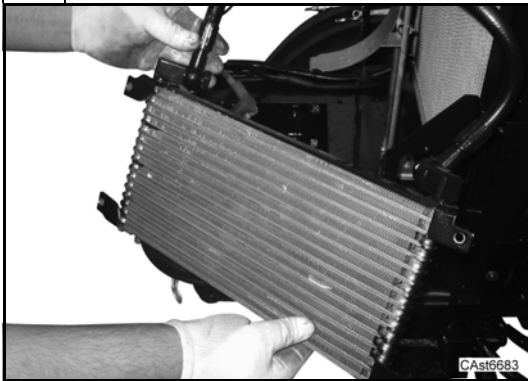
2.



Remove bolts (8).

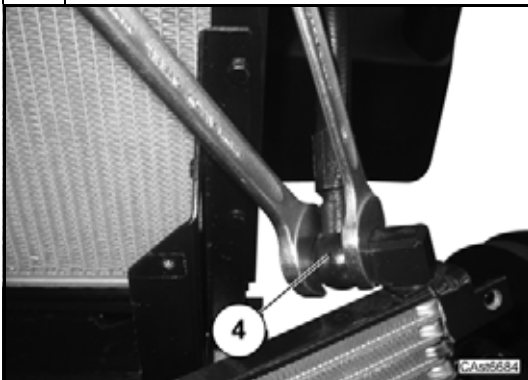
# Disassembly and Assembly Operations

3.



Place a suitable container under the oil cooler to collect oil.

4.

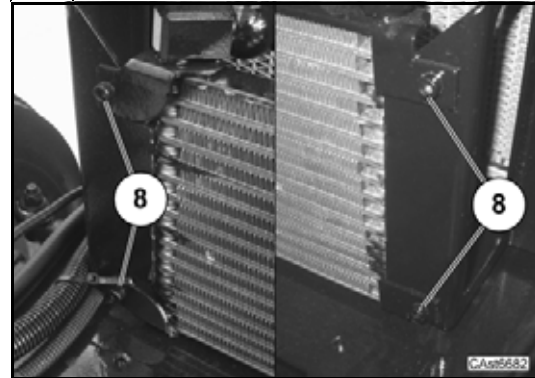


Loosen and remove bored cap screws (2) and (4) on both sides to disassemble the oil cooler.

## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

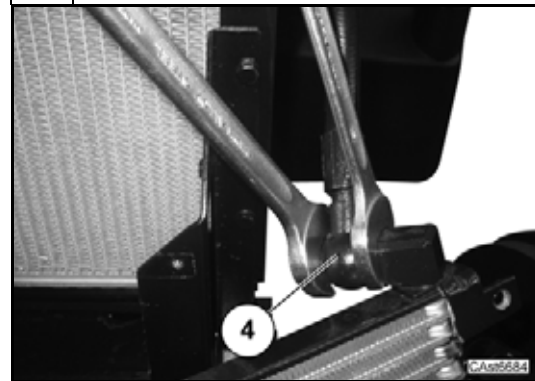
1.



Assemble the oil cooler (1) on the tractor.

Screw up bolts (8).

2.



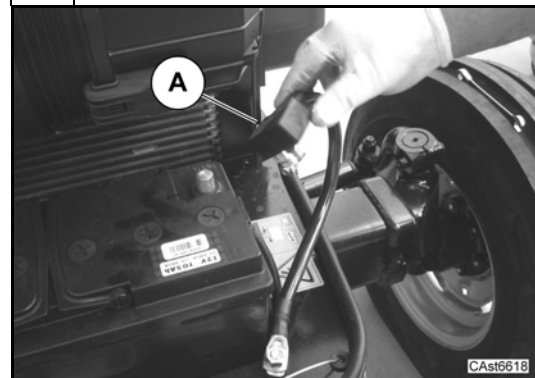
Assemble washers (3) and hose (6).

Screw up the bored cap screw (2).

Assemble the washers (5) and the hose (7).

Screw up the bored cap screw (4).

3.

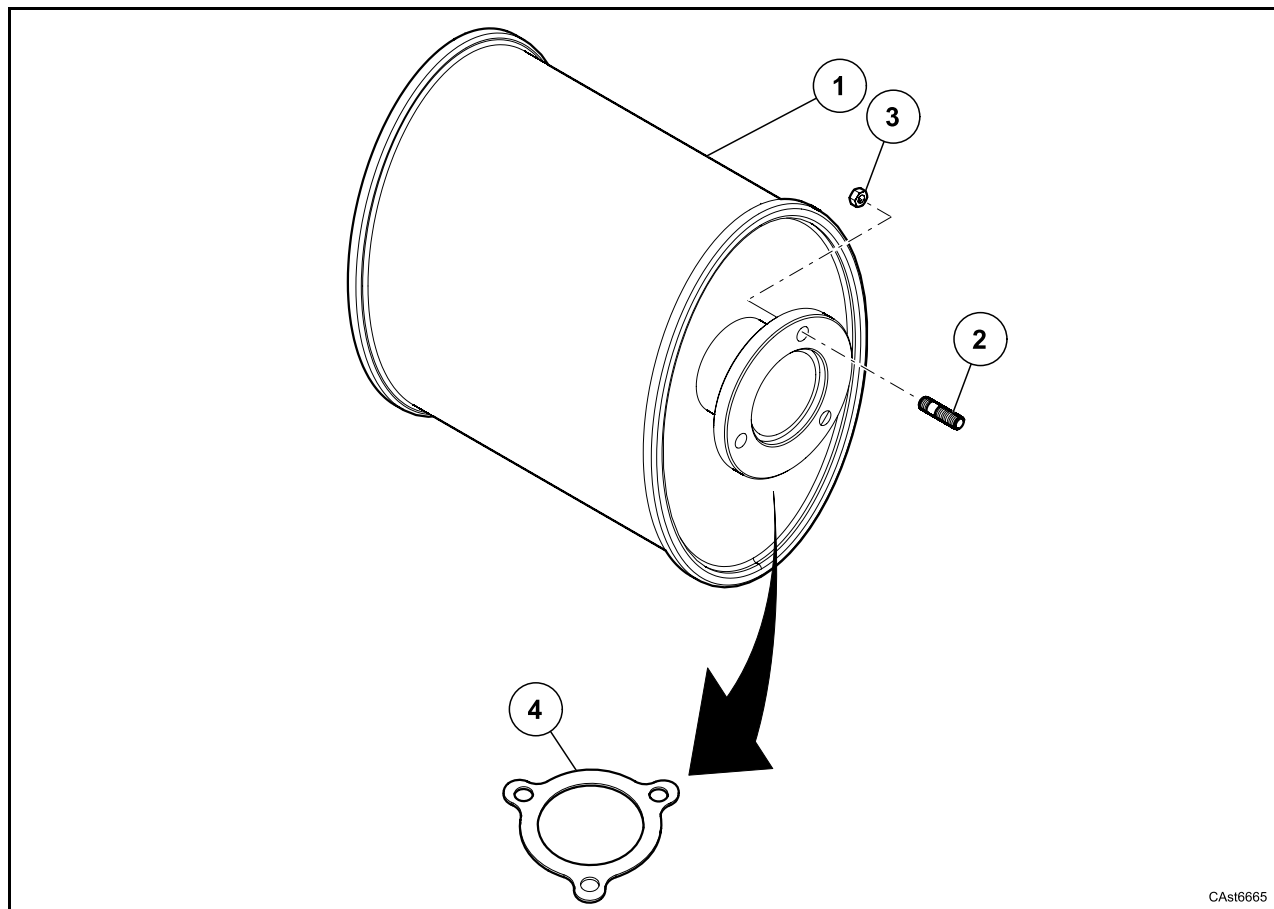


Connect cable (A) to battery negative pole.

Close the rubber cap.

# Disassembly and Assembly Operations

## MUFFLER

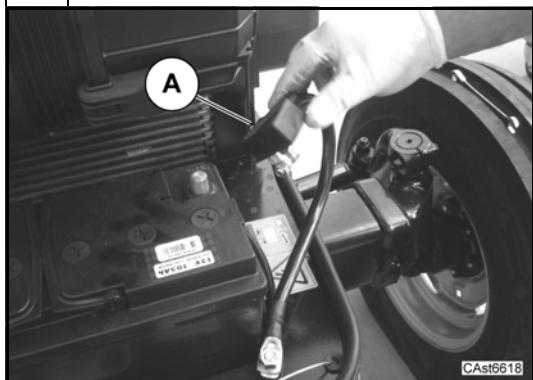


CAst6665

### Disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

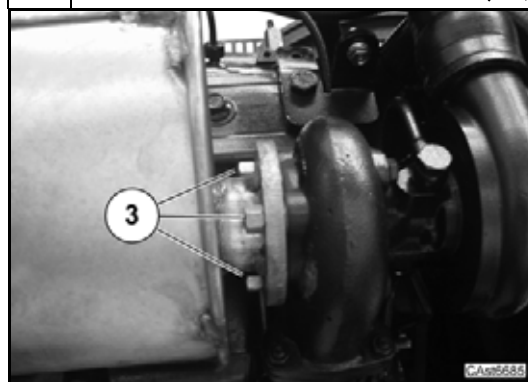
1.



Open the rubber cap and remove the negative (A) from the battery. Remove the vertical exhaust pipe.

Refer to: section D.7.

2.



Remove the nut (3) and the muffler (1).

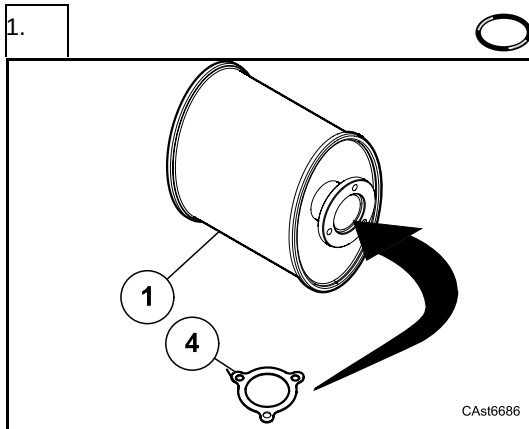
Check the wear condition of the gasket (4).

# Disassembly and Assembly Operations

## Assembly

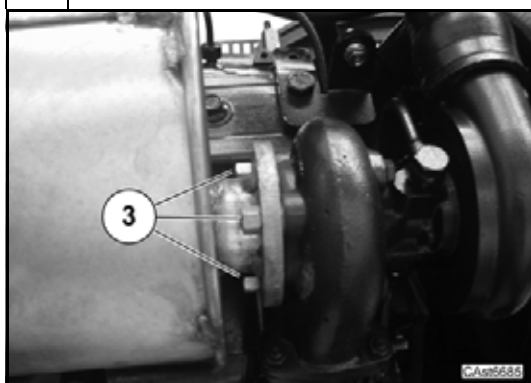
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



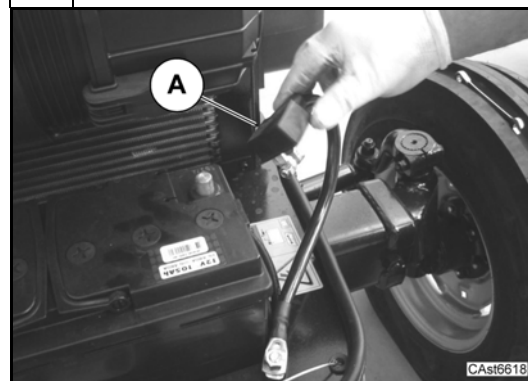
Assemble the gasket (4) on the muffler (1).

2.



Assemble the muffler (1). Screw up nuts (3).

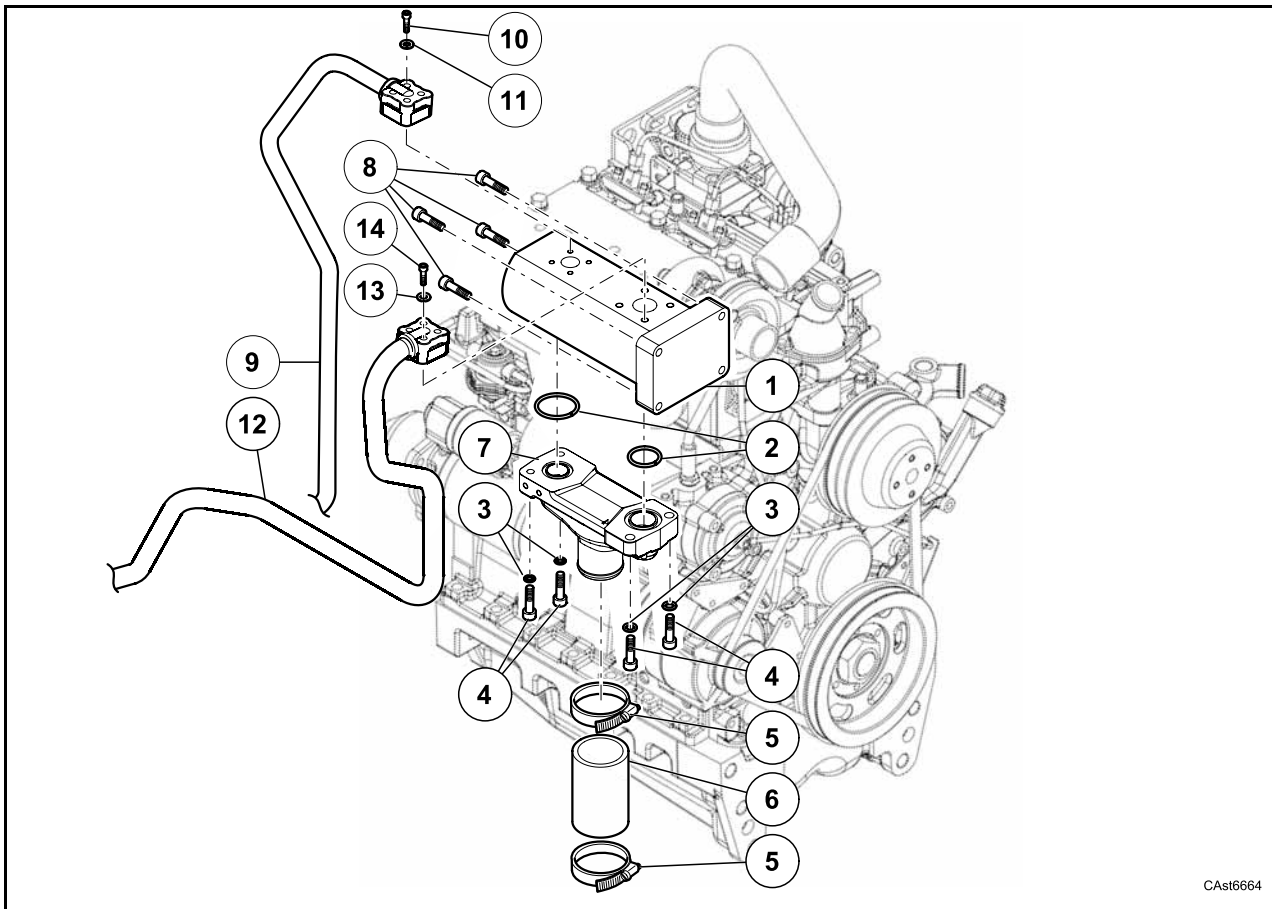
3.



Connect cable (A) to battery negative pole.  
Close the rubber cap.

# Disassembly and Assembly Operations

## HYDRAULIC PUMP

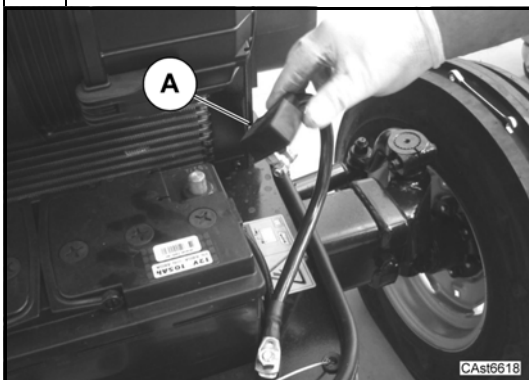


CAst6664

### Disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



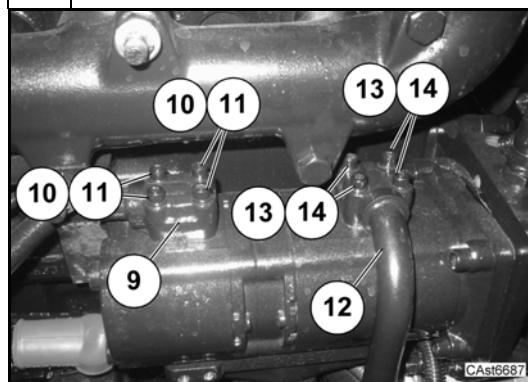
Open the rubber cap and remove the negative (A) from the battery. Remove the right fan protection.

Refer to: section D.6.

Remove the vertical exhaust pipe.

Refer to: section D.7.

2.



Remove bolts (10) and washers (11).

Disassemble pipe (9).

Remove bolts (14) and washers (13).

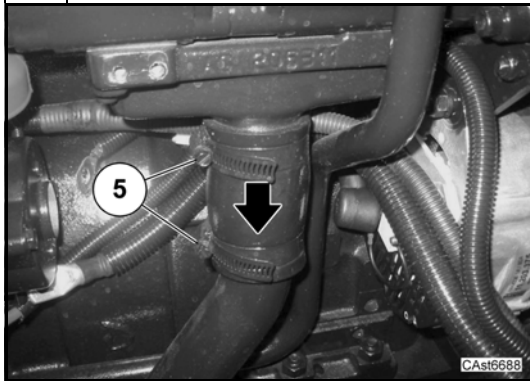
Disassemble pipe (12).

**NOTE:** Close all openings with caps and plugs.



# Disassembly and Assembly Operations

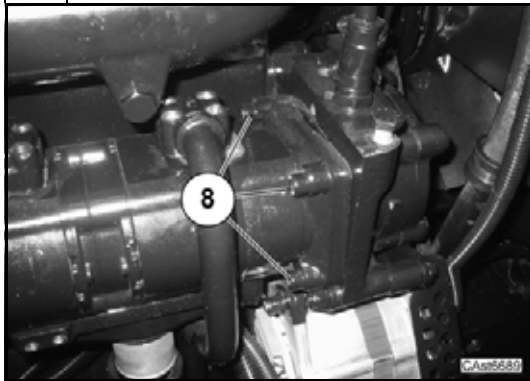
3.



Loosen the clamp (5).

**NOTE:** Close all openings with caps and plugs.

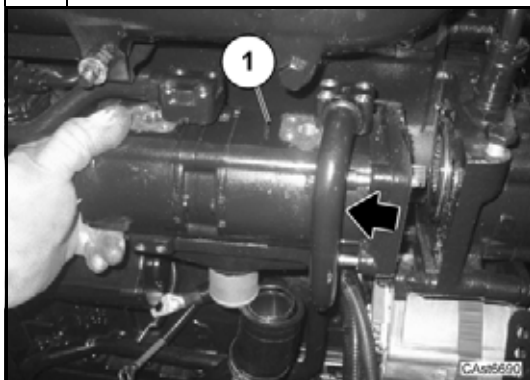
4.



Remove the four bolts (8).

**NOTE:** Close all openings with caps and plugs.

5.



Remove the hydraulic pump (1).

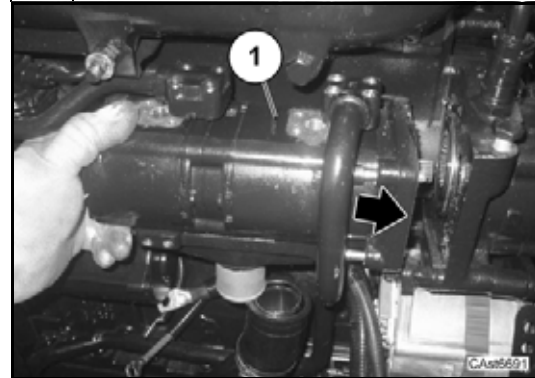
**NOTE:** Close all openings with caps and plugs.

**IMPORTANT:** Always use new O-Rings. Damaged or used O-Rings will leak.

## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

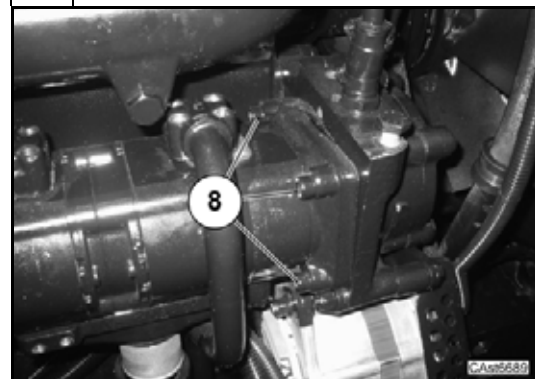
1.



Assemble hydraulic pump (1) on the engine.

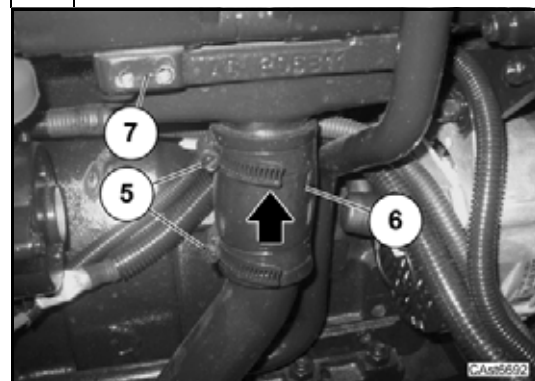
**IMPORTANT:** Always use new O-Rings. Damaged or used O-Rings will leak.

2.



Screw up bolts (8).

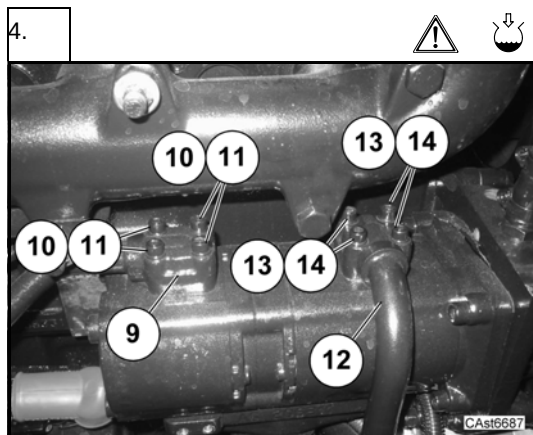
3.



Assemble sleeve (6) on manifold (7) and tighten the clamps (5).

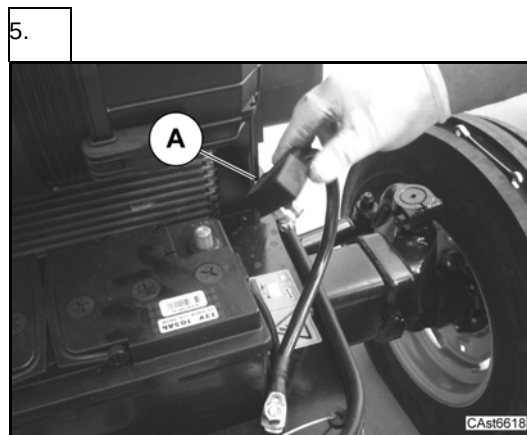
## Disassembly and Assembly Operations

---



Assemble pipes (9) and (12) on the hydraulic pump (1).  
Screw up washers (11) and bolts (10).  
Screw up washers (13) and bolts (14).

**IMPORTANT:** After the replacement, check the transmission oil level. Fill it if necessary.

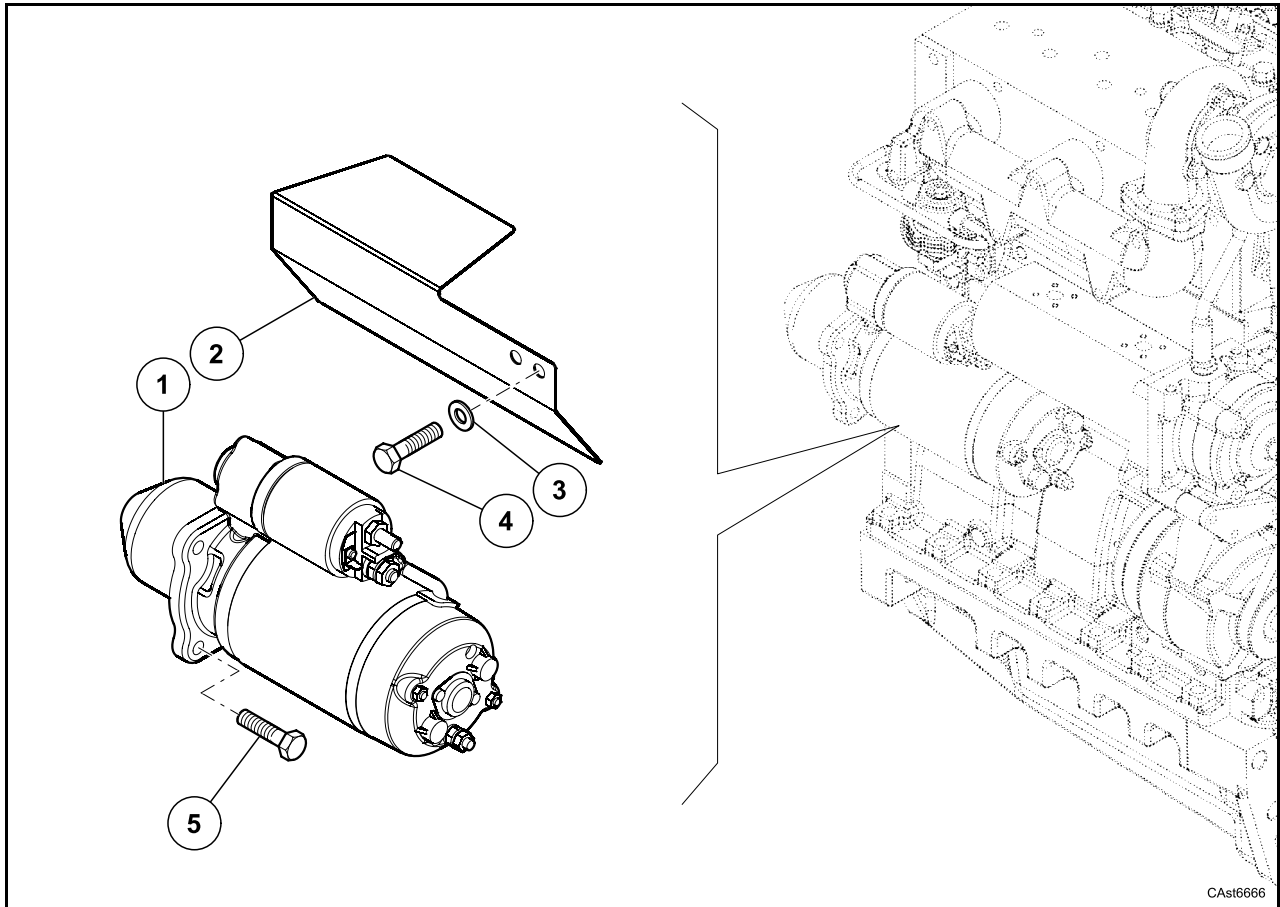


Connect cable (A) to battery negative pole.  
Close the rubber cap.



# Disassembly and Assembly Operations

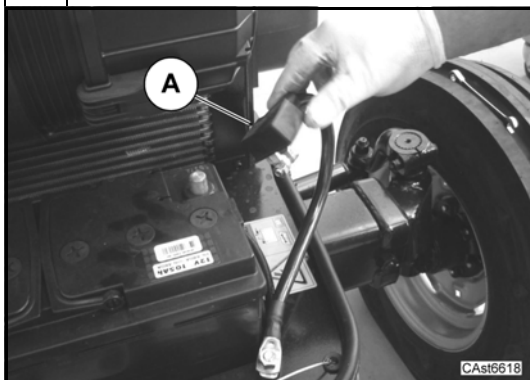
## STARTING MOTOR



### Disassembly

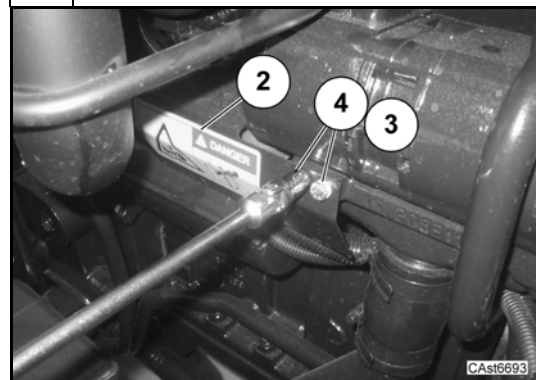
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Open the rubber cap and remove the negative (A) from the battery.

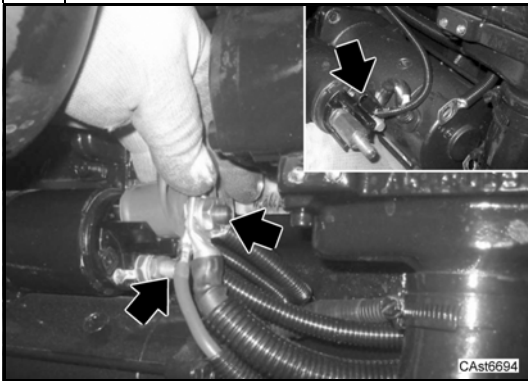
2.



Disassemble the starting motor protection (2) removing bolts (4) and washers (3).

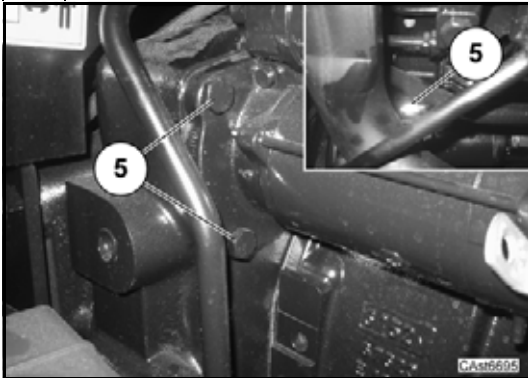
# Disassembly and Assembly Operations

3.



Remove all electrical connections.

4.

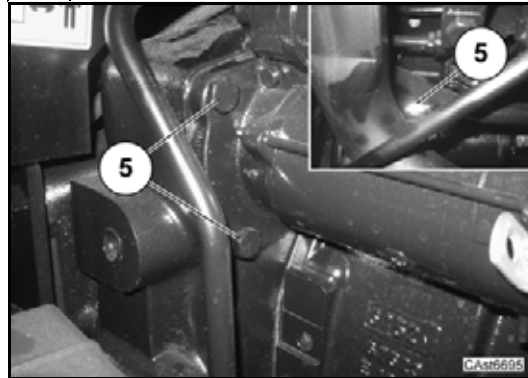


To remove the starting motor disassemble the bolts (5).

## Assembly

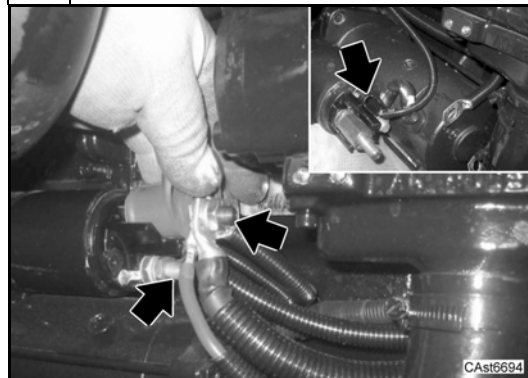
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Assemble the starting motor (1). Screw up bolts (5).

2.

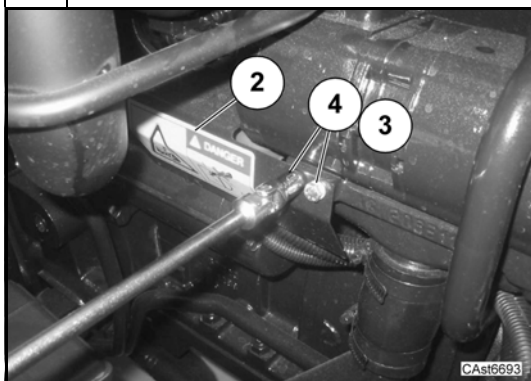


Restore electrical connections.

## Disassembly and Assembly Operations

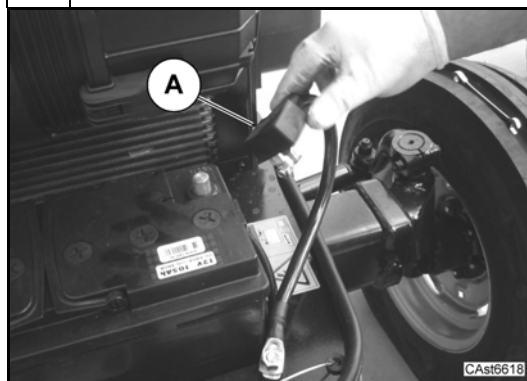
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3.



Assemble protection (2) of the starter motor and screw up washers (3) and bolts (4).

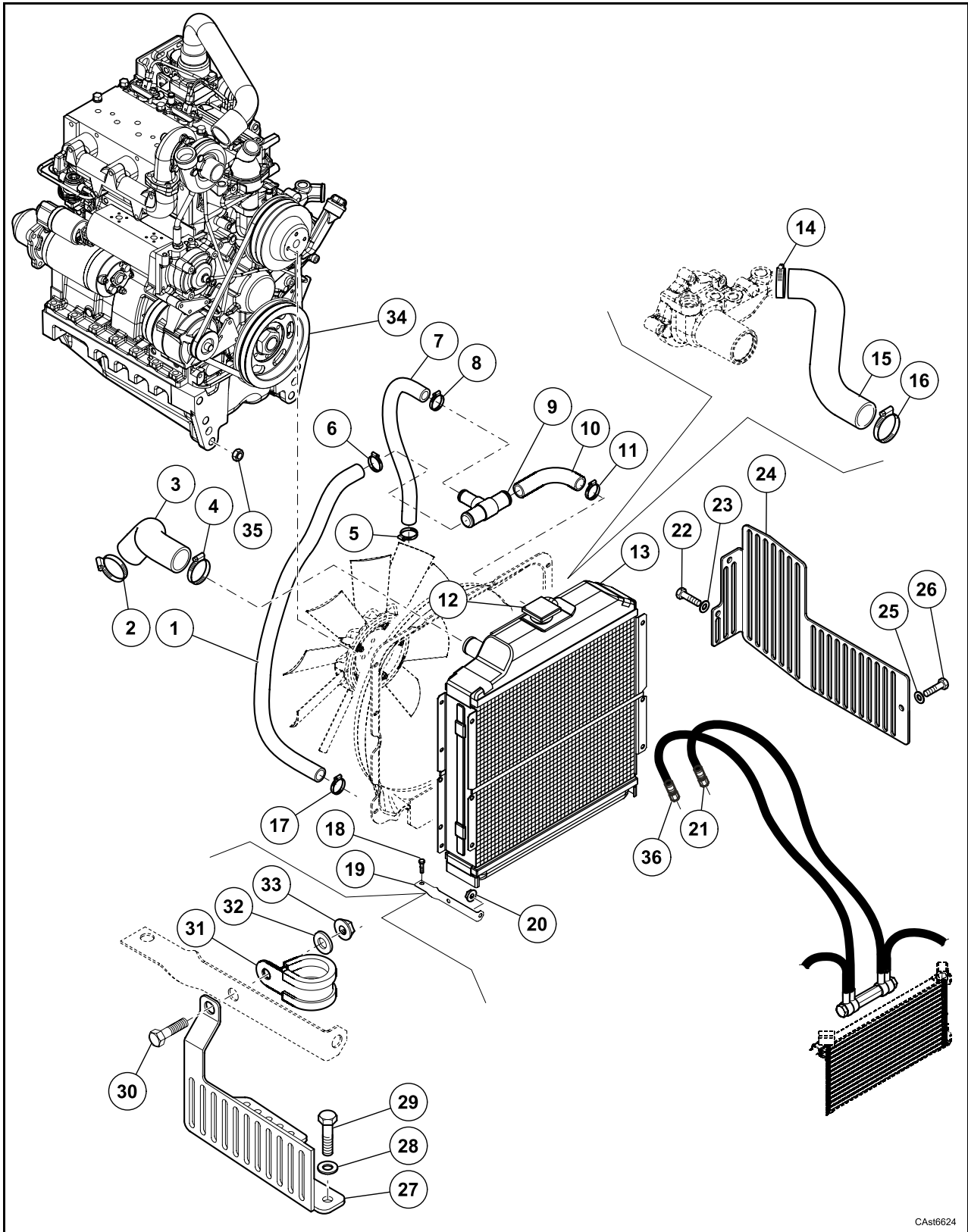
4.



Connect cable (A) to battery negative pole.  
Close the rubber cap.

# Disassembly and Assembly Operations

## ENGINE REMOVAL

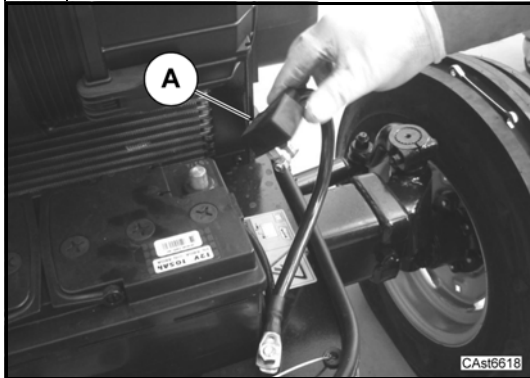


# Disassembly and Assembly Operations

## Disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.

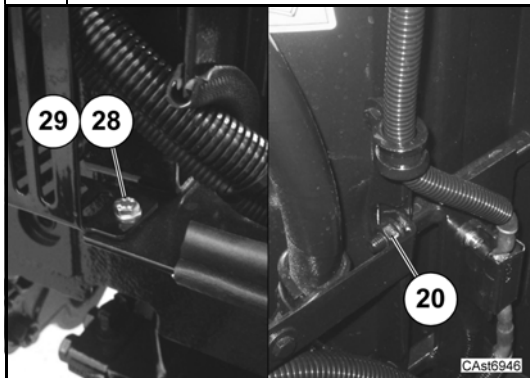


Apply hand brake.

Open the rubber cap and remove the negative (A) from the battery.

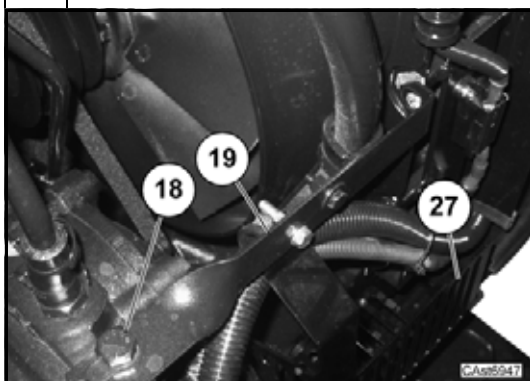
Remove the bonnet and the 4WD transmission shaft (is fitted).

2.



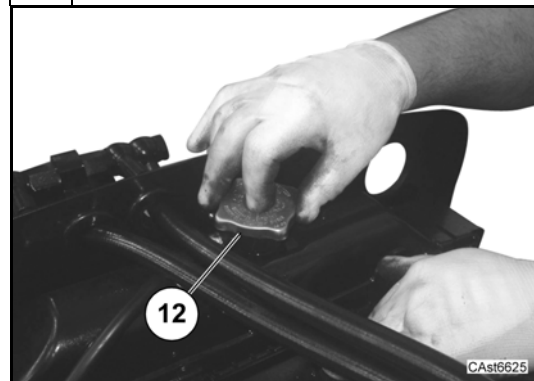
Remove bolt (29) and washer (28). Unscrew the nut (20).

3.



Unscrew bolt (18) and remove the right protections (27) and (19).

4.



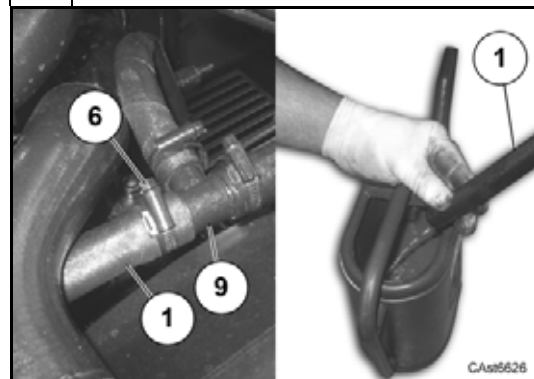
Loosen and remove radiator cap (12).



## Warning

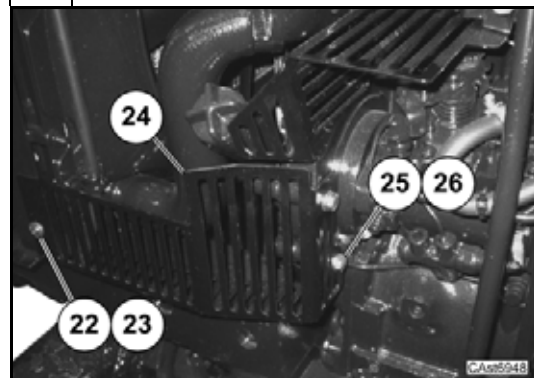
**If the engine is hot, gradually loosen the cap and remove it in order to release the pressure from the circuit.**

5.



Loosen the clamp (6) and drain the liquid into a clean container through the hose (1).

6.



Unscrew the bolt (22) and washer (23).

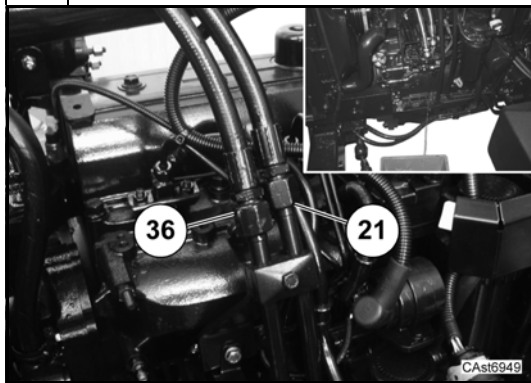
Unscrew the bolts (26) and washers (25).

Remove the left protection (24).



# Disassembly and Assembly Operations

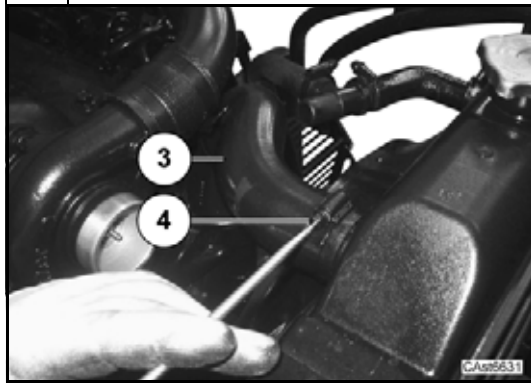
7.



Place a suitable and clean container under the tractor to collect oil (if present).

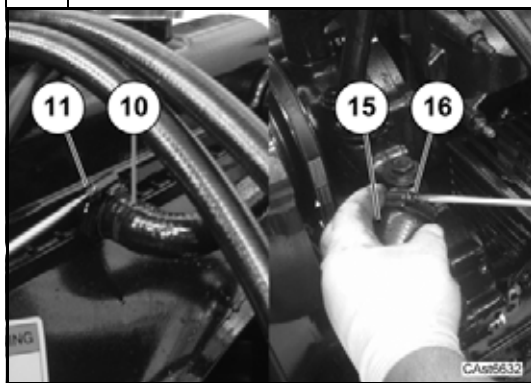
Disconnect the hydraulic oil lines (36) and (21).

8.



Loosen clamp (4) and remove the sleeve (3).

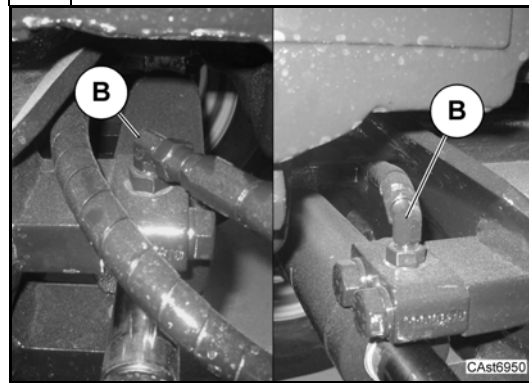
9.



Loosen clamp (11) and remove hose (10).

Loosen clamp (16) and remove hose (15).

10.

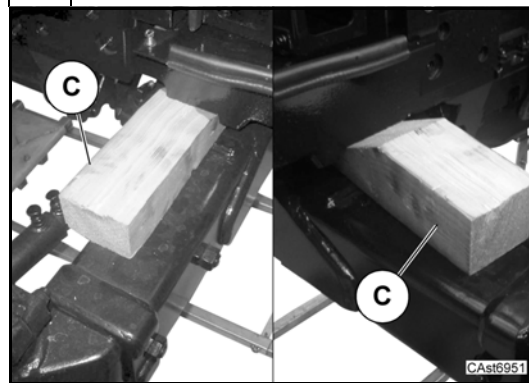


Place a suitable and clean container under the tractor to collect oil.

Loosen the connection (B) to the cylinder on the front axle.

Refer to: section D.17.

11.

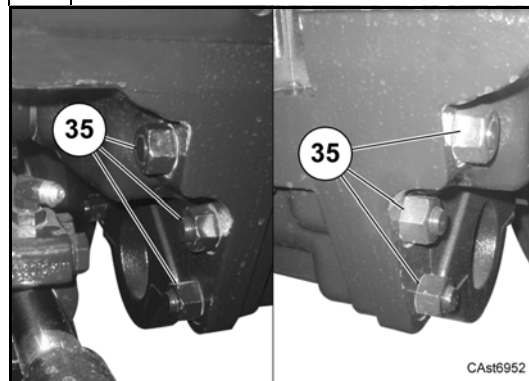


Prevent oscillation by inserting suitable wedges on either side of the frame.

Chock the rear wheels.

Install a mobile stand under the tractor.

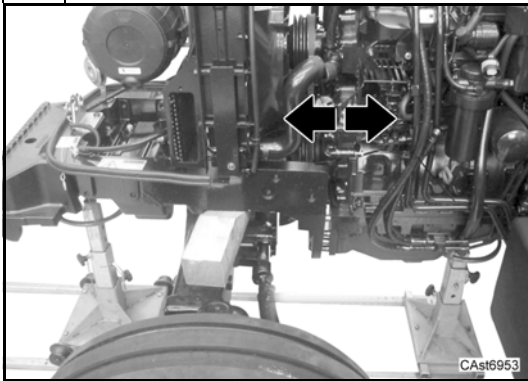
12.



Remove the six nuts (35).

# Disassembly and Assembly Operations

13.



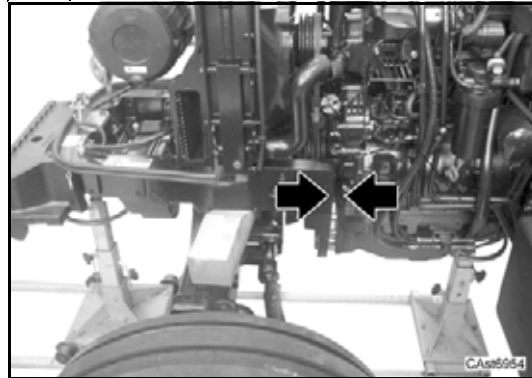
Split the engine from the front frame (with the help of an operator).

**IMPORTANT:** When disassembling, check that connections (hoses, pipes and harnesses) are all disconnected.

## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.

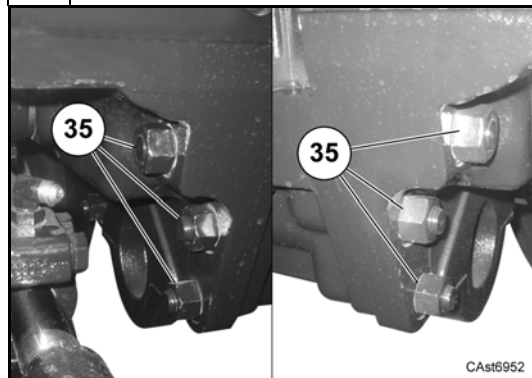


**IMPORTANT:** Before starting the assembly procedure, clean the mating faces of the engine and front frame.

With the help of an operator, assemble the front frame onto the engine.

Remove the guide studs.

2.



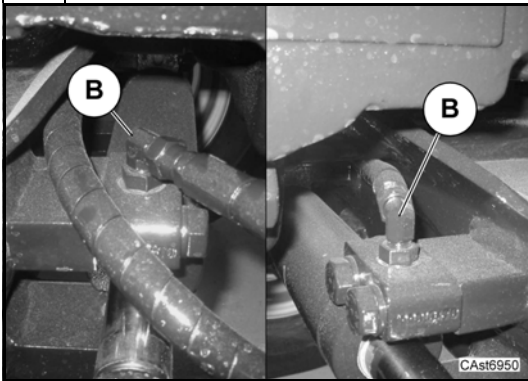
Assemble and tighten the nuts (35) to the specified torque:

Nuts (35) = 350 Nm (258.14 lb·ft)



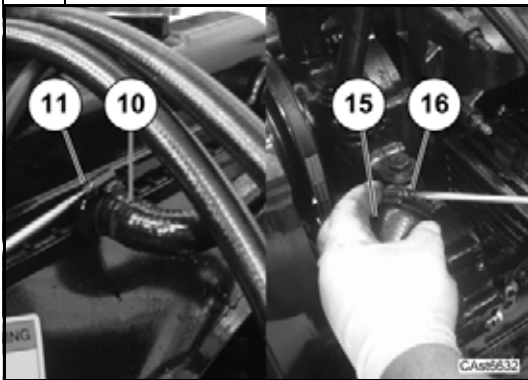
# Disassembly and Assembly Operations

3.



Connect the hydraulic hoses (B) to the cylinder.  
Refer to: section D.17.

4.



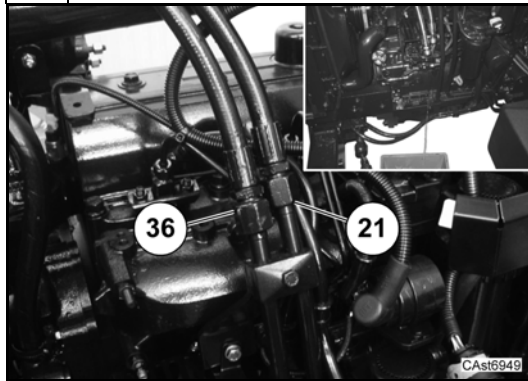
Assemble hose (10) and tighten clamp (11).  
Assemble hose (15) and tighten clamp (16).

5.



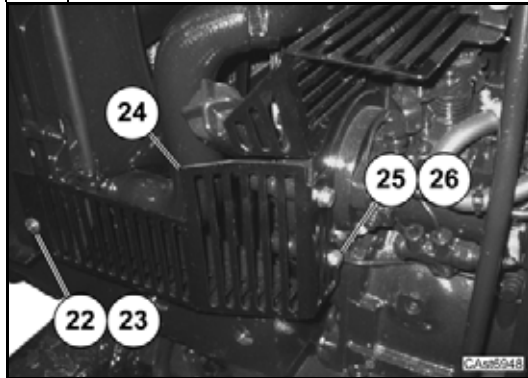
Assemble hose (3) and tighten the clamp (4).

6.



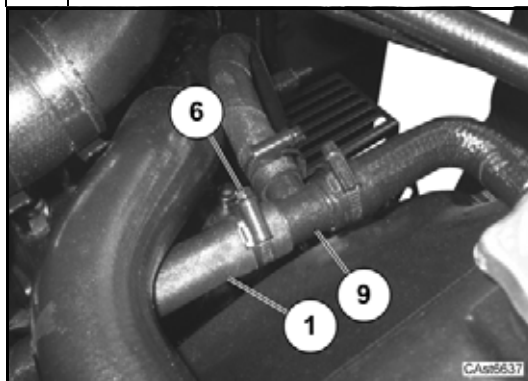
Connect hose (36) and (21).

7.



Assemble left protection (24).  
Screw up bolts (26) and washers (25).  
Screw up bolt (22) and washer (23).

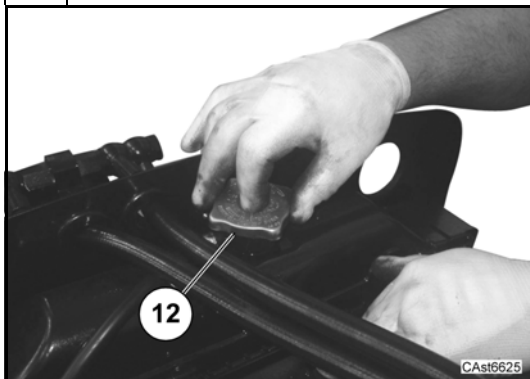
8.



Assemble hose (1) on connector (9).  
Tighten clamp (6).

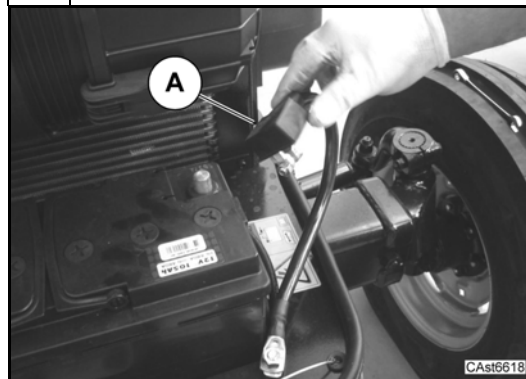
## Disassembly and Assembly Operations

9.



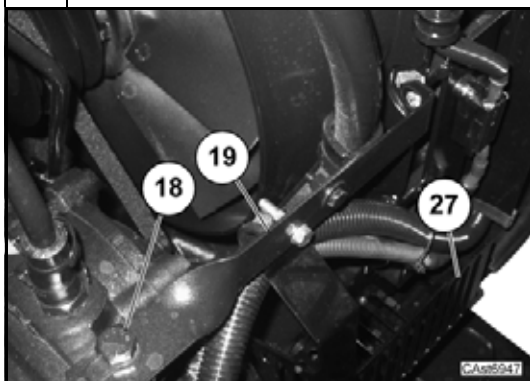
Fill radiator (see section D.05) and close cap (12).

12.



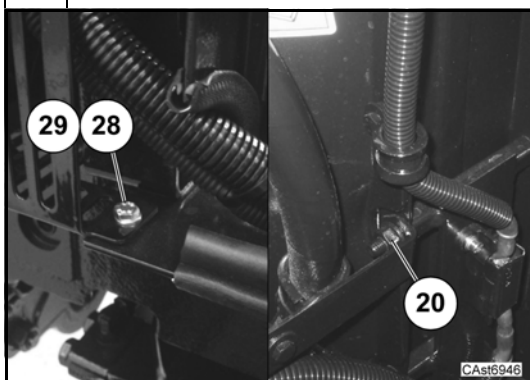
Connect cable (A) to battery negative pole.  
Close the rubber cap.

10.



Assemble right protections (27) and (19).  
Screw up bolt (18).

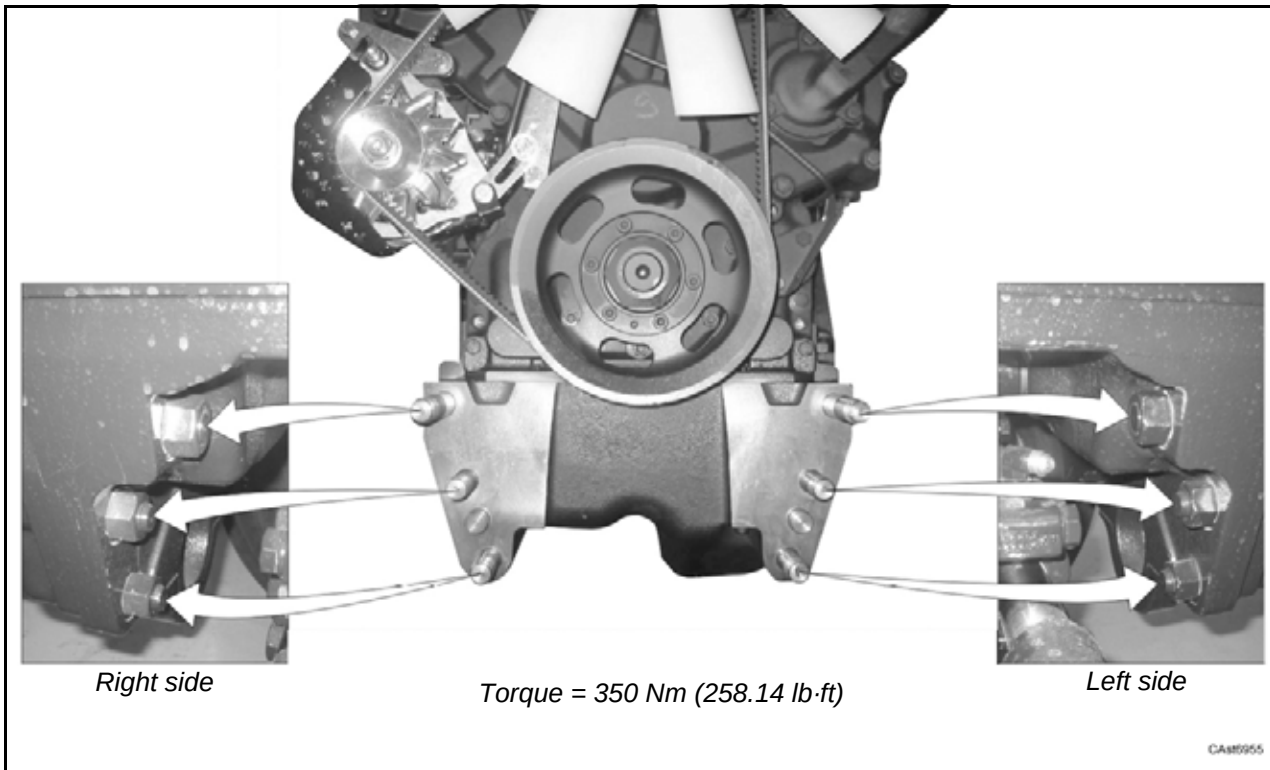
11.



Screw up nut (20).  
Assemble washer (28) and screw up bolt (29).

# Disassembly and Assembly Operations

## Front frame fitting nuts location



## Final operations

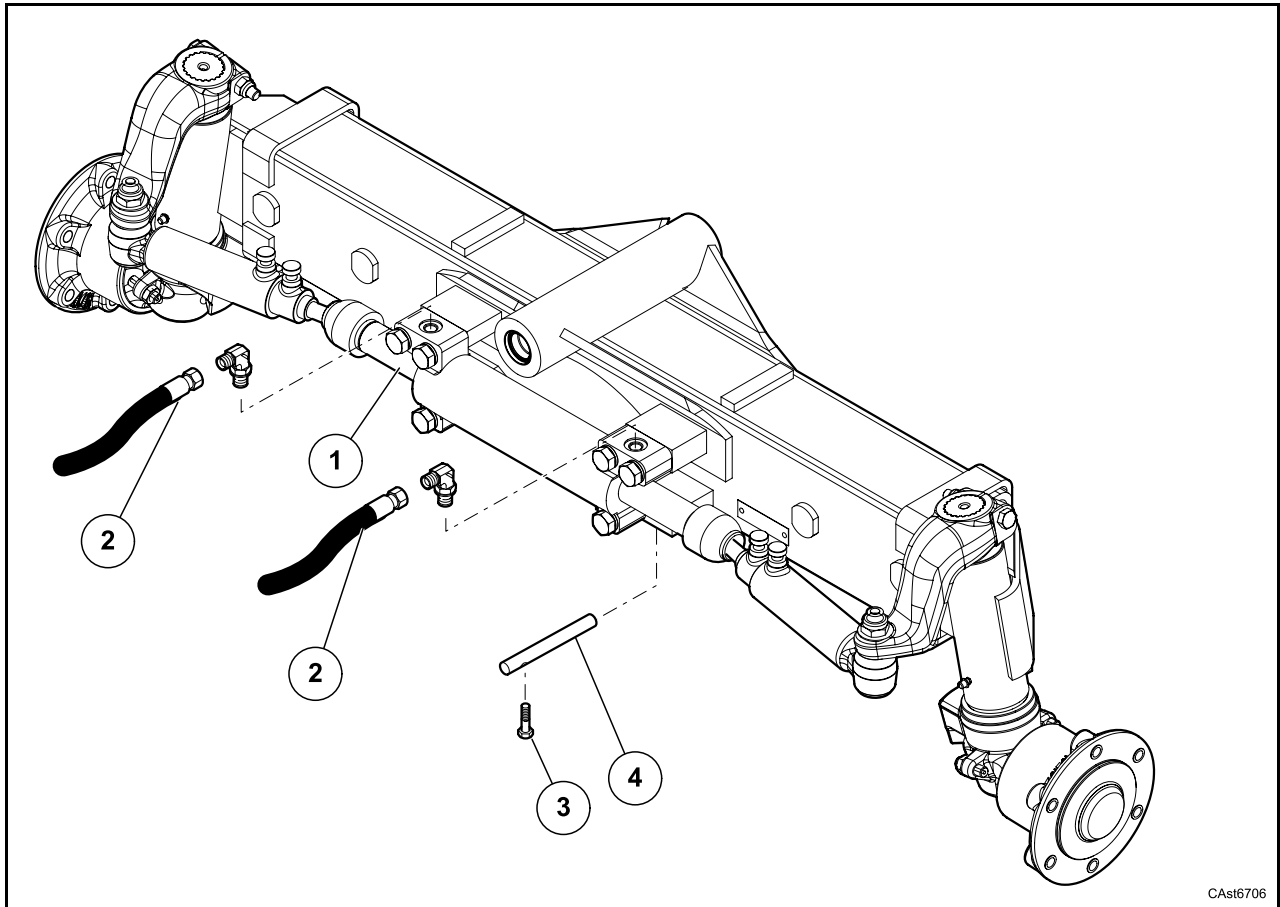
Final operations are not especially difficult.

However, it will be necessary during reassembly to carry out the following tightening torques, adjustments and test:

- Tightening torques  
As required, wheel screws or nuts.
- Topping up  
Of coolant, to maximum level.
- Tests:
  - of the air conditioning system (if fitted)
  - of all mechanical, hydraulic and electrical functions concerned by servicing.
- Check tightness:
  - of hydraulic connectors
  - of water hoses.

# Disassembly and Assembly Operations

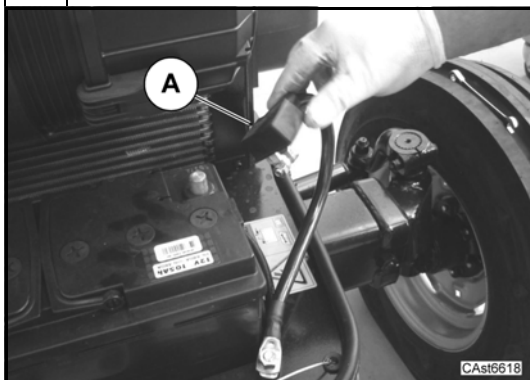
## FRONT AXLE 2WD



### Disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

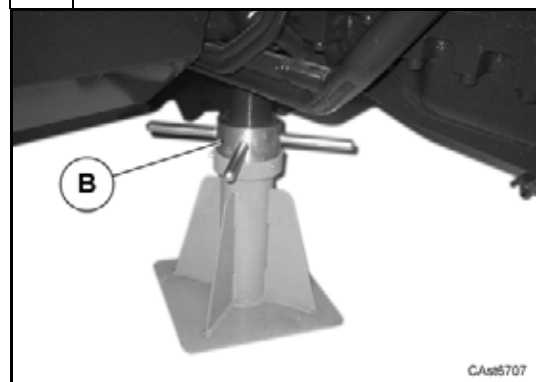
1.



Open the bonnet and disconnect the negative (A) from the battery.

Apply hand brake.

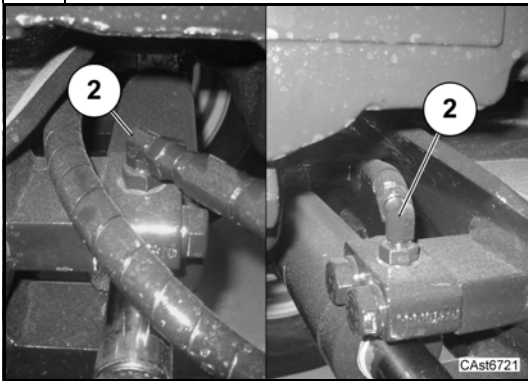
2.



Install floor jacks (B) under the front of clutch box.  
Raise front of tractor and remove front wheels.

# Disassembly and Assembly Operations

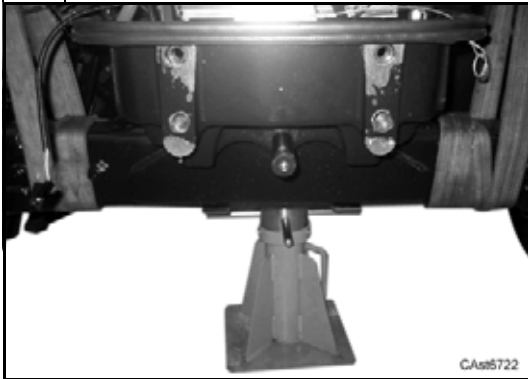
3.



Place a suitable container to collect oil and disconnect hydraulic lines (2) from both ends of steering cylinder.

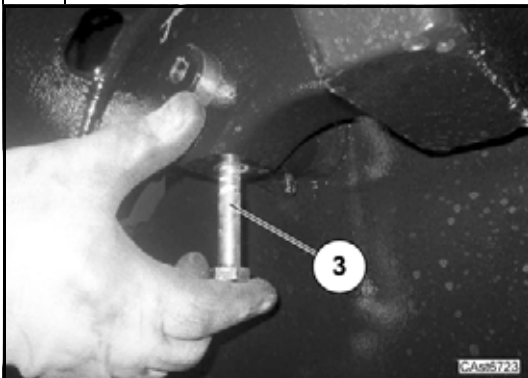
Close all openings with caps and plugs.

4.



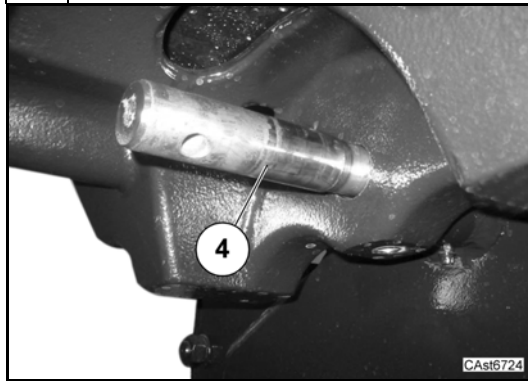
Attach the front axle to a suitable hoist as shown in the picture (in alternative place a floor jack under centre of axle).

5.



Remove bolt (3).

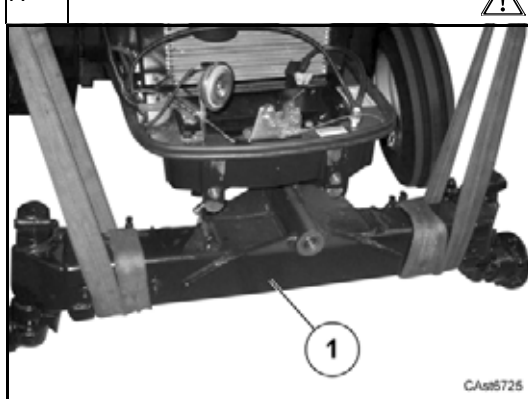
6.



Remove pivot pin (4).

**NOTE:** To remove the pivot pin, it's necessary to dismount the front weight (see section D11).

7.



Remove front axle (1).

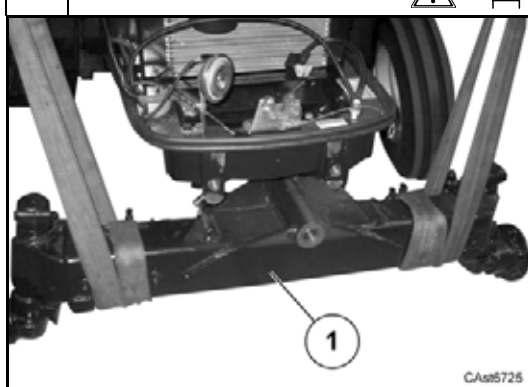
Check front axle for wear or damages

Repair/replace parts if necessary.

## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.

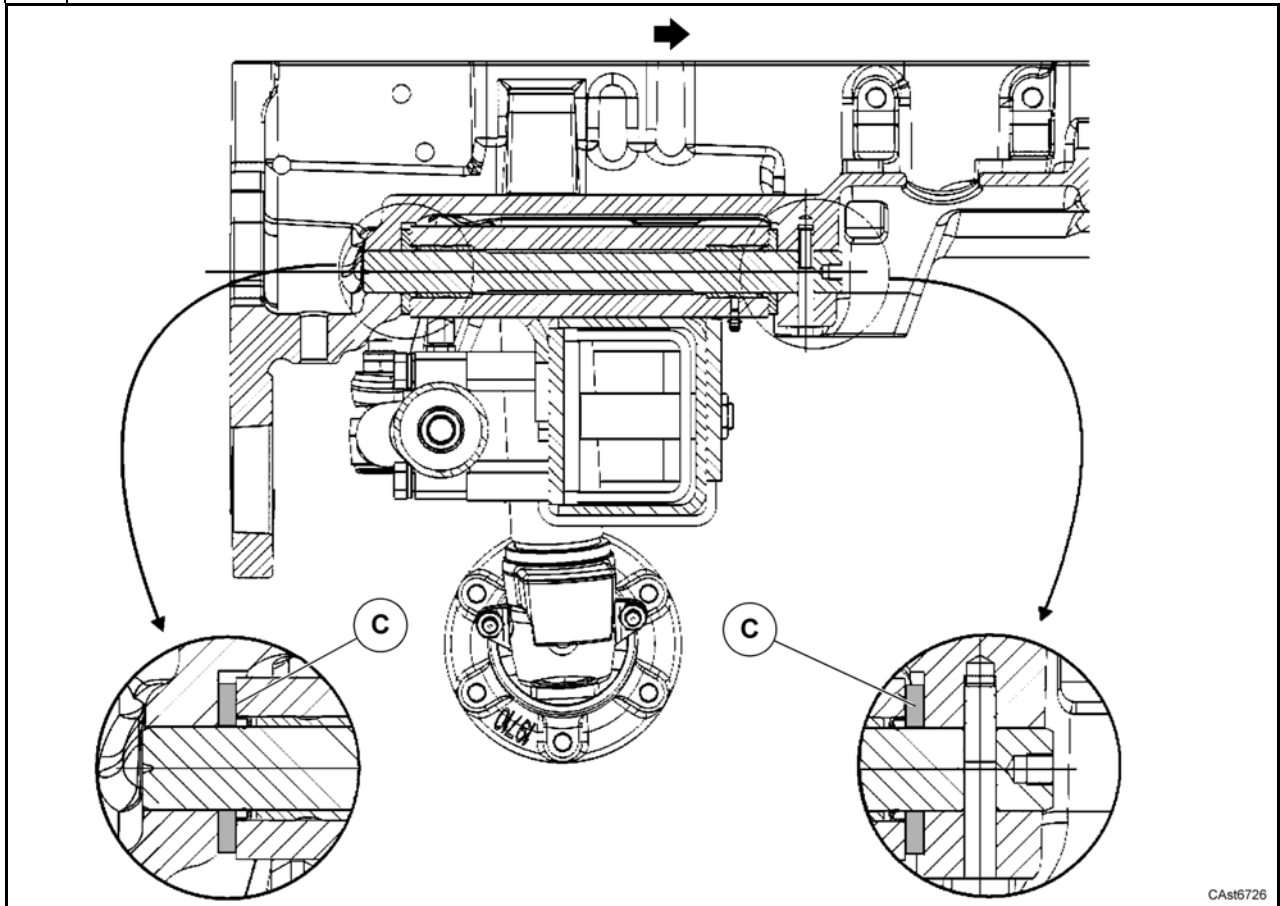




# Disassembly and Assembly Operations

Lift front axle (1) to align the axle hole with the pivot pin hole.

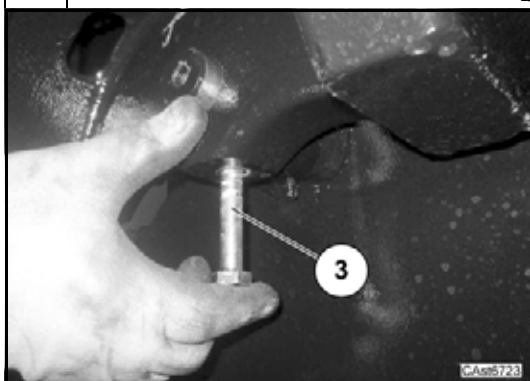
2.



CAst6726

Install the two spacers (C) as shown on the drawing.

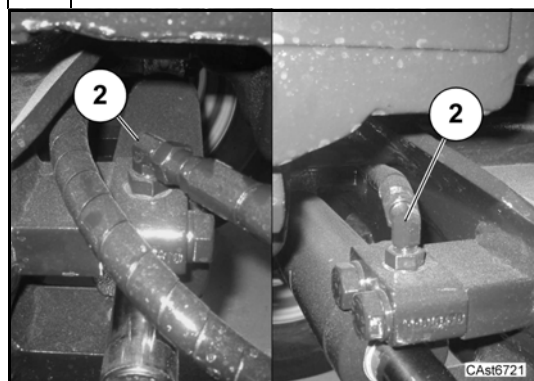
3.



Assemble bolt (3).

Torque wrench 80 Nm (59 lb-ft).

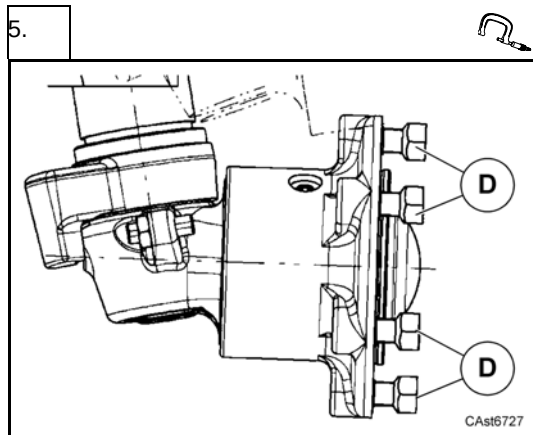
4.



Connect the hydraulic hoses (2) to the cylinder.



# Disassembly and Assembly Operations

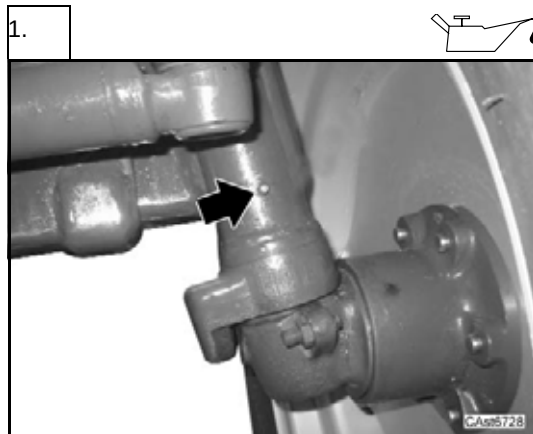


Install front wheels and tighten bolts (D).

Torque wrench 175 Nm (129.07 lb·ft)

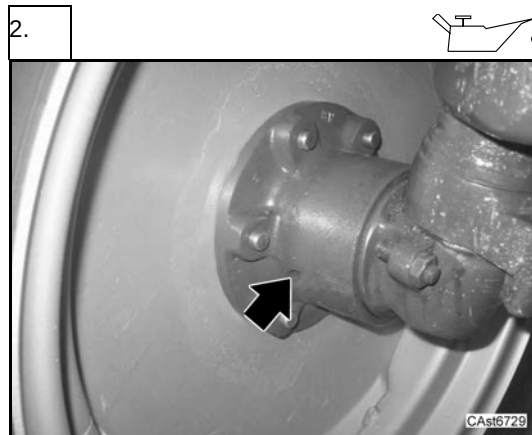
## 2WD front axle lubrication points

Lubricate front axle with multipurpose grease.



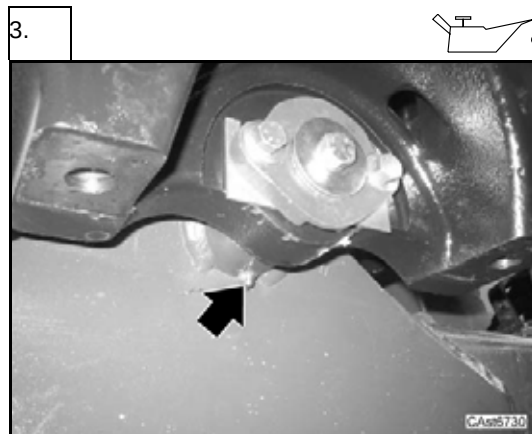
2WD spindle bushing.

Apply several shots of grease.



2WD axle hub.

Apply several shots of grease.

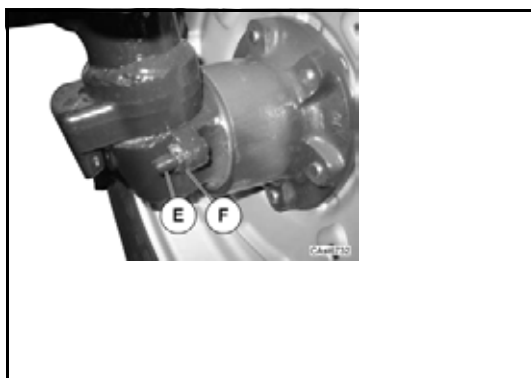
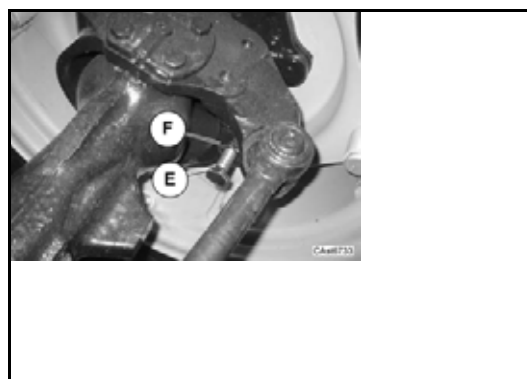
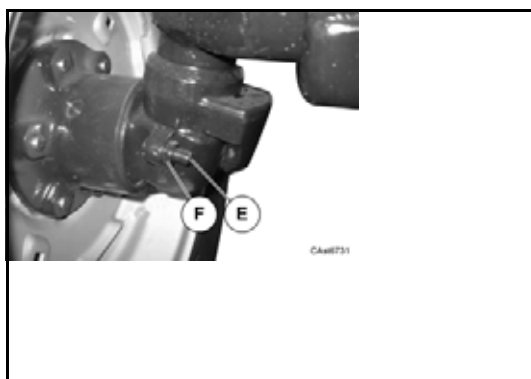


Axle pivots.

Apply several shots of grease.

Adjustment of steering angle

## Disassembly and Assembly Operations



When the front axle is in the condition of maximum oscillation and the wheels are turned to the maximum steering angle, there must be no interference between the tyres or wings and the engine bonnet. If necessary, adjust the internal angle by way of the steering stops (E). Make sure that bolts on each carrier are adjusted to contact at same time.

Adjust stops to limit travel in full right and full left turn.

**IMPORTANT:** *At the smaller track settings, an interference condition may occur between the tyres and the tractor or loader, if fitted, when the wheels are turned to the full lock position. To avoid this condition you must check by turning the wheels to full lock and adjusting the steering stops as necessary.*

1. Place the jack under the oil sump and raise the tractor enough to allow the axle to swing from one stop to the other.
2. Turn the front wheels to full lock and check that the inside edge of the tyre does not foul the tractor.
3. Carry out the same check on the other lock.
4. If necessary, adjust the length of the steering stops (E) on both sides so that a foul condition will not occur.
5. Tighten the lock-nuts (F) after adjustment.

### Specification

Front axle without front-wheel drive:

Torque 56 Nm (41.30 lb·ft)

Front axle with front-wheel drive:

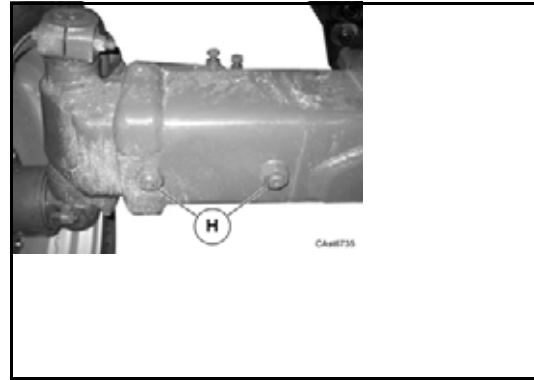
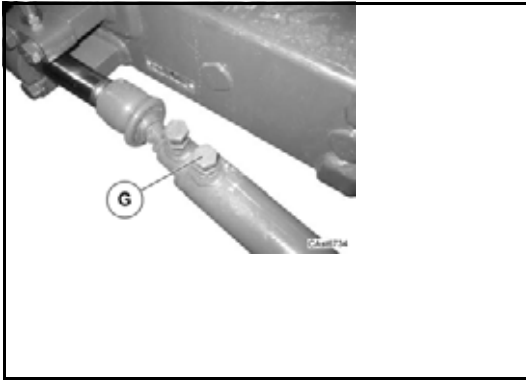
Torque 125 Nm (92.19 lb·ft)

6. Repeat this procedure on the left side.

# Disassembly and Assembly Operations

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## Adjusting the tracks



Track adjustment lets you adapt the tractor to suit specific requirements of various crops.

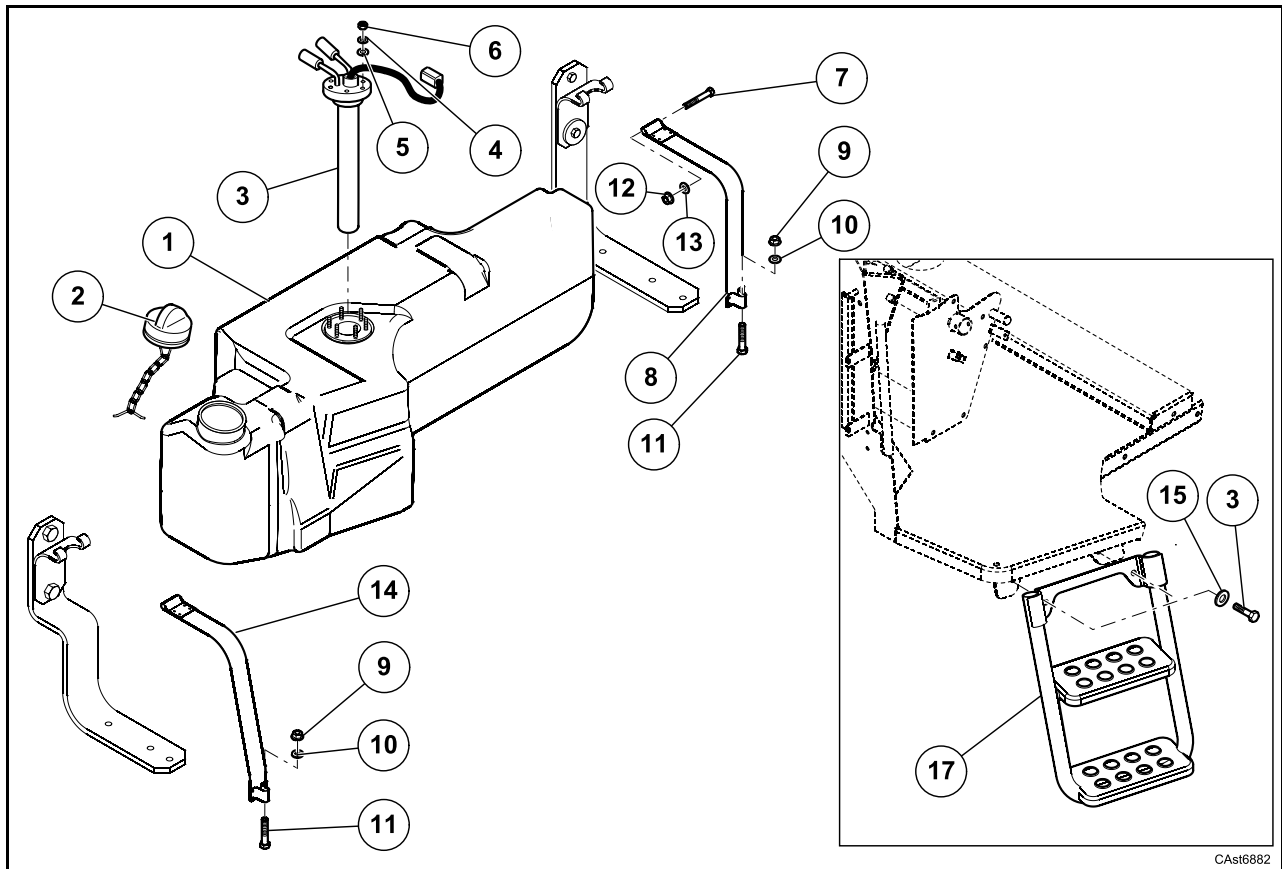
### *Front Track (two wheel drive model)*

To adjust the track you need to:

- Unscrew the nuts (G and H) fastening the wheel coupling rod, the bolts fastening the retracting ends of the axle, and steering cylinder pin.
- Slide the retracting ends into the axle housing until you obtain the required track and clamp the bolts.
- Then adjust the length of the wheel rod.
- Correctly locate the cylinder pin on the axle housing.
- The tread width can be adjusted in steps of 100 mm (3.94 inch), 50 mm (1.97 inch) on each side, to the ranges shown.

# Disassembly and Assembly Operations

## FUEL TANK

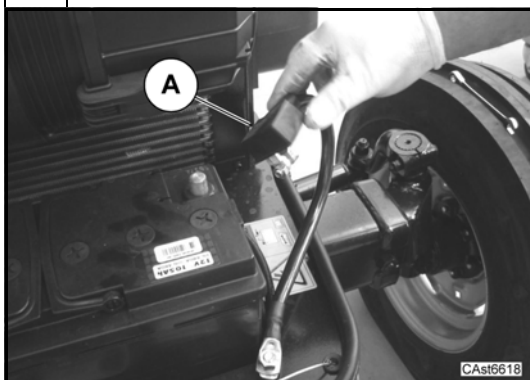


CAst6882

### Disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

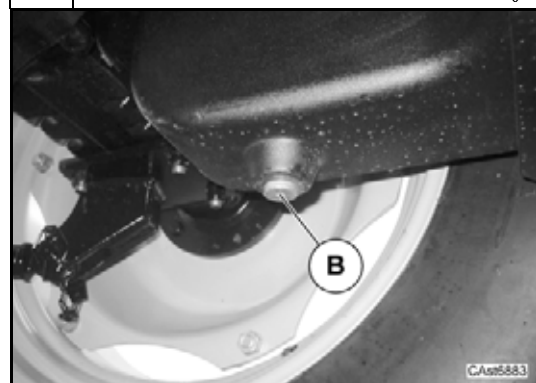
1.



Open the rubber cap and remove the negative (A) from the battery.

Apply hand brake.

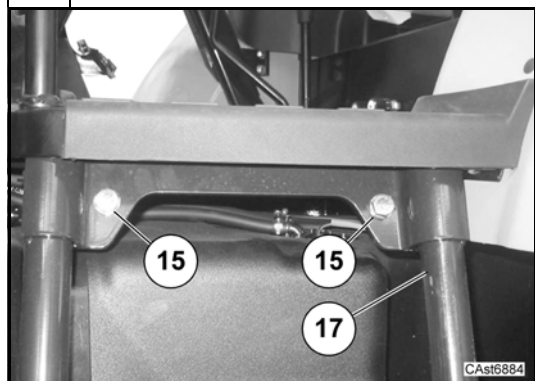
2.



Place a clean and suitable container under the fuel tank. Remove the fuel tank draining plug (B) and drain all fuel.

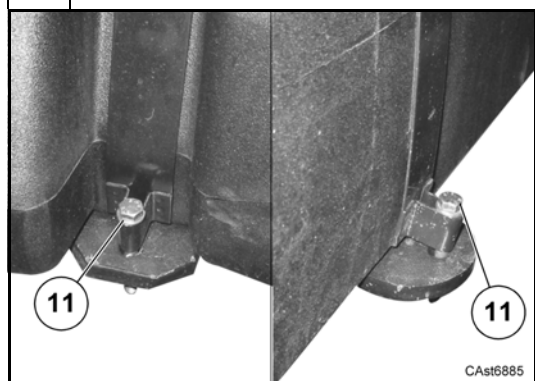
## Disassembly and Assembly Operations

3.



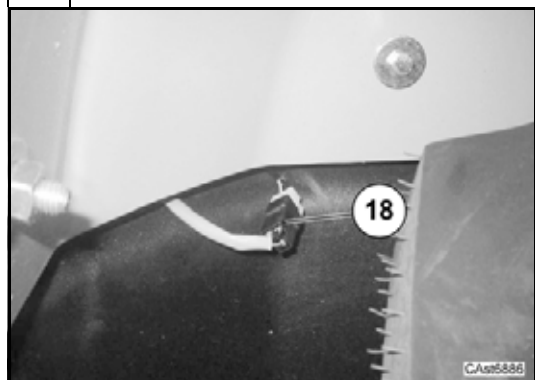
Remove bolts (16) and washers (15) to take off the left step (17).

4.



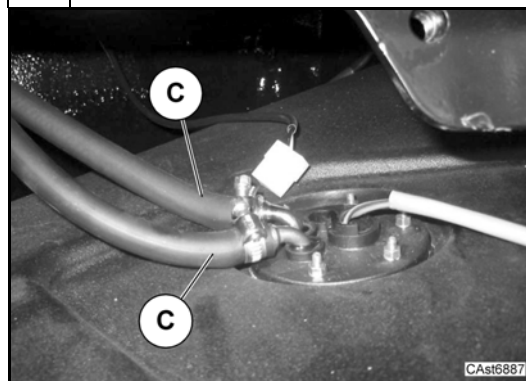
Loose and remove bolts (11).

5.



Disconnect fuel level sensor connector (18).

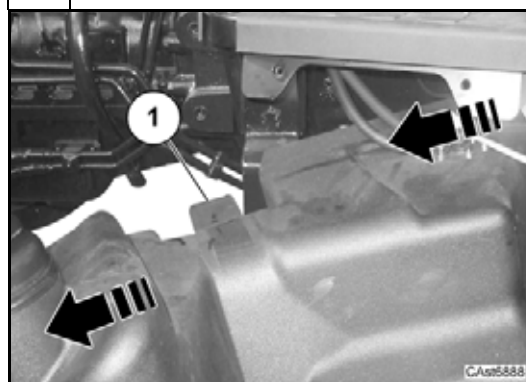
6.



Disconnect fuel lines (C) from the fuel level sensor.

**IMPORTANT:** Close all openings with caps and plugs.

7.



Remove the fuel tank (1).

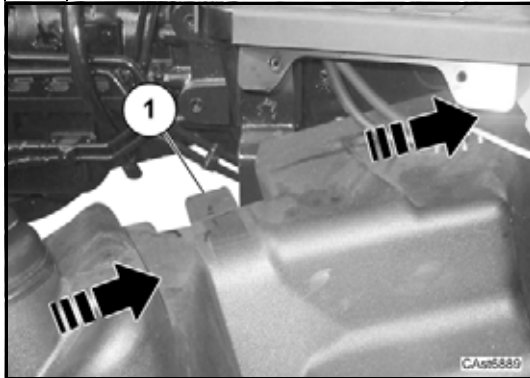
Check the fuel tank for wear or damage. Replace it if necessary.

# Disassembly and Assembly Operations

## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

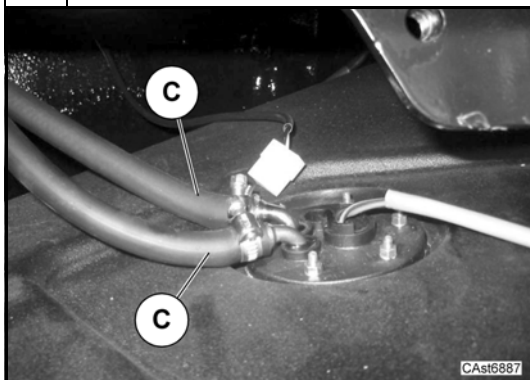
1.



Wash the fuel tank before reassembly.

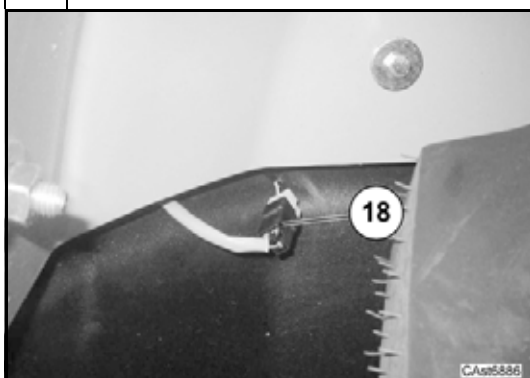
Assemble the fuel tank (1).

2.



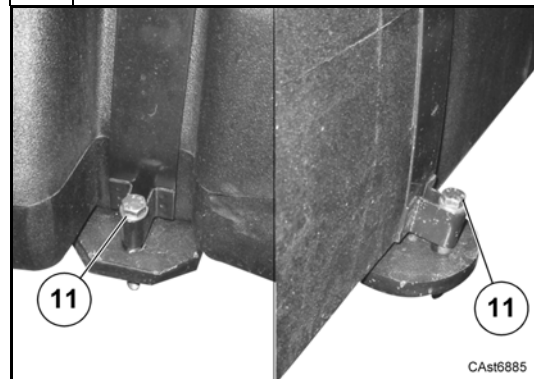
Connect the fuel lines (C) to the fuel level sensor.

3.



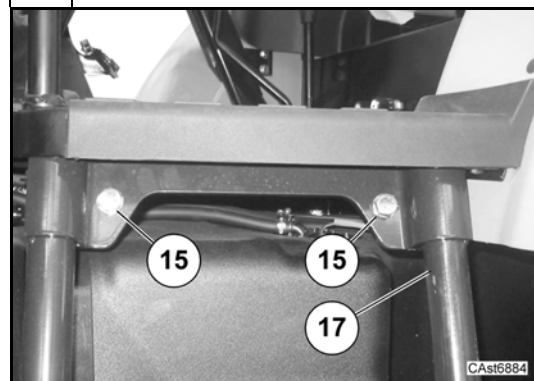
Connect fuel level sensor connector (18).

4.



Reassemble the fuel tank and tighten bolts (11).

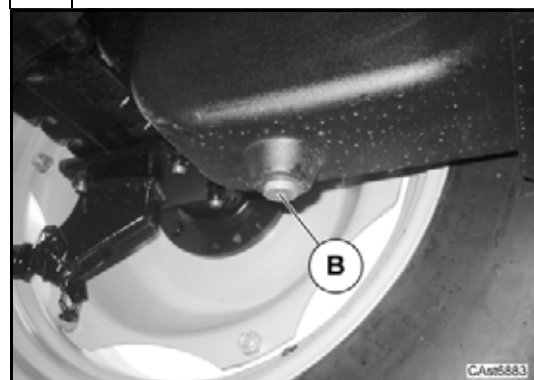
5.



Assemble the left step (17) end.

Screw up washers (15) and bolts (16).

6.

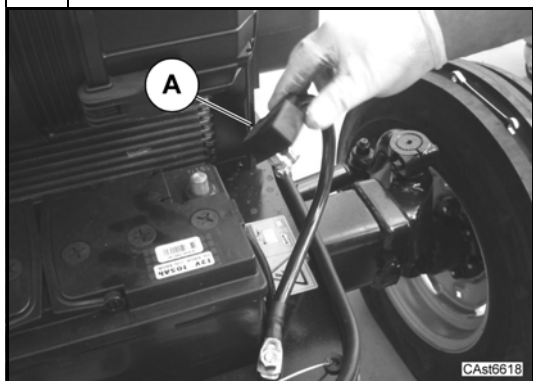


Reassemble draining plug (B).



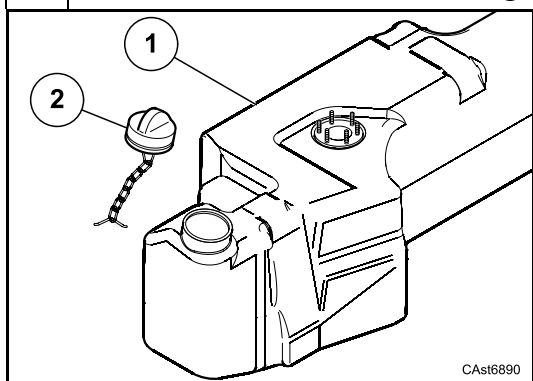
# Disassembly and Assembly Operations

7.



Connect cable (A) to battery negative pole.  
Close the rubber cap.

8.



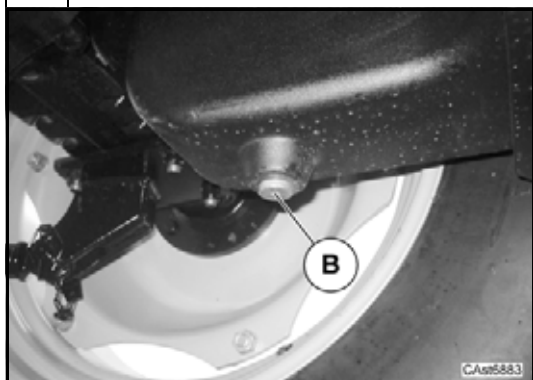
Fill fuel tank with fuel.

## FUEL CAPACITY

Cab/Platform tractors: 108 l (28.53 US gal)

Footstep tractors: 83 l (21.92 US gal)

9.



Fuel tank: drain residue.

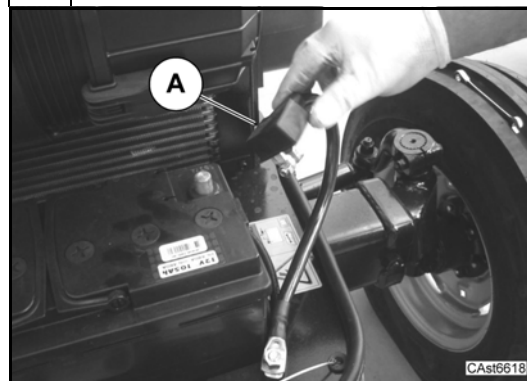
Drain the fuel tank from water and sediment removing the plug (B) located under the tank at rear.

**IMPORTANT:** Before removing plug (B), place a suitable container under the tank to collect drainage.

## Fuel level sensor disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

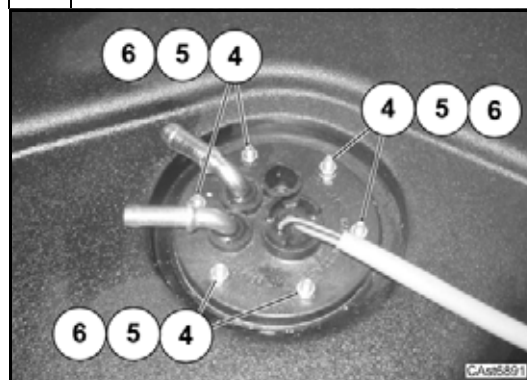
1.



Open the rubber cap and remove the negative (A) from the battery.

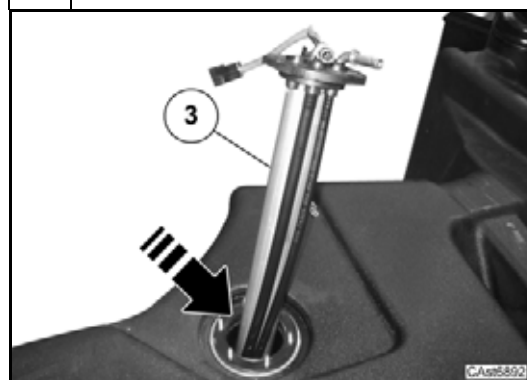
Apply hand brake.

2.



Remove nuts (6), washers (4) and (5).

3.



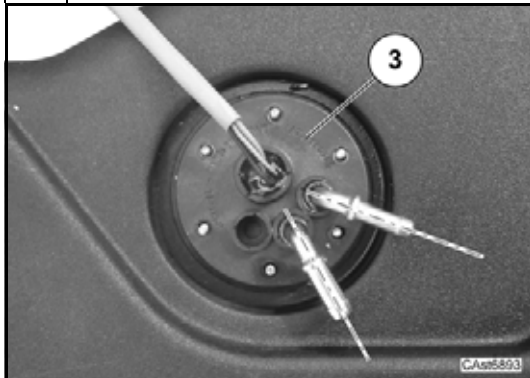
Remove and inspect the fuel level sensor (3) and the relevant gasket.

Replace parts if necessary.

# Disassembly and Assembly Operations

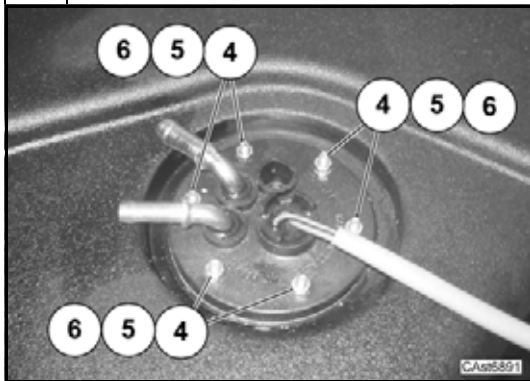
## Fuel level sensor assembly

1.



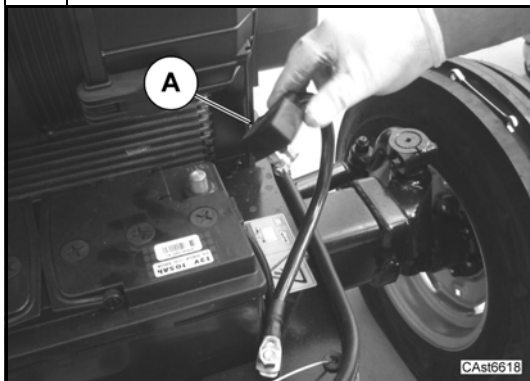
Assemble the fuel level sensor (3).

2.



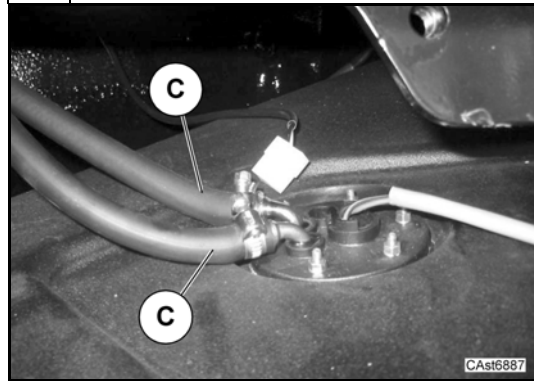
Assemble the washers (4) and (5). Screw up nuts (6).

3.



Connect cable (A) to battery negative pole. Close the rubber cap.

4.

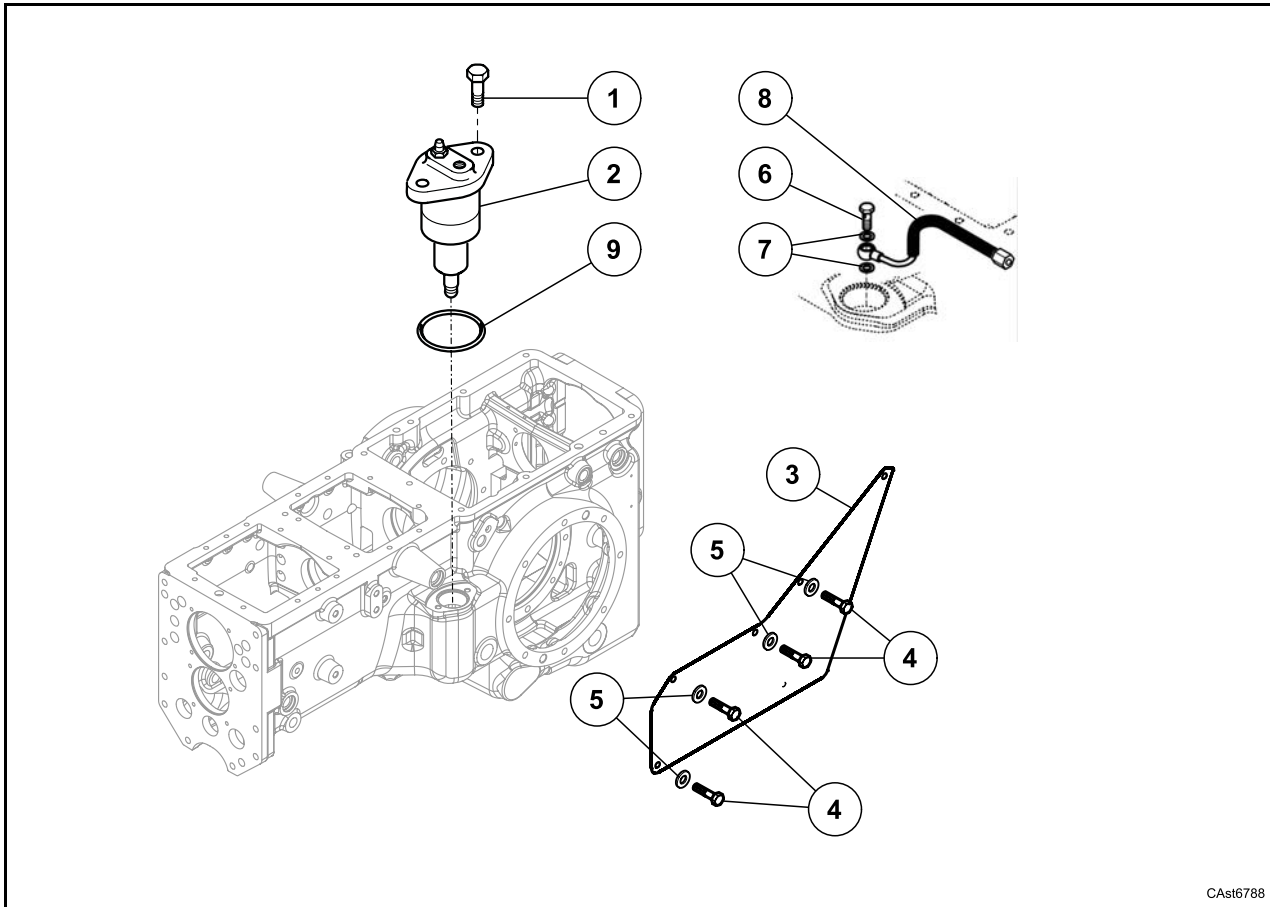


Check that the fuel level sensor indicates the correct amount in the fuel tank.

Check the correct connection between fuel lines (C) and fuel level sensor.

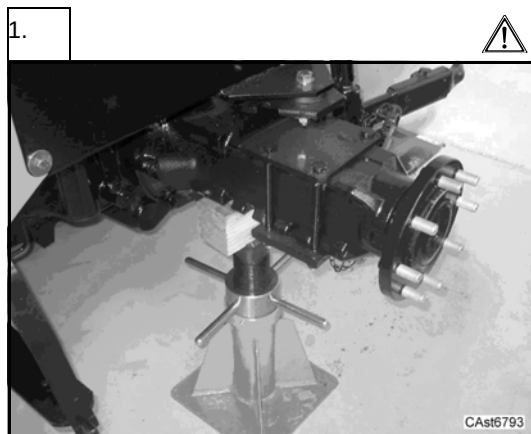
# Disassembly and Assembly Operations

## BRAKE CYLINDER



### Disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.



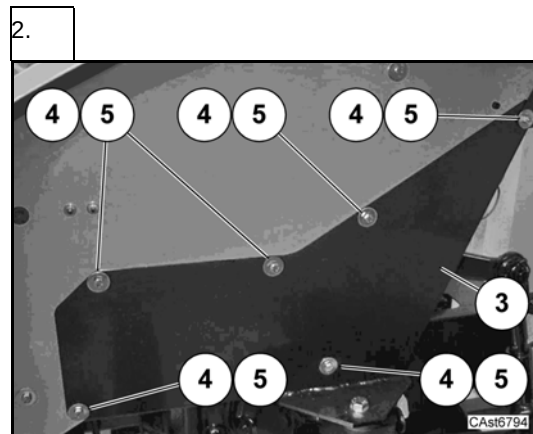
Apply hand brake

Chock the front wheels.

Support axle beams using suitable supports.

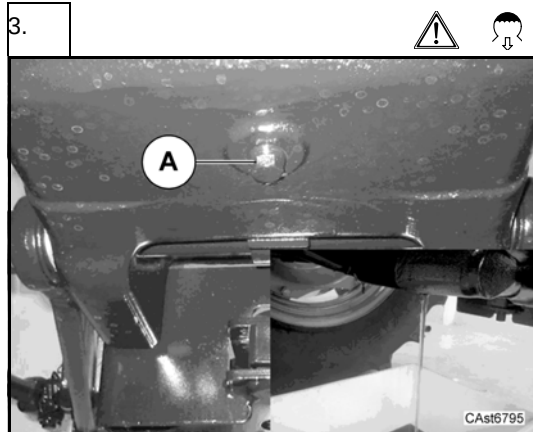
Remove rear wheel bolts and take away rear wheels.

Refer to: section D.23.



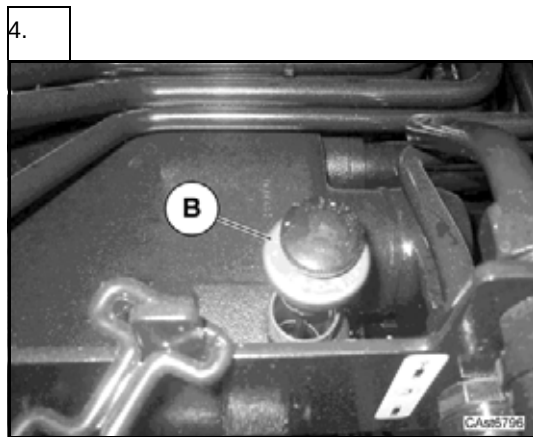
Remove the six bolts (4) and the six washer (5) and remove the panel (3) on both sides.

# Disassembly and Assembly Operations

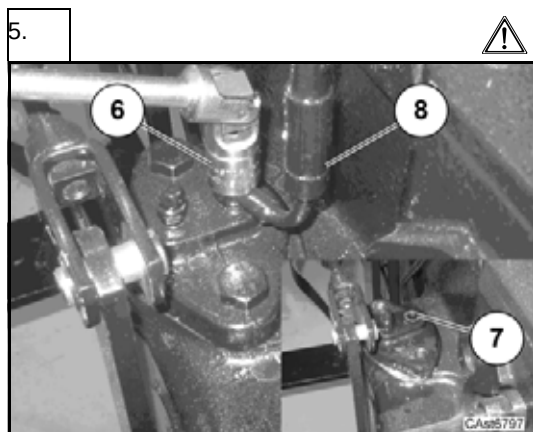


Place a clean and suitable container.

Remove the draining plug (A) and drain all of the oil from the transmission.

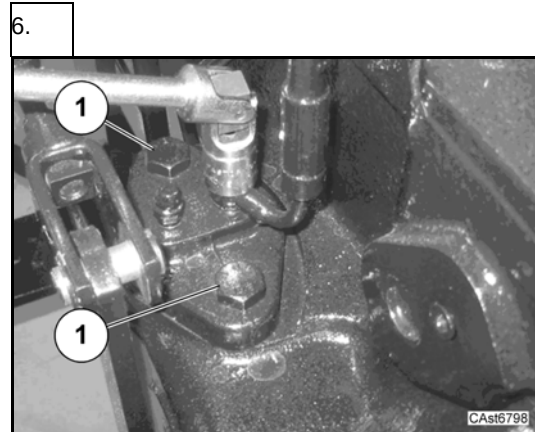


For a faster draining of oil remove the oil dipstick (B) from the upper side of the rockshaft.

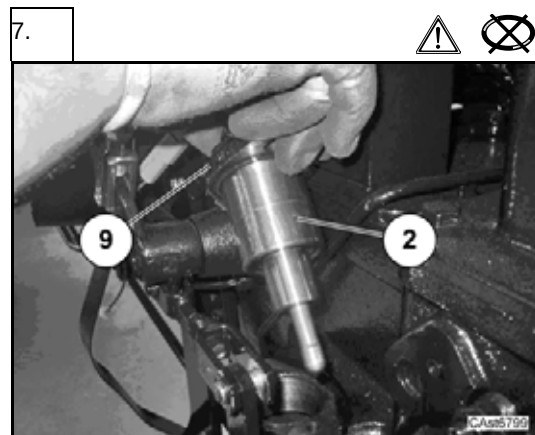


Remove bored screw (6) and the hose (8).

**IMPORTANT:** Collect copper washer (7).



Remove bolts (1).



Place a clean container and remove the cylinder (2).

**IMPORTANT:** The O-Ring (9) must not be damaged. Damaged or used O-Rings will leak. Replace them if necessary.

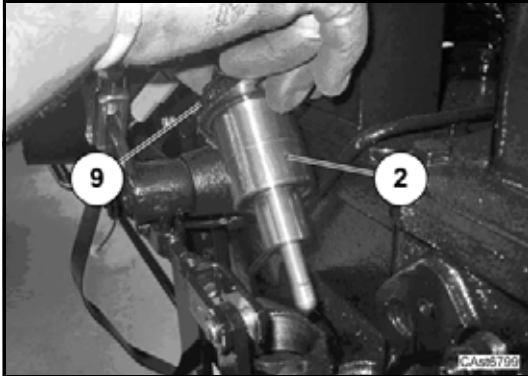


# Disassembly and Assembly Operations

## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

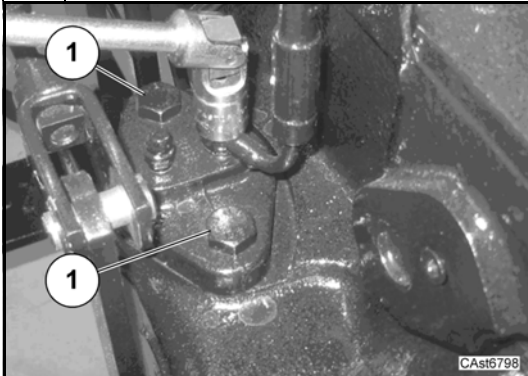
1.



Assemble the brake cylinder (2).

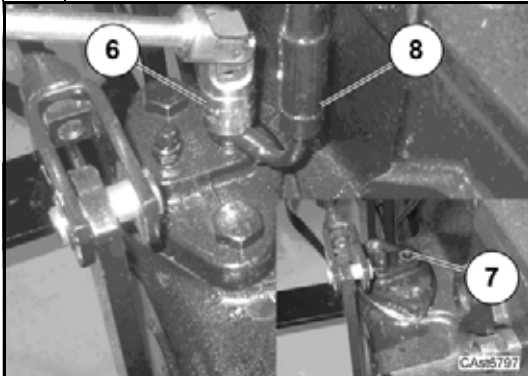
**IMPORTANT:** The O-Ring (9) must not be damaged. Damaged or used O-Rings will leak. Replace them if necessary.

2.



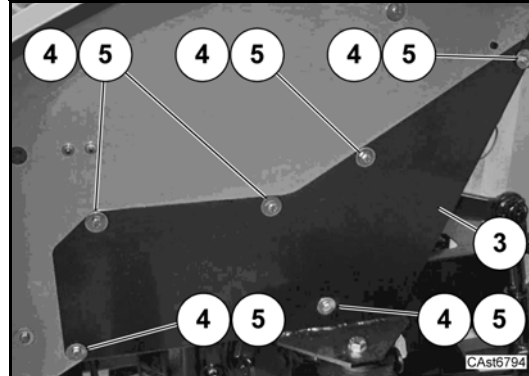
Screw up bolts (1).

3.



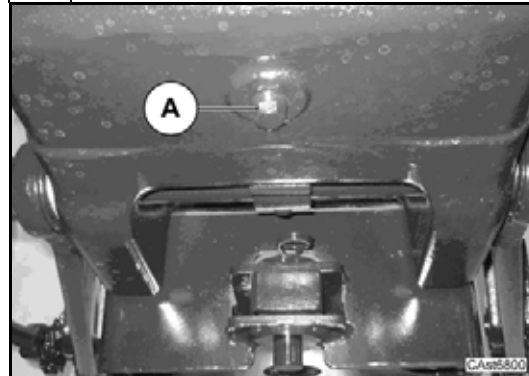
Assemble copper washers (7), hose (8) and bored screw (6).

4.



Assemble panel (3) and screw up washers (5) and bolts (4).

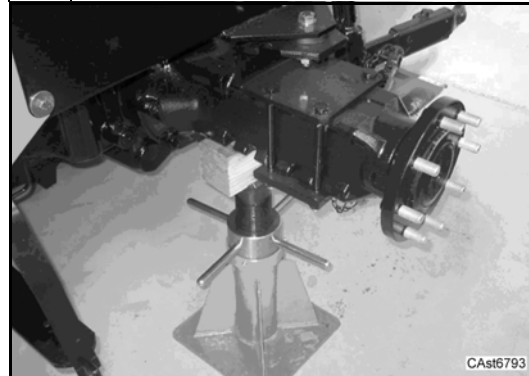
5.



Assemble plug (A) and fill transmission with oil.

**IMPORTANT:** Clean the magnetic plug (A) before its reassembly.

6.



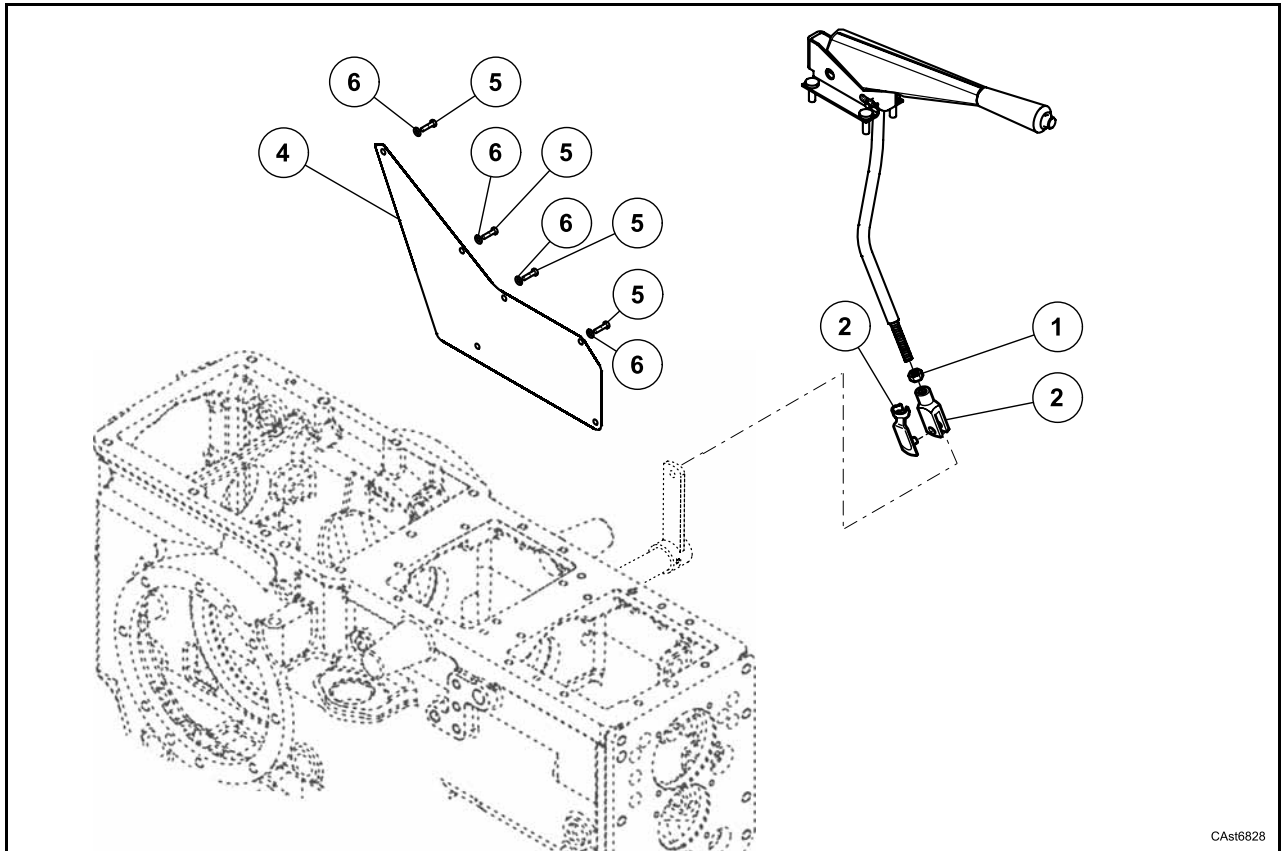
Assemble rear wheels.

Refer to: section C.23.

Release hand brake. Check for oil leaks.

# Disassembly and Assembly Operations

## HAND BRAKE ADJUSTMENT

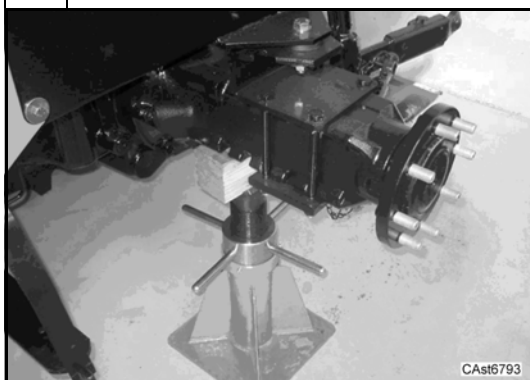


CAst6828

### Disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



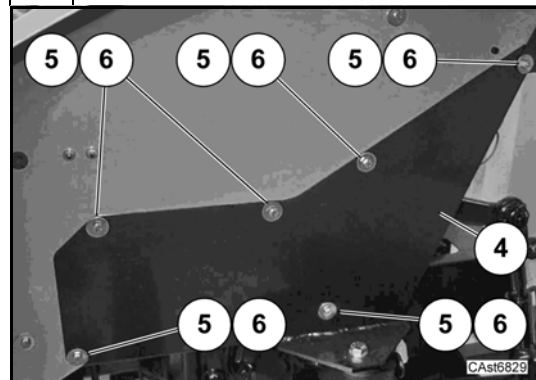
CAst6793

Support axle end using suitable support.

Remove left rear wheel bolts and take away rear wheel.

Refer to: section D.23.

2.



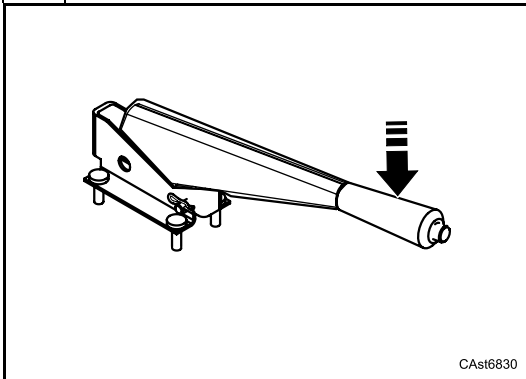
CAst6829

Remove the six bolts (5) and the six washer (6) and remove the panel (4) on left side.



# Disassembly and Assembly Operations

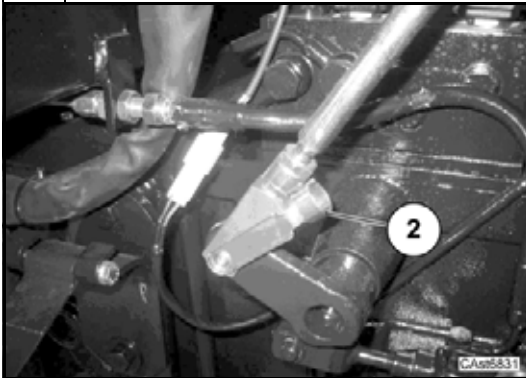
3.



CAst6830

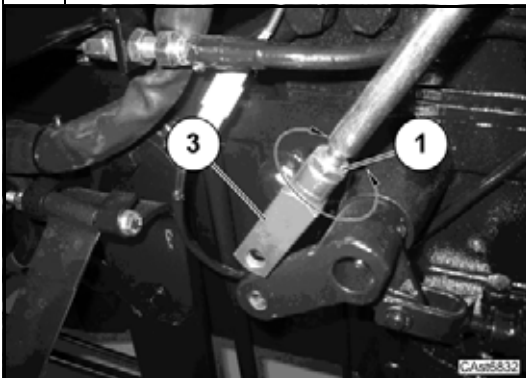
Move the hand brake lever completely down.

4.



Remove clip (2).

5.

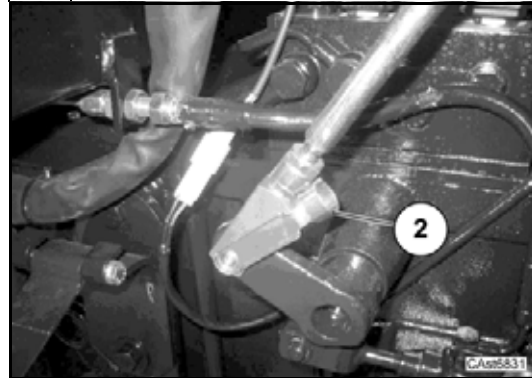


Loosen the nut (1) and adjust the hand brake turning the fork (3).

## Assembly

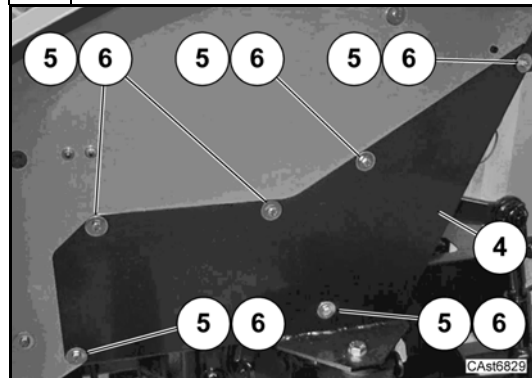
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Assemble clip (2).

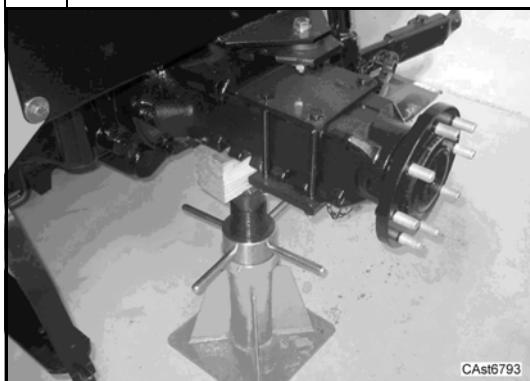
2.



Assemble the left side panel (4), the washers (6) and the bolts (5).

# Disassembly and Assembly Operations

3.



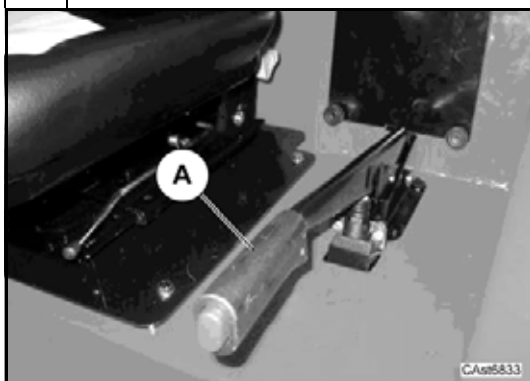
Assemble the left-hand wheel.

Refer to: section D.23.

Remove the support.

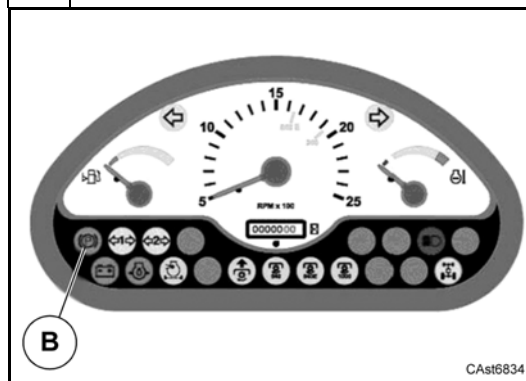
Check for the correct function of the hand brake.

4.



With the tractor stationary pull lever (A) up to engage hand brake.

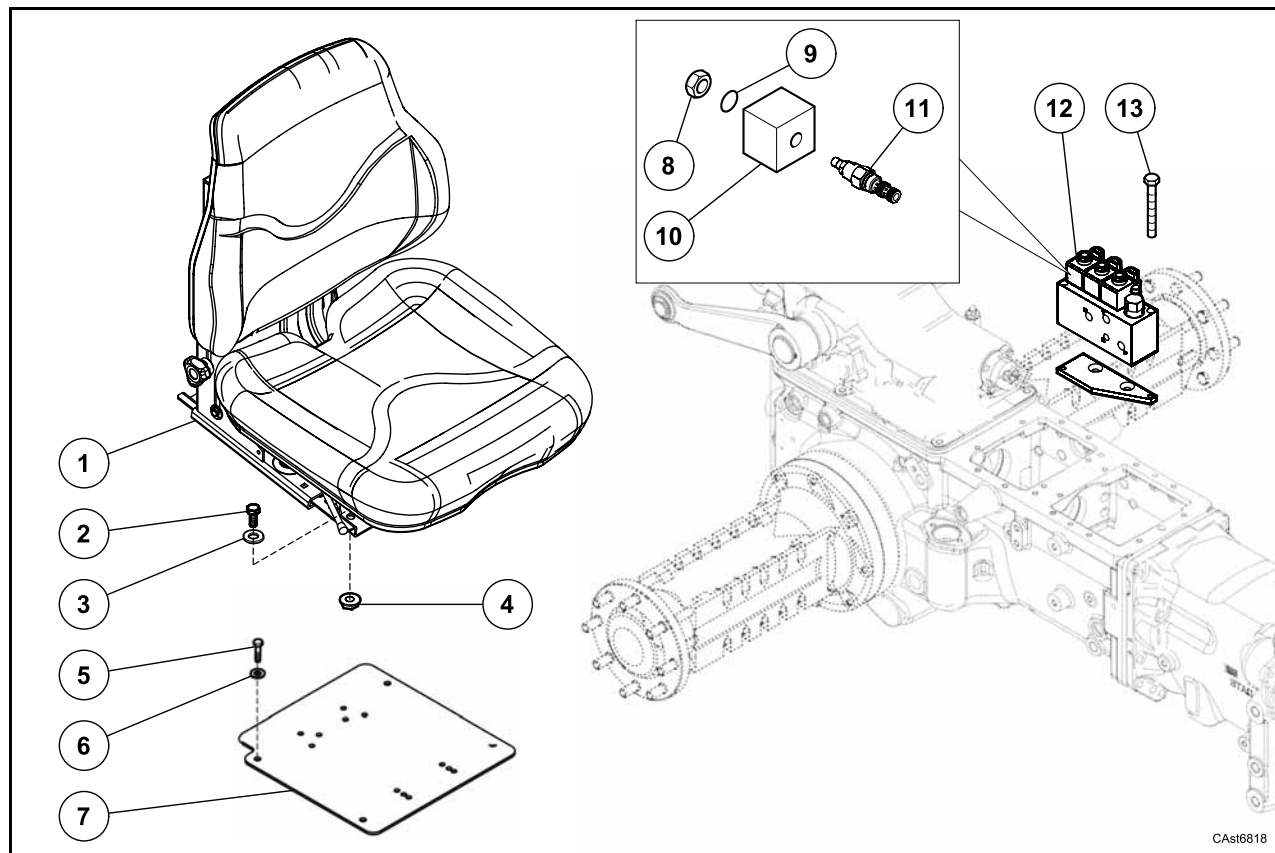
5.



Lever will lock in raised position and hand brake indicator light (B) will glow.

# Disassembly and Assembly Operations

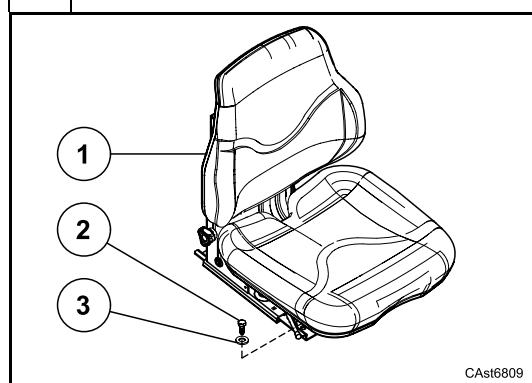
## LOCK VALVE



### Disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.

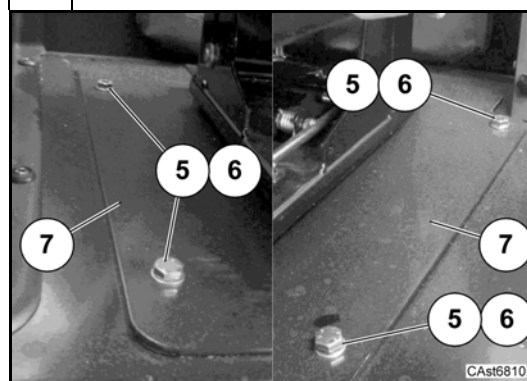


Apply hand brake.

Remove bolts (2) and washers (3).

Remove seat (1).

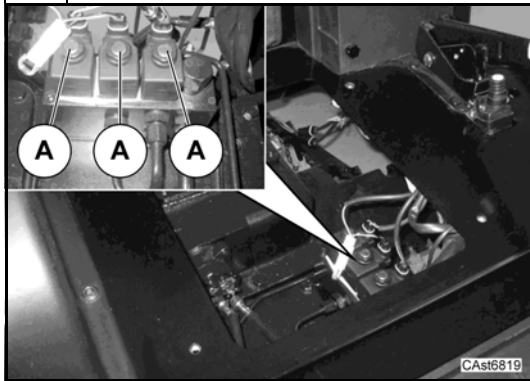
2.



Remove the seat support (7) taking off bolts (5) and washers (6).

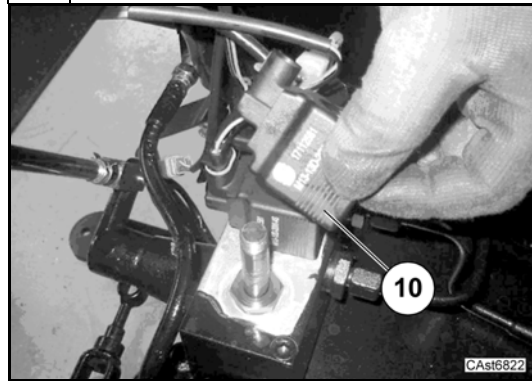
# Disassembly and Assembly Operations

3.



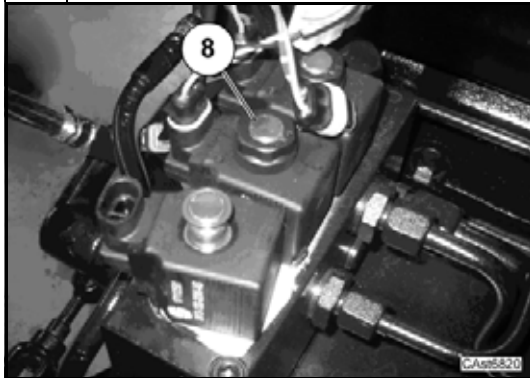
Disconnect electrical connections (A) from the valve.

6.



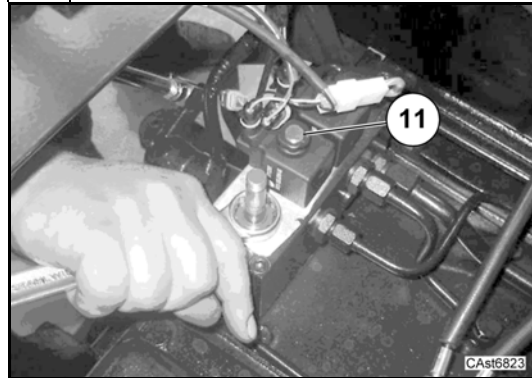
Remove the solenoid (10).

4.



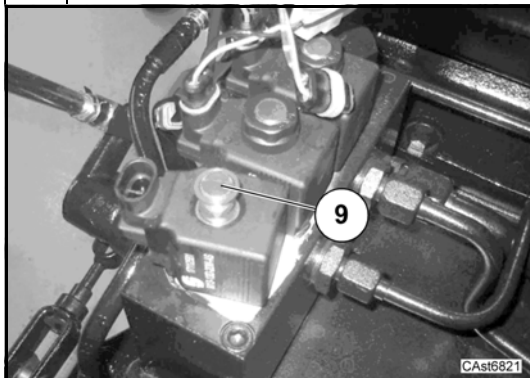
Procedure for removing the solenoid  
Remove ring (8).

7.



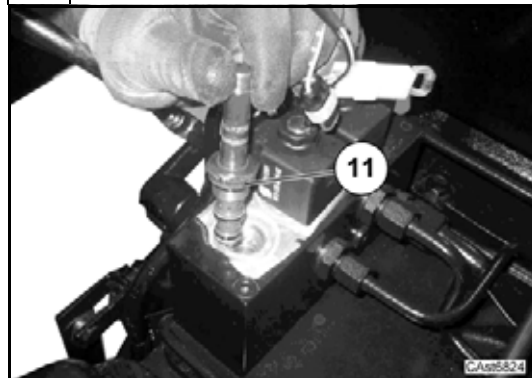
Procedure for removing the valve  
Unscrew the valve (11).

5.



Remove O-Ring (9) from the valve.

8.

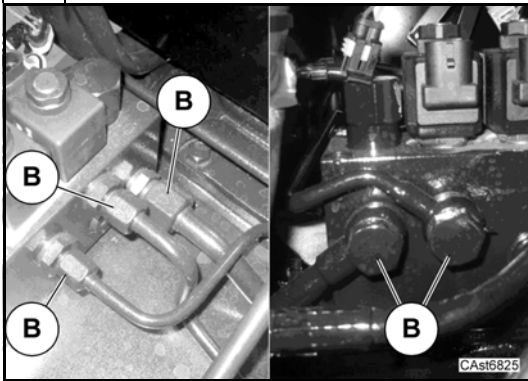


Remove the valve (11) and check it for wear or damages.  
Replace the valve if necessary.



# Disassembly and Assembly Operations

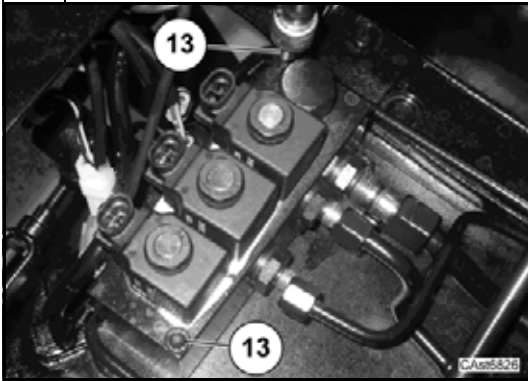
9.



Procedure for removing the valve assy

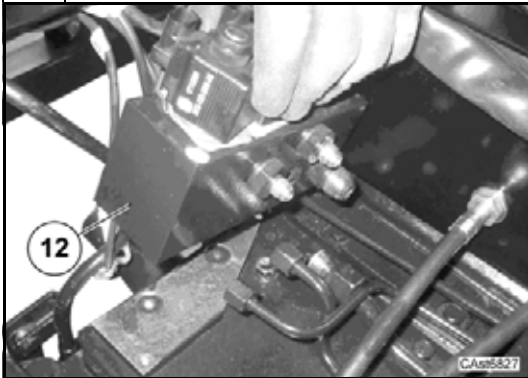
For removing the valve assy (12), loosen all hydraulic oil lines (B) to the valve.

10.



Remove the two bolts (13).

11.



Remove valve assy (12).

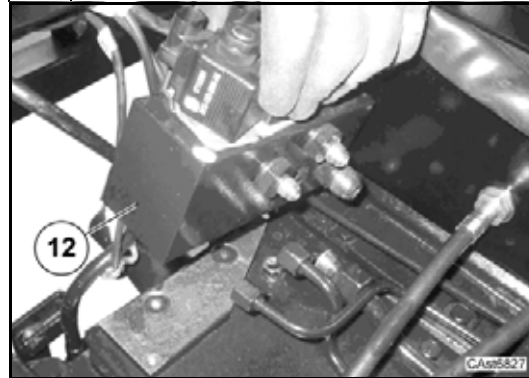
Check and inspect all parts.

Replace parts if necessary.

## Assembly

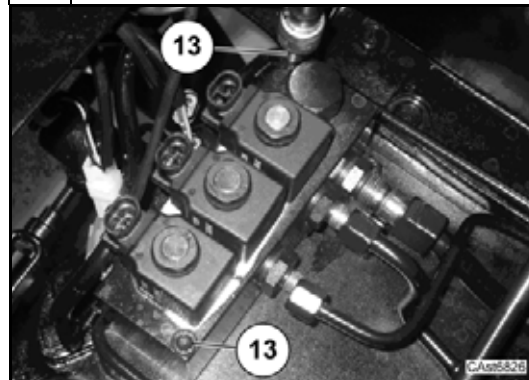
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



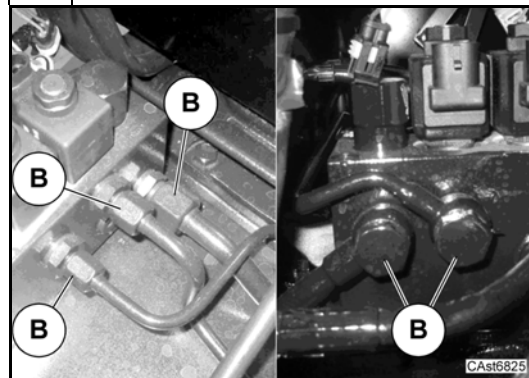
Assemble valve assy (12).

2.



Screw up bolts (13).

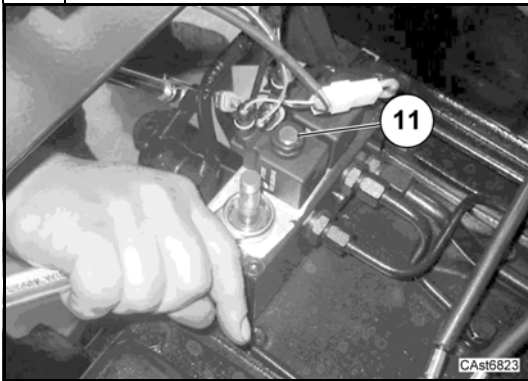
3.



Connect all hydraulic oil lines (B) on the valve.

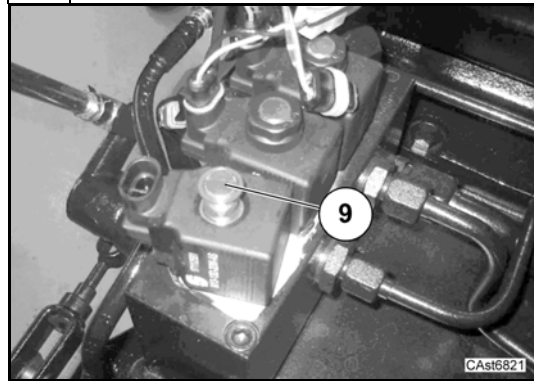
## Disassembly and Assembly Operations

4.



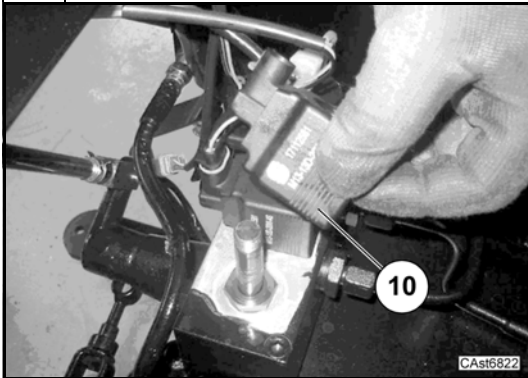
Assemble and screw up the valve (11).

6.



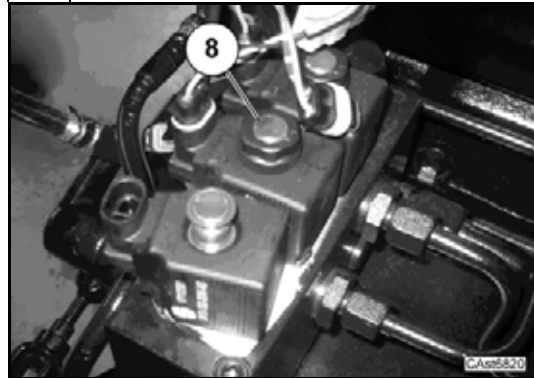
Assemble a new O-Ring (9).

5.



Assemble the solenoid (10).

7.

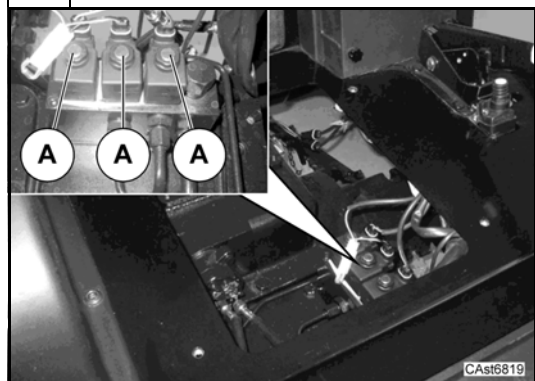


Assemble ring (8).



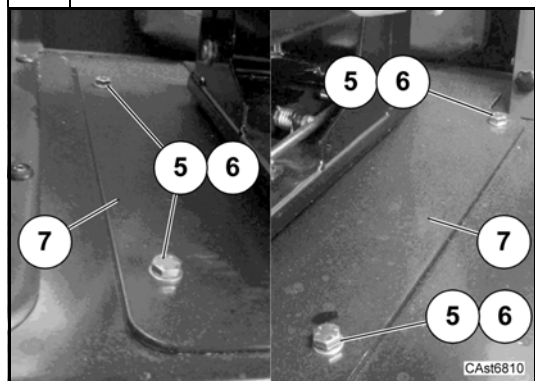
# Disassembly and Assembly Operations

8.



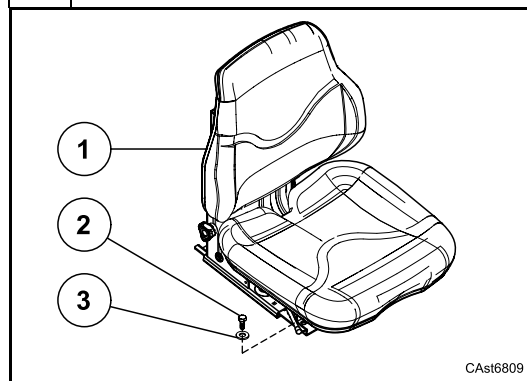
Restore electrical connections (A) on the valve.

9.



Assemble the seat support (7) and screw up washers (6) and bolts (5).

10.



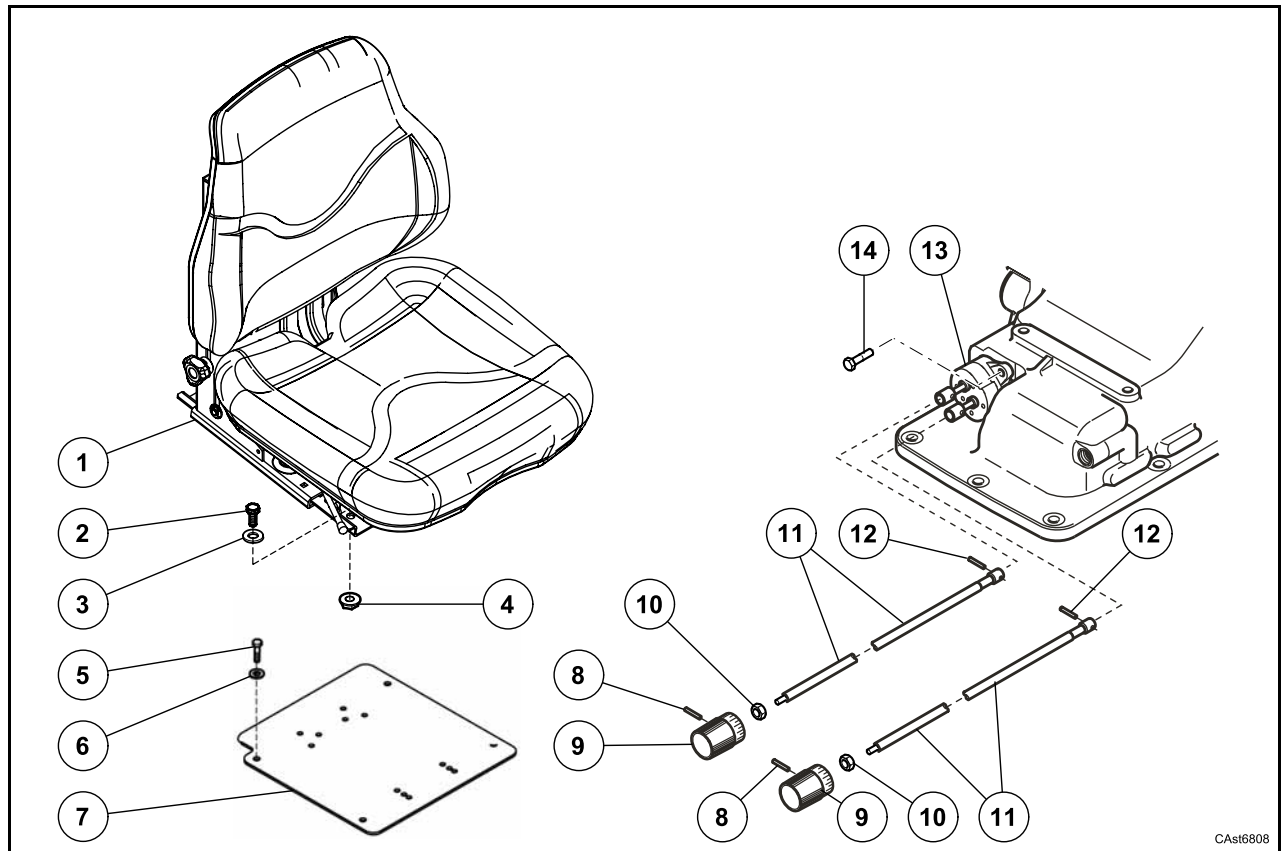
Assemble the seat (1) and screw up washers (3) and bolts (2).

Check oil level and fill it if necessary.

Check for the correct function of the system.

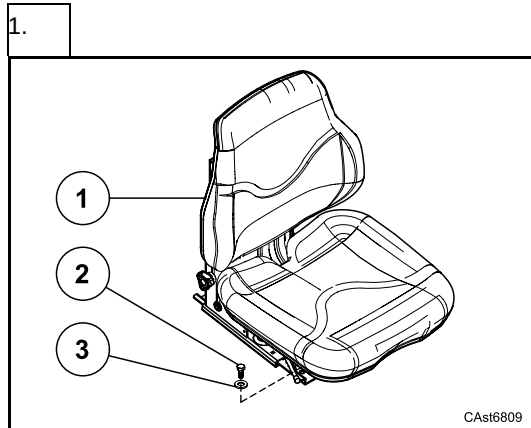
# Disassembly and Assembly Operations

## ROCKSHAFT VALVE



### Disassembly

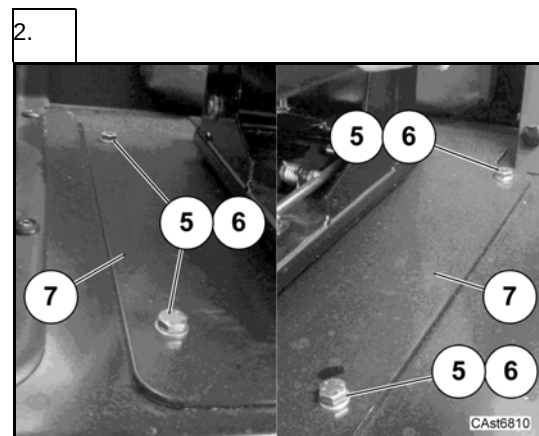
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.



Apply hand brake.

Remove bolts (2) and washers (3).

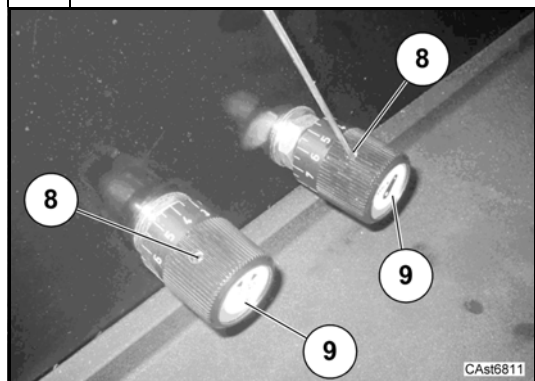
Remove seat (1).



Remove the seat support (7) taking off bolts (5) and washers (6).

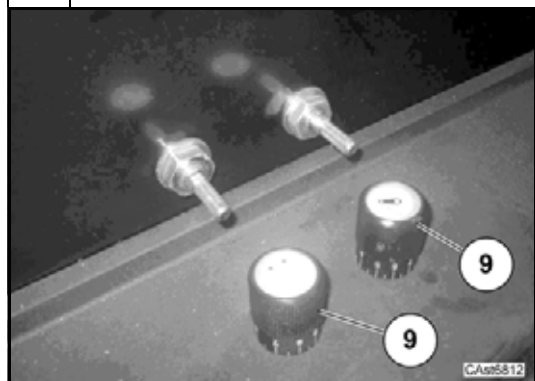
# Disassembly and Assembly Operations

3.



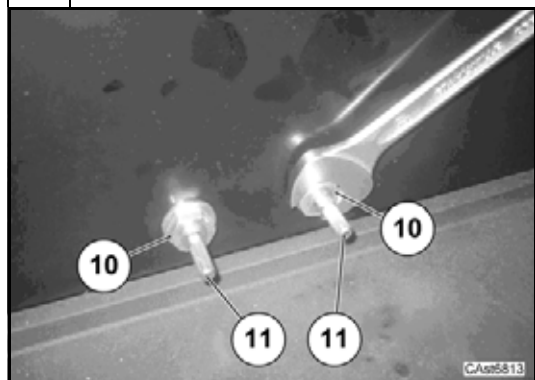
Loosen without removing the studs (8) on sensitivity and rate of drops knobs (9).

4.



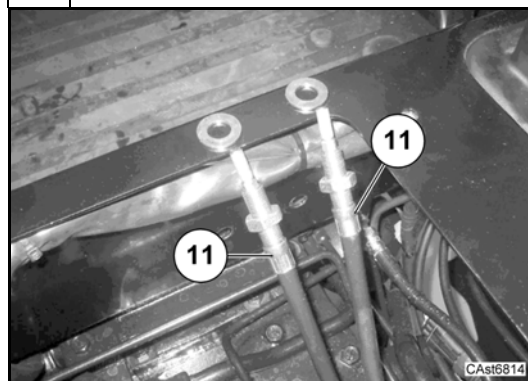
Remove both sensitivity and rate of drops knobs (9).

5.



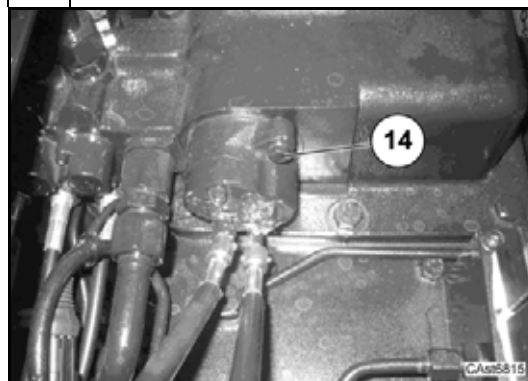
Loosen and remove the two nuts (10).

6.



Pull the bowden (11) out from the platform frame.

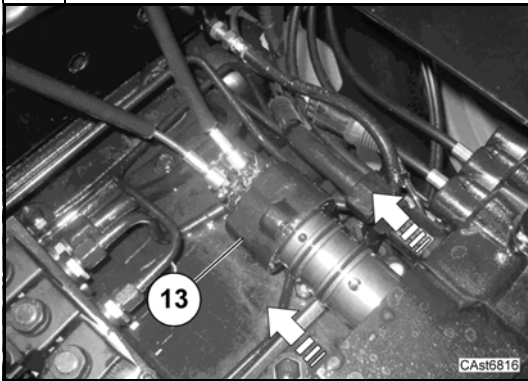
7.



Remove the two bolts (14).

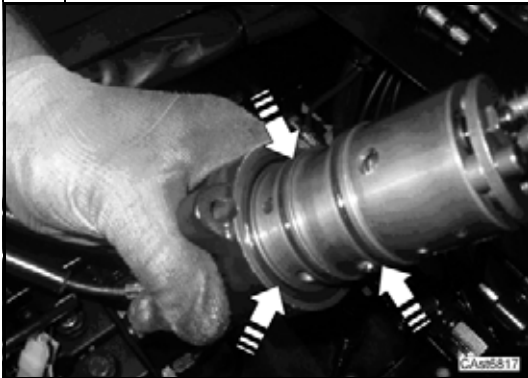
# Disassembly and Assembly Operations

8.



Remove the rockshaft distributor (13).

9.

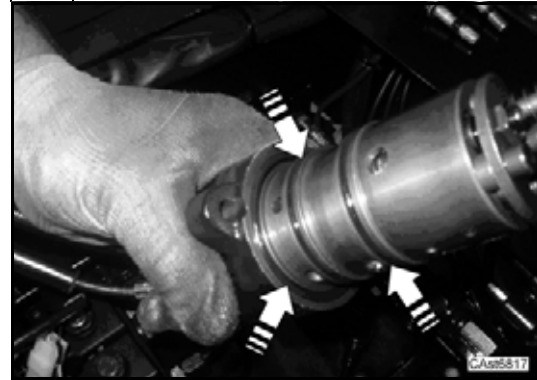
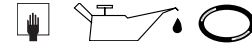


Inspect all parts for wear or damage.  
Replace them if necessary.

## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

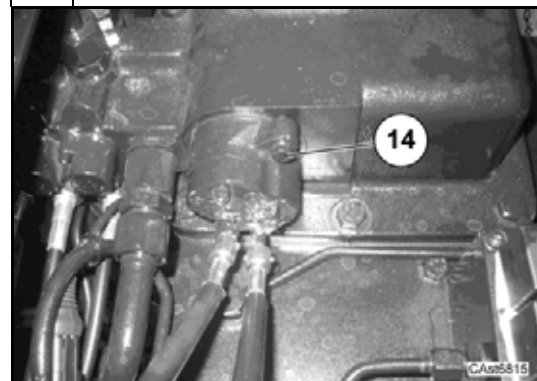
1.



Lubricate all internal parts with clean transmission/hydraulic oil during assembly.

**IMPORTANT:** Replace all O-Rings. Damaged or used O-Rings will leak.

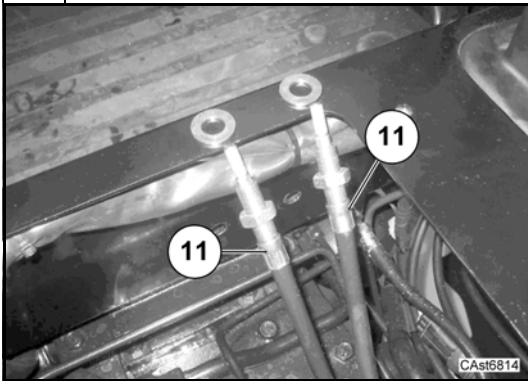
2.



Install rockshaft valve tightening bolt (14).

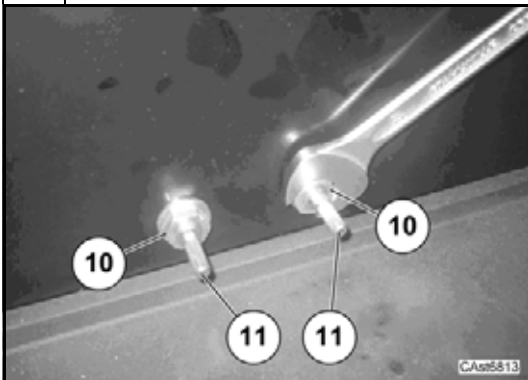
# Disassembly and Assembly Operations

3.



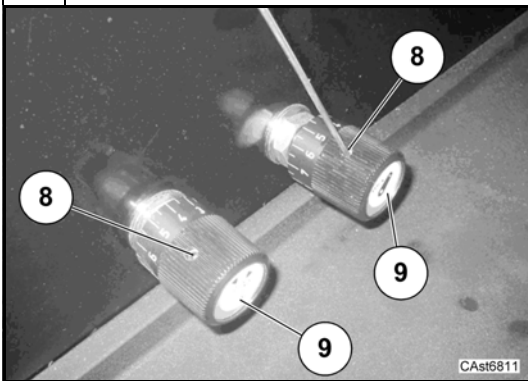
Insert the bowden (11) on the relevant holes on the platform frame.

4.



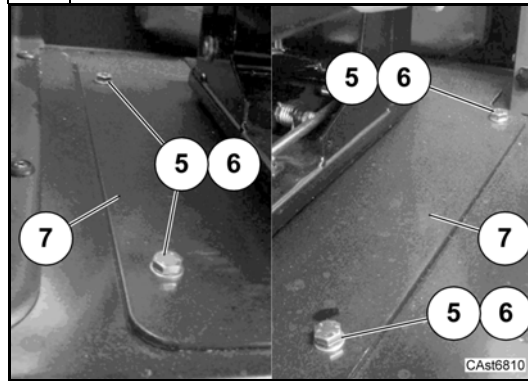
Reassemble the bowden (11) tightening nuts (10).

5.



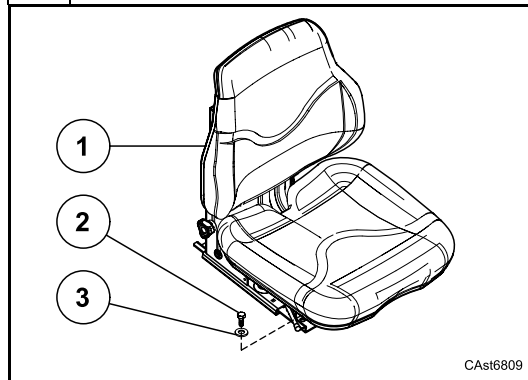
Assemble the knobs (9) tightening studs (8).

6.



Assemble the seat support (7) and screw up washers (6) and bolts (5).

7.



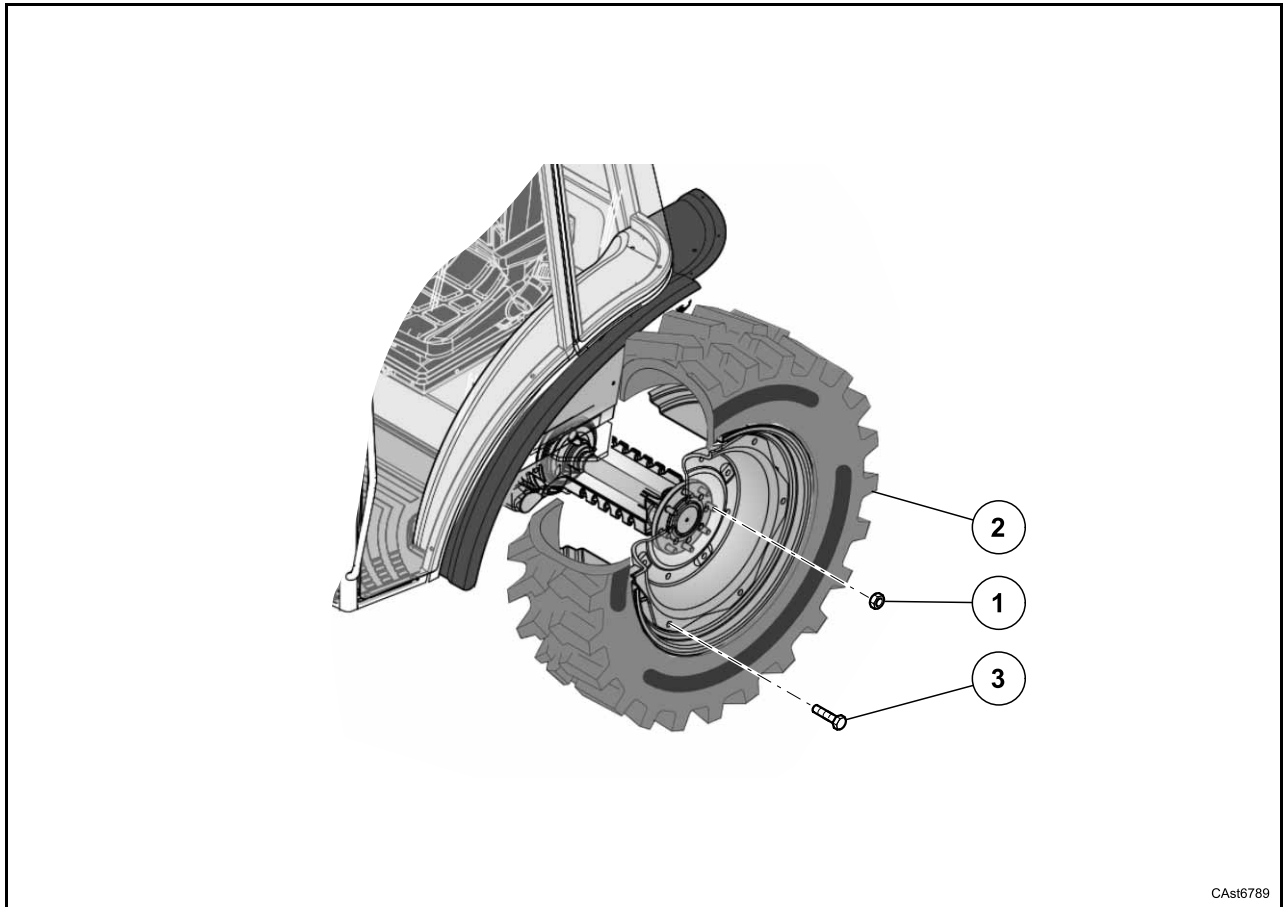
Assemble the seat (1) and screw up washers (3) and bolts (4).

Perform a function check of the system.



# Disassembly and Assembly Operations

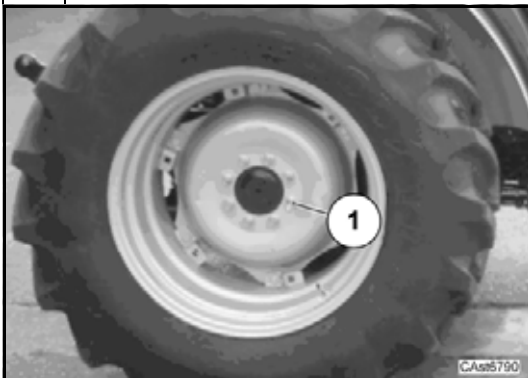
## REAR WHEELS



### Disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



2.



Remove nuts (1) and wheel (2).

Apply the hand brake in order to immobilize the tractor.

Chock the front wheels.

Unlock the wheel nuts (1) and lift the relevant side of the tractor.

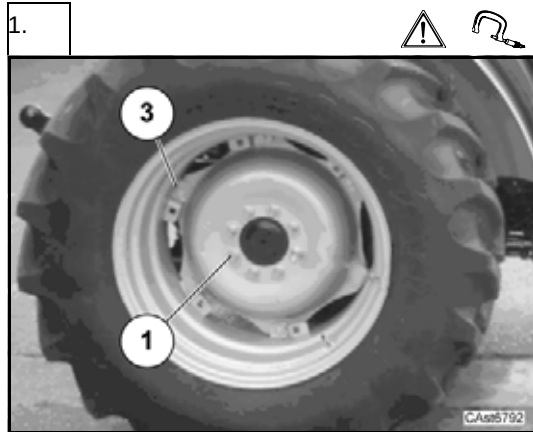


# Disassembly and Assembly Operations

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## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.



Assembly the wheel (2), tighten the wheel bolts.

Tighten rear wheel nuts and bolts to specified torque.

**IMPORTANT:** Check tightness of rim, disk and wheel bolts after 10 hours every time you replace wheels.

(1) Disk to axle flange: 500 Nm (370 lb·ft).

(3) Rim to disk: 300 Nm (220 lb·ft).

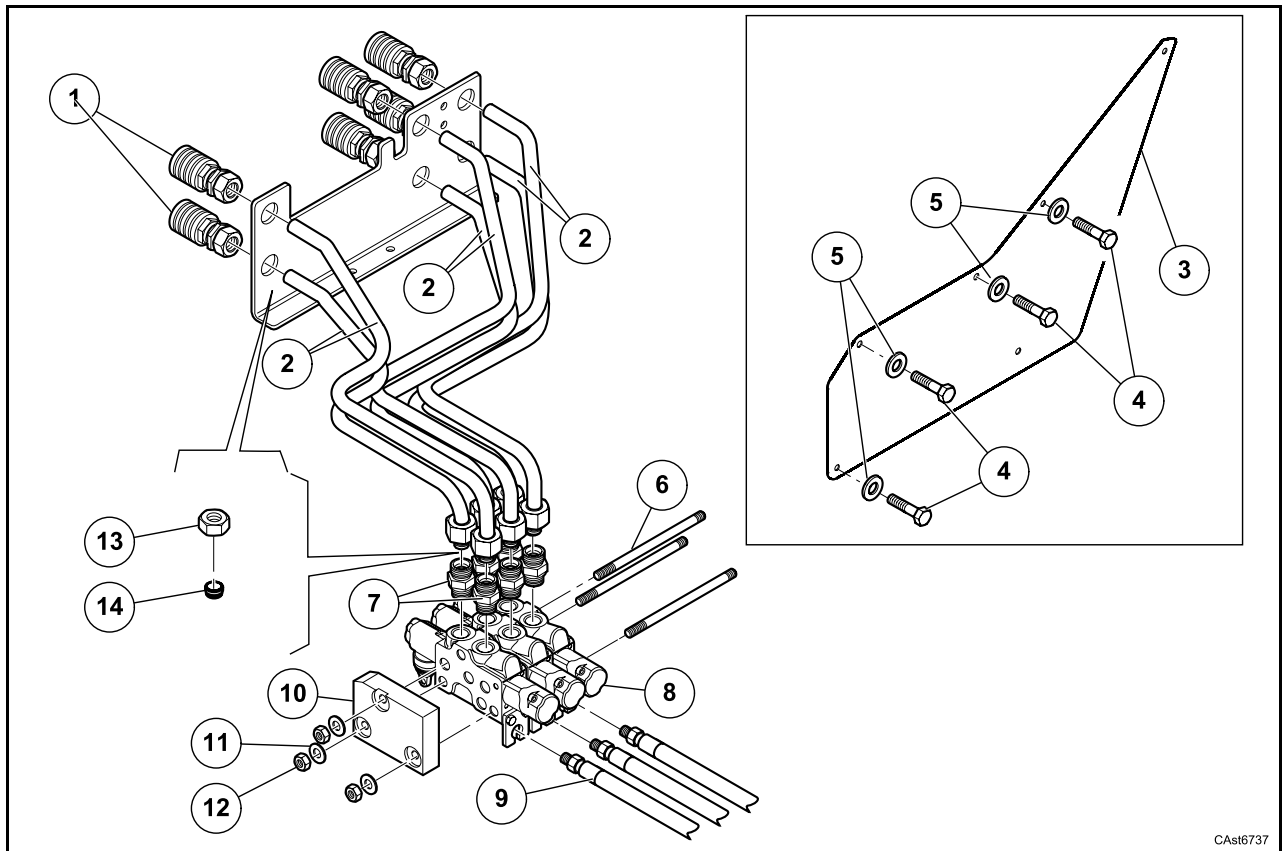
Tyre pressure.

Long life and satisfactory performance of the tyres depend on proper tyre inflation.

Under-inflation of tyres leads to rapid wear. Over-inflated tyres reduce traction and increase wheel slippage. A correct tyre pressure depends not only on tractor model, tyre size and manufacturer, but also on working conditions.

# Disassembly and Assembly Operations

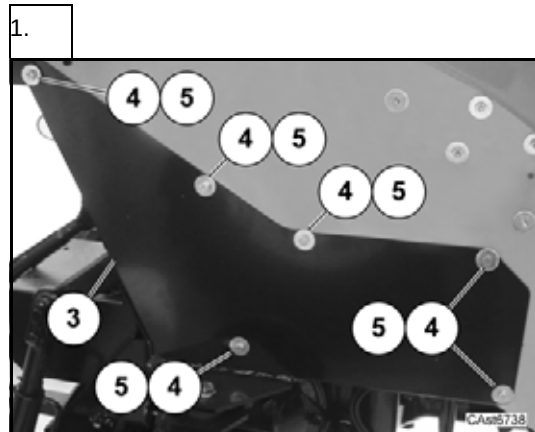
## AUXILIARY DISTRIBUTORS



CAst6737

### Disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

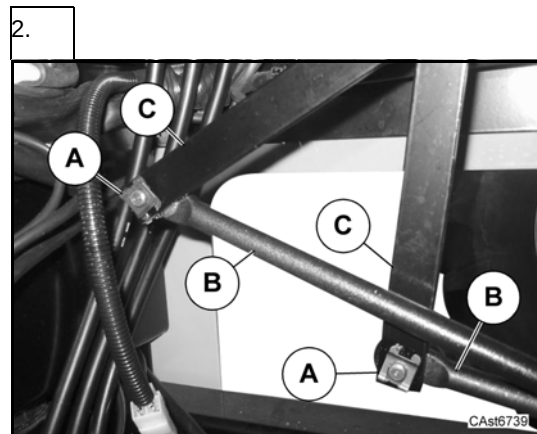


Apply the hand brake.

Remove the rear right wheel.

Refer to: section D.23.

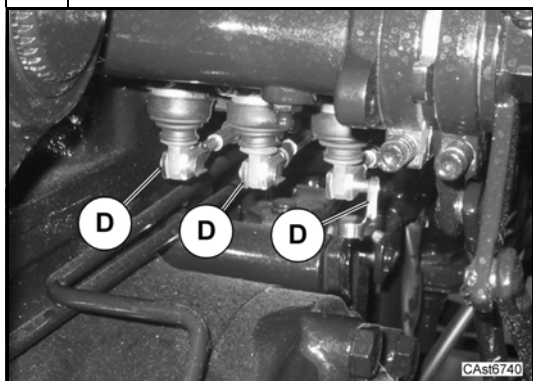
Remove the six bolts (4) and the six washers (5) and remove the panel (3).



Remove clips (A) to unlock rods (B) from the rockshaft levers (C).

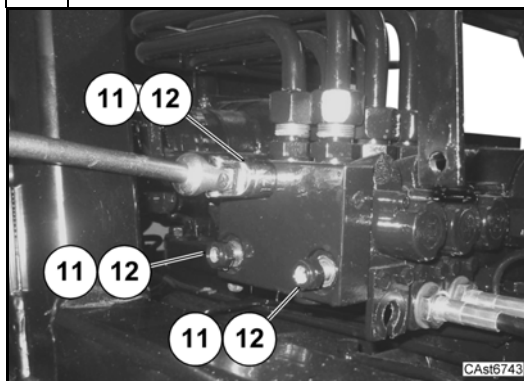
# Disassembly and Assembly Operations

3.



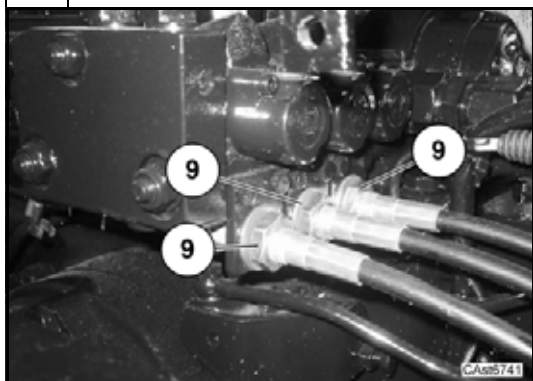
Remove the three pin (D) to unlock the push-pull cables from the auxiliary valves.

6.



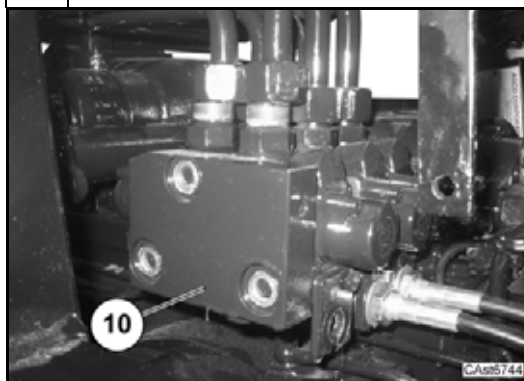
Loosen and remove the three nuts (12) and the three washers (11).

4.



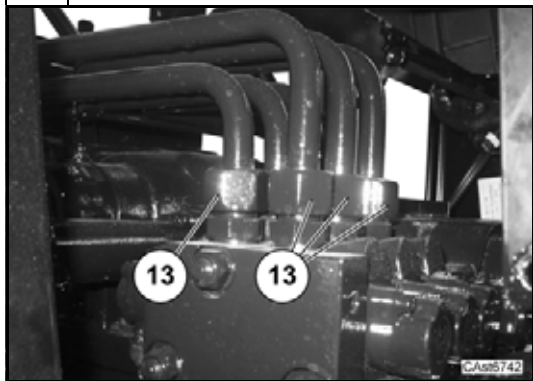
Loosen nuts (9).

7.



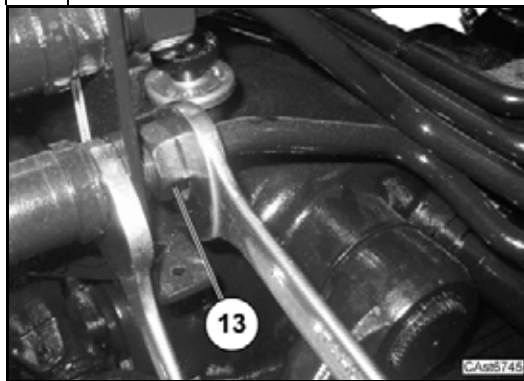
Remove flange (10).

5.



Loosen nuts (13) located on the top of the auxiliary valves.

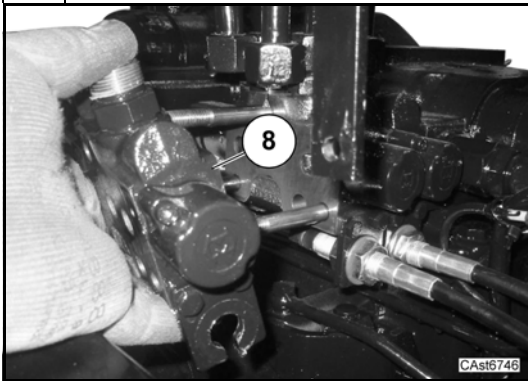
8.



Loosen connections to the rear quick couplers by unscrewing nut (13).

# Disassembly and Assembly Operations

9.



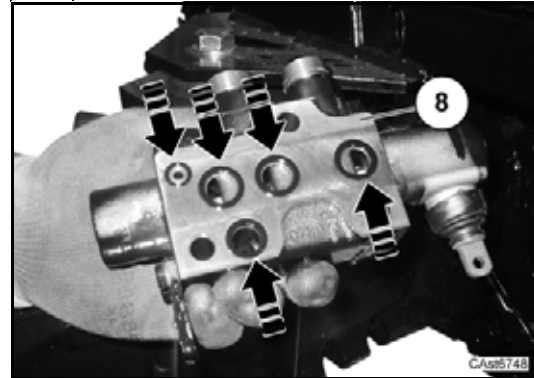
Remove auxiliary distributors (8).

Check all parts for wear or damages. Replace as necessary.

## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

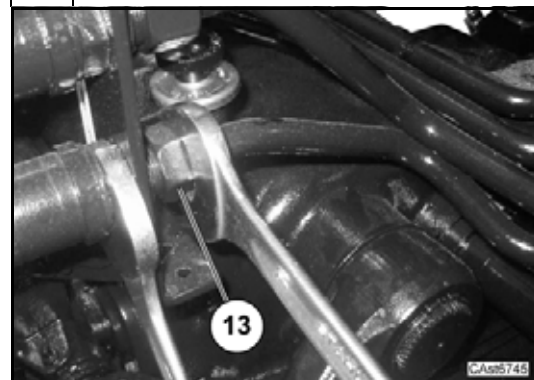
1.



Lubricate all internal parts with clean transmission/ hydraulic oil during assembly.

Assemble the auxiliary distributors (8).

2.



Restore rear quick connection by tightening the nuts (13).

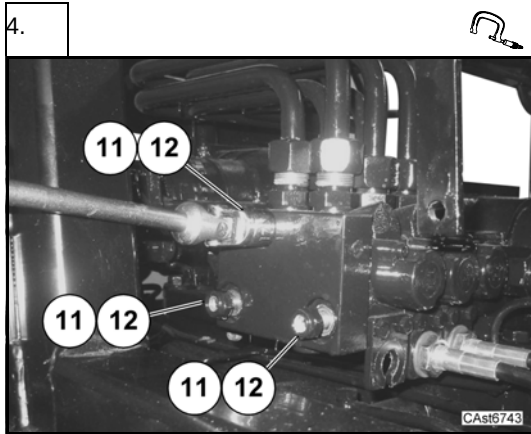
3.



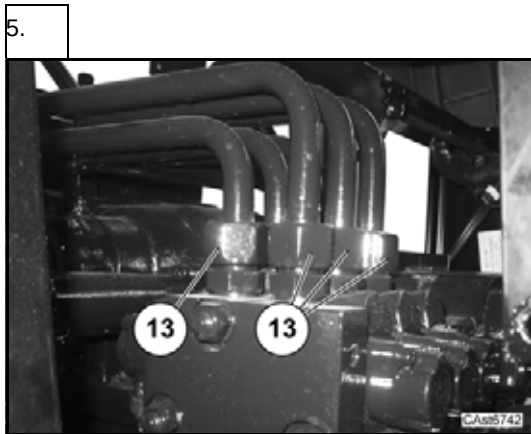
Assemble the flange (10).

**IMPORTANT:** Always use new O-Rings. Damaged or used O-Rings will leak.

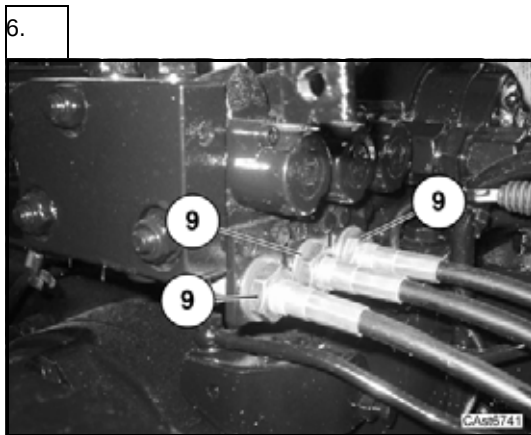
# Disassembly and Assembly Operations



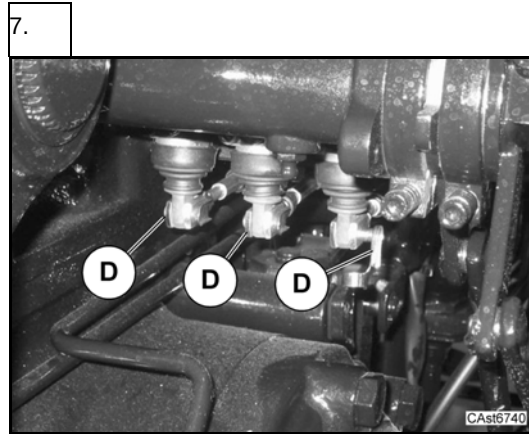
Screw up washers (11) and bolts (12).  
Torque wrench setting: 35 Nm (25.81 lb.ft)



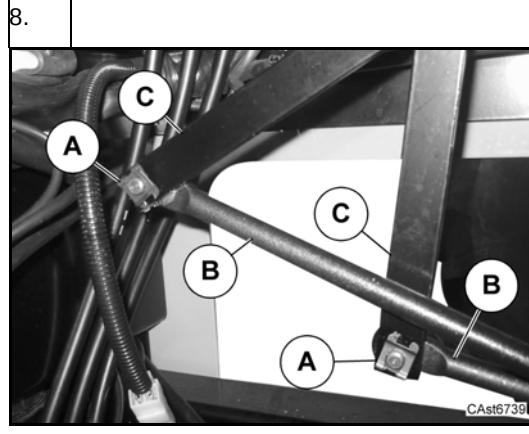
Assemble pipes (2) by tightening the nuts (13).



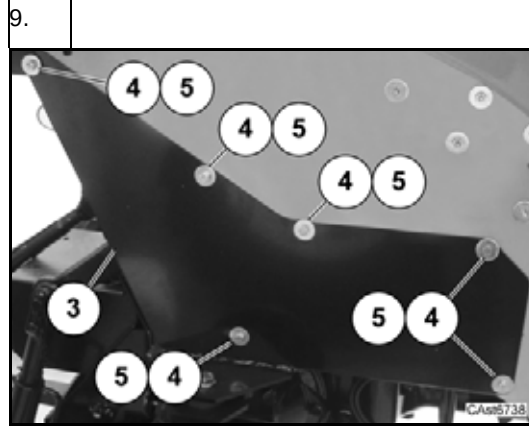
Screw up nuts (9).



Assemble the push-pull cables to the auxiliary valves with pin (D).



Lock rods (B) to the rock shaft levers (C) with clips (A).

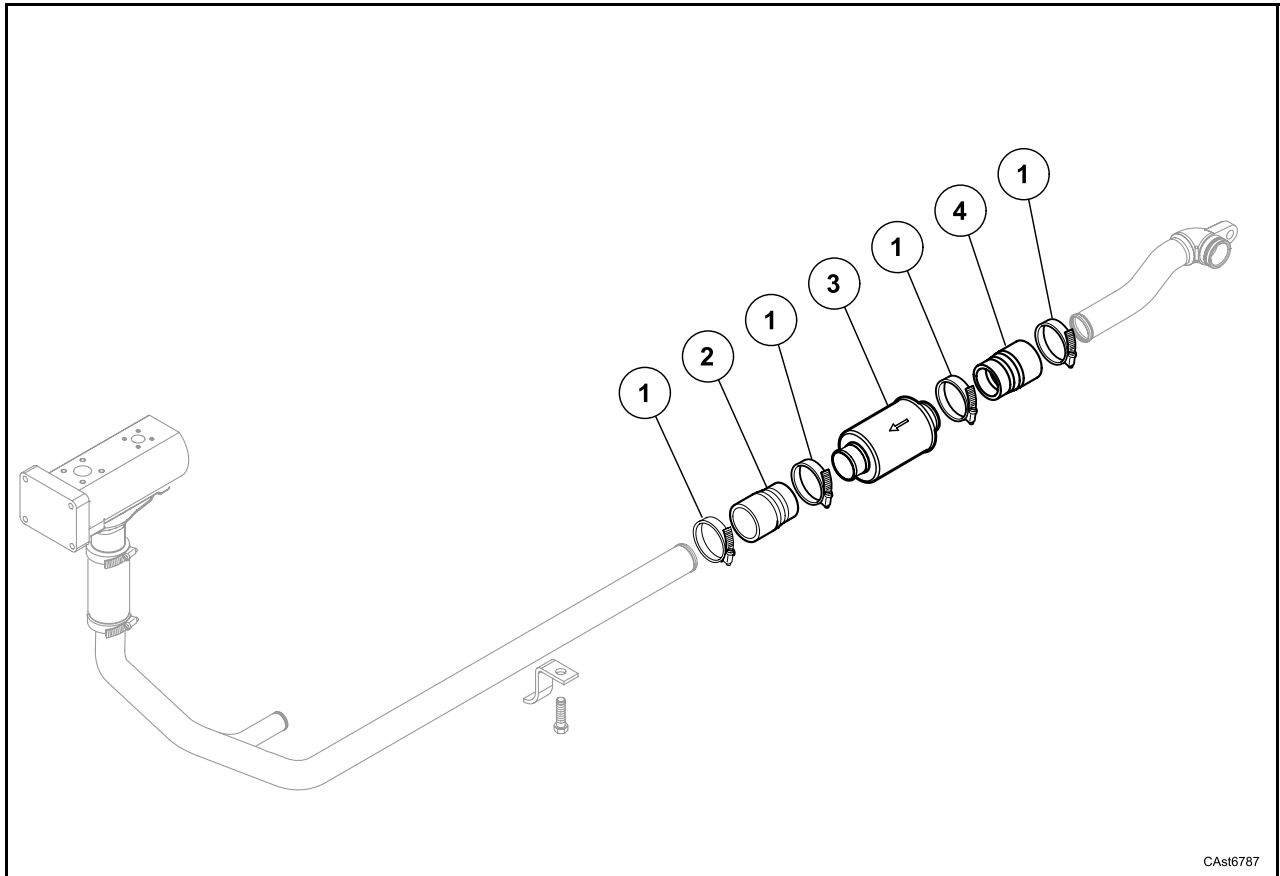


Assemble the panel (3).  
Screw up washers (5) and bolts (4).  
Assemble the right rear wheel.  
Refer to: section D.23.  
Check the oil level.  
Check for the correct operation of the auxiliary distributors.



# Disassembly and Assembly Operations

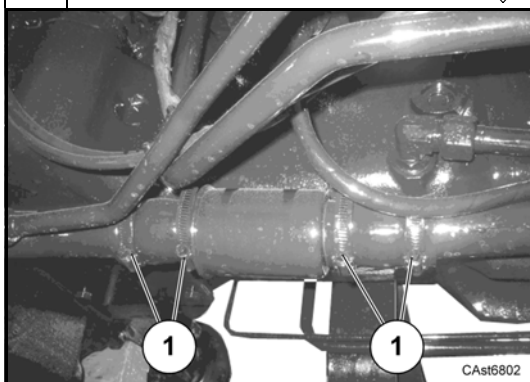
## OIL SUCTION STRAINER



### Disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.

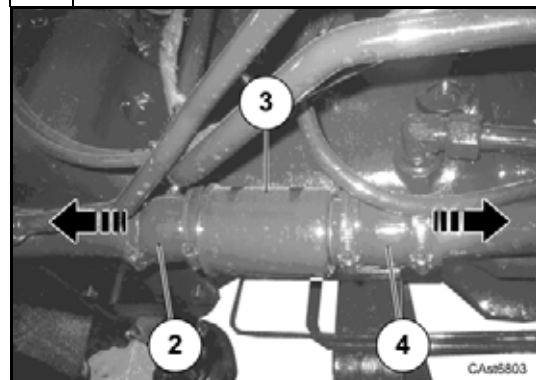


Place a suitable and clean container and drain transmission oil.

**NOTE:** Close all openings using caps and plugs.

Remove the four clamps (1).

2.



Move hose (2) backward and hose (4) forward to disassemble the filter (3).

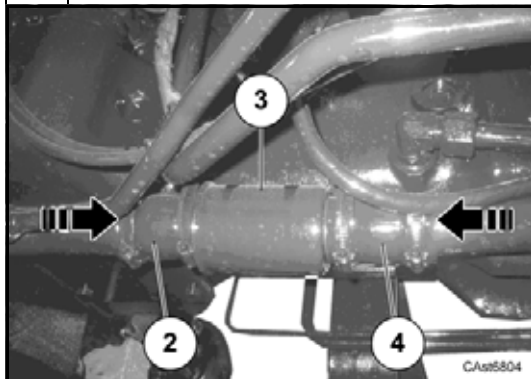


# Disassembly and Assembly Operations

## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

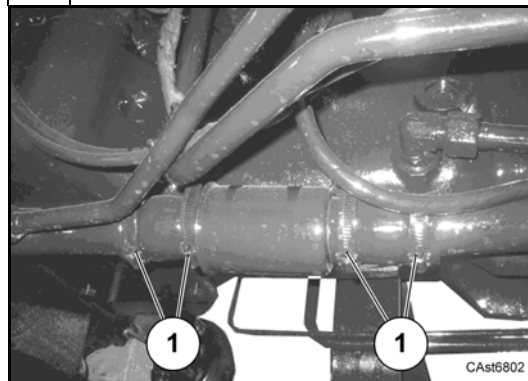
1.



Replace filter and reassemble all parts.

Move hose (2) forward and hose (4) backward to assemble the filter (3).

2.

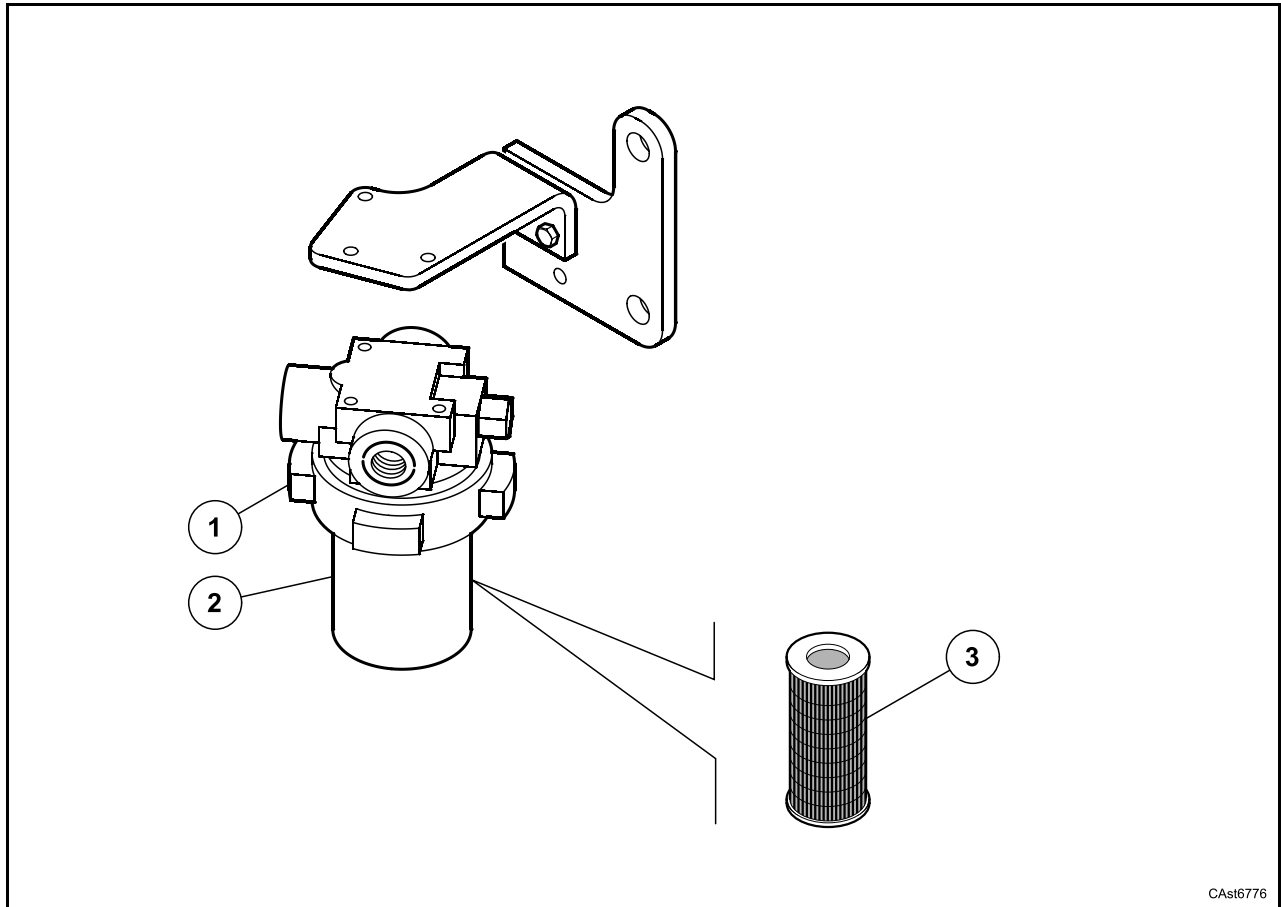


Assemble and tighten clamps (1).

Fill transmission with proper oil.

# Disassembly and Assembly Operations

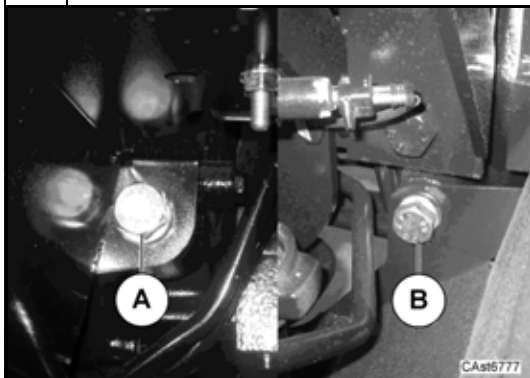
## OIL FILTER CARTRIDGE REPLACEMENT



### Disassembly

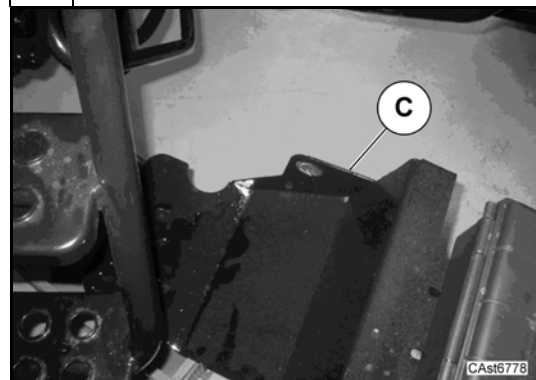
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Remove bolts (A) and (B).

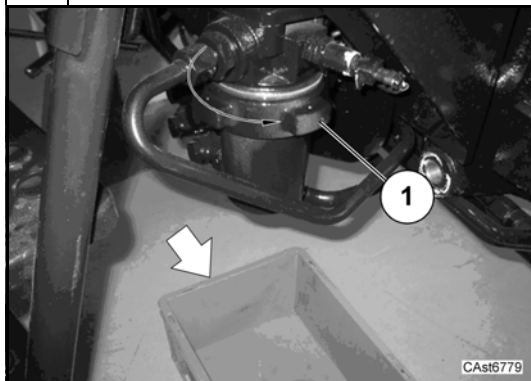
2.



Remove the tool box support/filter protection (C).

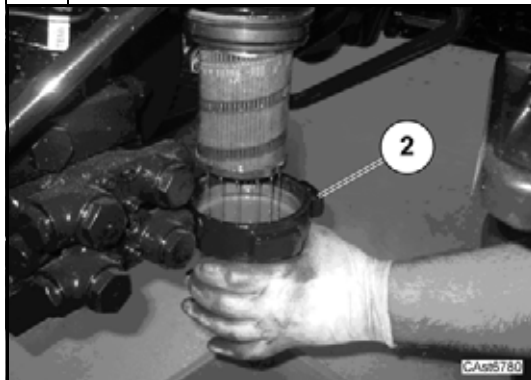
# Disassembly and Assembly Operations

3.



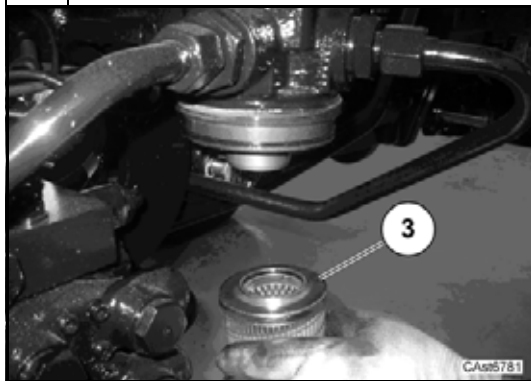
Place a suitable and clean container under the filter and screw up ring nut (1).

4.



Remove cover (2).

5.



Remove the filter cartridge (3).

## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

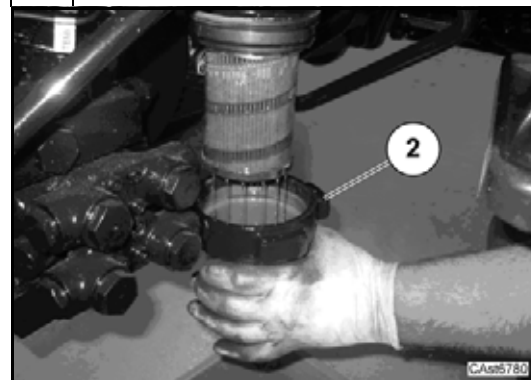
1.



Replace the oil filter cartridge (3).

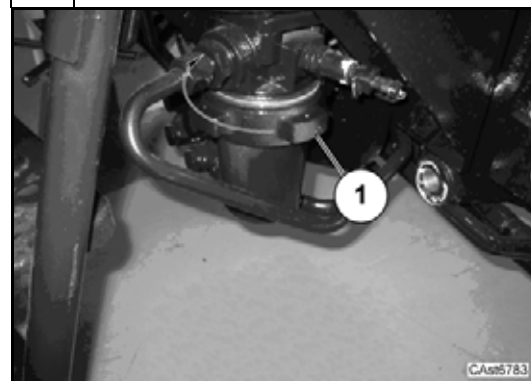
Apply a film of oil to the filter gasket and reassemble all parts.

2.



Assemble cover (2).

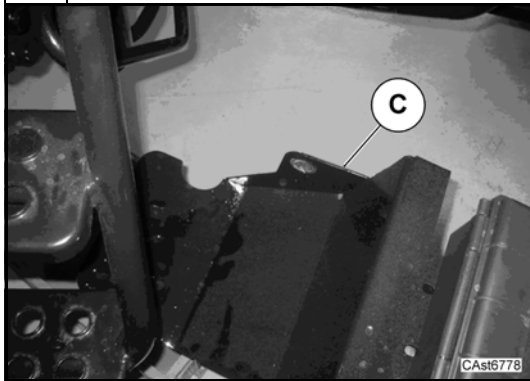
3.



Screw up ring nut (1).

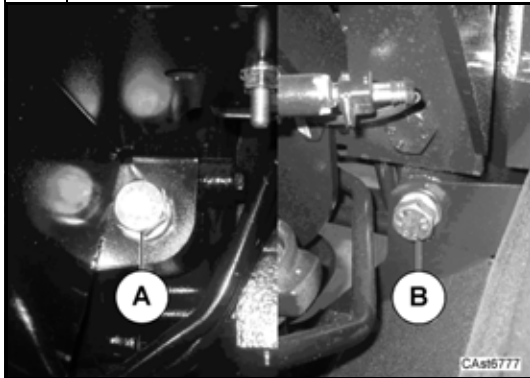
# Disassembly and Assembly Operations

4.



Assemble the tool box support/filter protection (C).

5.

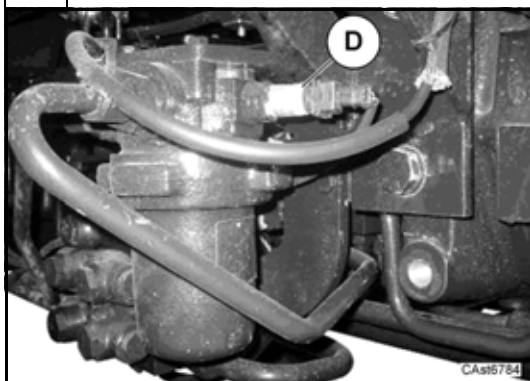


Tighten bolts (A) and (B).

**IMPORTANT:** On tractors equipped with Powershuttle transmission, the oil filter cartridge replacement must be done:

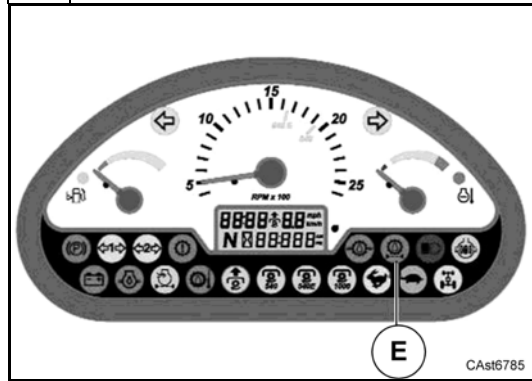
- after the first 50 hours.
- every 400 hours.

6.



All tractors with Powershuttle transmission are equipped with a transmission oil filter sensor (D).

7.



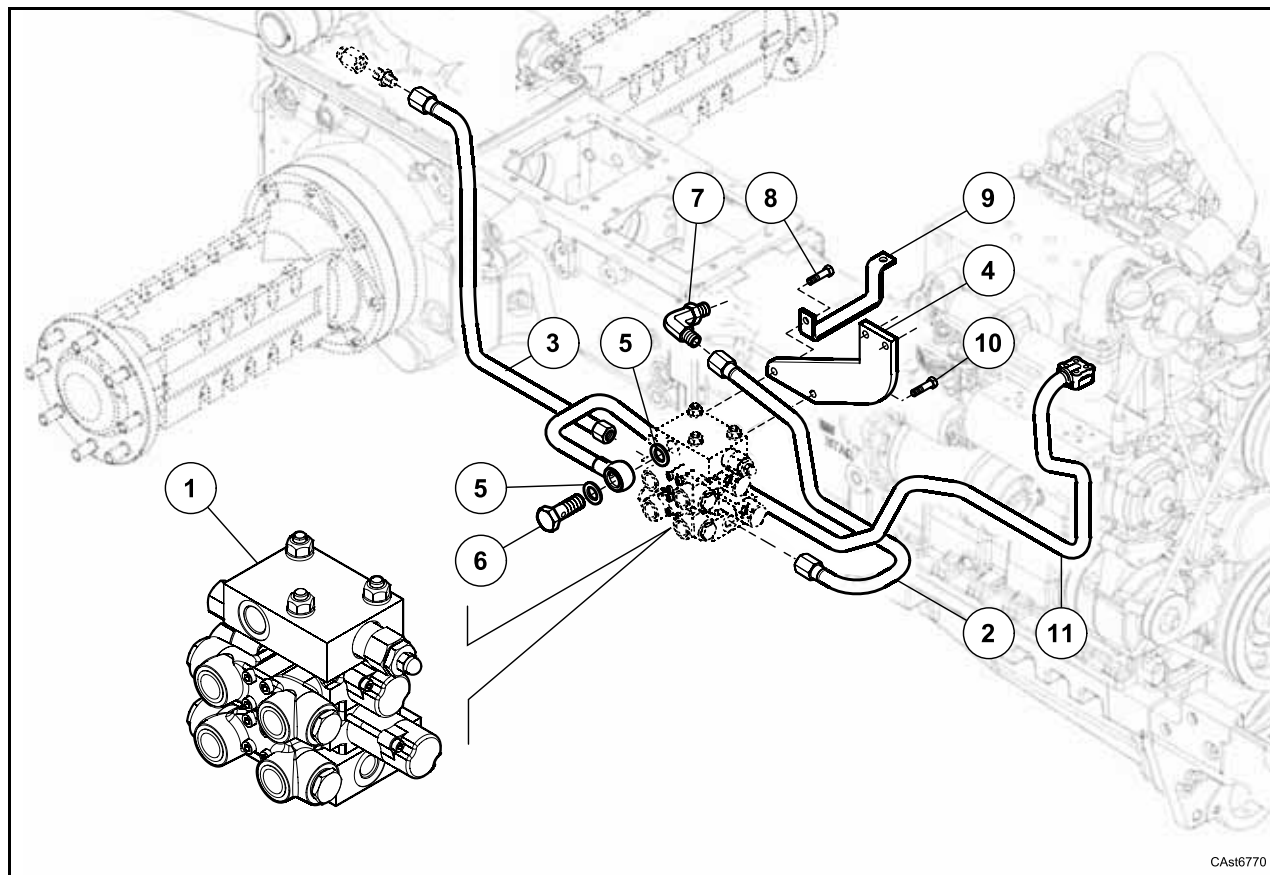
If the light (E) on dashboard is lit, the replacement of the oil filter cartridge is needed (see procedure in relevant section).

**IMPORTANT:** The filter cartridge must be replaced as soon as possible to ensure correct operation and protection of the Powershuttle System.

**IMPORTANT:** In case of use of the tractor in low temperature condition ( $<10^{\circ}\text{C}$  ( $50^{\circ}\text{F}$ )), light on the dashboard could be ON for a few minutes until the transmission oil reaches the normal function of temperature.

# Disassembly and Assembly Operations

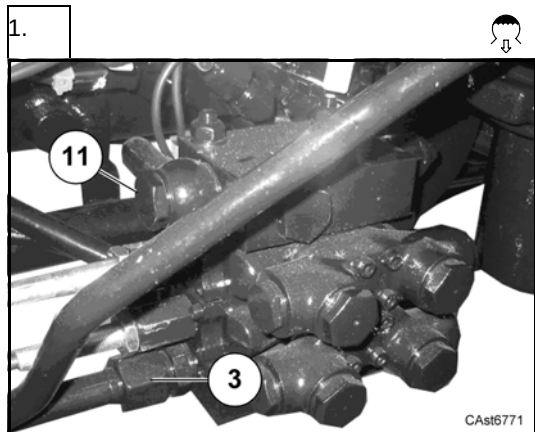
## SIDE AUXILIARY DISTRIBUTORS



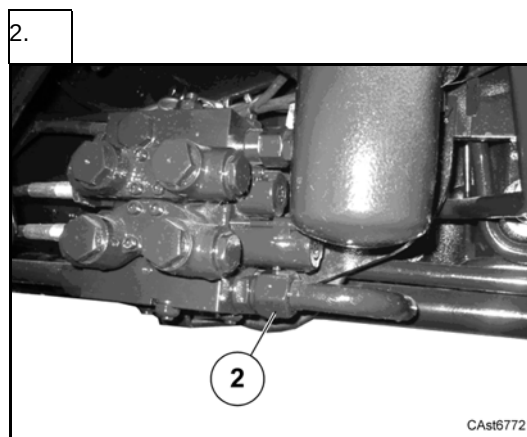
CAst6770

### Disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.



CAst6771



CAst6772

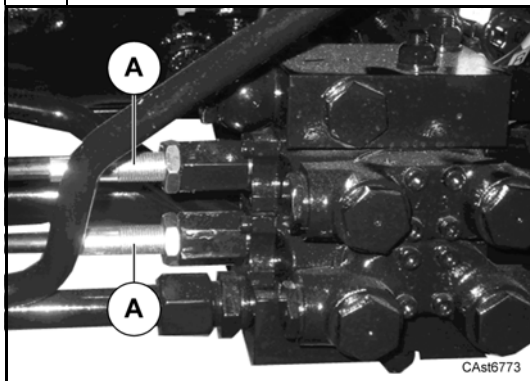
Loose pipe (2).

Place a suitable and clean container under the tractor to collect oil. Loosen pipes (11) and (3).



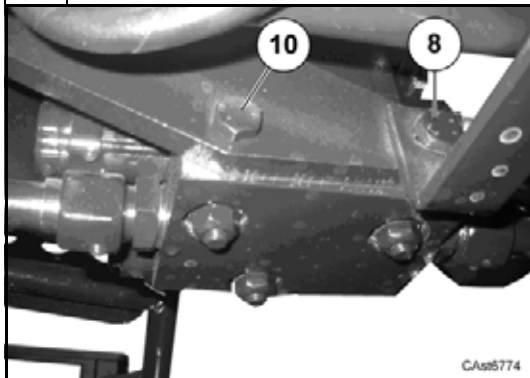
# Disassembly and Assembly Operations

3.



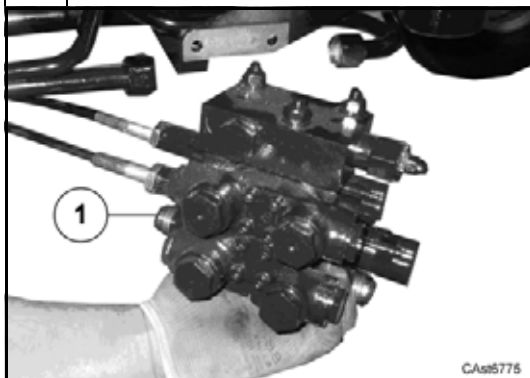
Unlock the bowden cable (A).

4.



Remove bolts (8) and (10).

5.

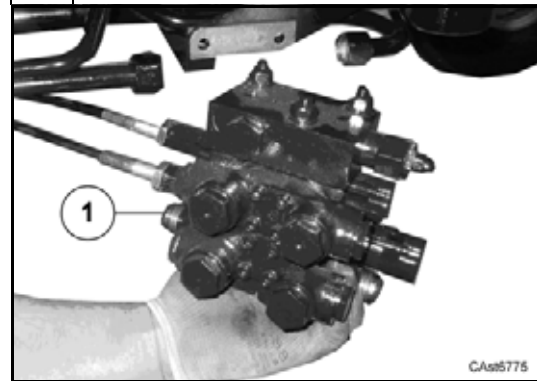


Remove the auxiliary distributor assembly (1).  
Check and inspect auxiliary distributor parts. Repair/  
replace parts if necessary.

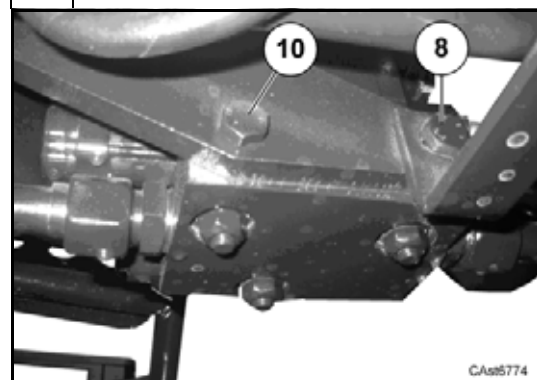
## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.

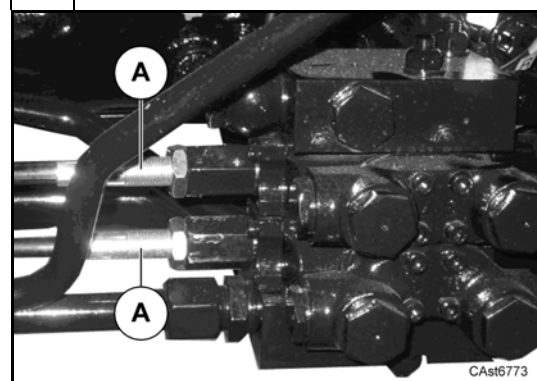


2.



Screw up bolts (8) and (10).

3.

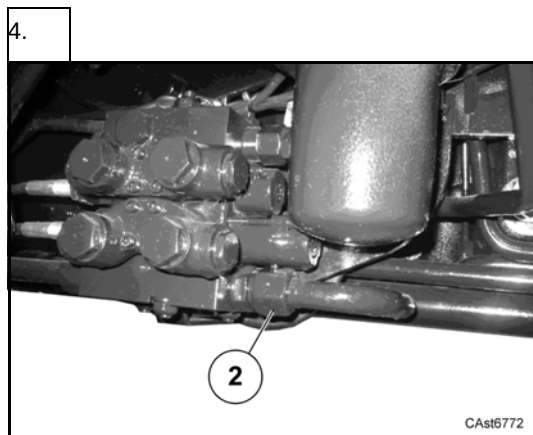


Lock the bowden cable (A).

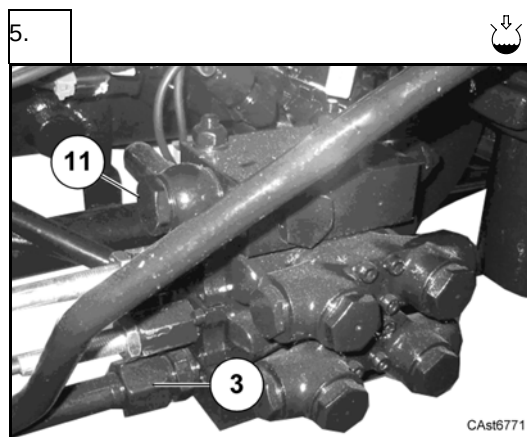


## Disassembly and Assembly Operations

---



Assemble pipe (2).

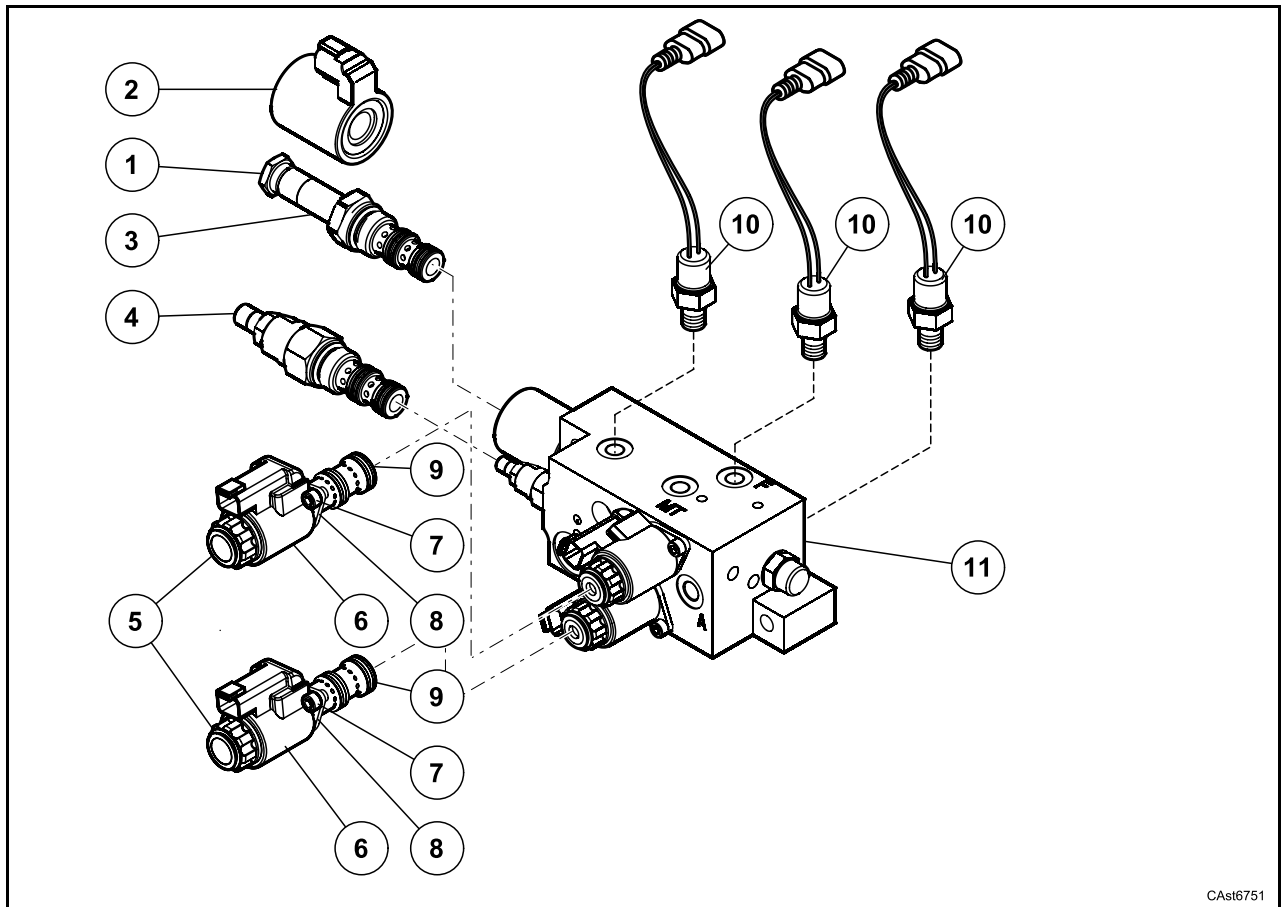


Assemble pipes (11) and (3).

Check the oil level. Fill it if necessary. Check for the correct function of the distributor.

# Disassembly and Assembly Operations

## POWERSHUTTLE HYDRAULIC VALVE

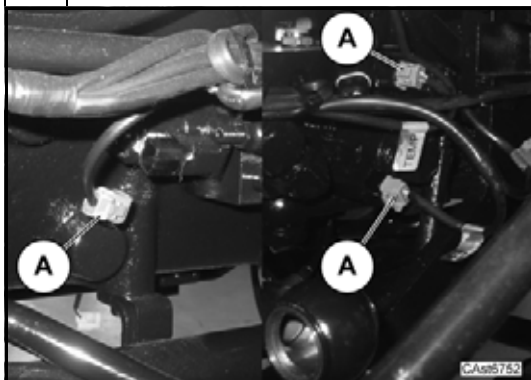


CAst6751

### ON-OFF valve disassembly

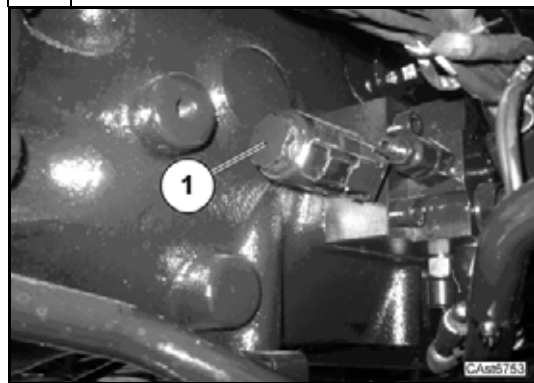
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Remove the electrical connections (A) to the solenoid valves.

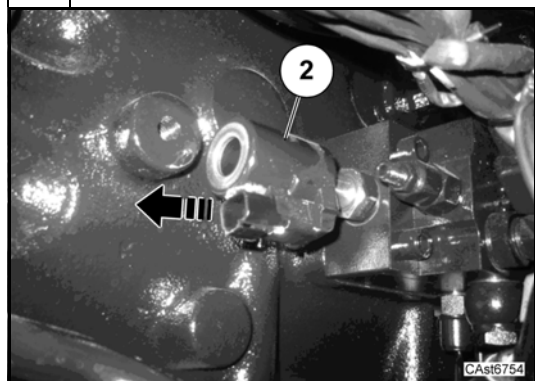
2.



Unscrew and remove ring (1).

## Disassembly and Assembly Operations

3.



Remove solenoid (2).

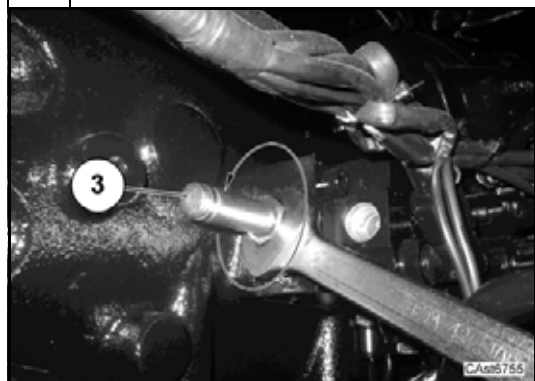
5.



Remove valve (3).

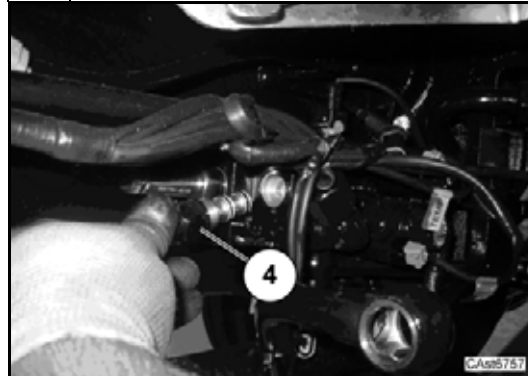
Flow divider valve disassembly

4.



Unscrew valve (3).

1.



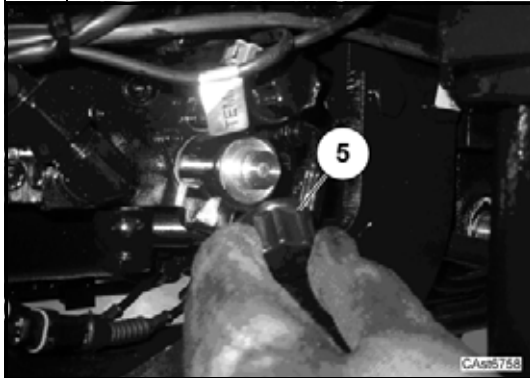
Unscrew and remove the flow divider valve (4).

# Disassembly and Assembly Operations

## Proportional valve disassembly

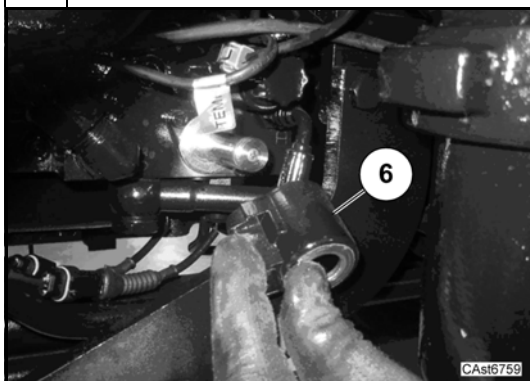
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



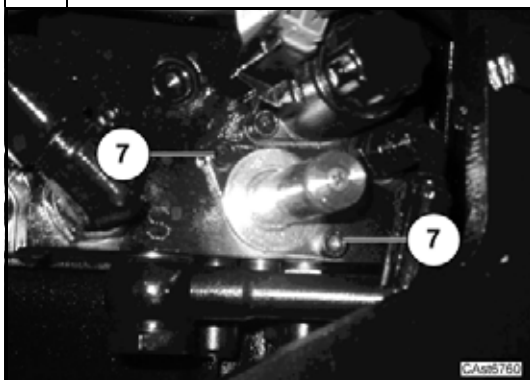
Unscrew and remove nut (5).

2.



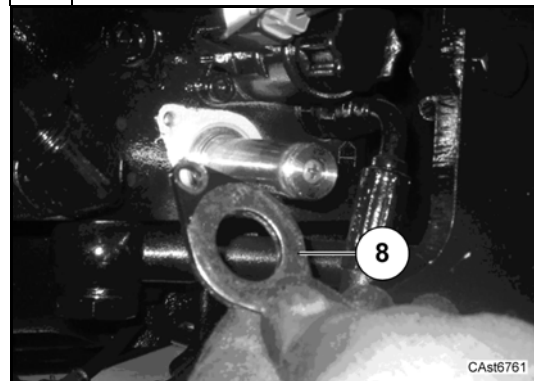
Remove solenoid (6).

3.



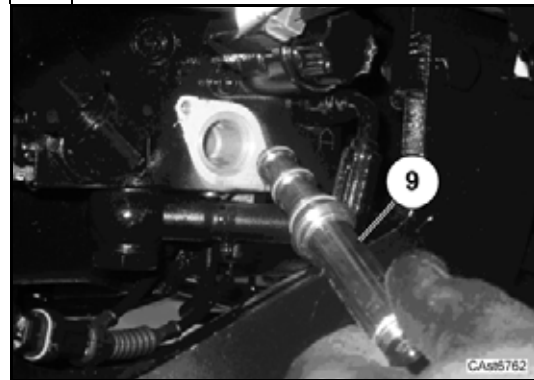
Remove bolts (7).

4.



Remove flange (8).

5.



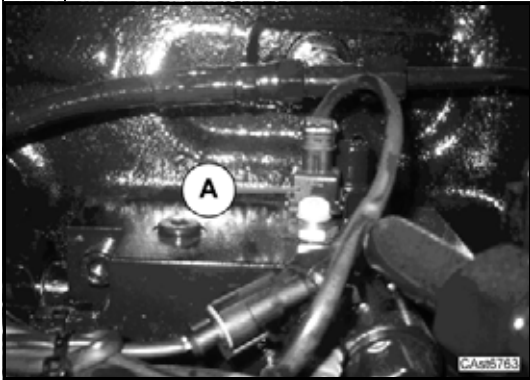
Unscrew and remove proportional valve (9).

# Disassembly and Assembly Operations

## Temperature sensor disassembly

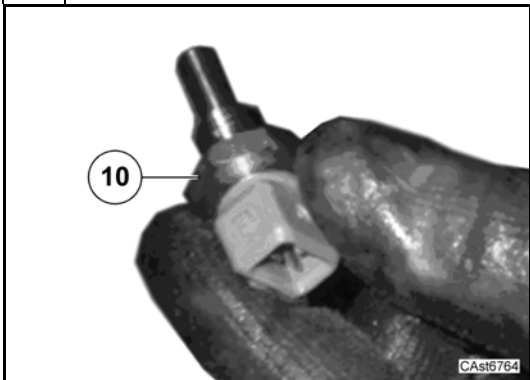
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Disconnect electrical connection (A).

2.

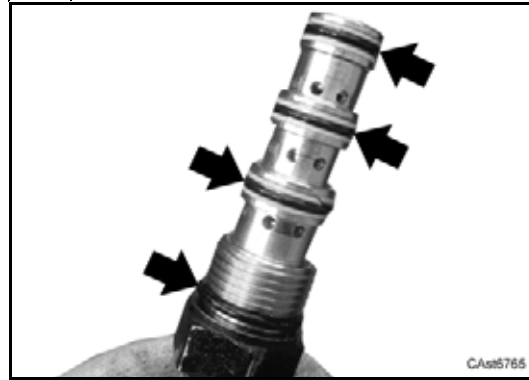


Unscrew and remove the temperature sensor (10).

## ON-OFF valve assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Check that the valve is clean and free from impurities.

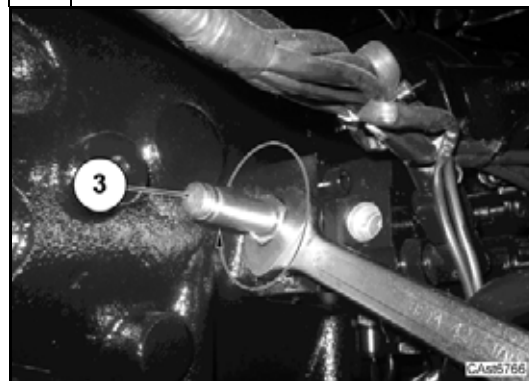
Clean it if necessary.

Check that the O-Rings are not damaged.

Replace them if necessary.

**IMPORTANT:** Contamination will badly affect the result of your work. Ensure your tools and work place are kept clean at all times.

2.

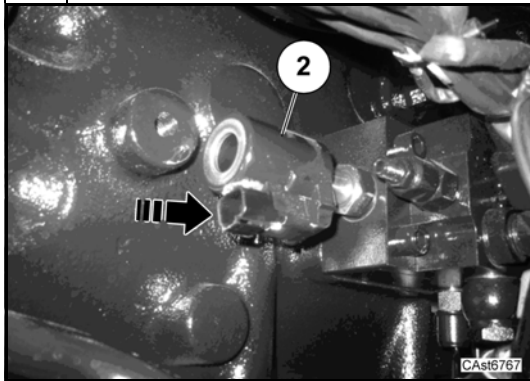


Assemble and screw up valve (3).



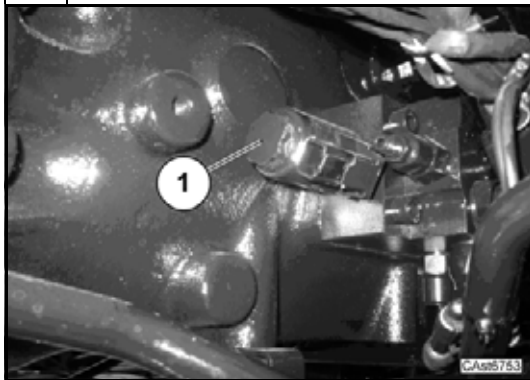
# Disassembly and Assembly Operations

3.



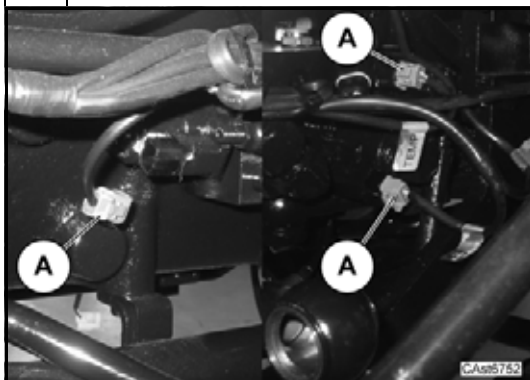
Assemble solenoid (2).

4.



Assemble and screw up bolt (1).

5.



Restore all electrical connections (A).

## Flow divider valve assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

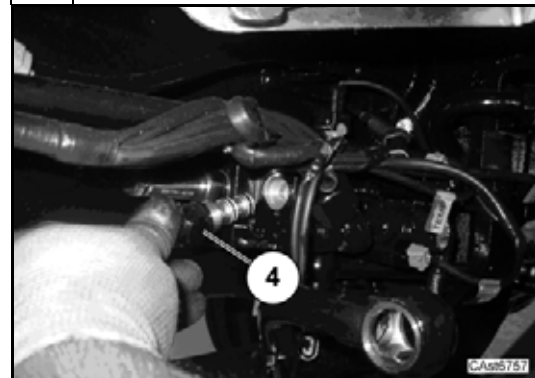
1.



Check the valve is clean and free from impurities. Clean it if necessary. Check the O-Rings are not damaged. Replace it if necessary.

**IMPORTANT:** Contamination will badly affect the result of your work. Ensure your tools and work place are kept clean at all times.

2.



Assemble and tighten the flow divider valve (4).



# Disassembly and Assembly Operations

## Proportional valve assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

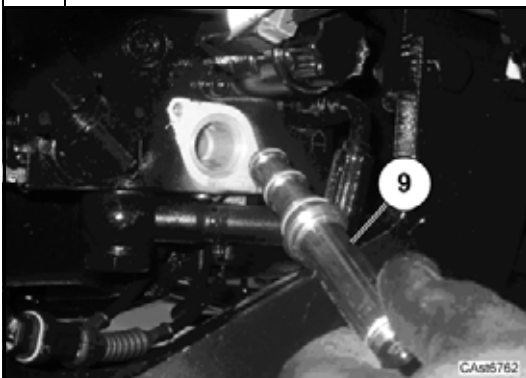
1.



Check the valve is clean and free from impurities. Clean it if necessary. Check the O-Rings are not damaged. Replace it if necessary.

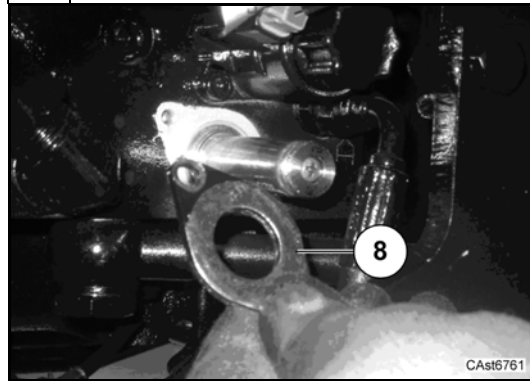
**IMPORTANT:** Contamination will badly affect the result of your work. Ensure your tools and work place are kept clean at all times.

2.



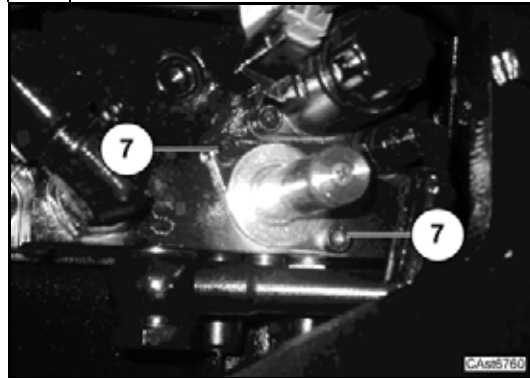
Assemble and screw up proportional valve (9).

3.



Assemble flange (8).

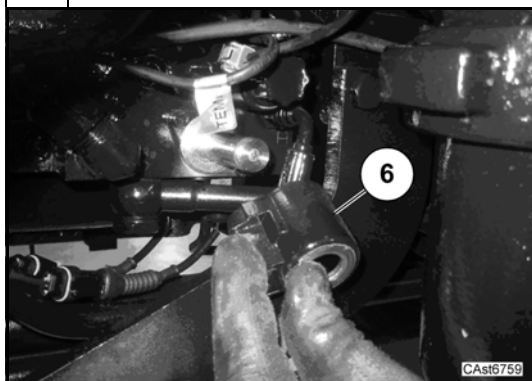
4.



Screw up bolts (7).

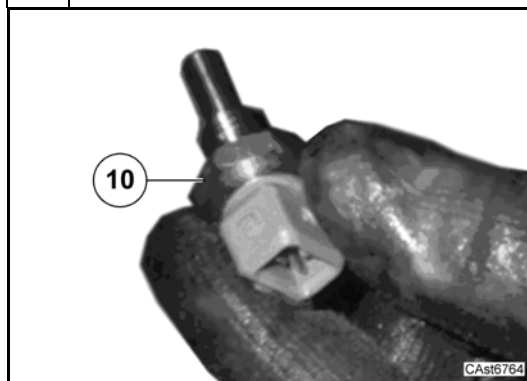
## Disassembly and Assembly Operations

5.



Assemble solenoid (6).

7.



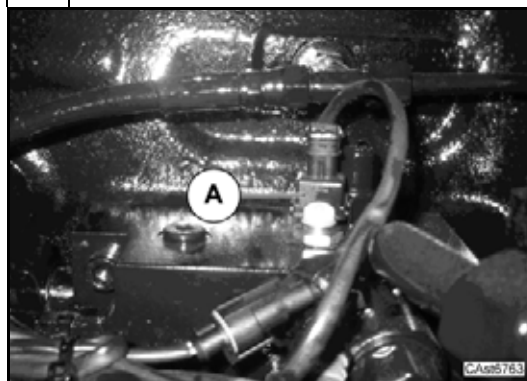
Assemble and screw up a new temperature sensor (10).

6.



Screw up nut (5).

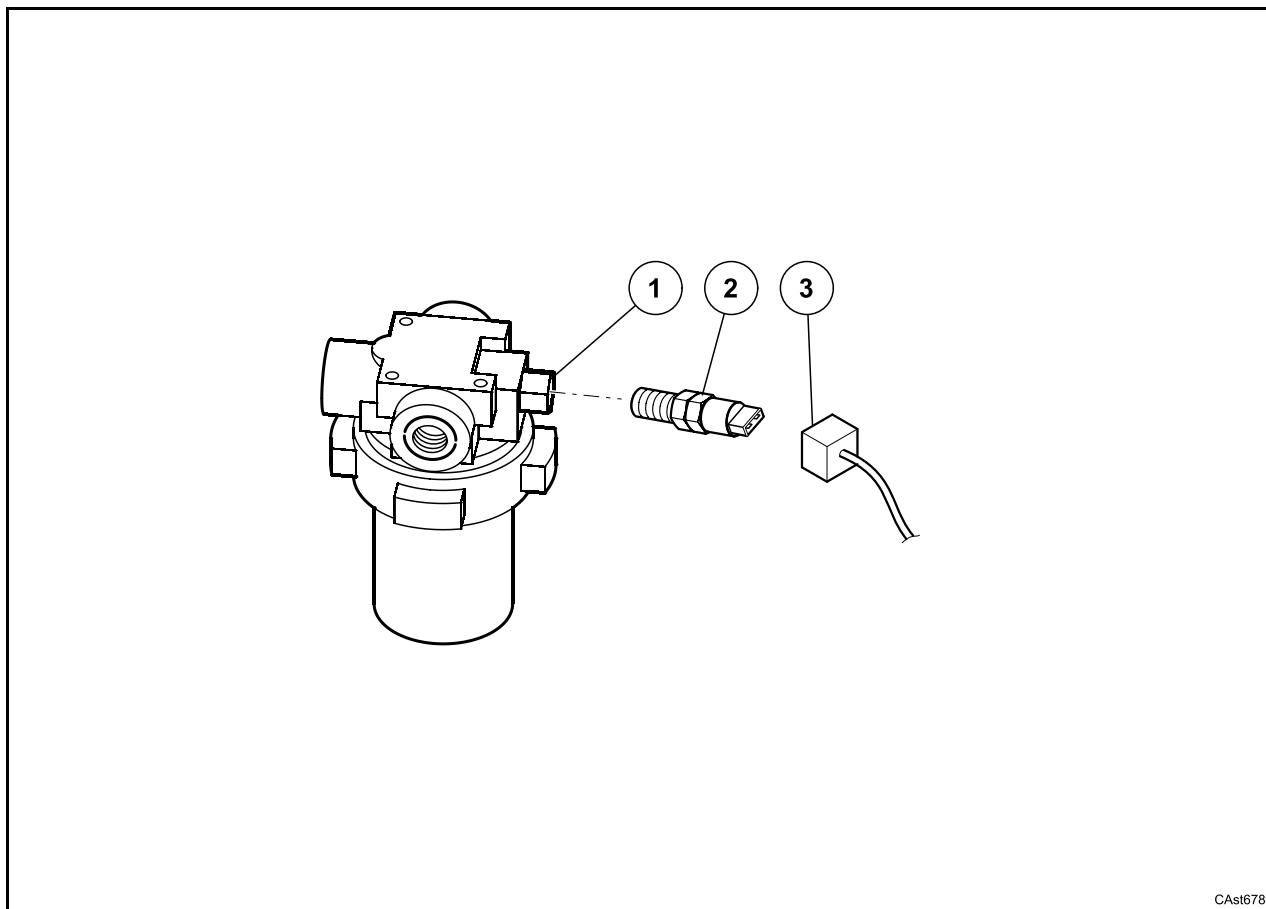
8.



Restore electrical connection (A).

# Disassembly and Assembly Operations

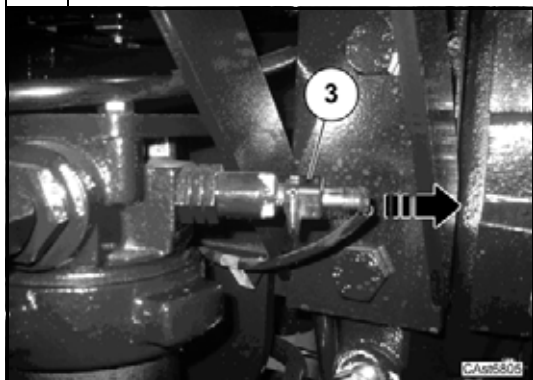
## OIL FILTER SENSOR



### Disassembly

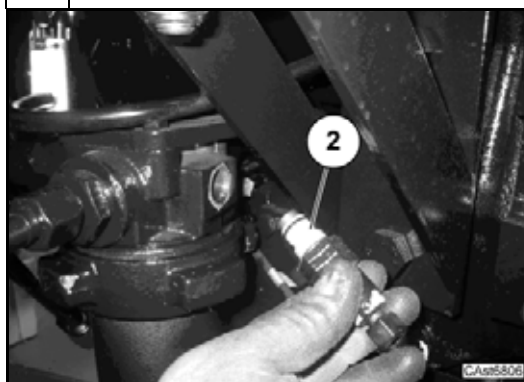
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Disconnect electrical connection of sensor (3).

2.



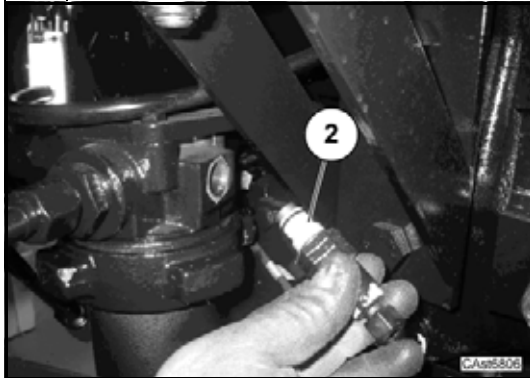
Unscrew and remove sensor (2).

# Disassembly and Assembly Operations

## Assembly

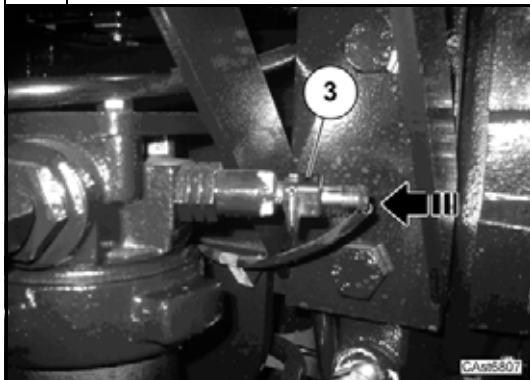
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



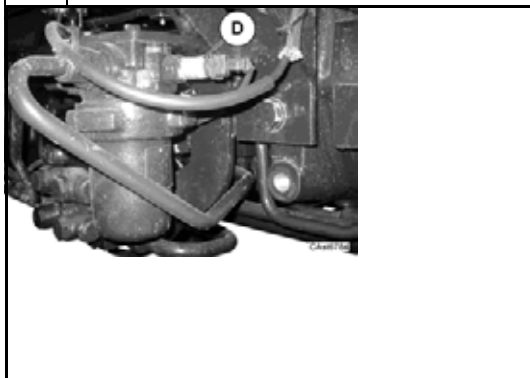
Install new sensor (2).

2.



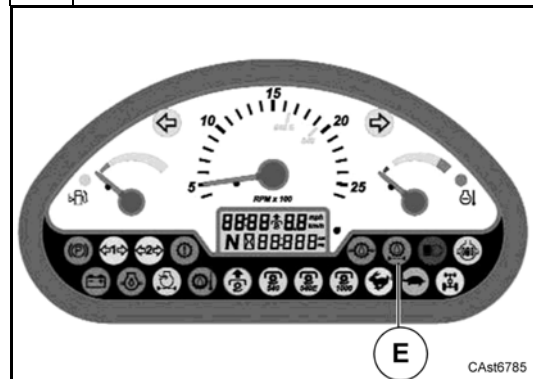
Connect electrical connection of sensor (3).

3.



All tractors with Powershuttle transmission are equipped with a transmission oil filter sensor (A).

4.



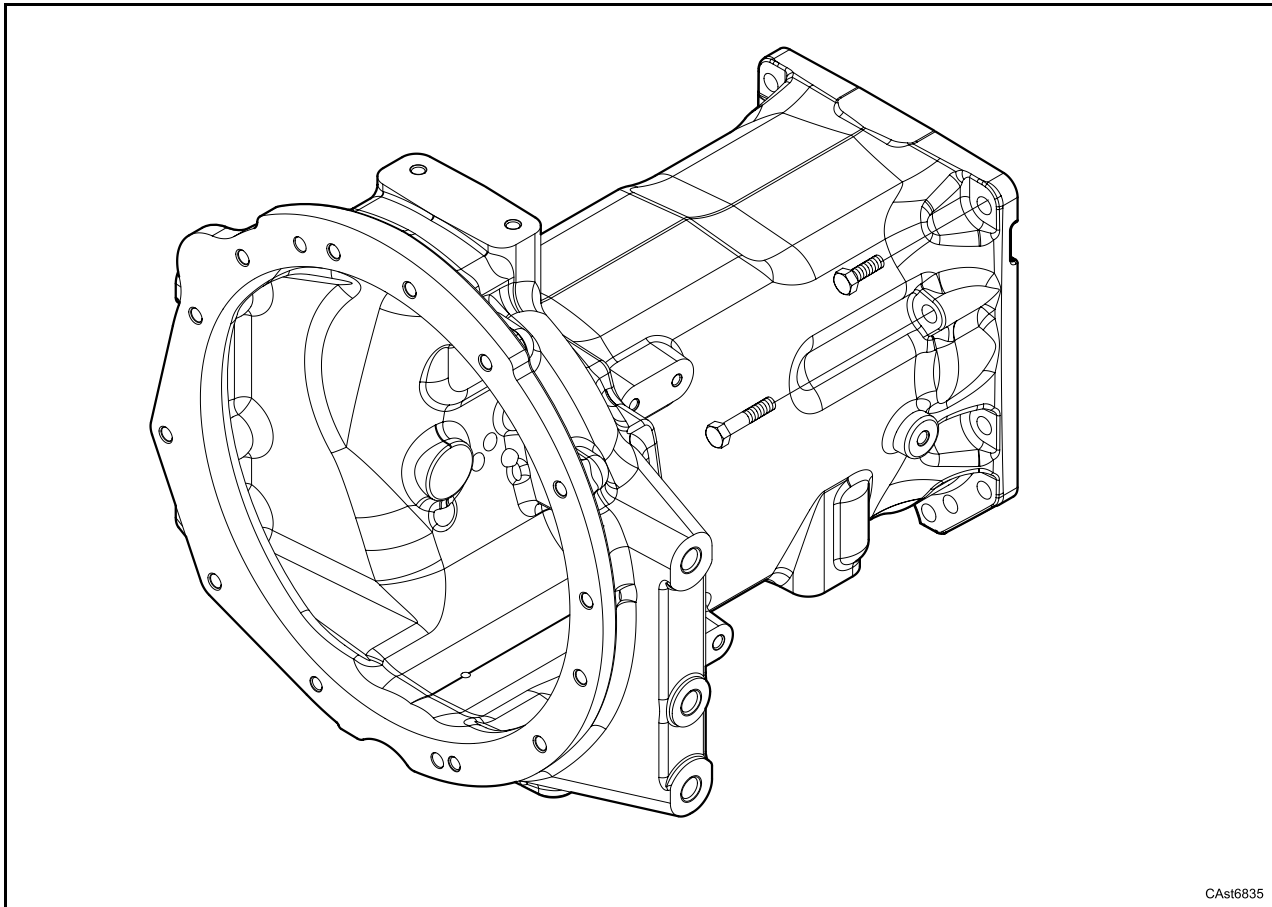
If the light (E) on the dashboard is lighted, the replacement of the filter cartridge is needed (see procedure in relevant section).

**IMPORTANT:** The filter cartridge must be replaced as soon as possible to ensure correct operation and protection of the Powershuttle System.

**IMPORTANT:** In case of use of the tractor in low temperature condition ( $< 10^{\circ}\text{C}$  ( $50^{\circ}\text{F}$ )), light on the dashboard could be ON for a few minutes until the transmission oil reaches the normal function temperature.

# Disassembly and Assembly Operations

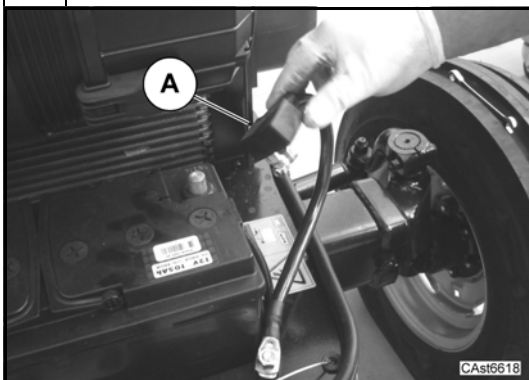
## CLUTCH BOX



### Disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Open the rubber cap and remove the negative (A) from the battery.

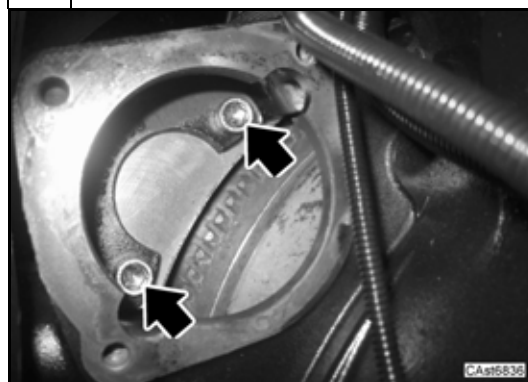
Engage the hand brake.

Remove bonnet (see section D.10).

Remove vertical exhaust pipe (see section D.7).

Remove the starting motor (see section D.15).

2.

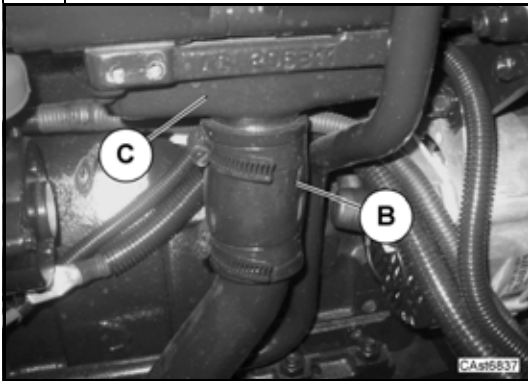


Remove the two bolts.



# Disassembly and Assembly Operations

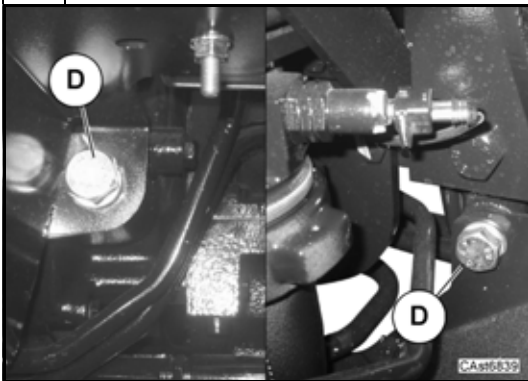
3.



Loosen the connections between sleeve (B) and hydraulic pump (C).

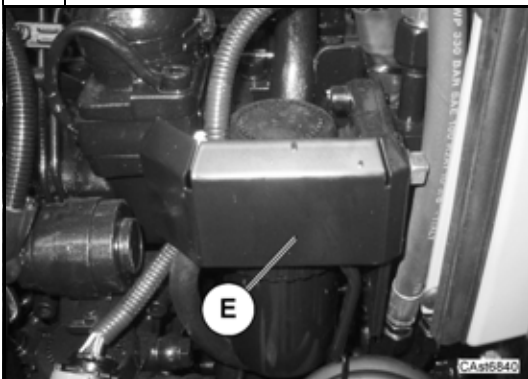
Refer to: section C.14.

4.



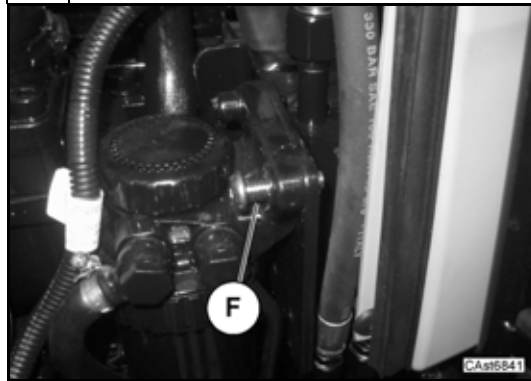
Remove the tool box support loosening bolts (D).

5.



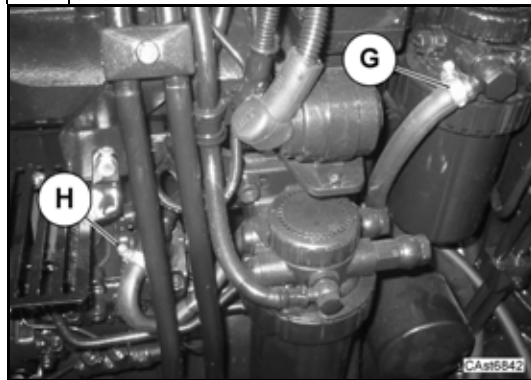
Remove the fuel filter protection (E).

6.



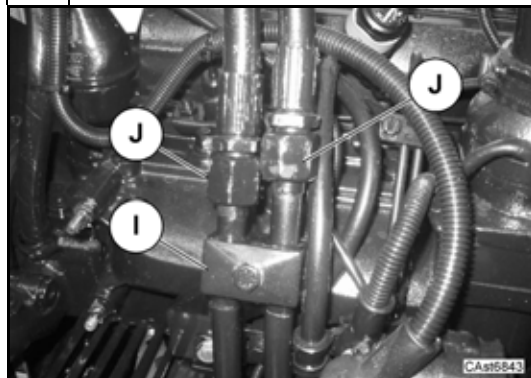
Loosen without removing bolt (F).

7.



Loose the fuel lines (G) and (H).

8.

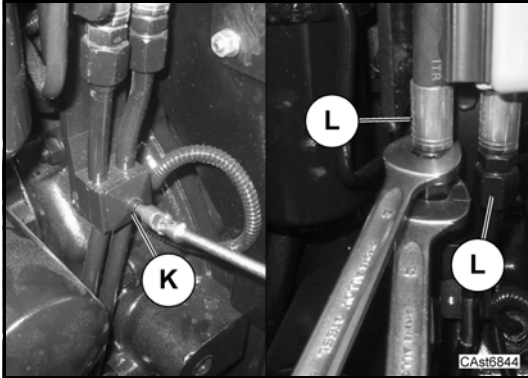
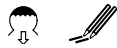


Remove clip (I), place a suitable container under the tractor, mark and disconnect pipes (J).



# Disassembly and Assembly Operations

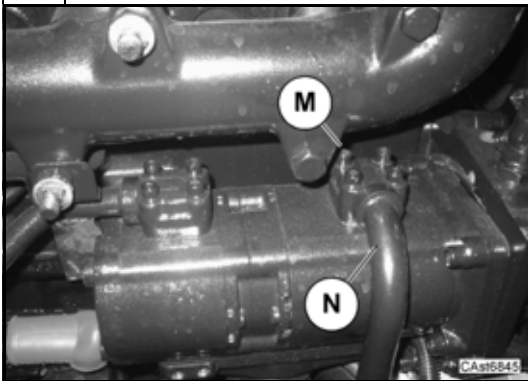
9.



Remove bolt (K) to take off the clamp.

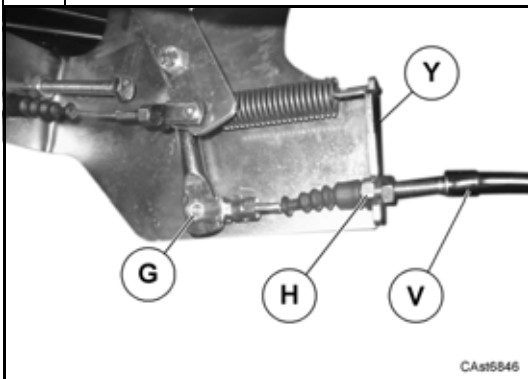
Place a suitable container under the tractor, mark and disconnect hydraulic lines (L).

10.



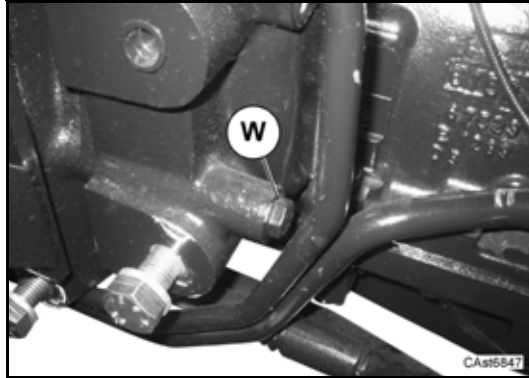
Remove bolts (M) to loosen the pipe (N).

11.



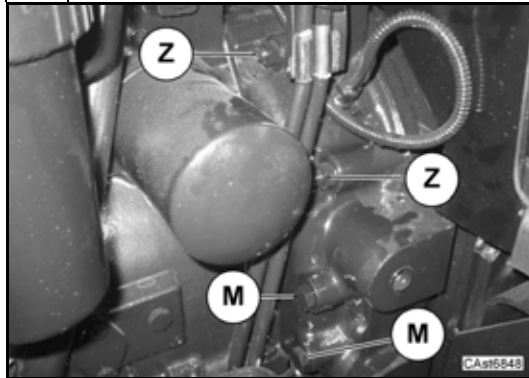
Remove pin (G), unscrew nut (H) and pull cable (V) out of the bracket (Y).

12.



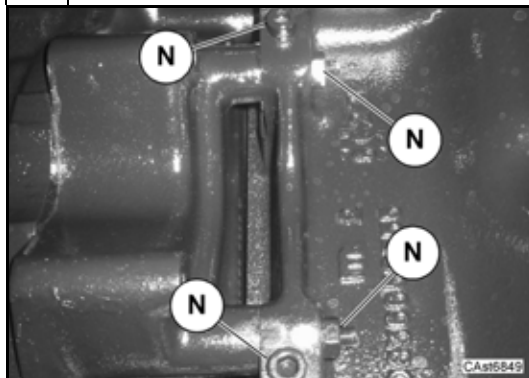
Remove nut (W).

13.



Remove nut (Z) and bolt (M).

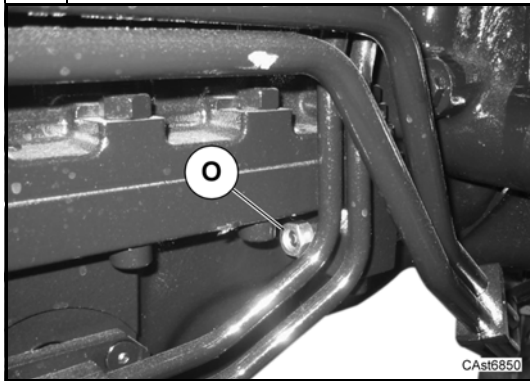
14.



Remove bolts and nuts (N) located under the tractor.

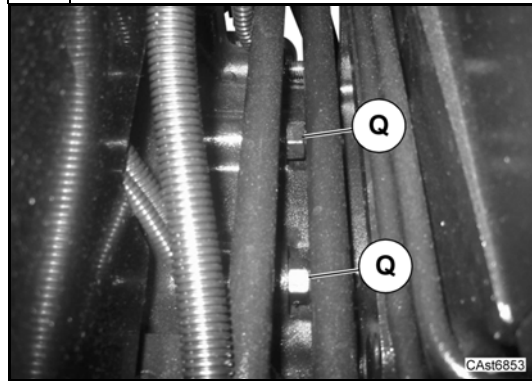
# Disassembly and Assembly Operations

15.



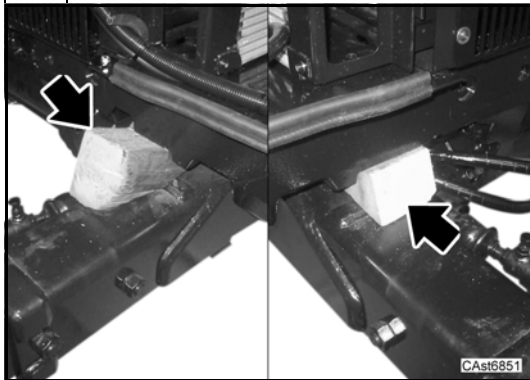
Remove nut (O).

18.



Remove the two bolts (Q).

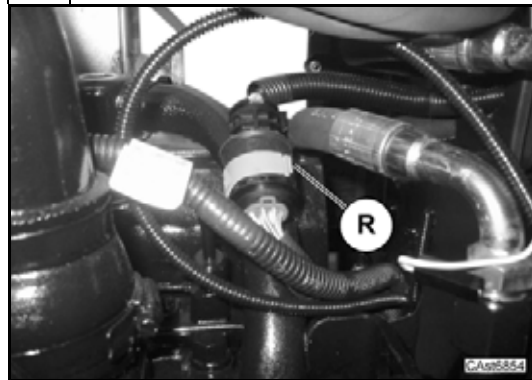
16.



Cancel the axle oscillation by inserting a suitable shim on either side of the frame.

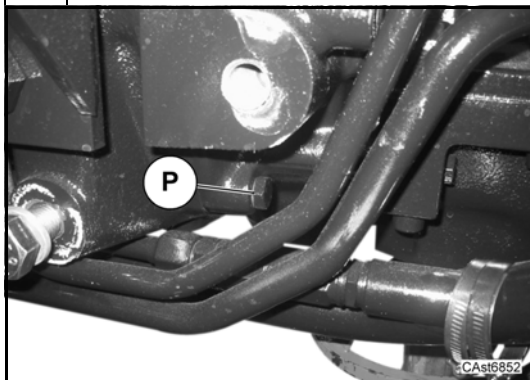
**IMPORTANT:** Chock the rear wheels. Install a mobile stand under the tractor.

19.



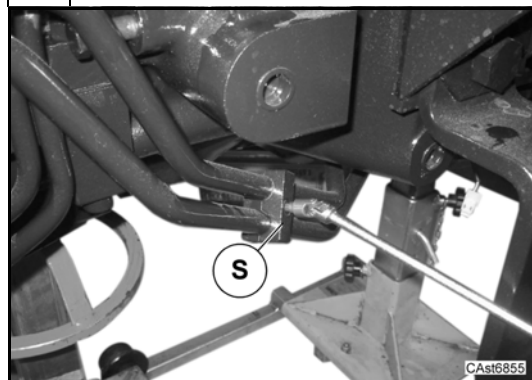
Mark and disconnect main connector (R).

17.



Remove bolt (P).

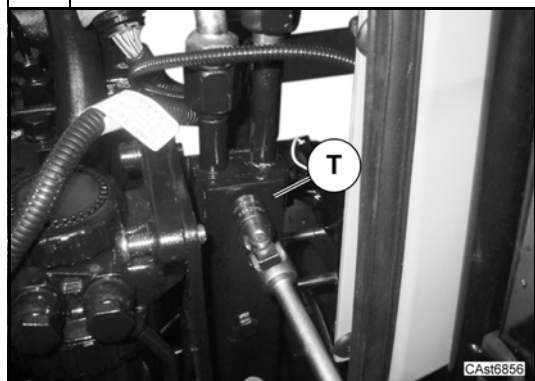
20.



Loosen clip (S).

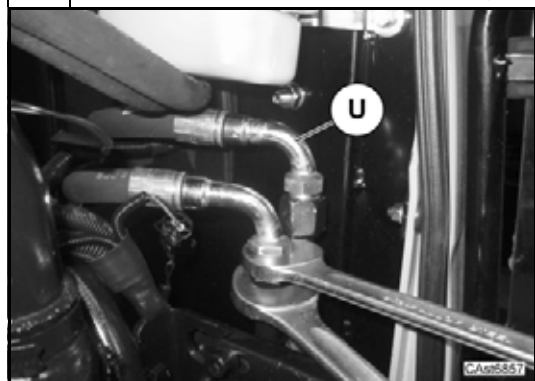
# Disassembly and Assembly Operations

21.



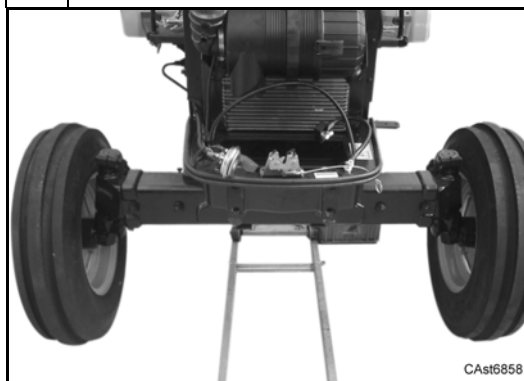
Loosen clip (T).

22.



Mark and disconnect hose (U).

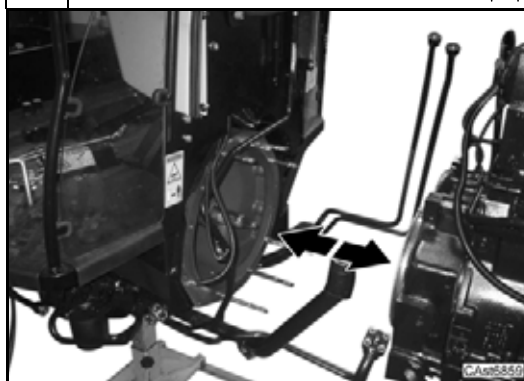
23.



Before starting to slip out the engine from the clutch box, be sure front wheels are aligned.

**IMPORTANT:** When disassembling, check that connections (hoses, pipes and harnesses) are all disconnected.

24.

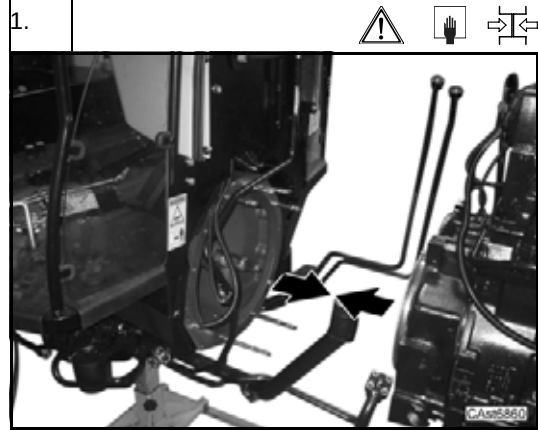


Separate the assemblies with the help of an operator.

# Disassembly and Assembly Operations

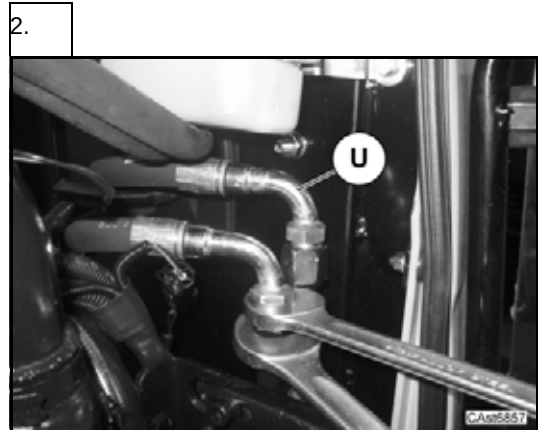
## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

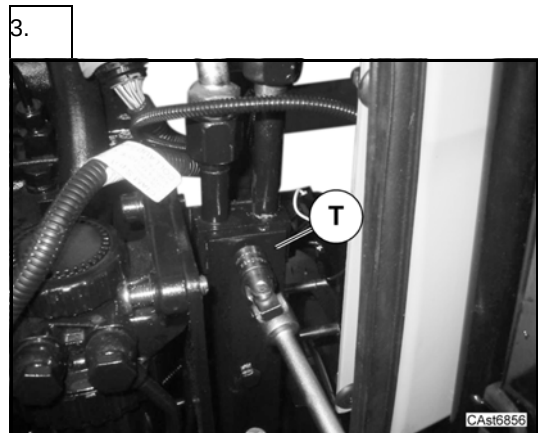


Clean mating surfaces of clutch housing and engine.

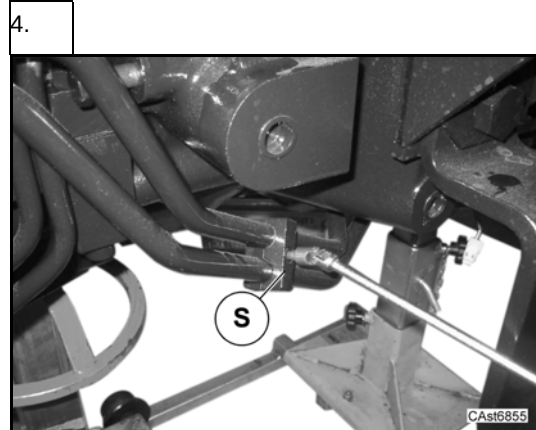
Ensure that disconnected hydraulic lines do not entangle with engine components or electrical wiring during clutch housing installation.



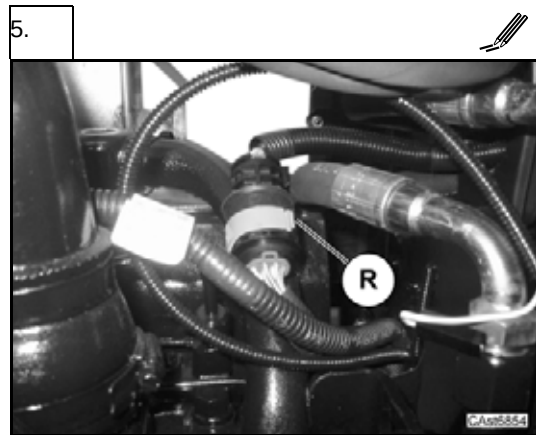
Connect hose (U).



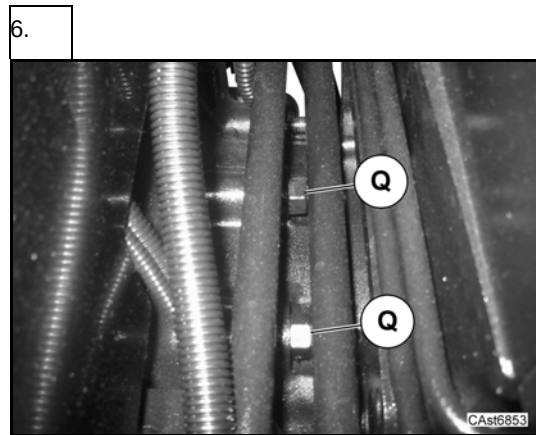
Assemble clip (T).



Assemble clip (S).



Connect main connector (R) paying attention to the reference marks applied during disassembly.

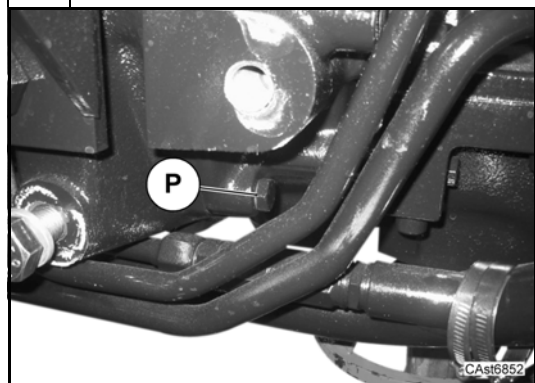


Assemble bolts (Q).



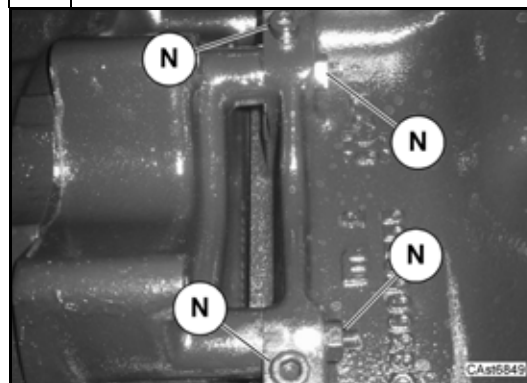
# Disassembly and Assembly Operations

7.



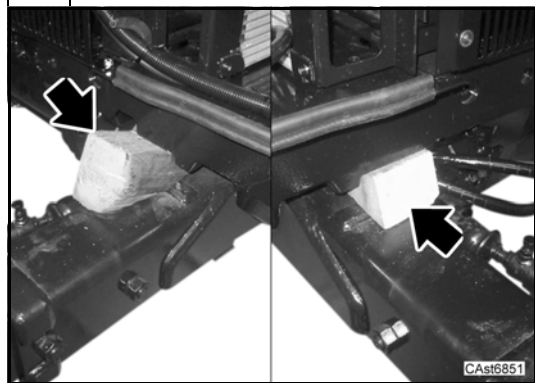
Assemble bolt (P).

10.



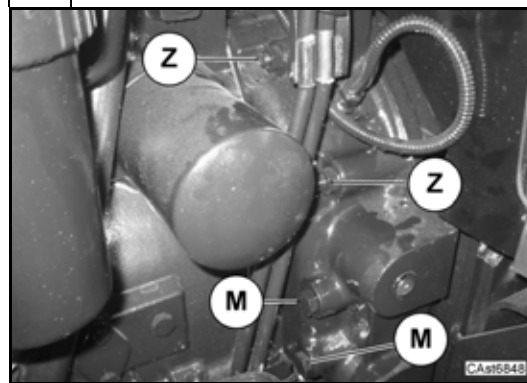
Assemble bolts and nuts (N) under the tractor.

8.



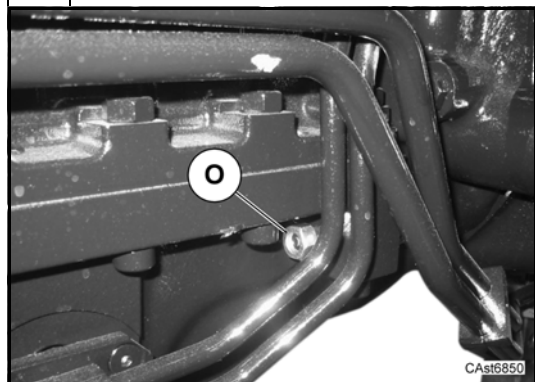
Remove shims.

11.



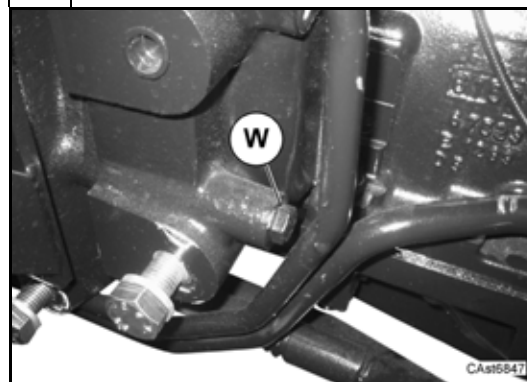
Assemble bolts (M) and nuts (Z).

9.



Assemble nut (O).

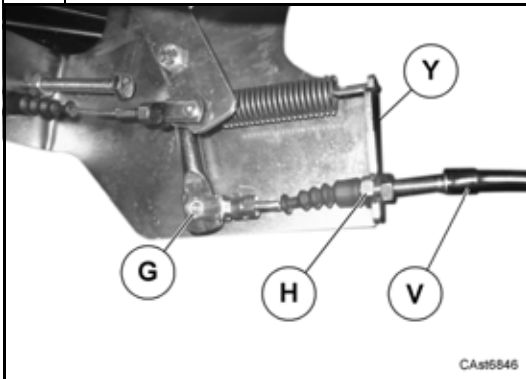
12.



Assemble nut (W).

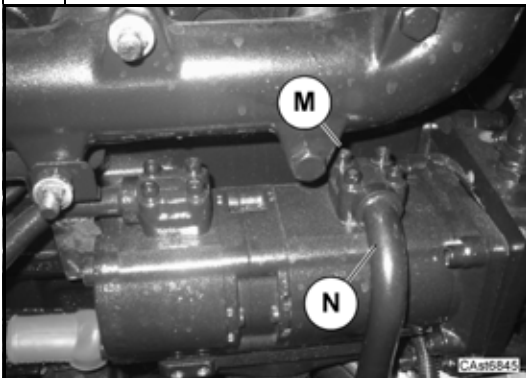
# Disassembly and Assembly Operations

13.



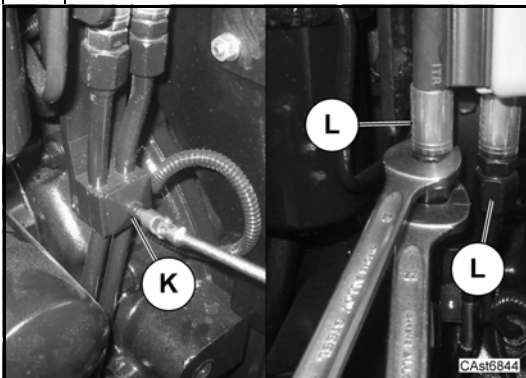
Assemble cable (V) on the bracket (Y).  
Screw up nut (H) and insert pin (G).

14.



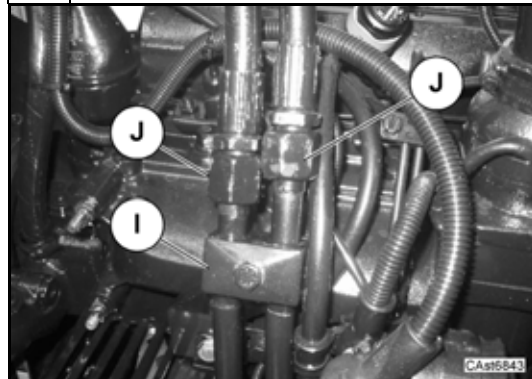
Assemble pipe (N) and tighten bolts (M).

15.



Assemble pipes (L) paying attention to the reference marks applied during disassembly.  
Assemble clips and screw up bolts (K).

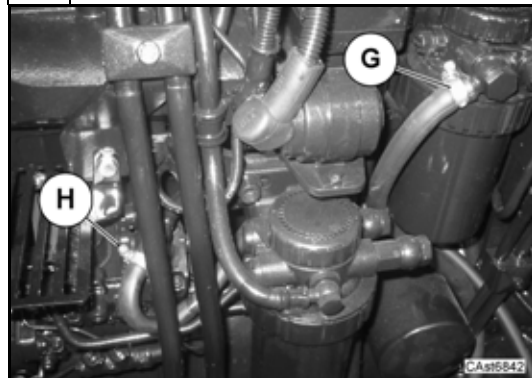
16.



Assemble pipes (J) paying attention to the reference marks applied during disassembly.

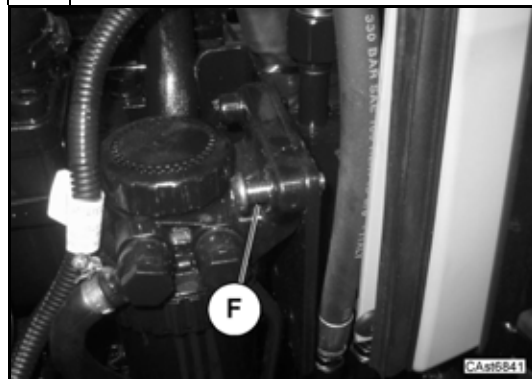
Assemble clip (I).

17.



Assemble the fuel lines (G) and (H).

18.

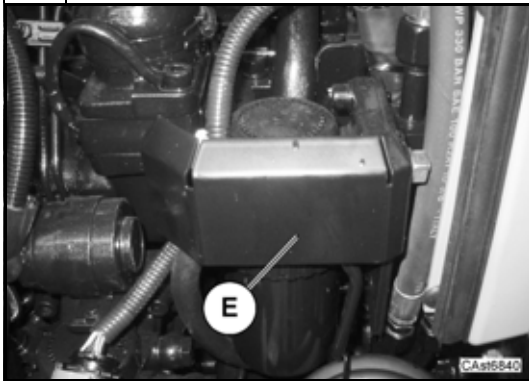


Tighten screw (F).



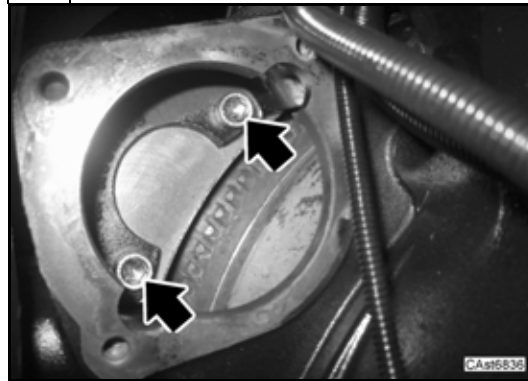
# Disassembly and Assembly Operations

19.



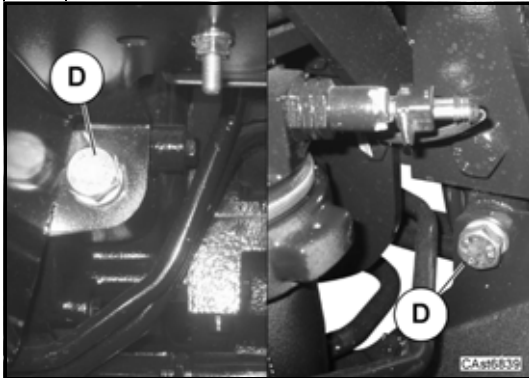
Assemble protection (E) of fuel filter.

22.



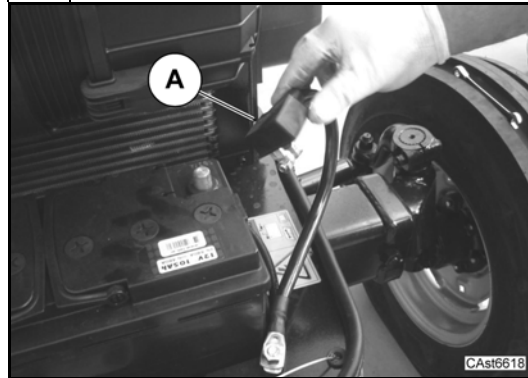
Assemble the two bolts.

20.



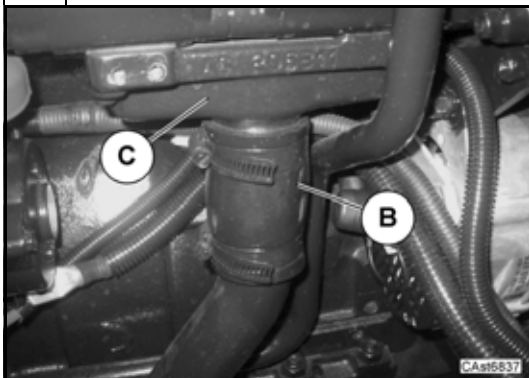
Assemble the tool box support and tighten bolts (D).

23.



Assemble the starting motor (see section D.15).  
 Assemble the exhaust pipe (see section D.7).  
 Assemble the bonnet (see section D.10).  
 Connect cable (A) to battery negative pole.  
 Close the rubber cap.  
 Check the transmission oil level. Fill if necessary.  
 Check the engine oil level. Fill if necessary.  
 Check the brake oil level. Fill if necessary.  
 Fill cooling system with proper coolant.  
 Bleed fuel system.  
 Adjust throttle controls.  
 Perform a function check.  
 Check for leaks.

21.



Restore connection between sleeve (B) and hydraulic pump (C).

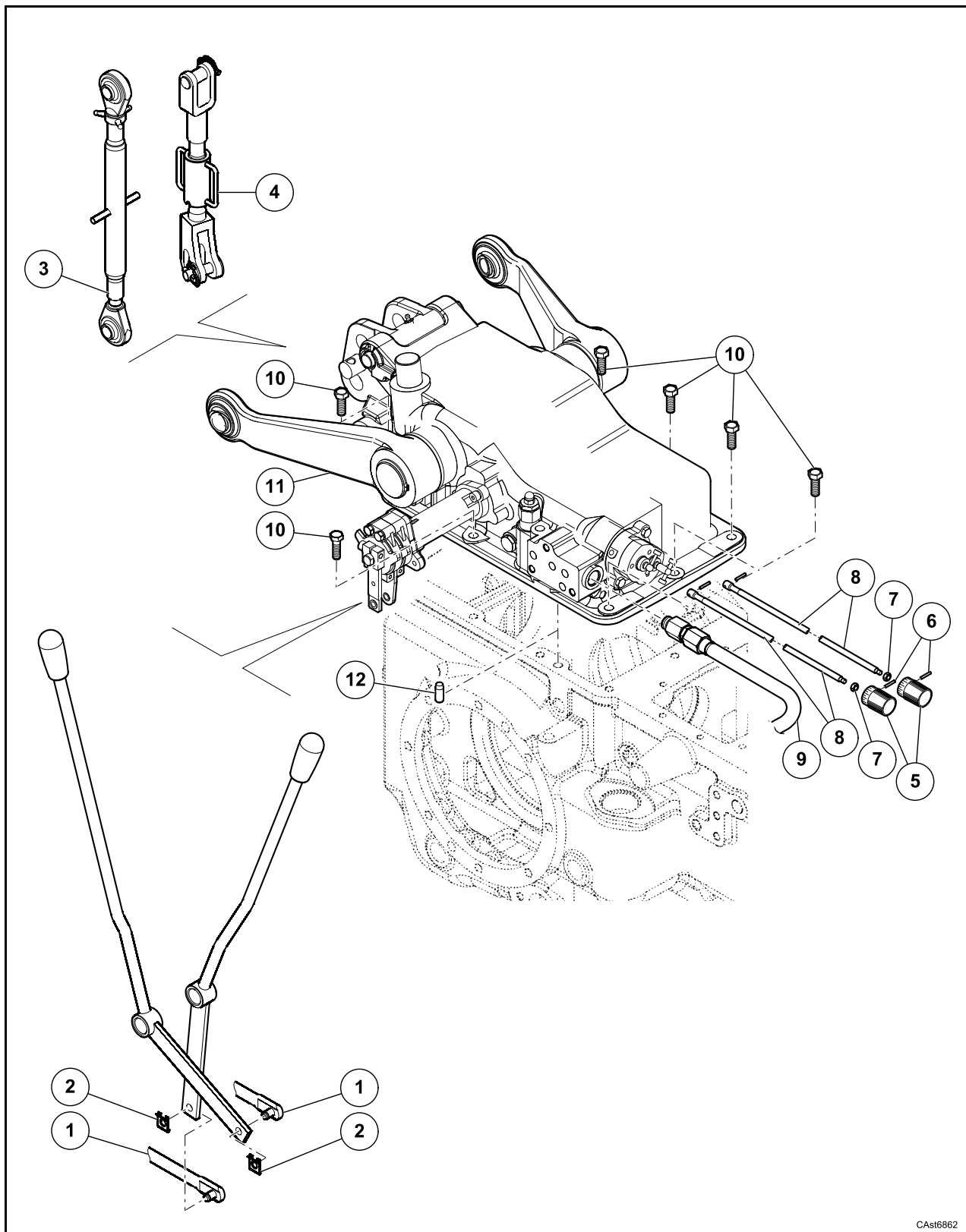
Refer to: section D.14.

*Engine to clutch box fitting points location*



# Disassembly and Assembly Operations

## ROCKSHAFT

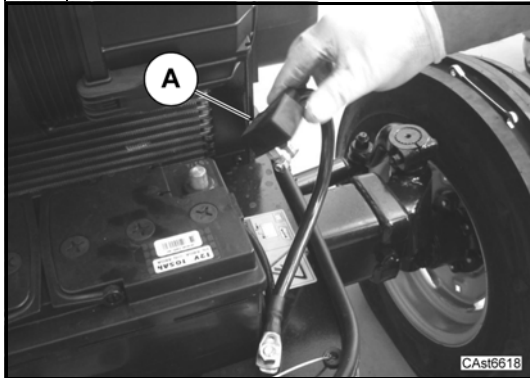


# Disassembly and Assembly Operations

## Disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



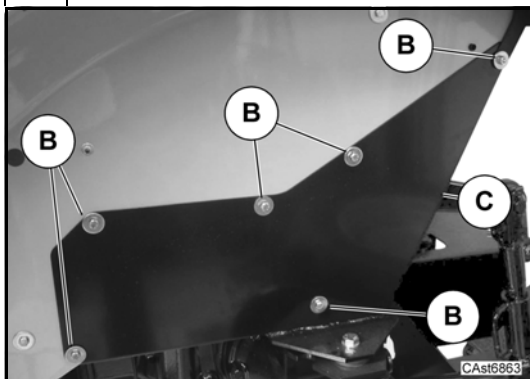
Lower rockshaft arms completely. Apply hand brake.

Open the rubber cap and remove the negative (A) from the battery.

Remove the rear wheels.

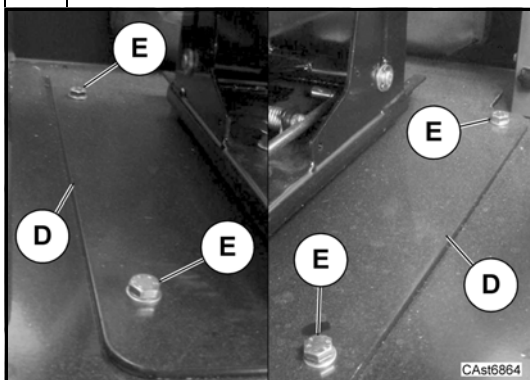
Refer to: section D.23.

2.



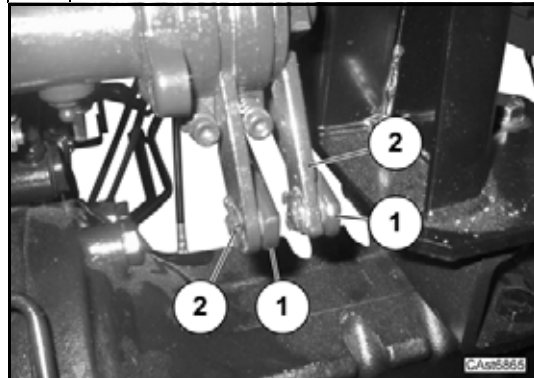
Remove the six bolts (B) and remove the panel (C) on left side.

3.



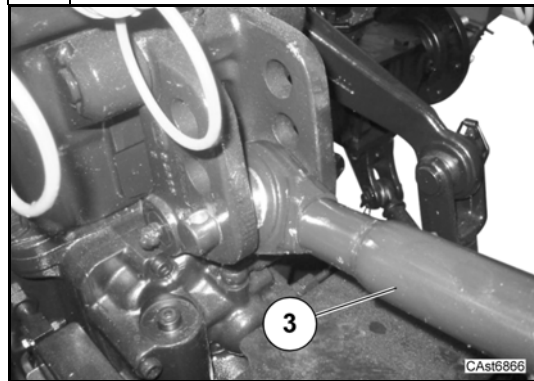
Remove the seat and the seat support (D) taking off the four bolts (E).

4.



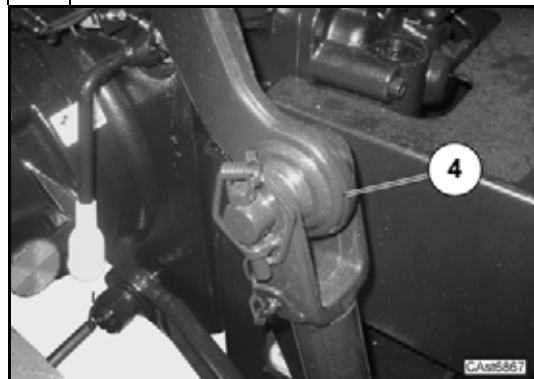
Loosen the rockshaft levers (1) removing clips (2).

5.



Remove the 3rd point tie-rod (3).

6.

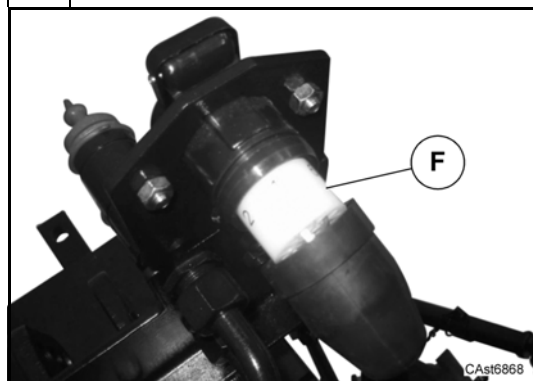


Unlock vertical lever (4).



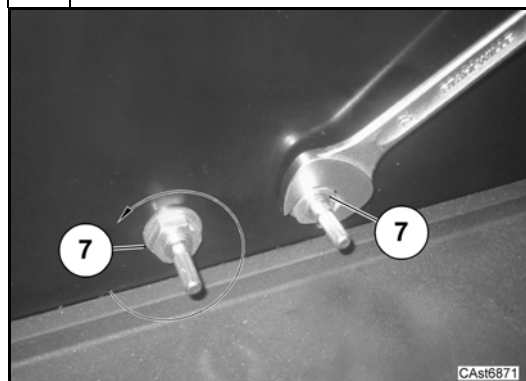
# Disassembly and Assembly Operations

7.



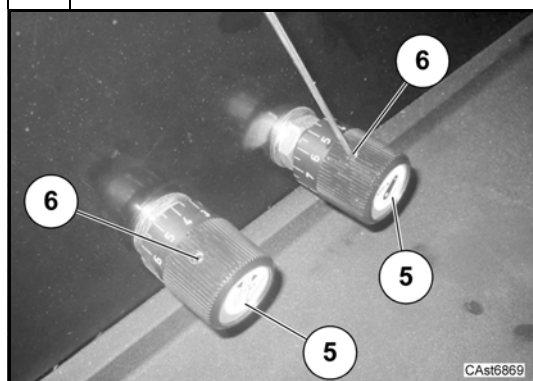
Disconnect the trailer socket (F).

10.



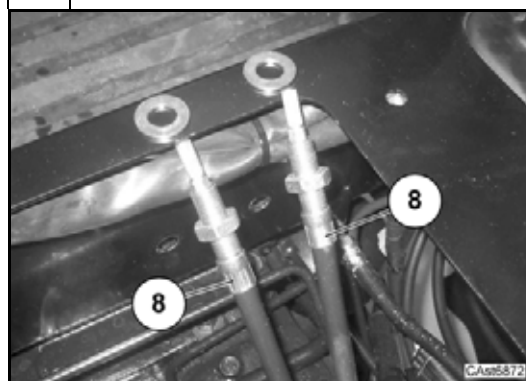
Loosen and remove the two nuts (7).

8.



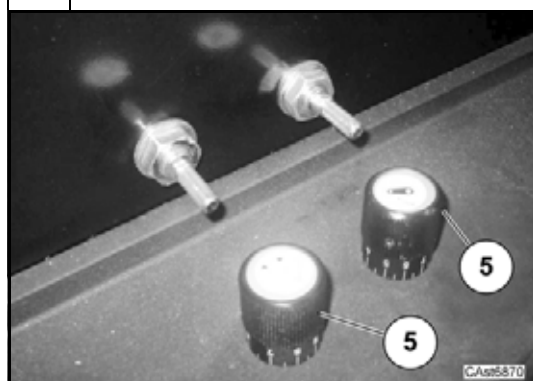
Loosen without removing the stud (6) on sensitivity and rate of drops knobs (5).

11.



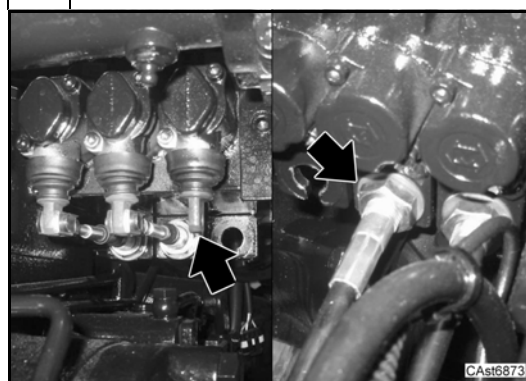
Pull the bowden (8) out from the platform frame.

9.



Remove both knobs (5).

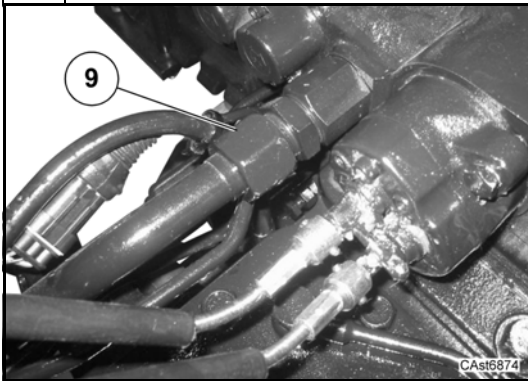
12.



Loosen the auxiliary distributor push-pull cables.

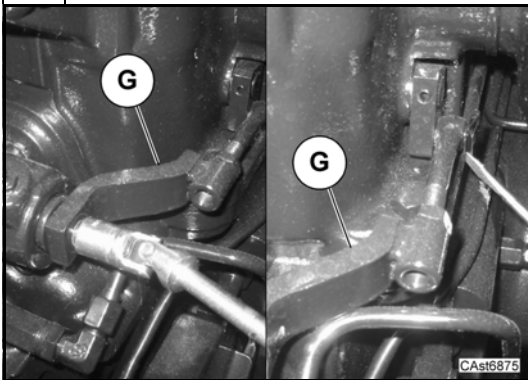
# Disassembly and Assembly Operations

13.



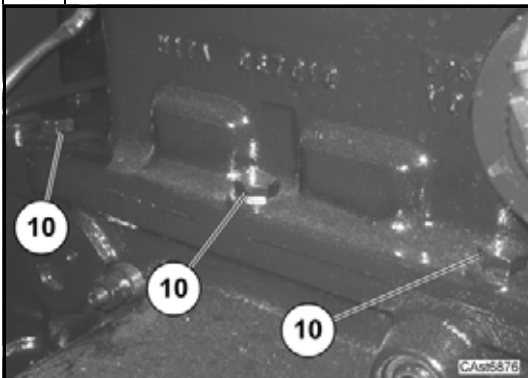
Loosen pipe (9) from the flange.  
Close all openings with cap and plugs.

14.



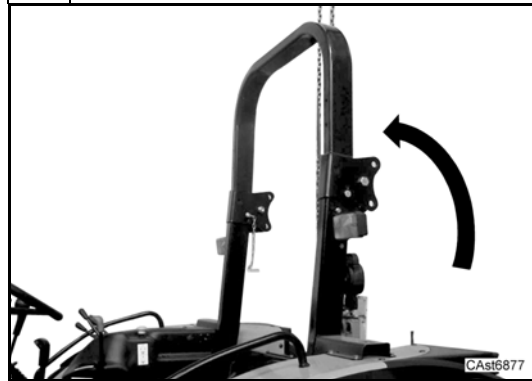
Unlock rods (G).

15.



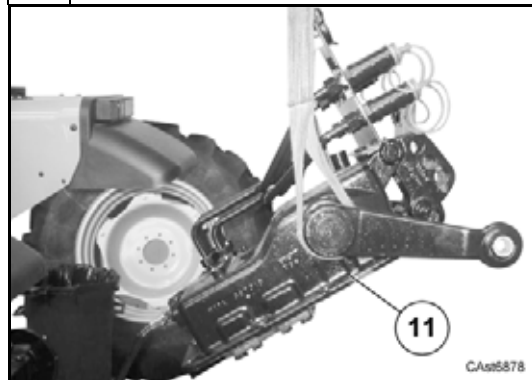
Loosen and remove the nine bolts (10).

16.



Move the roll bar frame to the highest position and lock it with the relevant pins.

17.



Remove the oil dipstick.  
Hook the rockshaft to a suitable lifting device.  
Remove the rockshaft case (11).



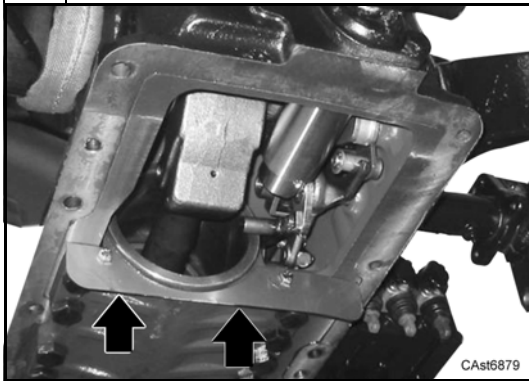
## Warning

**The approximate weight of rockshaft case assembly is 82 Kg (180 lb).**



# Disassembly and Assembly Operations

18.



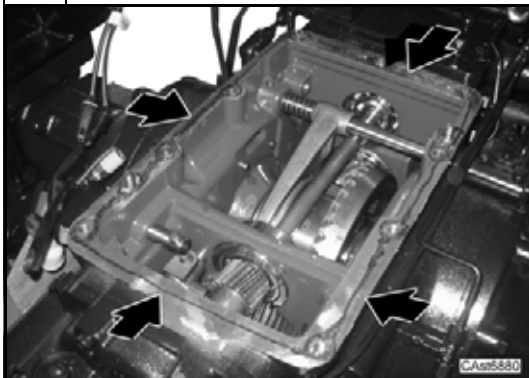
## Warning

**During the disassembly procedure do not damage the shield.**

### Assembly

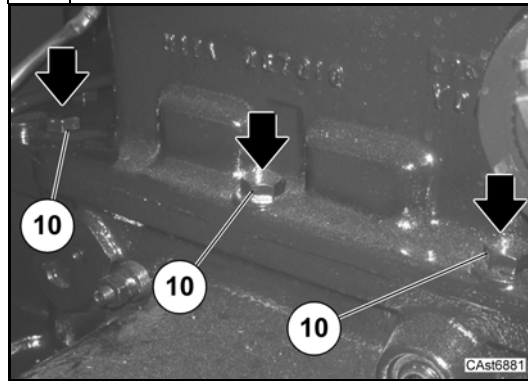
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Clean mating surfaces of rockshaft case and differential housing. Apply a coat of Loctite® 574 to mating surfaces.

2.



Install rockshaft case (11) using a suitable lifting device. Screw up the nine bolts (10).

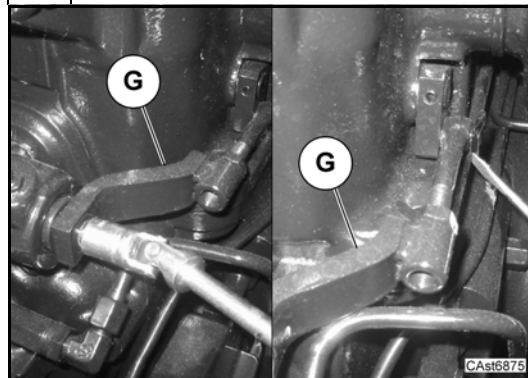
Torque wrench setting: 120 Nm (90 lb.ft)



## Warning

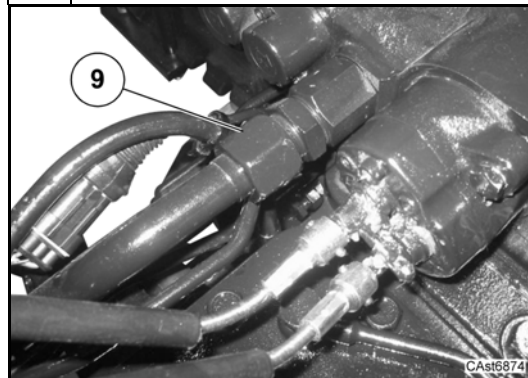
**During the assembly procedure do not damage the shield.**

3.



Assemble rods (G).

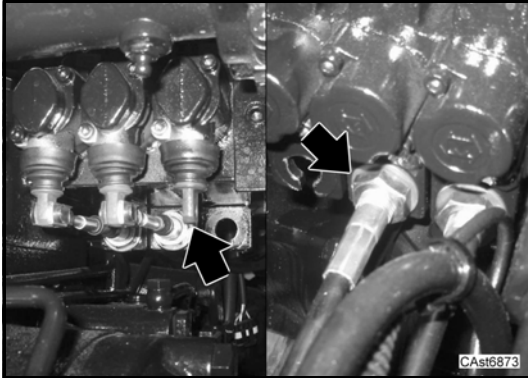
4.



Assemble pipe (9).

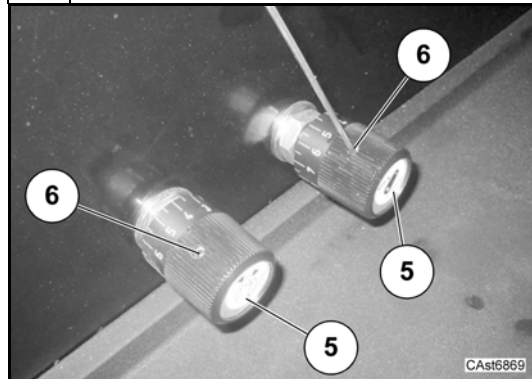
# Disassembly and Assembly Operations

5.



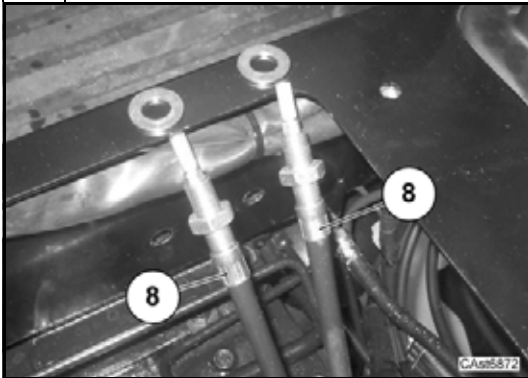
Assembly the auxiliary distributor push-pull cables.

8.



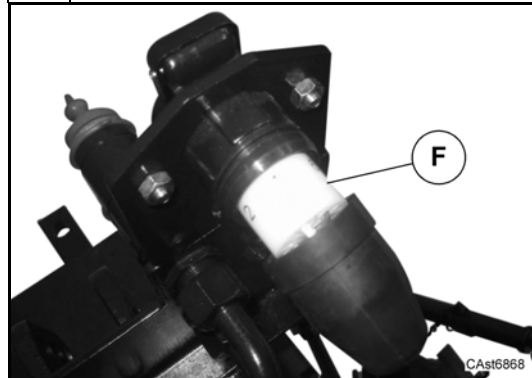
Assemble sensitivity and rate of drops knobs (5) and lock them inserting the pins (6).

6.



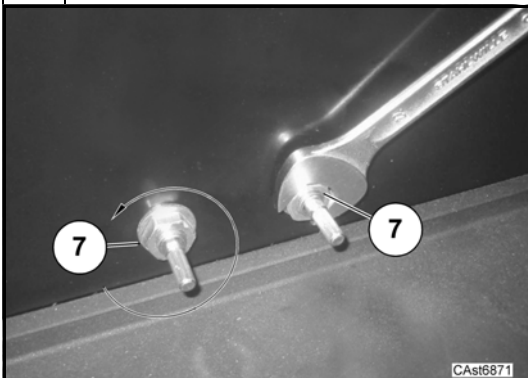
Insert the bowden (8) in the platform frame.

9.



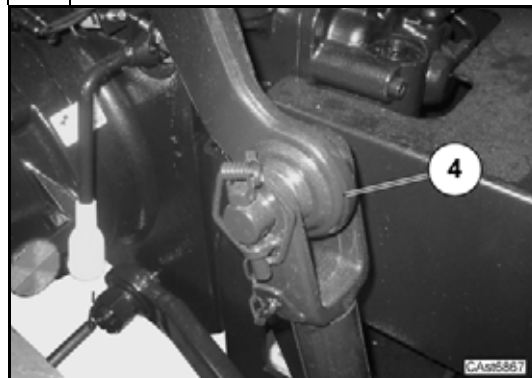
Connect the trailer socket (F).

7.



Screw up nuts (7).

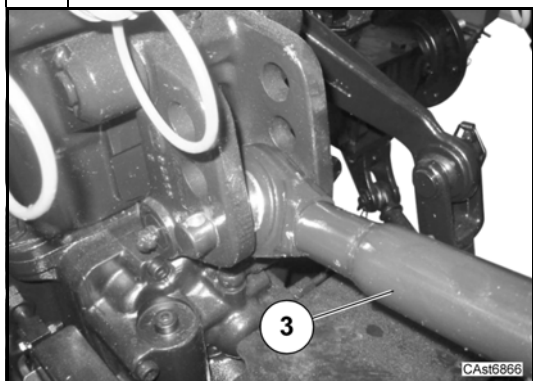
10.



Lock the vertical lever (4).

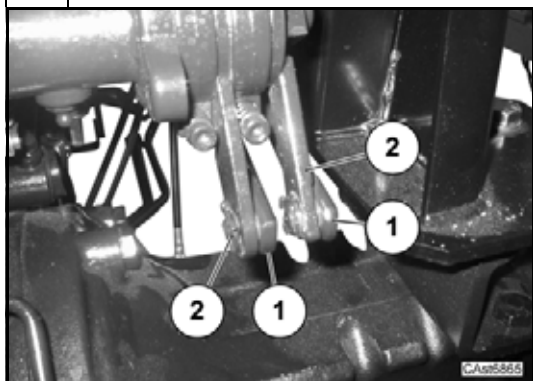
# Disassembly and Assembly Operations

11.



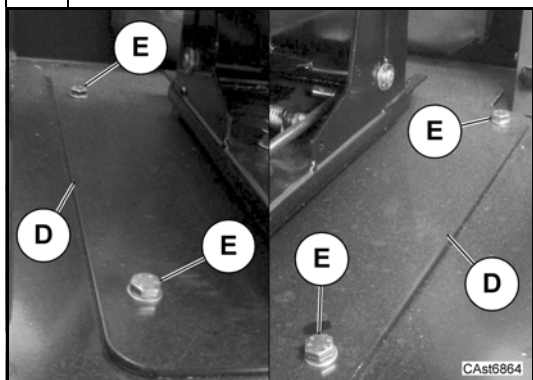
Assemble the 3rd point tie-rod (3).

12.



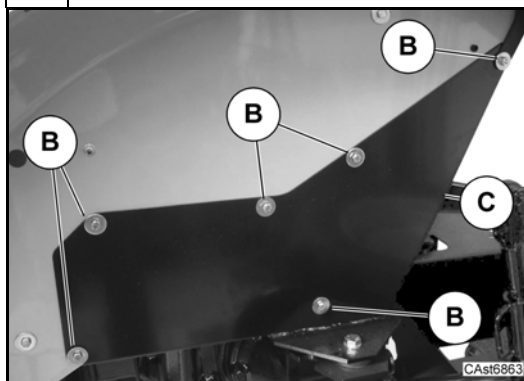
Assemble the rockshaft rods (1) and lock them with the clips (2).

13.



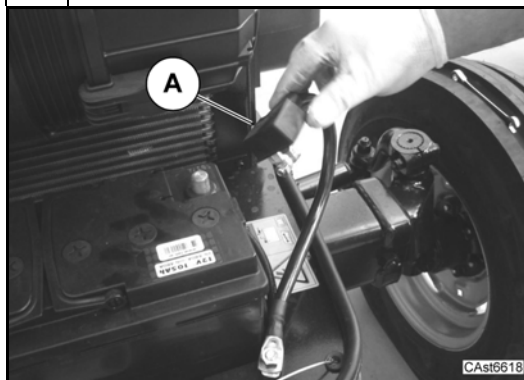
Assemble the seat support (D) and the seat.  
Tighten bolts (E).

14.



Assemble the panel (C) on the left side of the tractor.  
Tighten bolts (B).

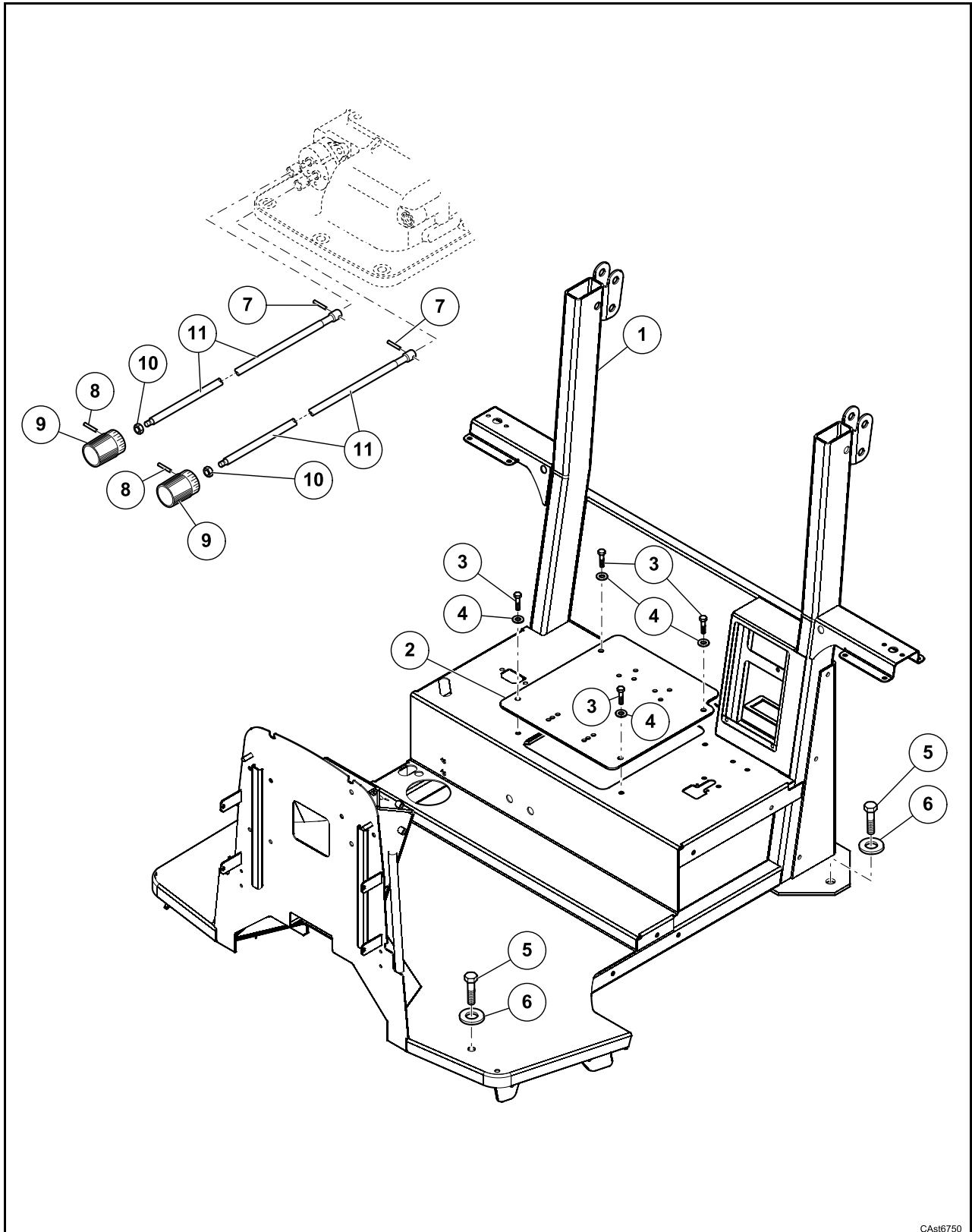
15.



Connect cable (A) to battery negative pole.  
Close the rubber cap.  
Check for correct operation of the rockshaft.

# Disassembly and Assembly Operations

## PLATFORM



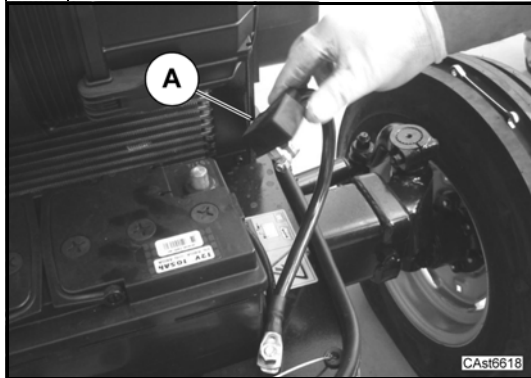


# Disassembly and Assembly Operations

## Disassembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



Open the rubber cap and remove the negative (A) from the battery.

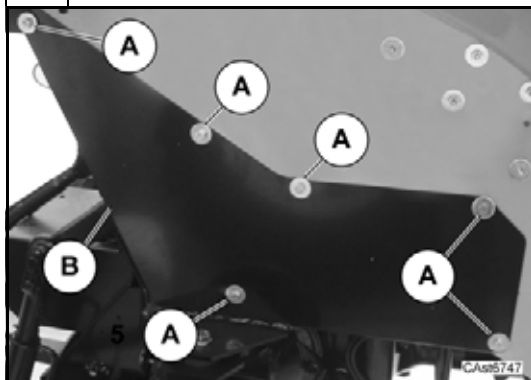
Remove the bonnet.

Refer to: section D.10.

Remove the rear wheels.

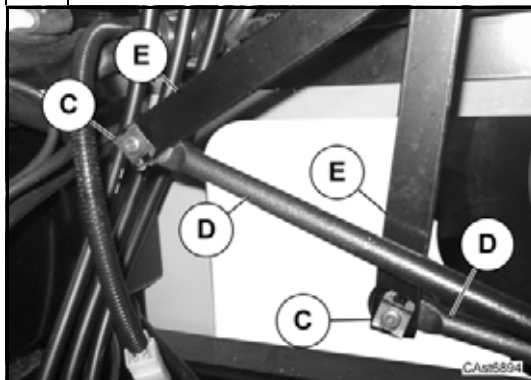
Refer to: section D.23.

2.



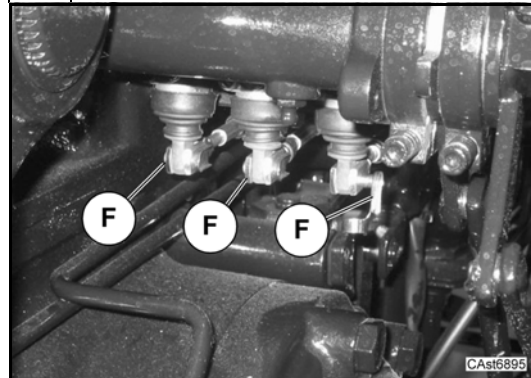
Remove the six bolts (A) and the panel (B).

3.



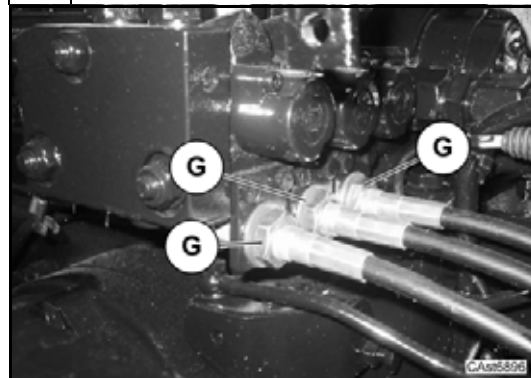
Remove the clips (C) to unlock rods (D) from the rockshaft levers (E).

4.



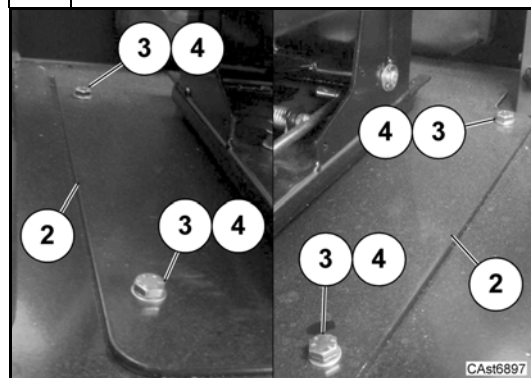
Remove the three pins (F) to unlock the push-pull cables from the auxiliary valves.

5.



Loosen nuts (G).

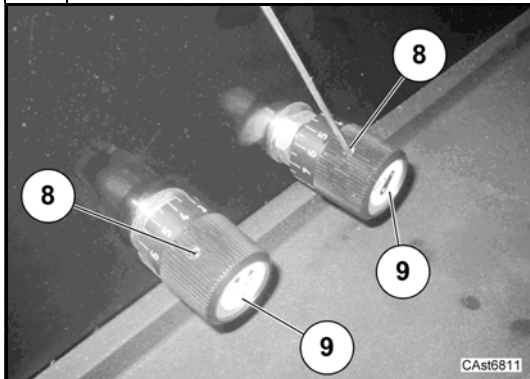
6.



Remove the seat from its support (2) removing the four bolts (3) and the four washers (4).

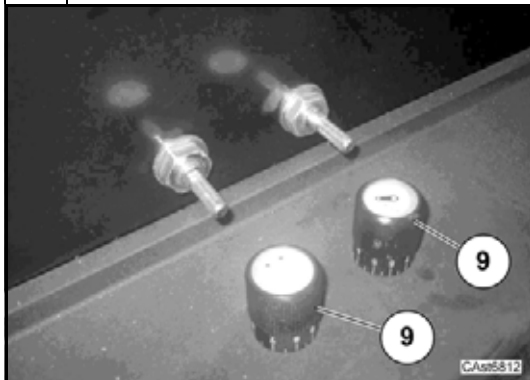
# Disassembly and Assembly Operations

7.



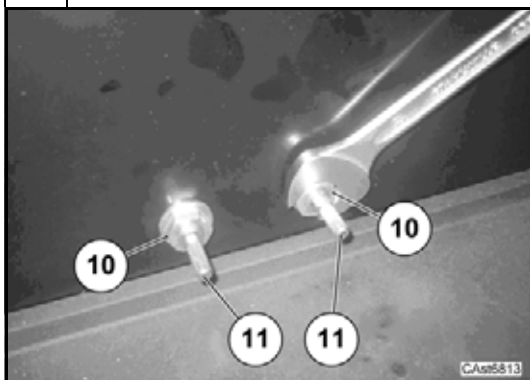
Loosen the studs (8) without removing them from the knobs (9).

8.



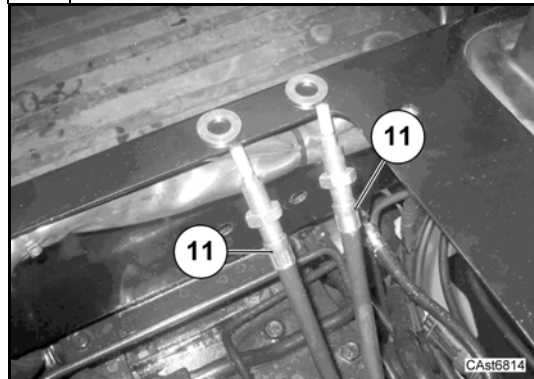
Remove both sensitivity and rate of drops knobs (9).

9.



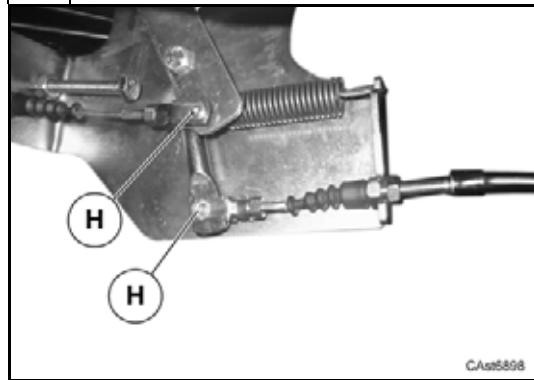
Loosen and remove the two nut (10).

10.



Pull the bowden (11) out from the platform frame.

11.



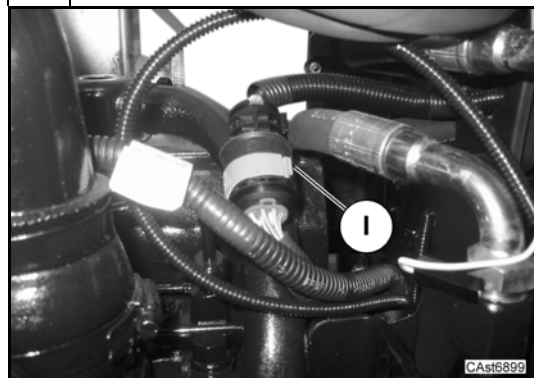
Unlock the joystick push-pull cables (if equipped).

Remove the vertical exhaust pipe.

Refer to: section D.7.

Unlock the foot throttle and the hand throttle cables (H) from right side.

12.



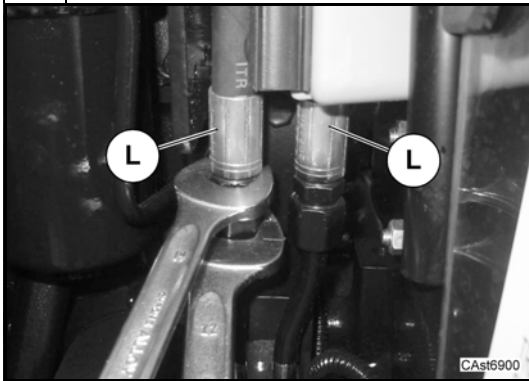
Remove the tool box support from the right side.

Disconnect the connector (I) to separate the main wiring harness to the engine wiring harness.



# Disassembly and Assembly Operations

13.



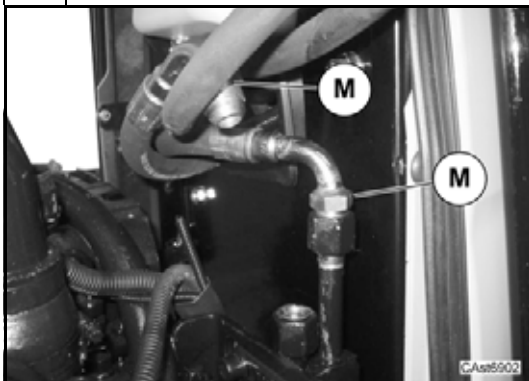
Mark and disconnect the hydraulic lines (L).



**Danger**

Close all openings with caps and plugs.

14.



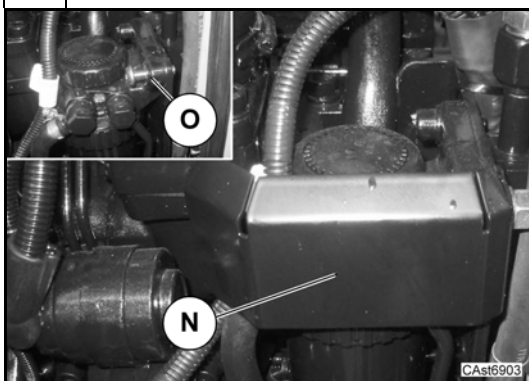
Mark and disconnect the hydraulic lines (M).



**Danger**

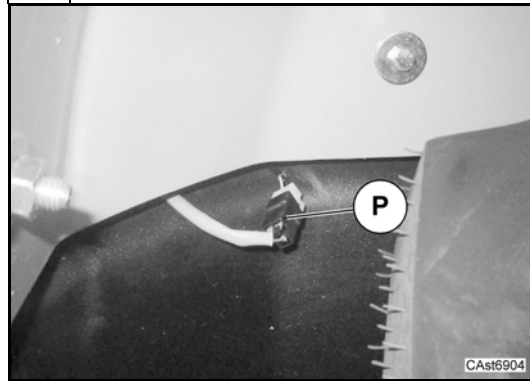
Close all openings with caps and plugs.

15.



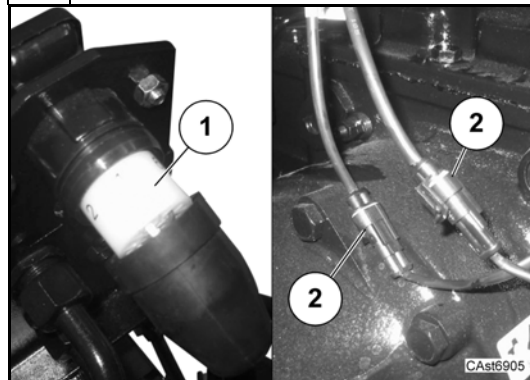
Remove the filter protection (N) and loosen (without removing) bolt (O).

16.



Separate the fuel level sender to the main wiring harness disconnecting connector (P).

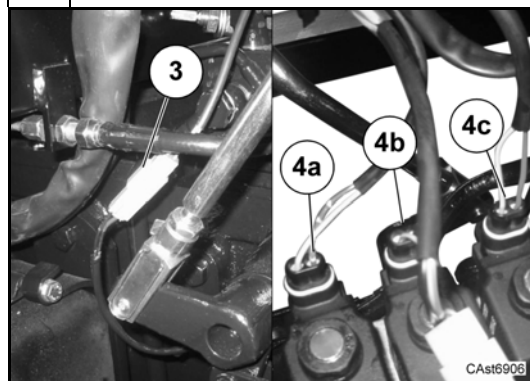
17.



Disconnect following connectors:

- (1) - trailer socket
- (2) - PTO speed switch

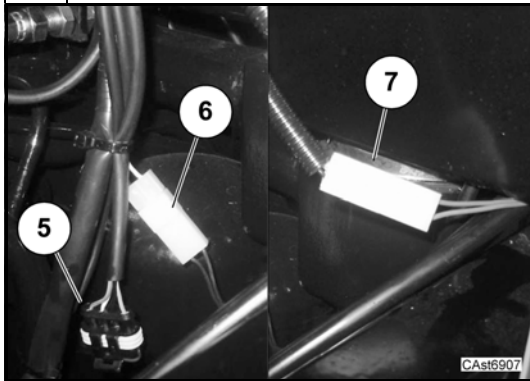
18.



- (3) - range sensor (if equipped)
- (4a) - FWD valve
- (4b) - differential lock valve
- (4c) - PTO valve

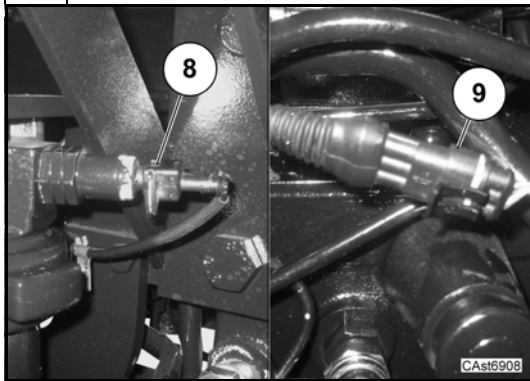
# Disassembly and Assembly Operations

19.



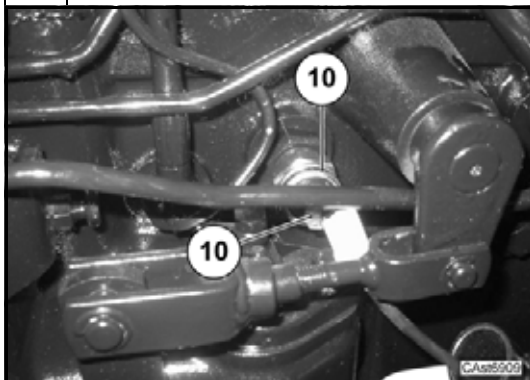
- (5) - HI-LOW/ground speed connection  
 (6) - declutch switch (if equipped)  
 (7) - joystick switch (if equipped)

20.



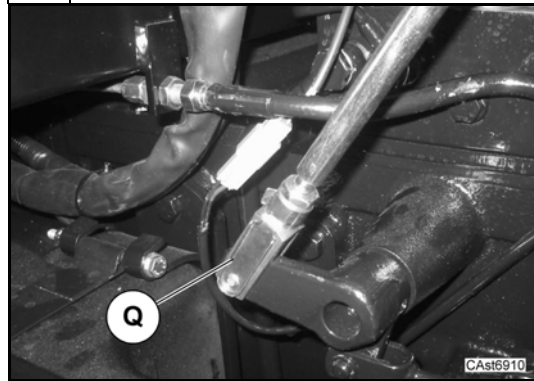
- (8) - hydraulic filter sensor (Powershuttle only)  
 (9) - speed sensor

21.



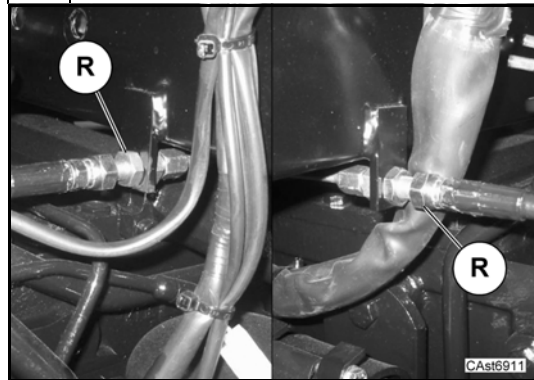
- (10) - neutral start switch

22.



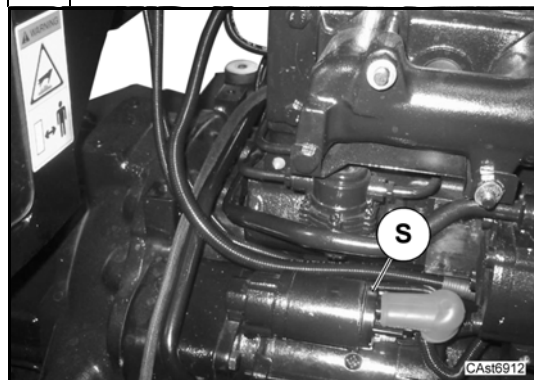
Remove the clip (Q) from the hand brake rod.

23.



Loosen hydraulic lines (R) from both sides.

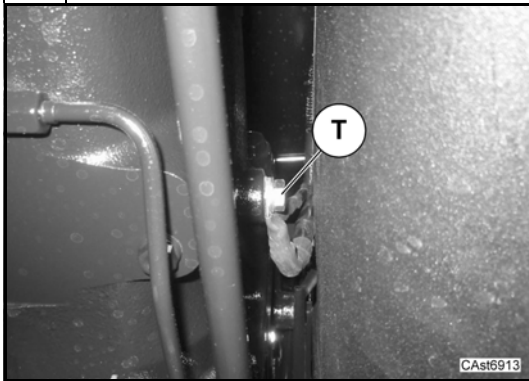
24.



Remove all electrical connections to the starting motor (S).

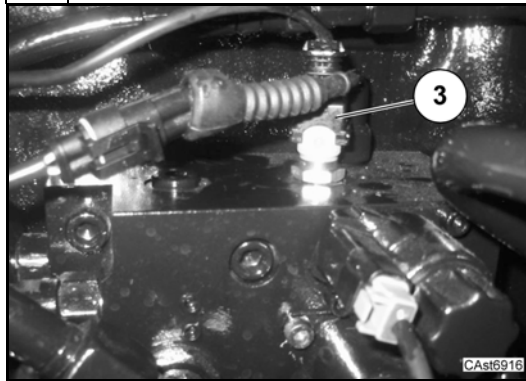
# Disassembly and Assembly Operations

25.



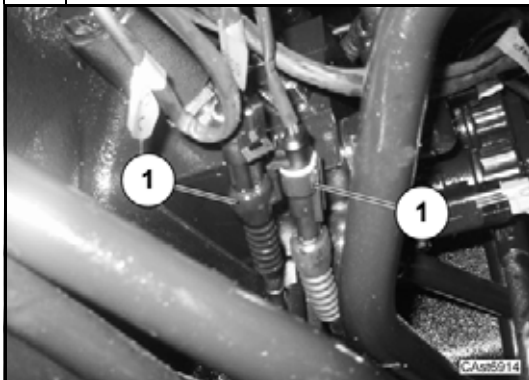
Remove the ground connections (T) from the left side, behind the fuel tank.

28.



(3) - temperature sensor connection

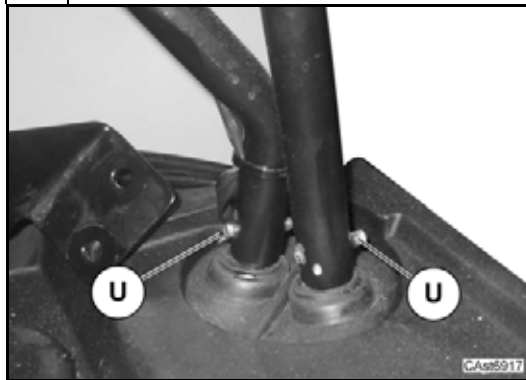
26.



Disconnect all electrical connections to the hydraulic valve located on the right side (Powershuttle only).

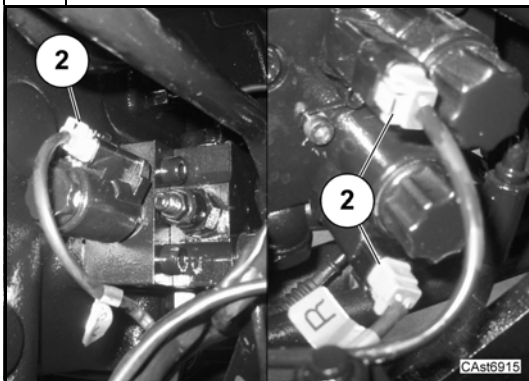
(1) - pressure sensors

29.



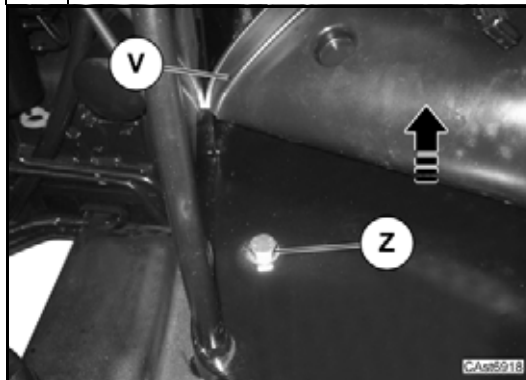
Remove pin (U) to unlock the speed and range levers.

27.



(2) - solenoid valve connections

30.

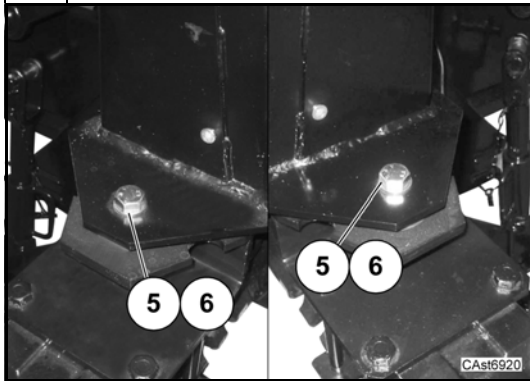


On both sides, lift up the floor mat (V) and remove the bolt (Z).



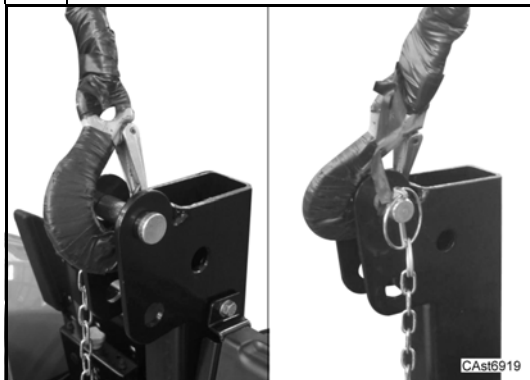
# Disassembly and Assembly Operations

31.



On both sides remove silent block bolts (5) and washer (6).

32.



Attach a suitable hoist at rear side platform.

33.

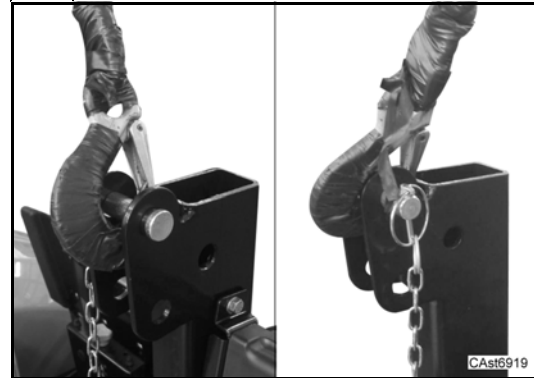


Attach a suitable hoist at front side platform.

## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



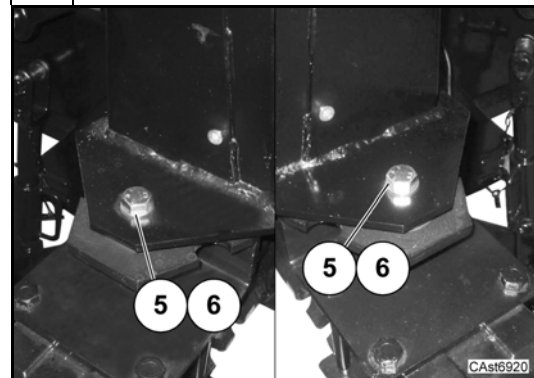
Attach a suitable hoist at rear side platform.

2.



Attach a suitable hoist at front side platform.

3.

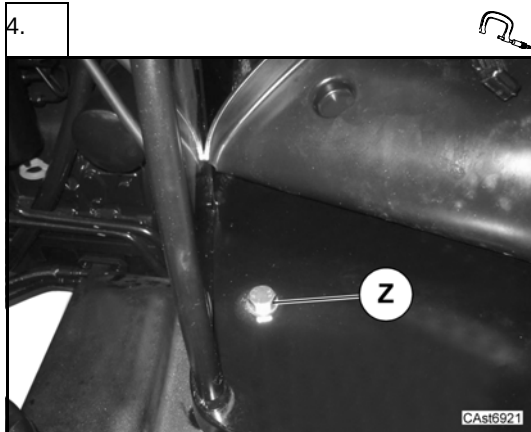


Assemble platform (1).

Screw up bolts (5) and washers (6).

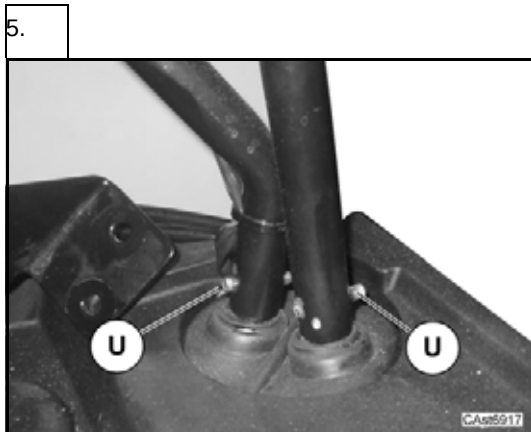
Torque wrench: 220 Nm (165 lb·ft).

# Disassembly and Assembly Operations

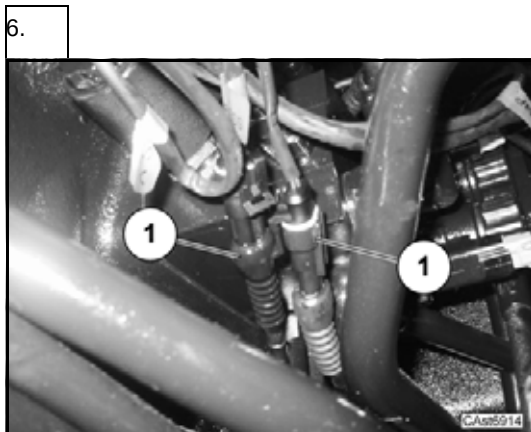


Screw up bolt (Z).

Torque wrench: 220 Nm (165 lb·ft).

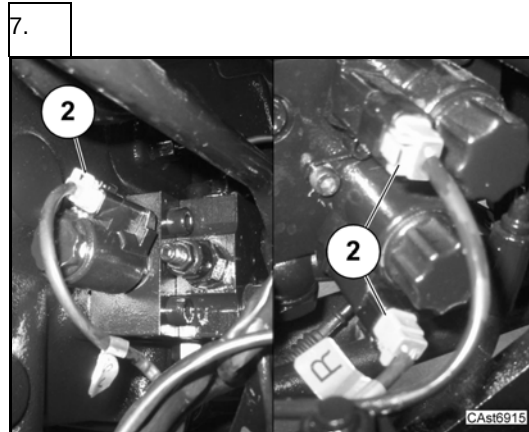


Assembly pin (U) to lock the speed and range levers.

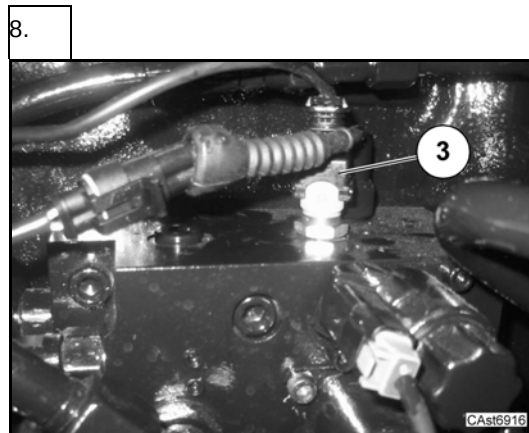


Restore all electrical connections to the hydraulic valve located on the right side (Powershuttle only).

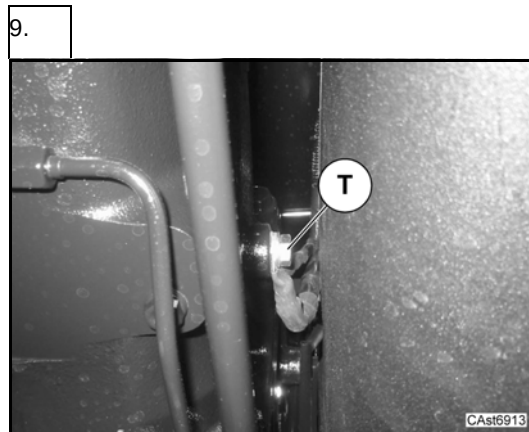
(1) - pressure sensors



(2) - solenoid valve connections



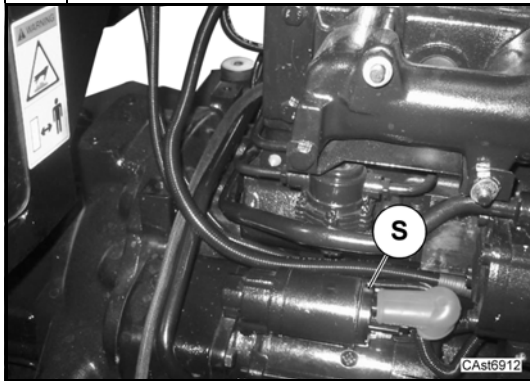
(3) - temperature sensor connection



Restore the ground connections (T) from left side, behind the fuel tank.

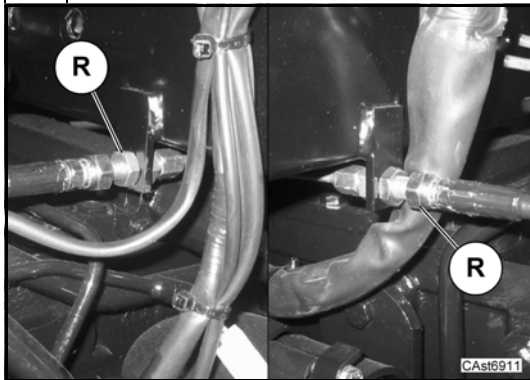
# Disassembly and Assembly Operations

10.



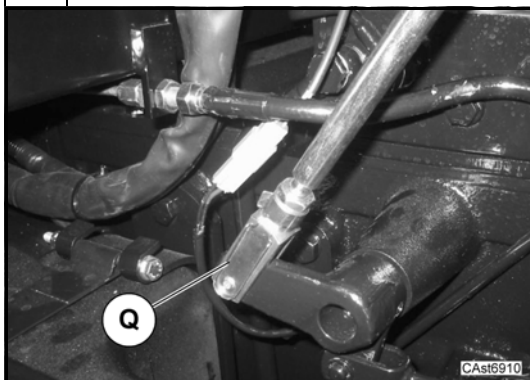
Restore all electric connections to the starting motor (S).

11.



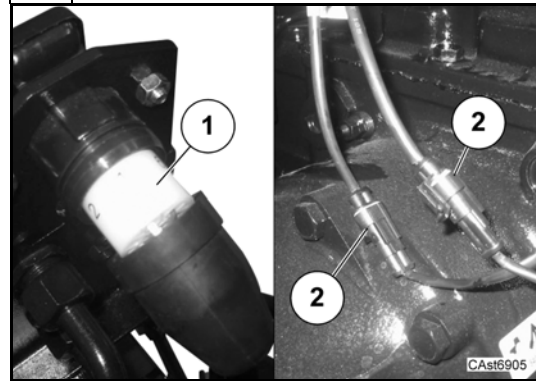
Assemble hydraulic lines (R) from both sides.

12.



Assemble the hand brake lever and lock it with the clip (Q).

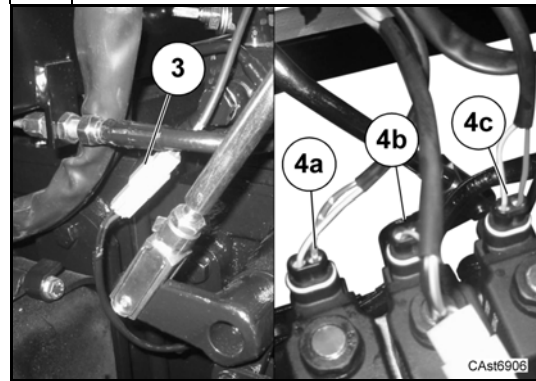
13.



Connect following connectors:

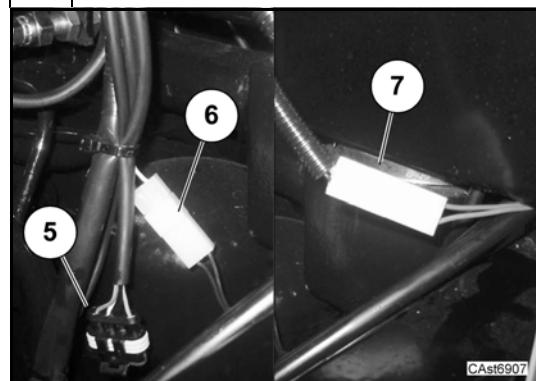
- (1) - trailer socket
- (2) - PTO speed switch

14.



- (3) - range sensor (if equipped)
- (4a) - FWD valve
- (4b) - differential lock valve
- (4c) - PTO valve

15.

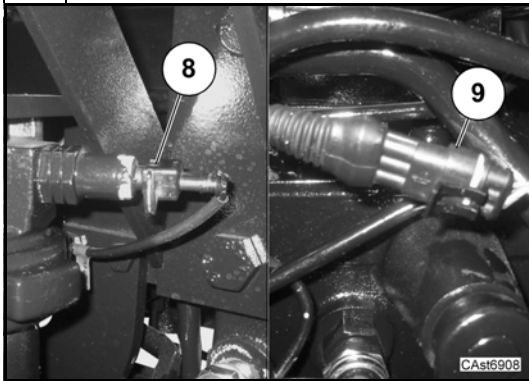


- (5) - HI-LOW/ground speed connection
- (6) - declutch switch (if equipped)
- (7) - joystick switch (if equipped)



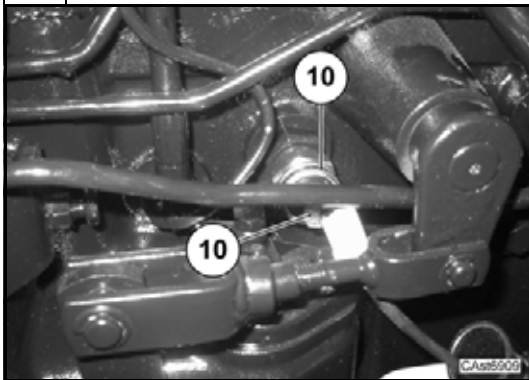
## Disassembly and Assembly Operations

16.



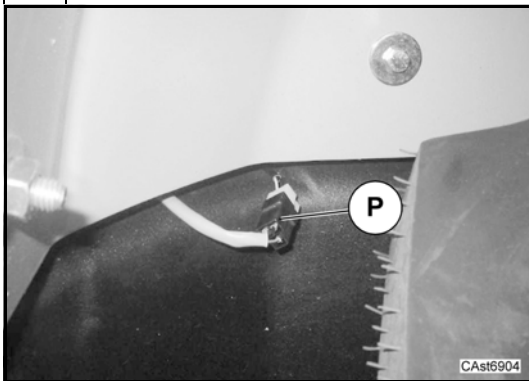
- (8) - hydraulic filter sensor (Powershuttle only)  
 (9) - speed sensor

17.



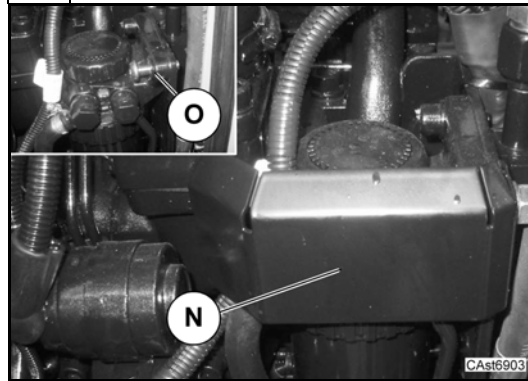
- (10) - neutral start switch

18.



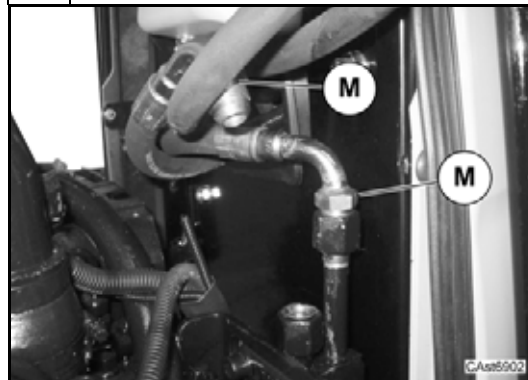
- Connect the fuel level sender with the main wiring harness connecting connector (P).

19.



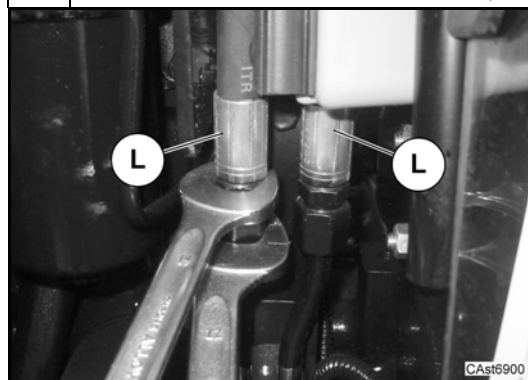
- Tighten screw (O) and assemble the protection (N) of fuel filter.

20.



- Connect the hydraulic lines (M) paying attention to the reference marks applied during the assembly.

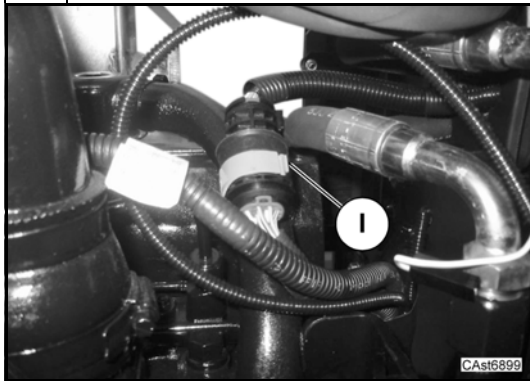
21.



- Connect the hydraulic lines (L) paying attention to the reference marks applied during the assembly.

# Disassembly and Assembly Operations

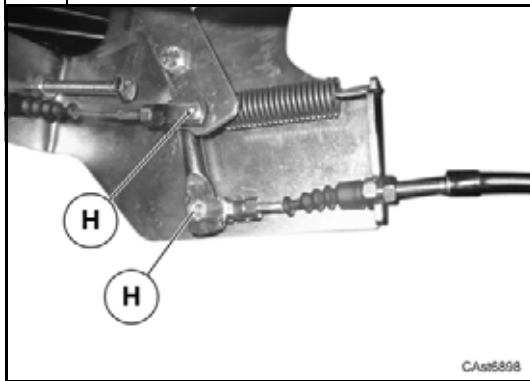
22.



Connect the connector (I) to joint the main wiring harness to the engine wiring harness.

Assemble the tool box support from right side.

23.



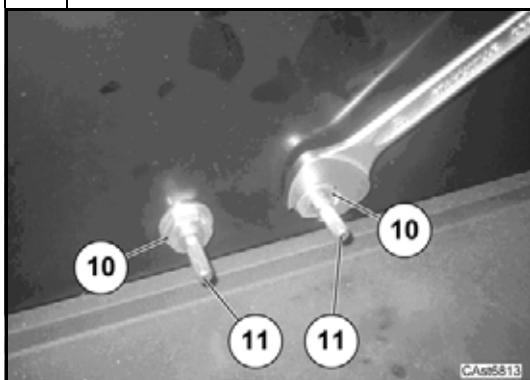
Lock the foot throttle and the hand throttle cables (H) from right side.

Assembly the vertical exhaust pipe.

Refer to: section D.7.

Lock the joystick push-pull cables (if equipped).

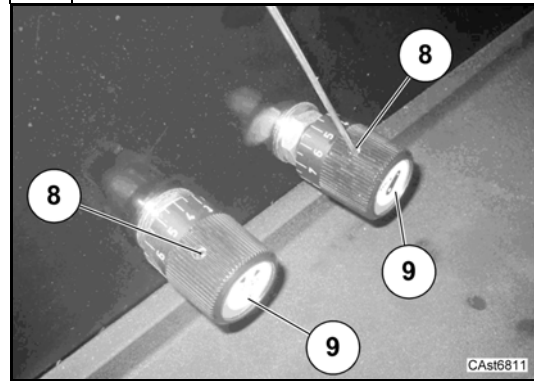
24.



Insert the bowden (11) in the platform frame.

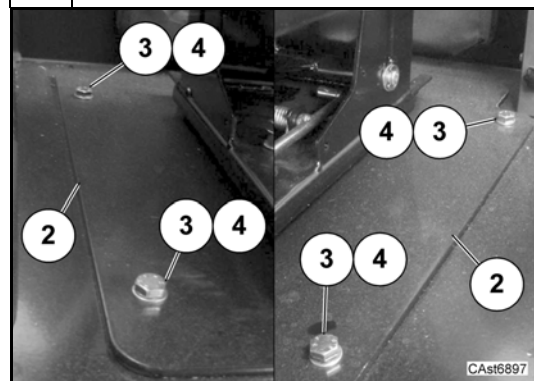
Tighten nuts (10).

25.



Assemble the sensitivity and rate drops knobs (9) and lock them with pins (8).

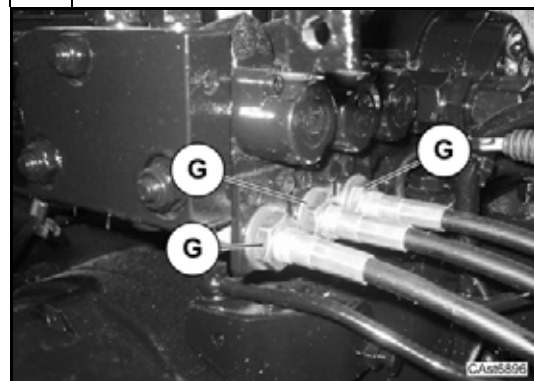
26.



Assemble the seat and its support (2).

Screw up washers (4) and bolts (3).

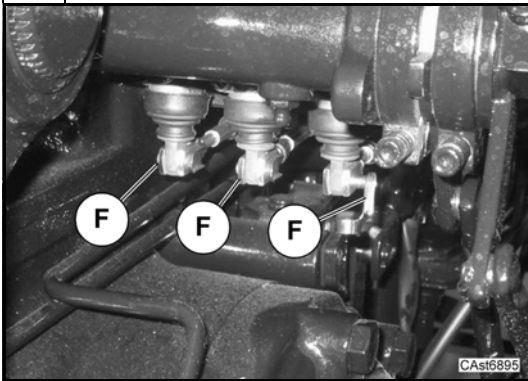
27.



Tighten nuts (G).

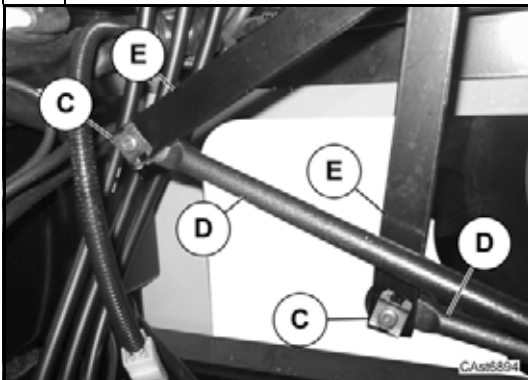
# Disassembly and Assembly Operations

28.



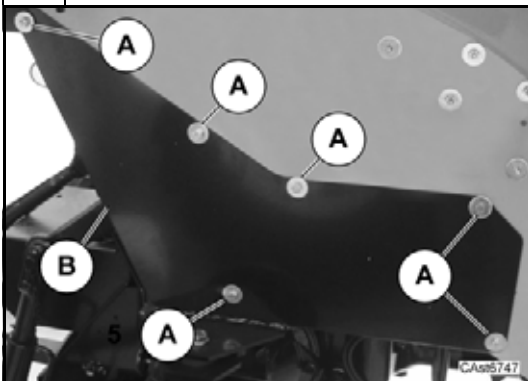
Assembly the three pins (F) to lock the push-pull cables on the auxiliary valves.

29.



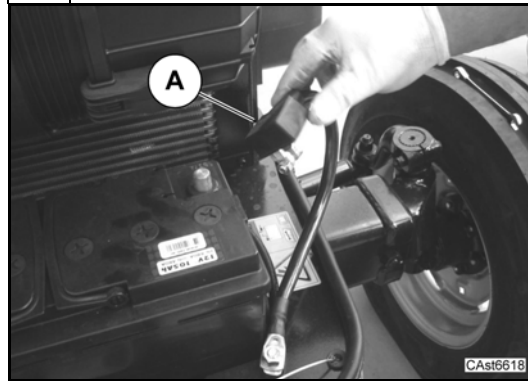
Assembly the clips (C) to lock rods (D) on the rockshaft levers (E).

30.



Assemble panel (C) and tighten bolts (A).

31.



Assemble rear wheels.

Refer to: section D.23.

Assembly the bonnet.

Refer to: section D.10.

Connect cable (A) to battery negative pole. Close the rubber cap.

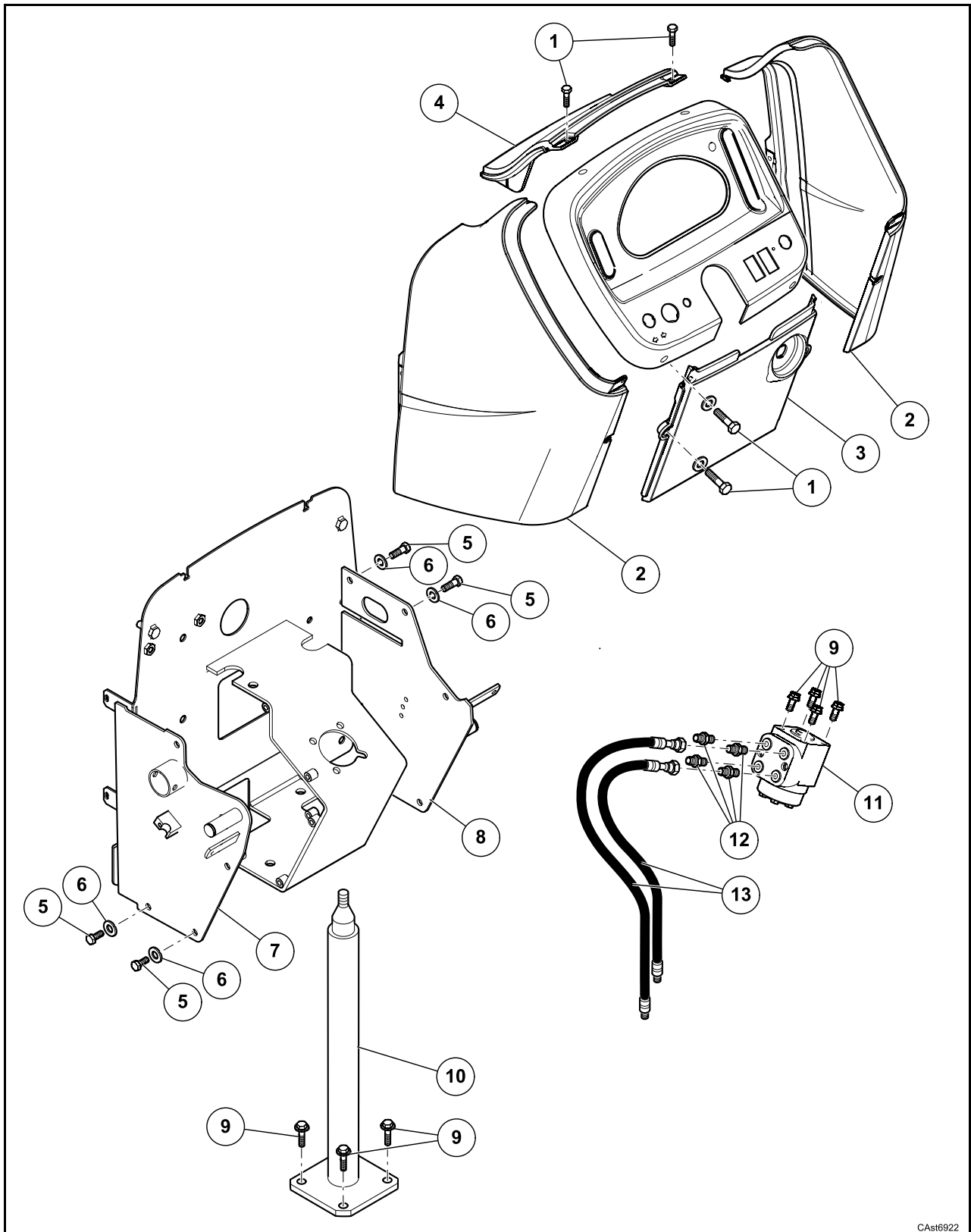
Bleed the brake system.

Perform a general function check.

Check for leaks.

# Disassembly and Assembly Operations

## STEERING VALVE



CAst6922

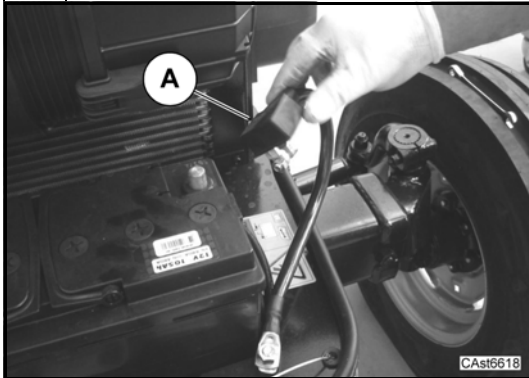


# Disassembly and Assembly Operations

## Disassembly

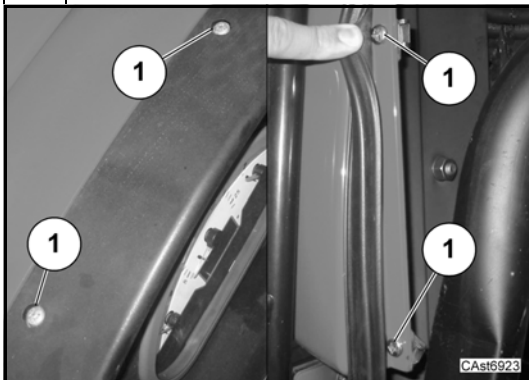
Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.



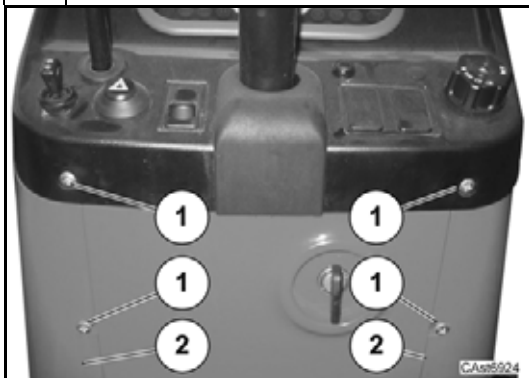
Open the rubber cap and remove the negative (A) from the battery.

2.



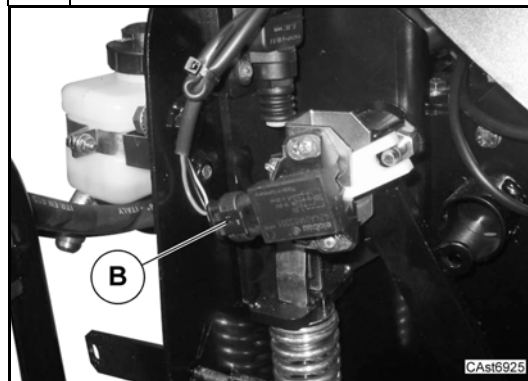
Loosen and remove the bolts (1).

3.



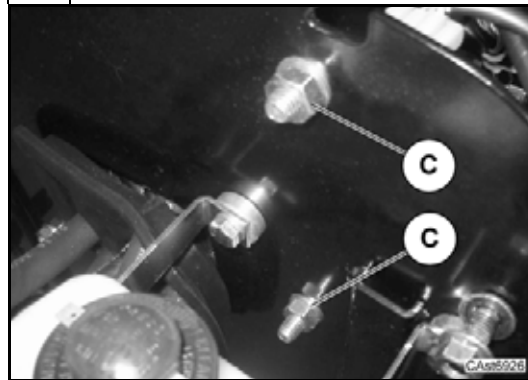
Loosen and remove the screws (1) for removing cover (2) on both sides.

4.



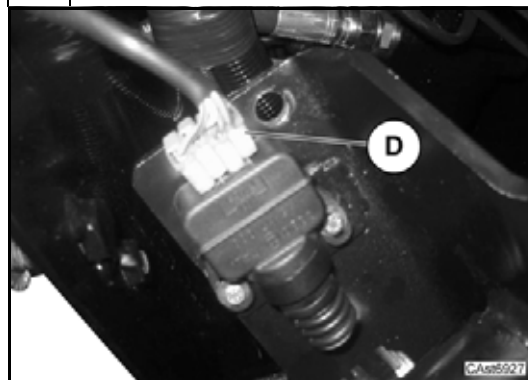
Disconnect connector (B).

5.



Remove bolt (C).

6.

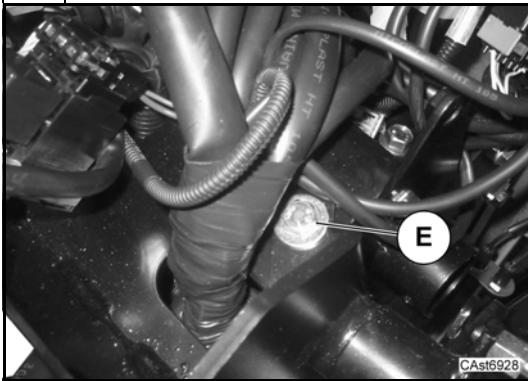


Remove the four connectors (D).



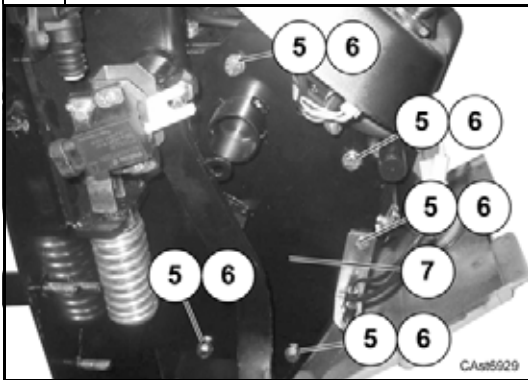
# Disassembly and Assembly Operations

7.



Remove the bolt (E) located on the left side.

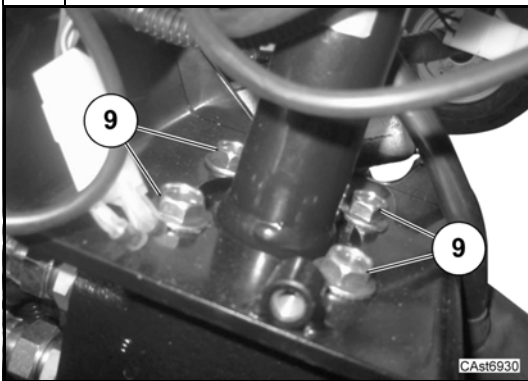
8.



Remove the five bolts (5) and the five washers (6) located on the left side.

Remove the left support (7).

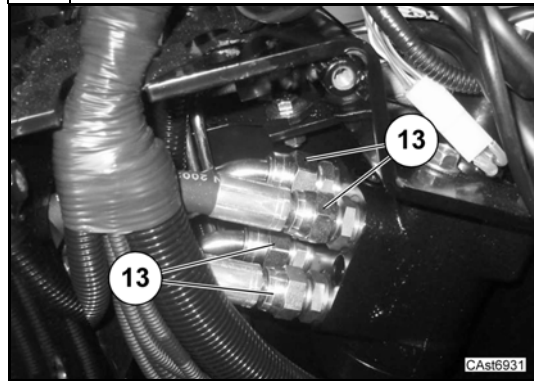
9.



Remove the four bolts (9) to separate the steering column from the steering valve.

Check steering column for wear or damages.

10.



Mark and disconnect the hoses (13).

11.



Remove and repair the steering valve (11) if necessary.

## Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.

1.

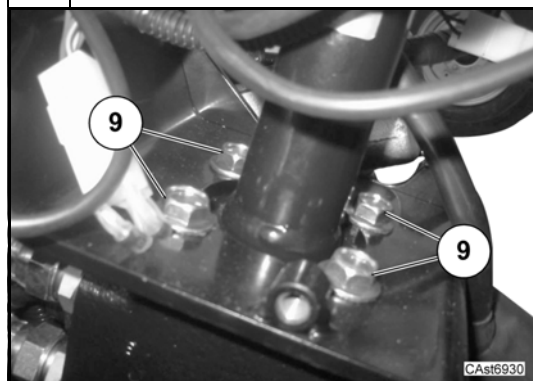


Assemble the steering valve (11).

**IMPORTANT:** Always use new O-Rings.

# Disassembly and Assembly Operations

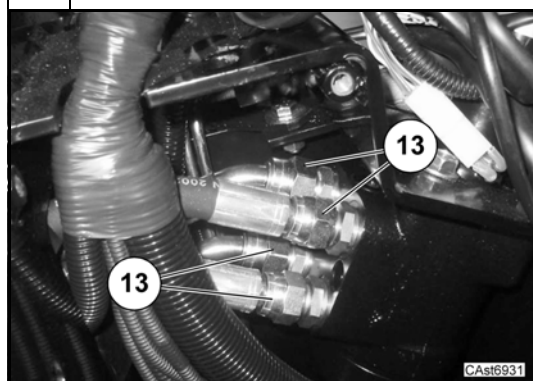
2.



Screw up bolts (9).

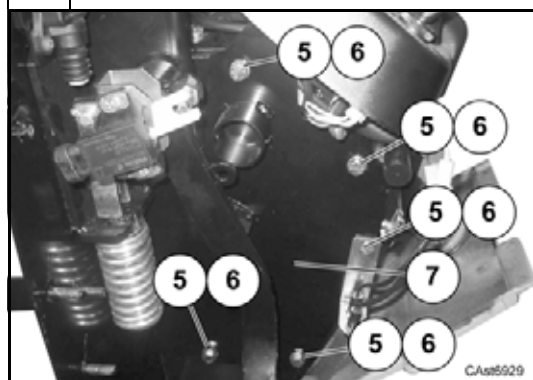
Torque wrench: 71 Nm (52 lb·ft)

3.



Assemble hoses (13) paying attention to the reference marks applied during disassembly.

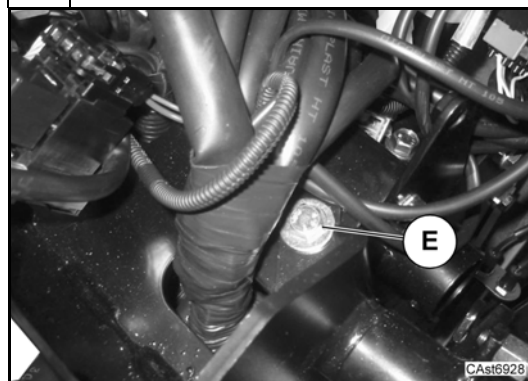
4.



Assemble left support (7).

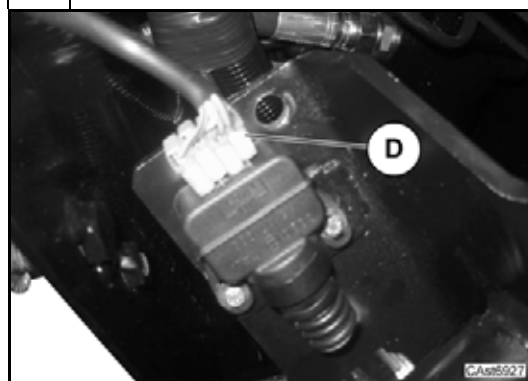
Screw up bolts (5) and washers (6).

5.



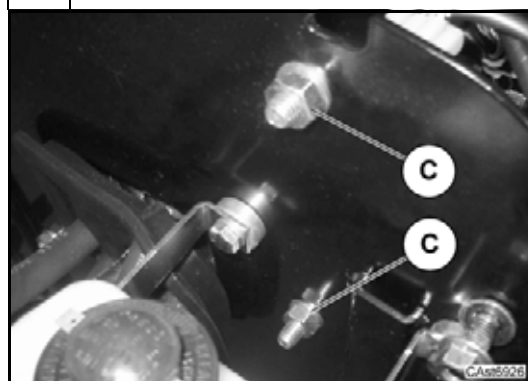
Screw up bolt (E) located on the left side.

6.



Connect the four connectors (D).

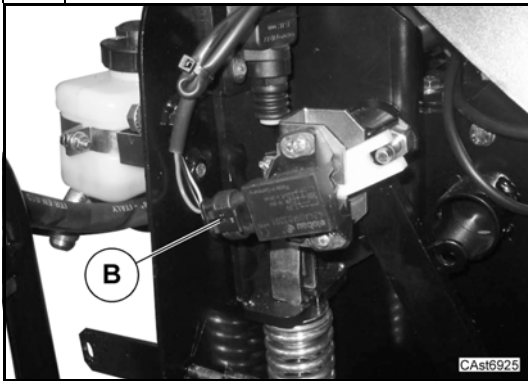
7.



Screw up bolt (C).

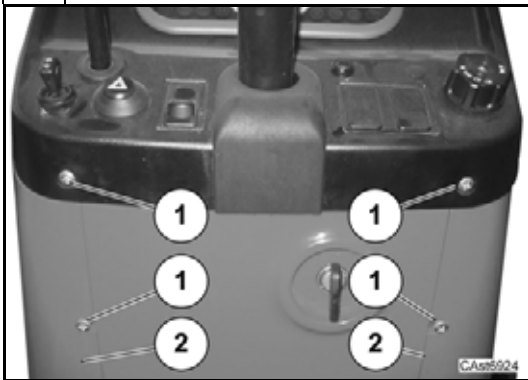
# Disassembly and Assembly Operations

8.



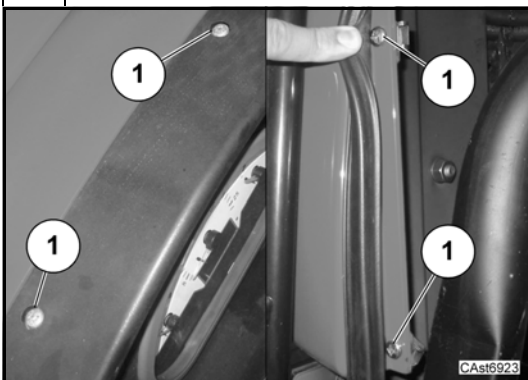
Connect connector (B).

9.



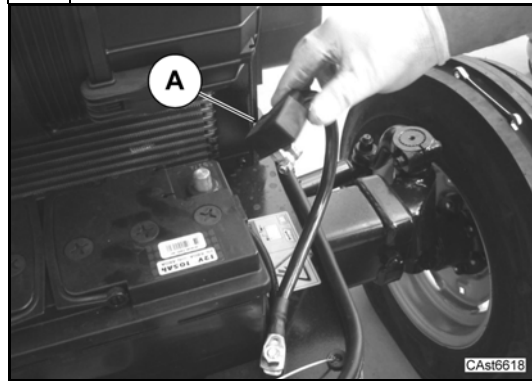
Assemble covers (2) and screw up bolts (1).

10.



Screw up bolts (1).

11.



Connect cable (A) to battery negative pole.

Close the rubber cap.

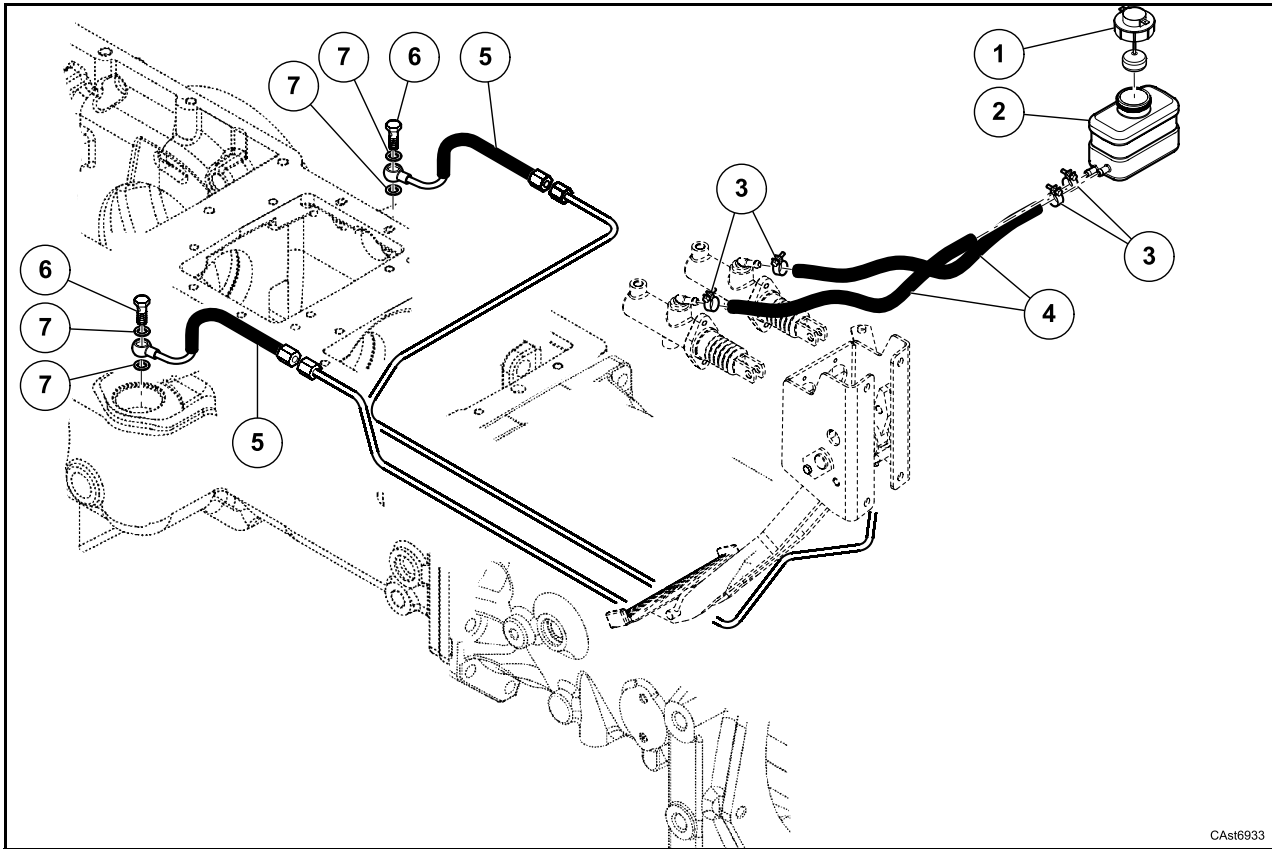
Check for oil leaks.

Switch ON the engine, operate steering and check for hydraulic oil leaks.

Perform a function check of the system.

# Disassembly and Assembly Operations

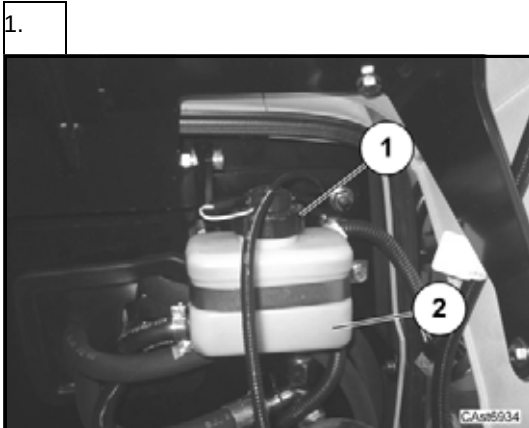
## BRAKE CIRCUIT BLEEDING



CAst6933

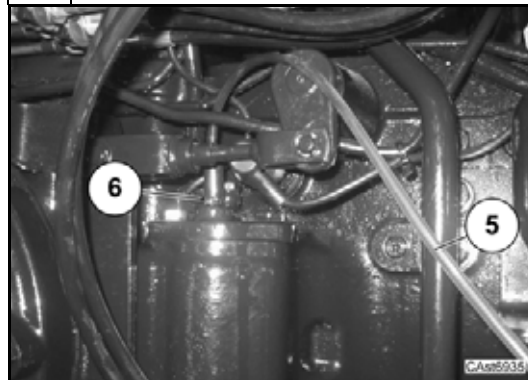
### Disassembly/Assembly

Some of the following pictures may not show exactly your tractor, but the indicated operations are correct anyway.



Remove the cap (1) from the hydraulic oil brake tank (2) and fill it with proper oil.

2.



Connect the clear plastic hose (5) to the bleed screws (6). Put the other end of hose into a bucket.

**NOTE:** Two service technicians are needed to bleed the brake system, one to operate the brake pedal and the other to open and close the bleed screws.

Pump brake pedal to obtain highest pedal position and hold. Loosen bleed screw (6) 3/4 turn and slowly push on brake pedal. Before brake pedal completes full travel, tighten bleed screw.

Let pedal return slowly to the top of its stroke. Continue this operation until the oil flow in the plastic hose is free of air bubbles.

## Disassembly and Assembly Operations

---

When oil flow is free of air bubbles hold the pedal down and tighten bleed screw.

Remove the plastic hose.

Repeat brake bleed procedure for the other brake and for trailer brake valve (if equipped).

Perform a function check.



# Disassembly and Assembly Operations

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# Electrical System

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## Electrical System Section 2

# Electrical System

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# Electrical Diagrams

## Electrical Diagrams

### Section 2

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# Electrical Diagrams

## ELECTRIC DIAGRAM

Colour abbreviation

|   |                 |
|---|-----------------|
| A | Light blue      |
| B | White           |
| C | Orange          |
| G | Yellow          |
| H | Gray (silver)   |
| L | Dark blue       |
| M | Brown           |
| N | Black           |
| R | Red             |
| S | Pink            |
| V | Green           |
| Z | Violet (purple) |



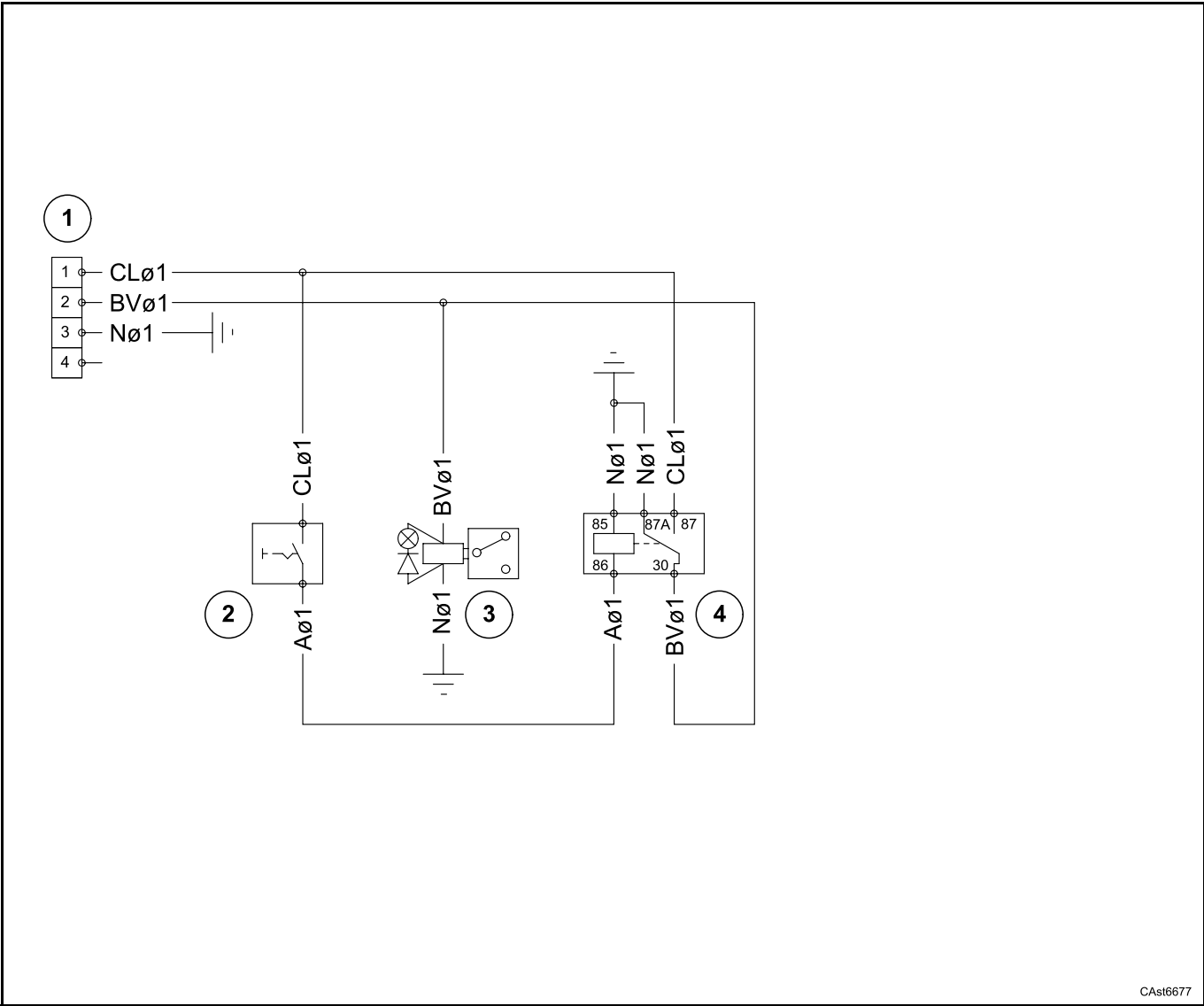
# Electrical Diagrams

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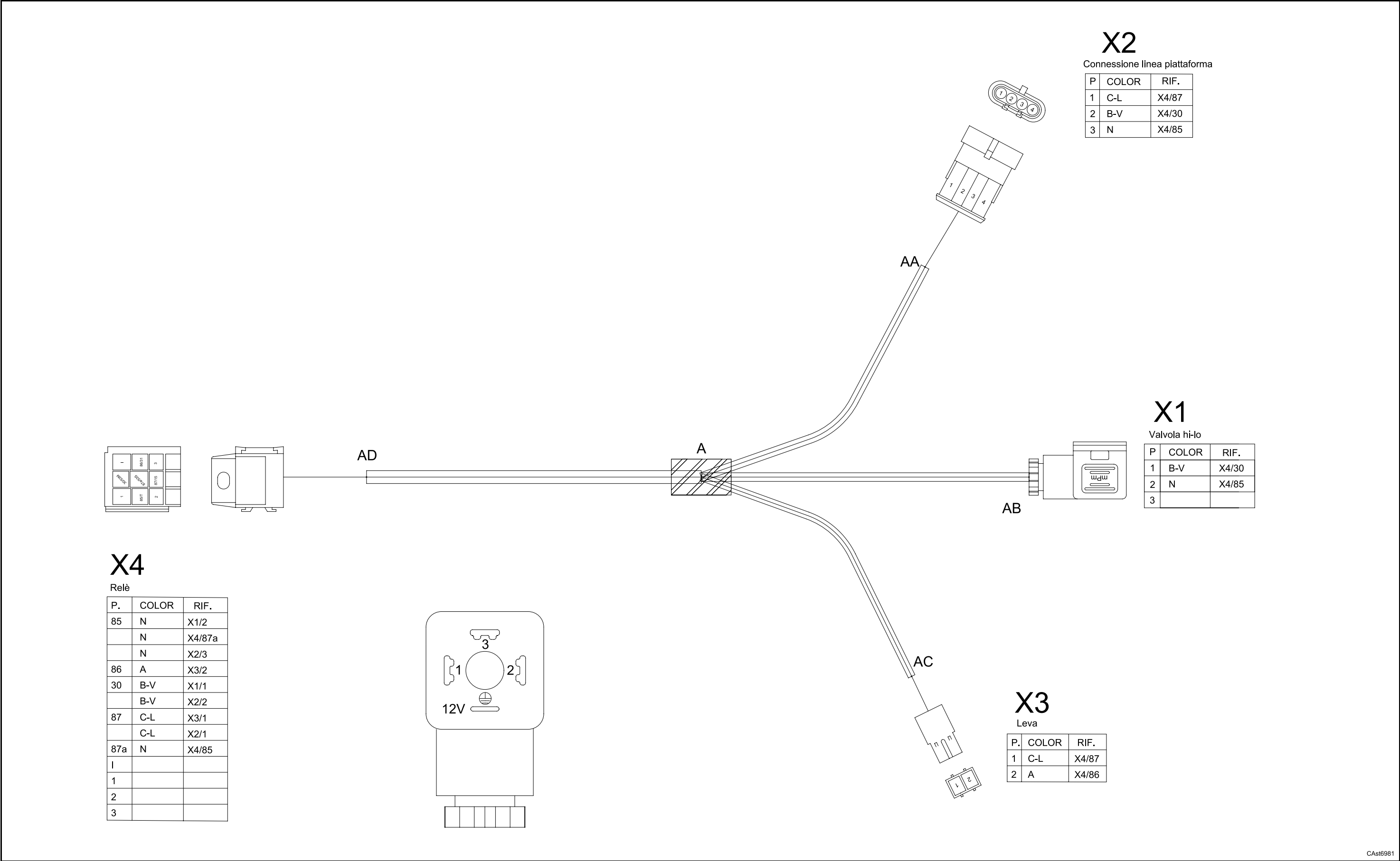
# Electrical Diagrams

HI-LO power harness



- 1. Platform line connection
- 2. HI-LO lever
- 3. HI-LO solenoid valve
- 4. HI-LO relay

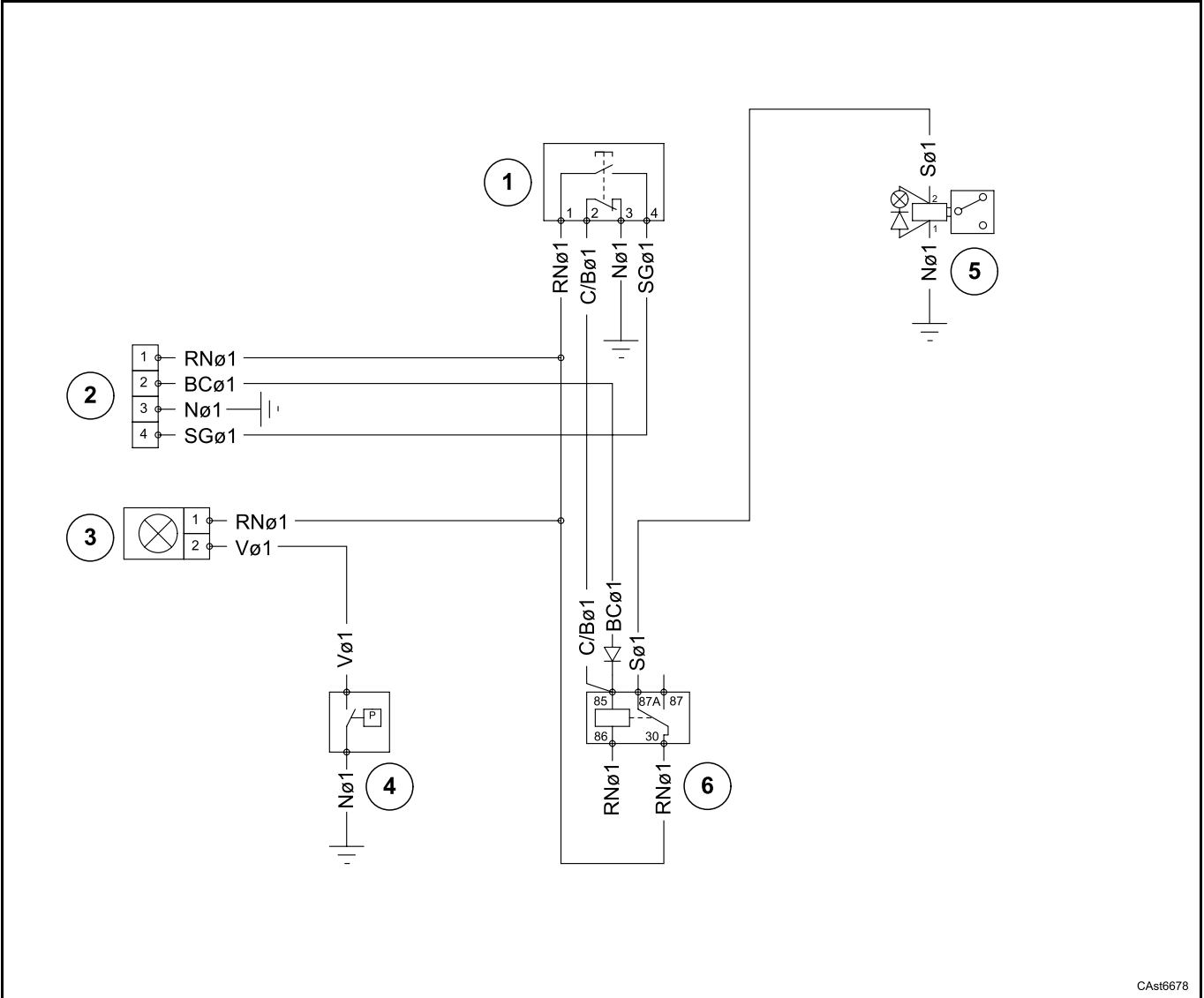
HI-LO power harness



CAst6981

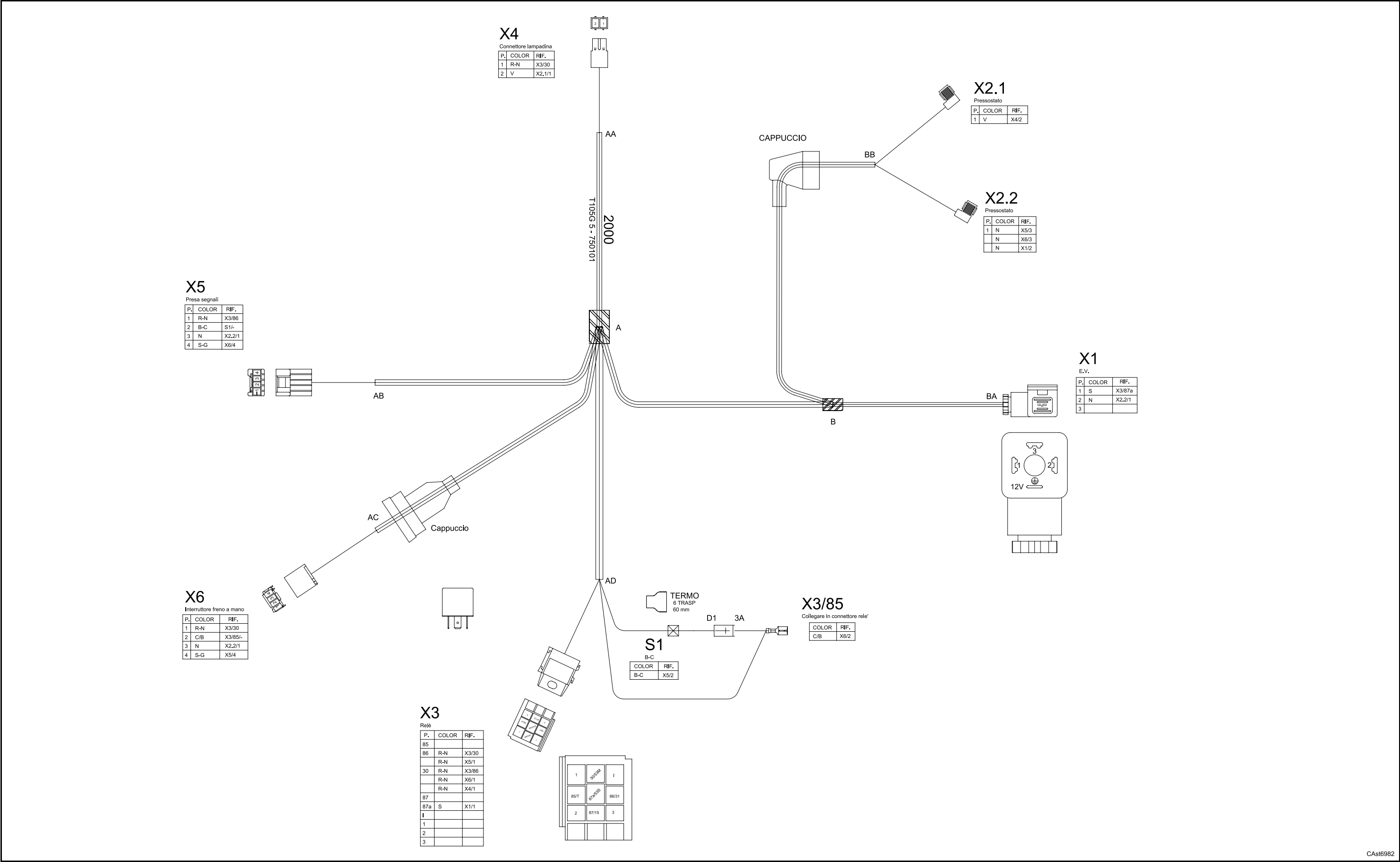
# Electrical Diagrams

Trailer Brake Valve Italy harness



- 1. Hand brake switch
- 2. Signals socket
- 3. Brake applied indicator light
- 4. Brakes pressure switch
- 5. Brake solenoid valve
- 6. Brake activation relay

Trailer Brake Valve Italy harness

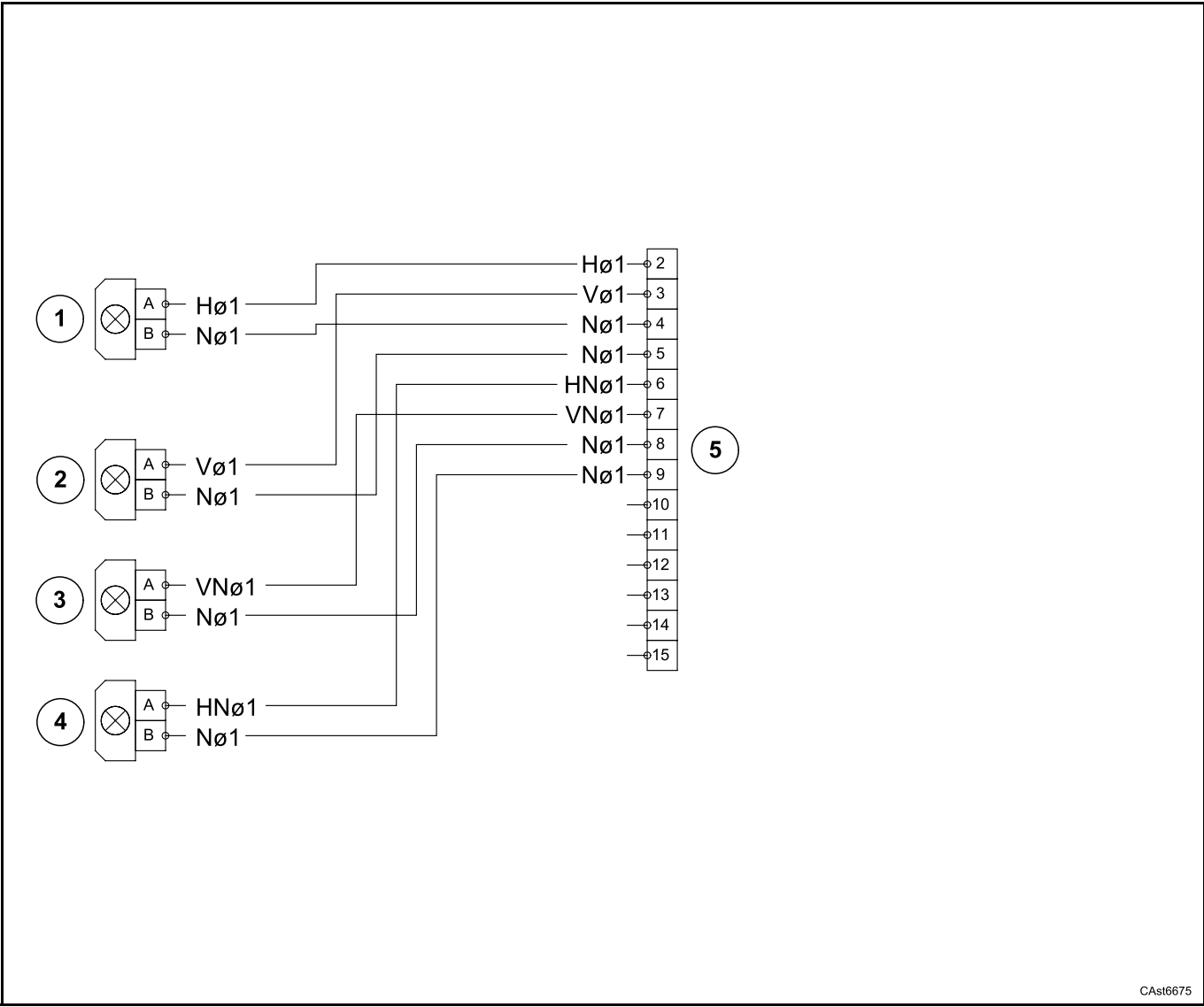


CAst6982



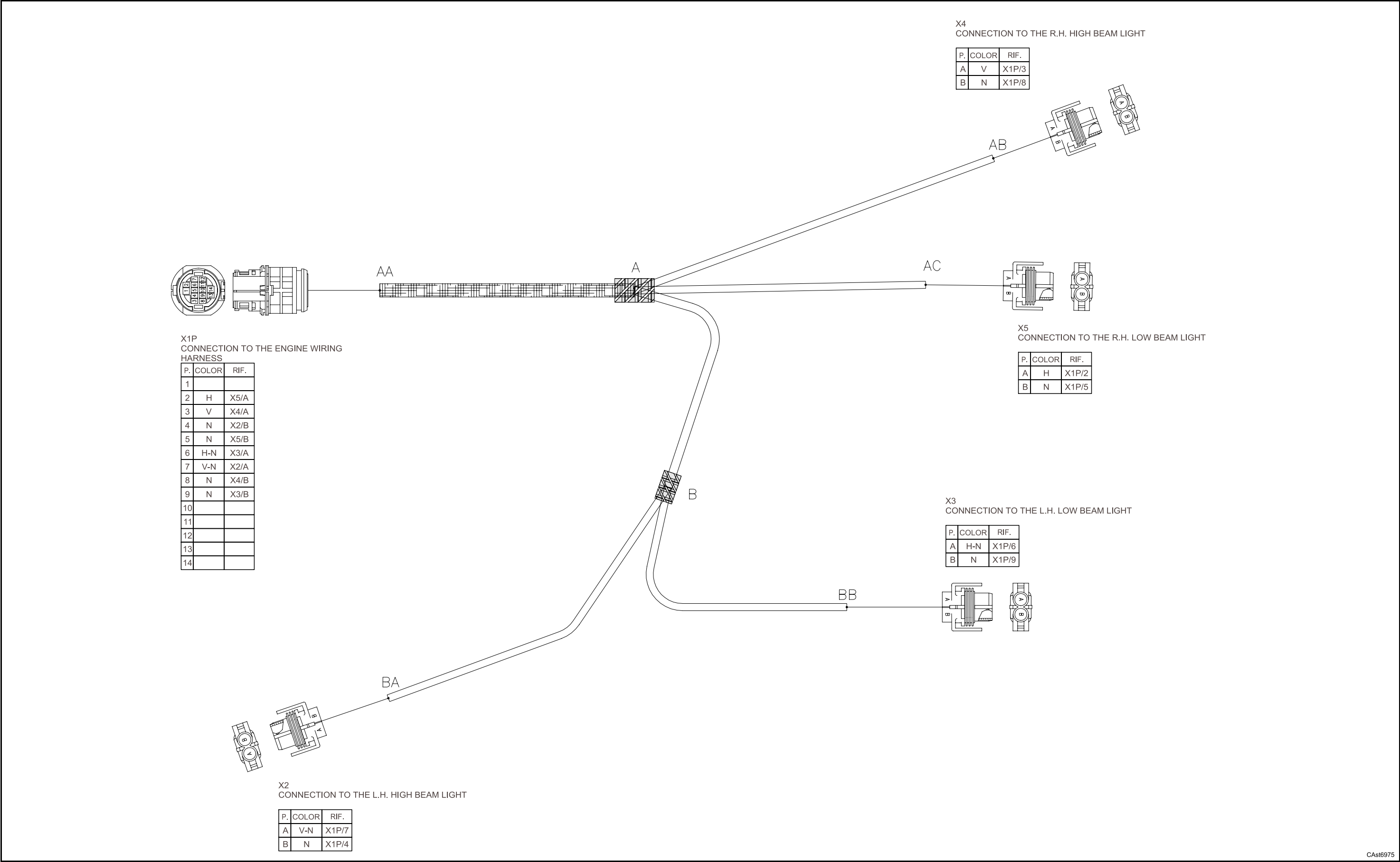
# Electrical Diagrams

Massey Ferguson bonnet line



- 1. Right dipped headlight front beam
- 2. Right headlight front beam
- 3. Left headlight front beam
- 4. Left dipped headlight front beam
- 5. Engine line connector

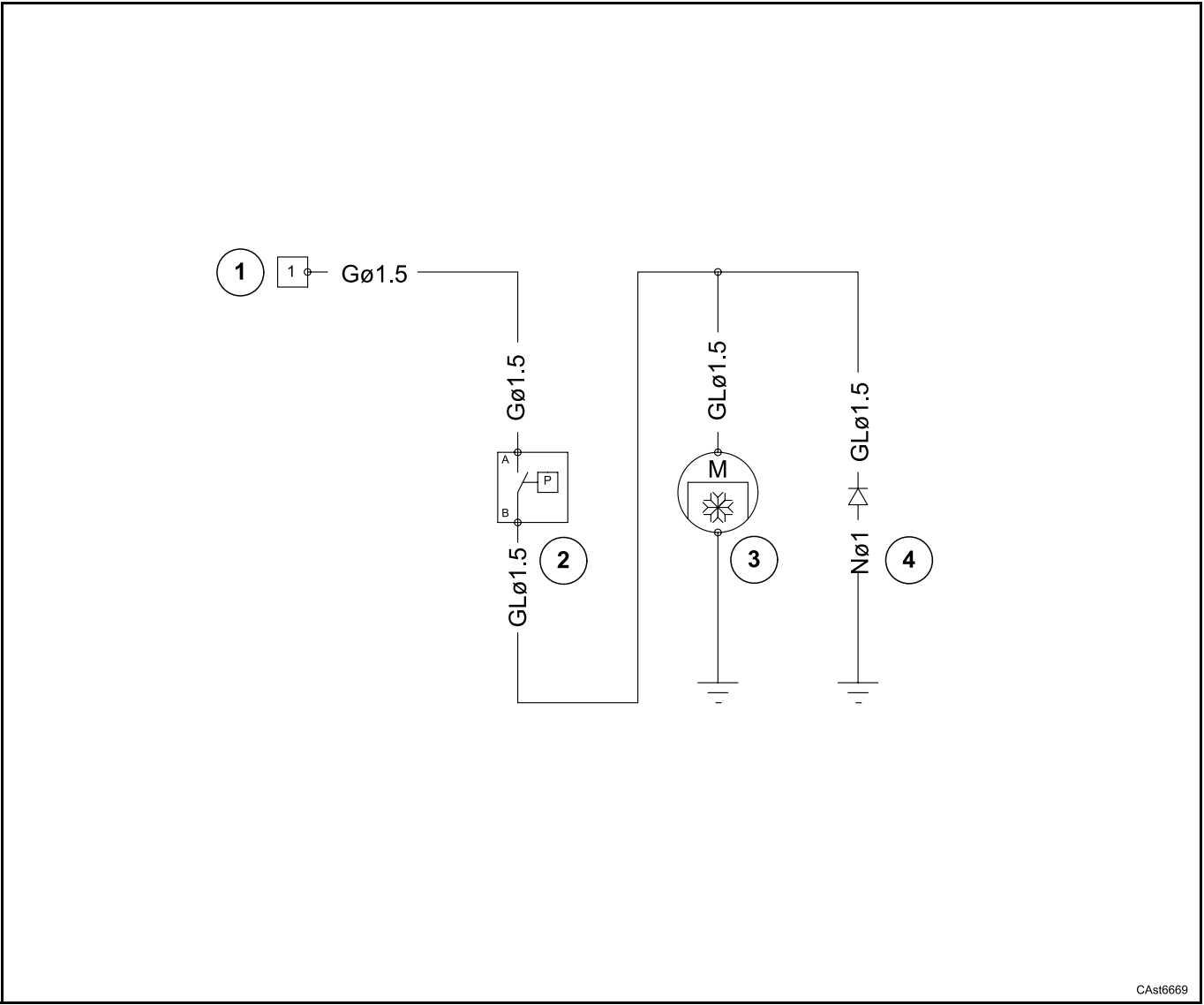
Massey Ferguson bonnet line



CAst6975

# Electrical Diagrams

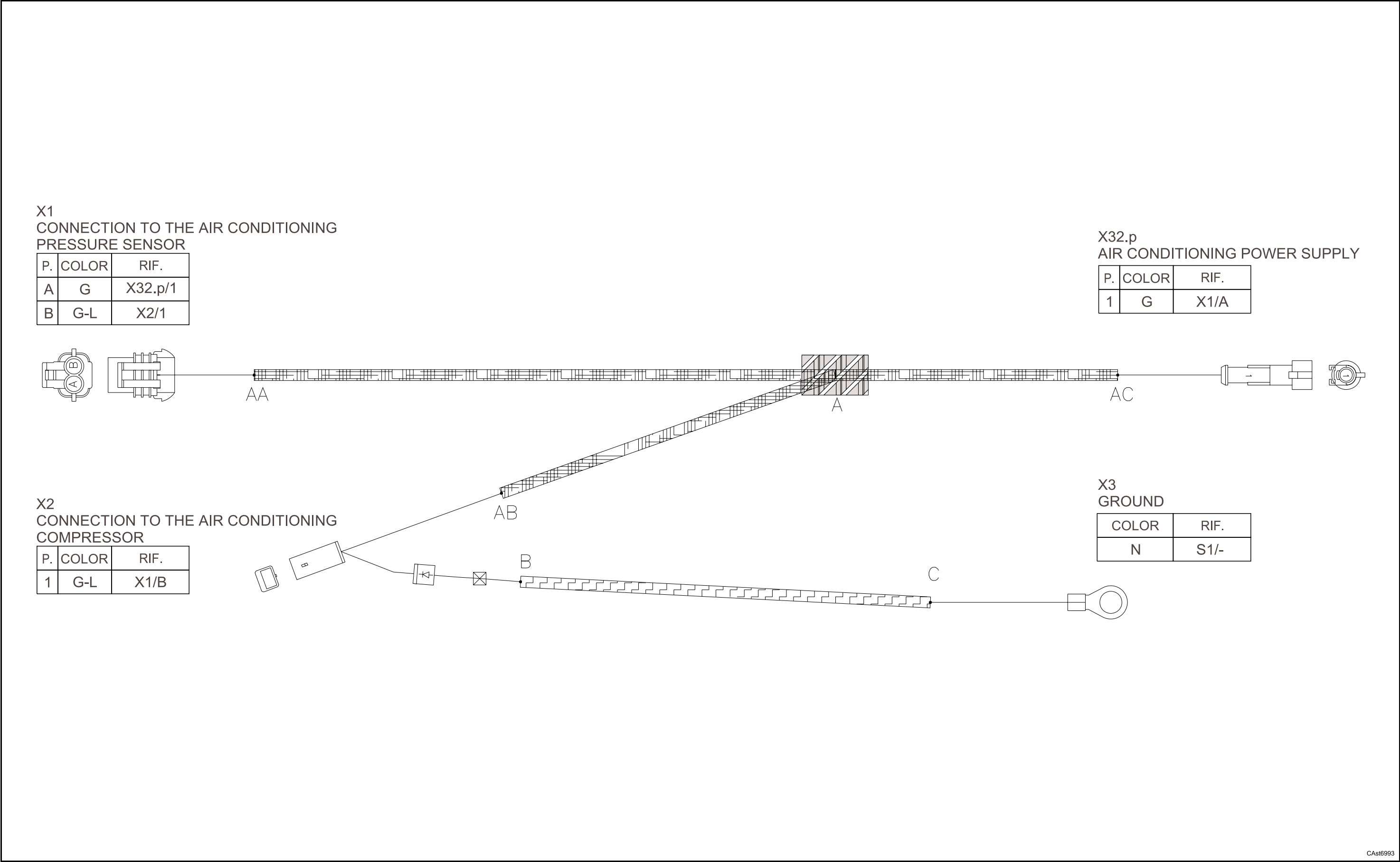
A/C power harness



- 1. Frame system connector
- 2. Air conditioning pressure switch
- 3. Air conditioning compressor
- 4. De-scrambling diode

CAst6669

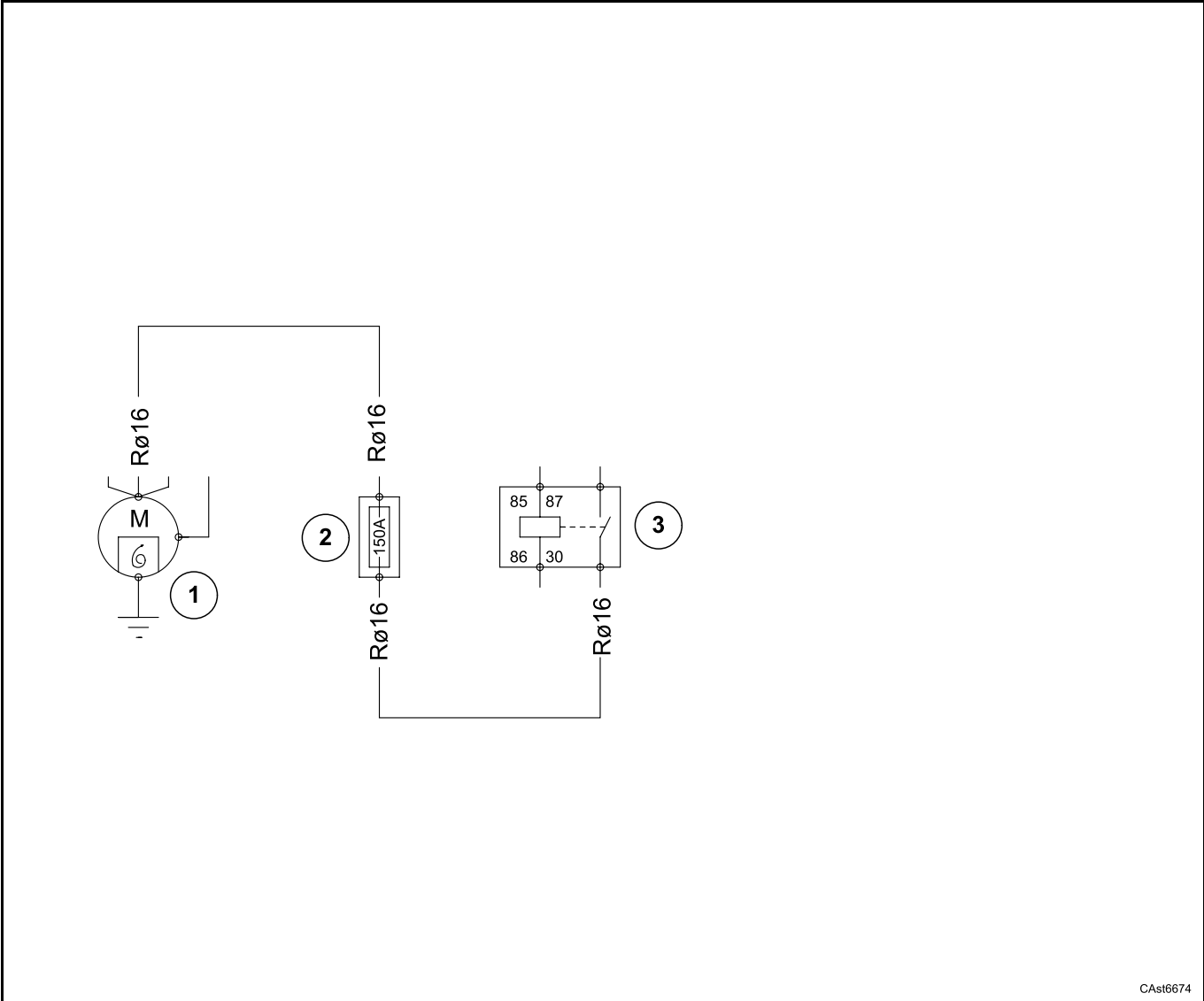
A/C power harness



CAst6993

# Electrical Diagrams

## Preheating harness

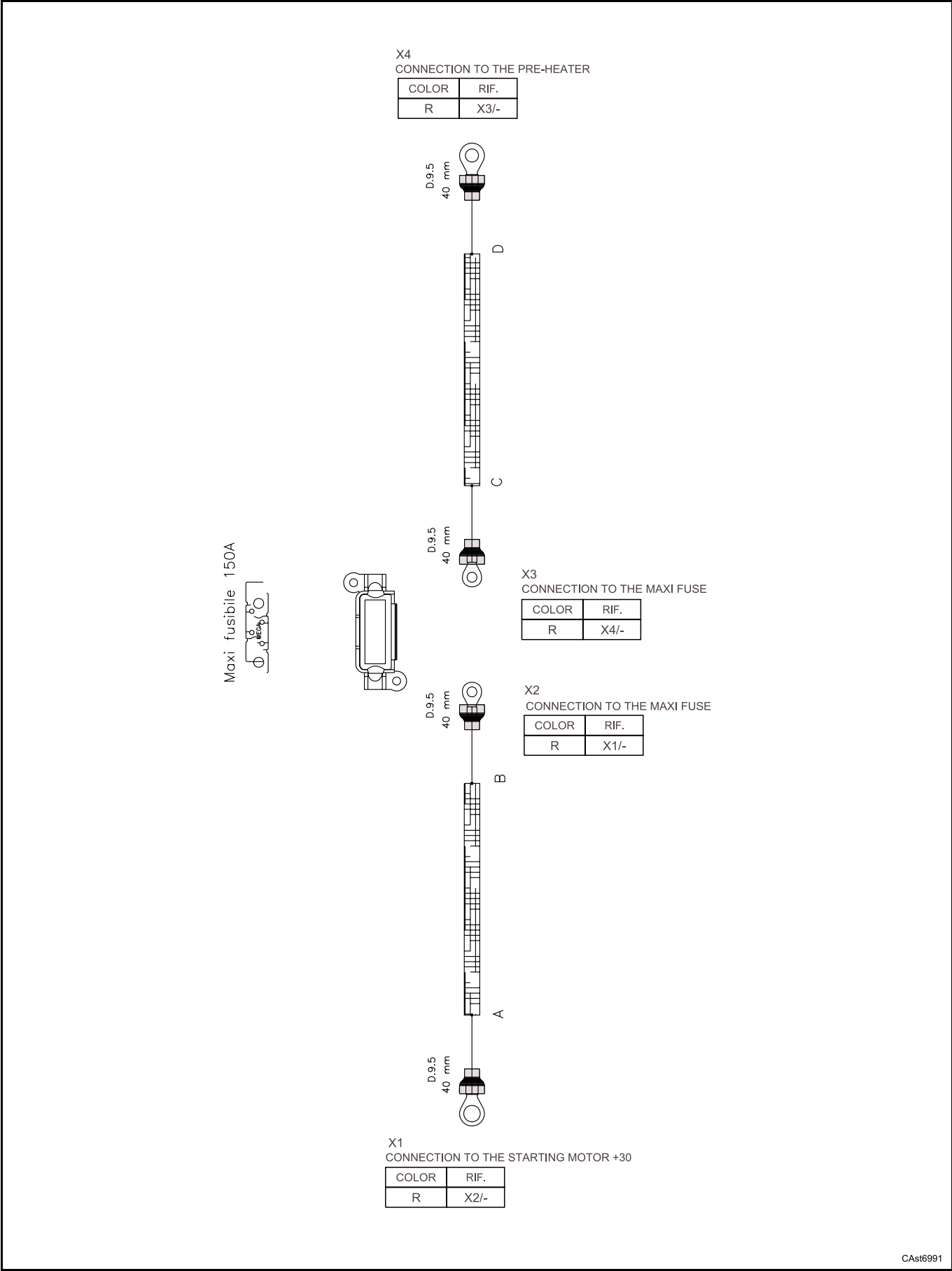


CAst6674

- 1. (+30) Starting motor
- 2. Maxi fuse for glow plugs protection
- 3. Preheating relay

Electrical Diagrams

Preheating harness





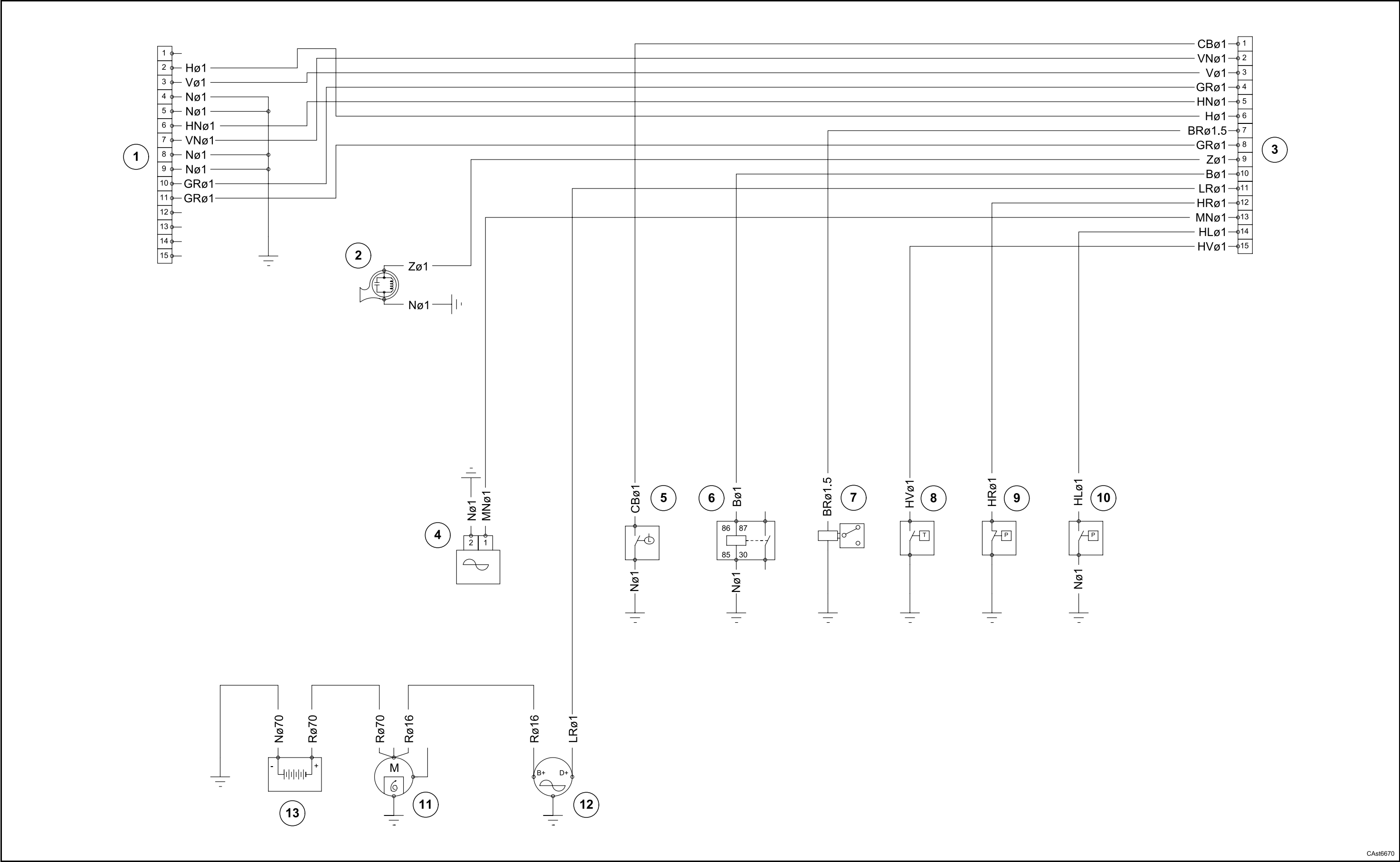
# Electrical Diagrams

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Electrical Diagrams

MF3600 engine line



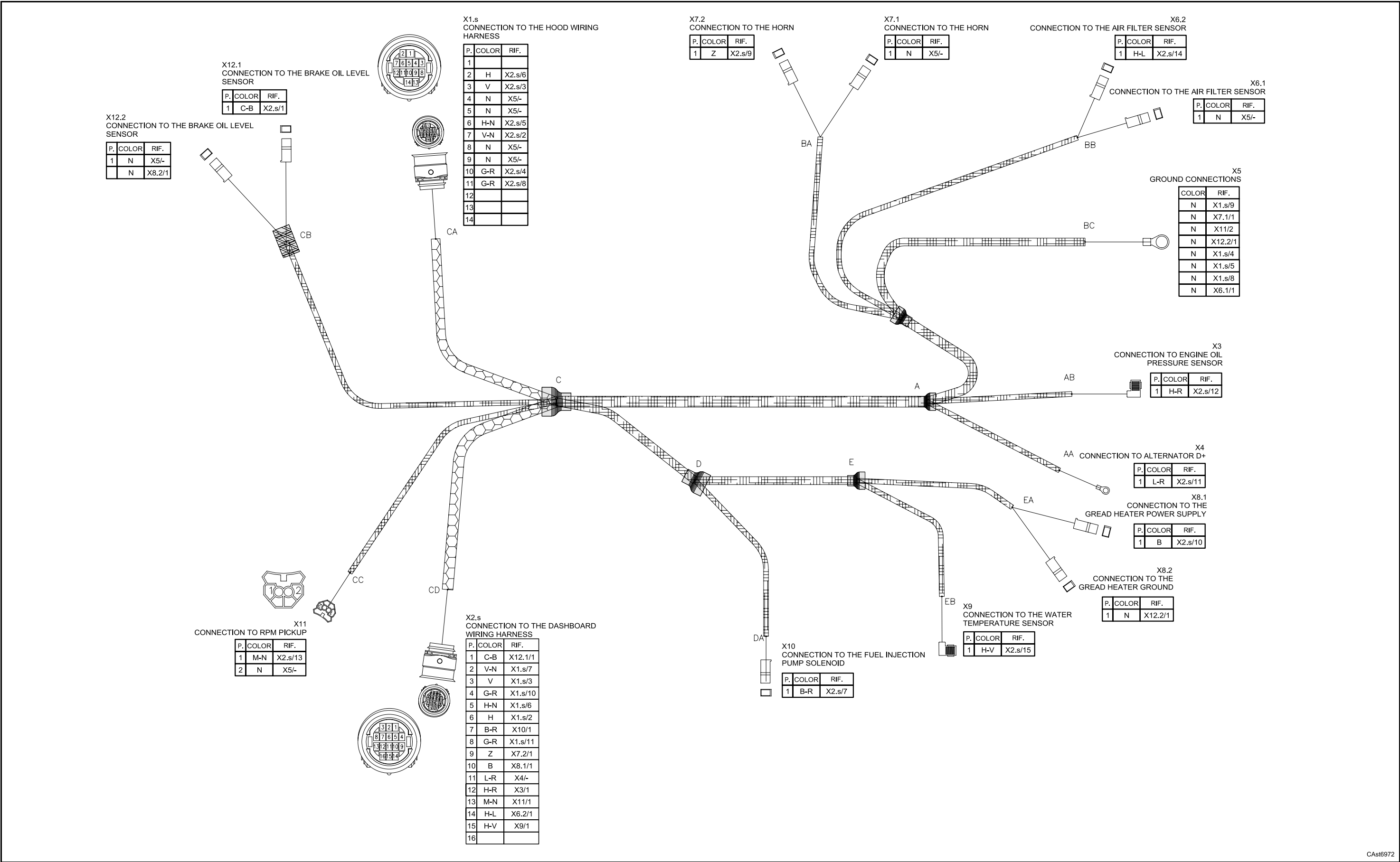
CAst6670

# Electrical Diagrams

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- 1. Bonnet line connection
- 2. Horn
- 3. Platform line connector
- 4. Engine revolutions counter connector
- 5. Brakes oil level sensor
- 6. Glow plug relay
- 7. Engine stop
- 8. Water temperature probe sensor
- 9. Engine oil pressure sensor
- 10. Air filter sensor
- 11. Starting motor
- 12. Alternator
- 13. Battery

MF3600 engine line



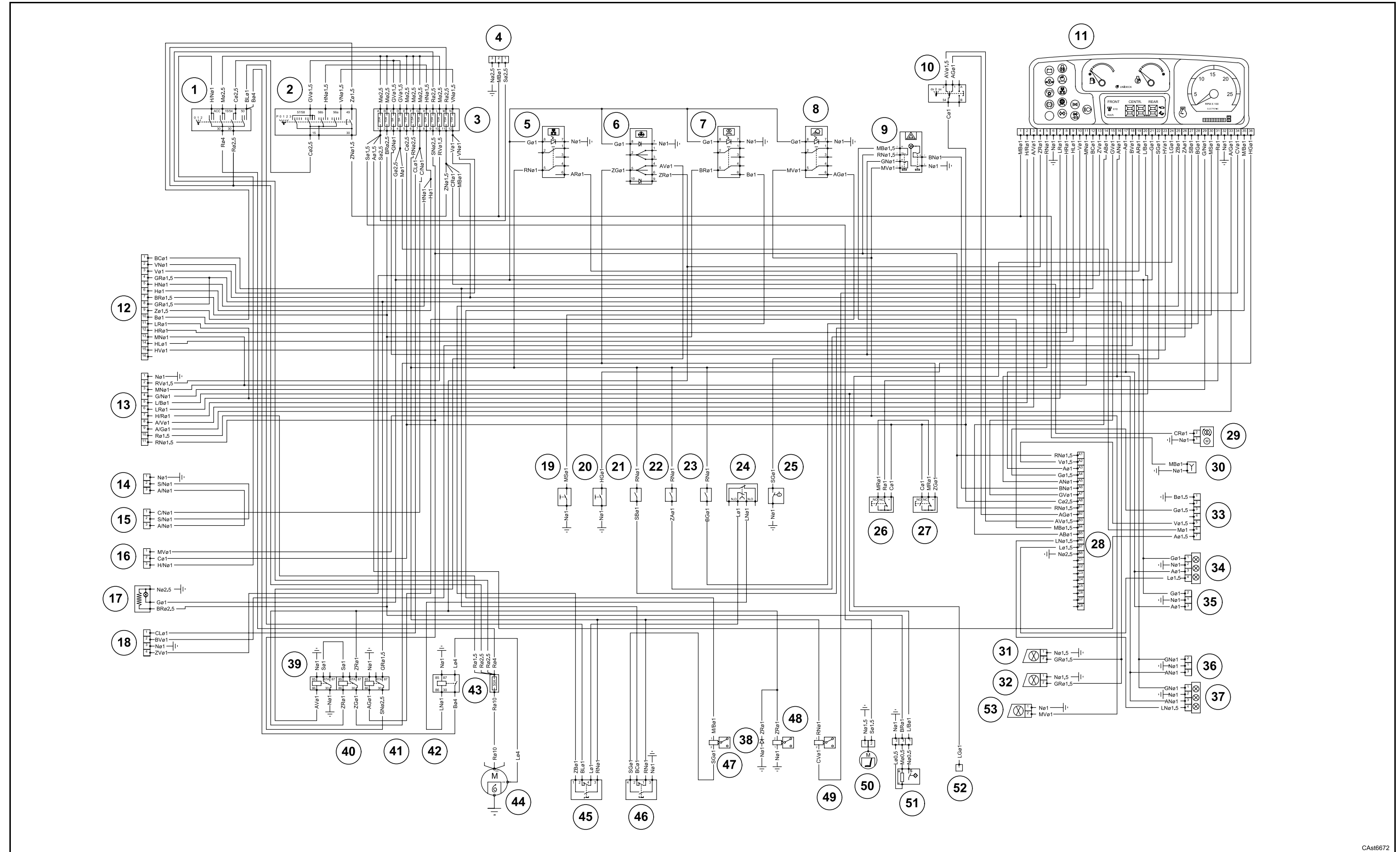
CAst6972

# Electrical Diagrams

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## NA platform line





# Electrical Diagrams

1. Key switch

2. Lights selector

3. Fuses box

4. Three-poles socket

5. Ground switch

6. Differential lock switch

7. Glow plugs switch

8. Working light switch

9. Emergency lights switch

10. Turn signal lights switch

11. Dashboard panel

12. Engine line connection

13. Powershuttle line connection

14. Joystick connection

15. Loader connector

16. Cab connector

17. Lighter

18. HI/LO line connection

19. Instrument calibration push-button

20. Clock push-button

21. PTO 540 E switch

22. PTO 540 switch

23. PTO 1000 switch

24. Start-up enable switch

25. Fuel low floater

26. Left brake light switch

27. Right brake light switch

28. Turn signal lights flashing

29. Beacon light connector

30. 1-pole socket

31. H4 working lights

32. H4 working lights

33. Trailer socket

34. Left rear beam

35. Cab right beam connection

36. Cab left beam connection

37. Right rear beam

38. Diode

39. Differential lock relay (1)

40. Differential lock relay (2)

41. Working lights relay

42. Start relay

43. Maxi fuse for system protection

44. Starting motor

45. Clutch PTO switch

46. Hand brake switch

47. 4WD solenoid valve
48. Differential lock solenoid valve

49. PTO solenoid valve

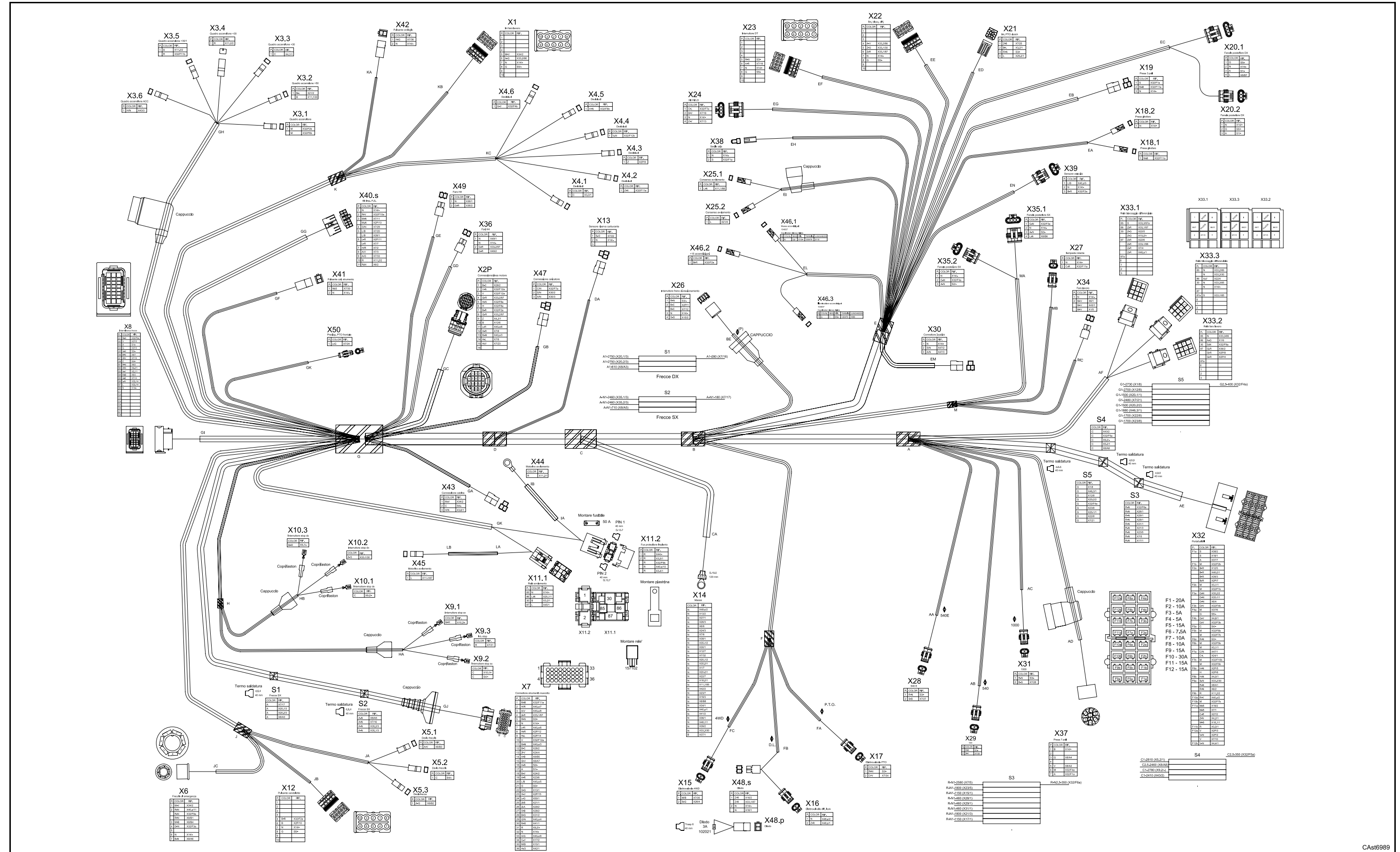
50. Seat power supply

51. Speed sensor

52. Front PTO arrangement

53. Working light

## NA platform line



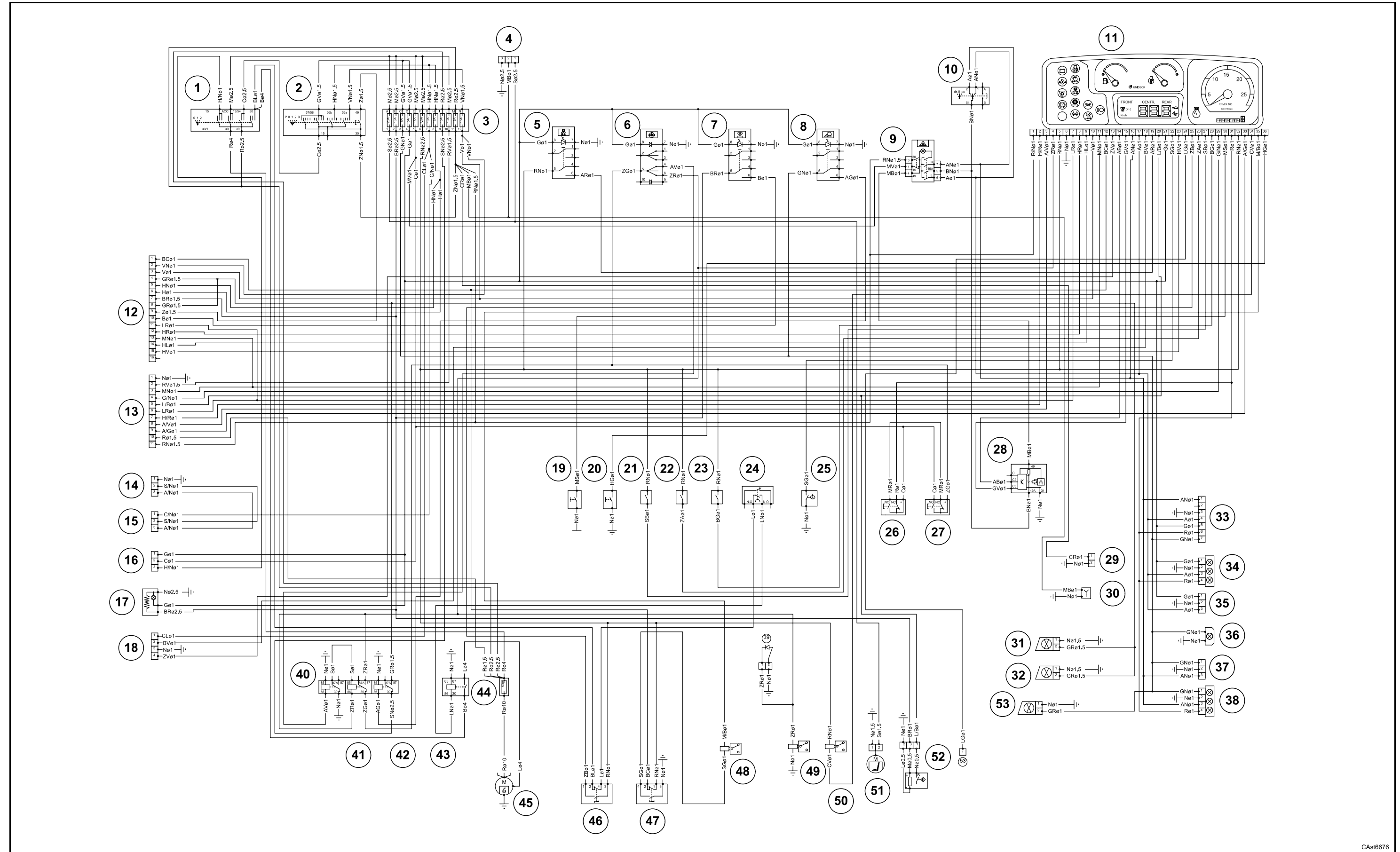
CAst6989

# Electrical Diagrams

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## ROW platform line



CAst6676

# Electrical Diagrams

1. Start-up switch

2. Lights selector

3. Fuses box

4. Three-poles socket

5. Ground switch

6. Differential lock switch

7. Glow plugs switch

8. Working light switch

9. Emergency lights switch

10. Turn signal lights switch

11. Dashboard panel

12. Engine line connection

13. Powershuttle system connection

14. Joystick connection

15. Loader connector

16. Cab connector

17. Lighter

18. HI/LO line connection

19. Instrument calibration push-button

20. Clock push-button

21. PTO 540 E switch

22. PTO 540 switch

23. PTO 1000 switch

24. Start-up enable switch

25. Fuel low floater

26. Left brake light switch

27. Right brake light switch

28. Turn signal lights flashing

29. Beacon light connector

30. 1-pole socket swinging beam

31. H4 working lights

32. H4 working lights

33. Trailer socket

34. Right rear beam

35. Cab right beam connection

36. License plate light

37. Cab left beam connection

38. Left rear beam

39. Diode

40. Differential lock relay (disengagement)

41. Differential lock relay (engagement)

42. Working light relay

43. Start relay

44. Maxi fuse for system protection

45. Starting motor

46. Clutch PTO switch

47. Hand brake switch
48. 4WD solenoid valve

49. Differential lock solenoid valve

50. PTO solenoid valve

51. Pneumatic seat

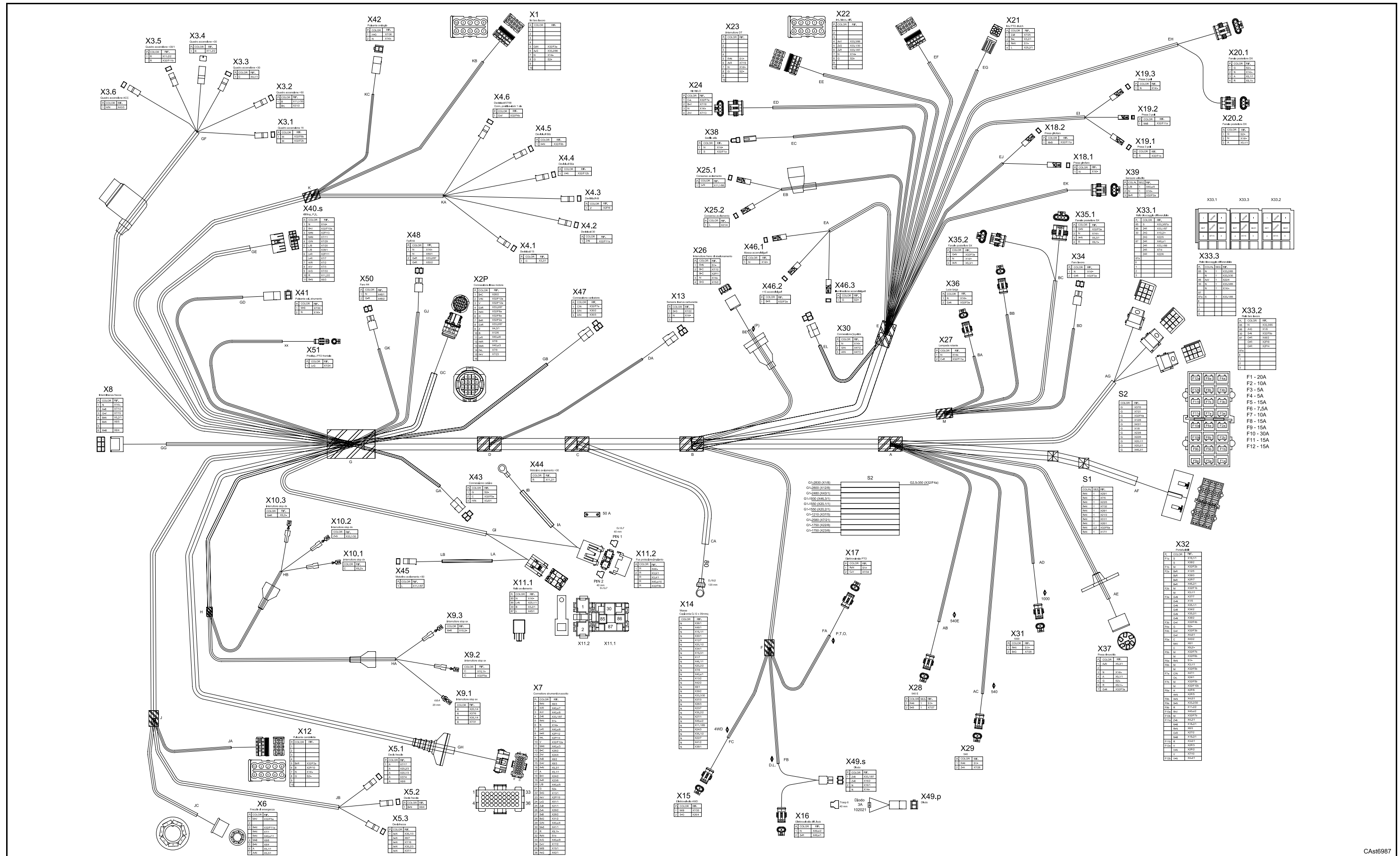
52. Speed sensor

53. Front PTO arrangement

54. Working light

## Electrical Diagrams

ROW platform line



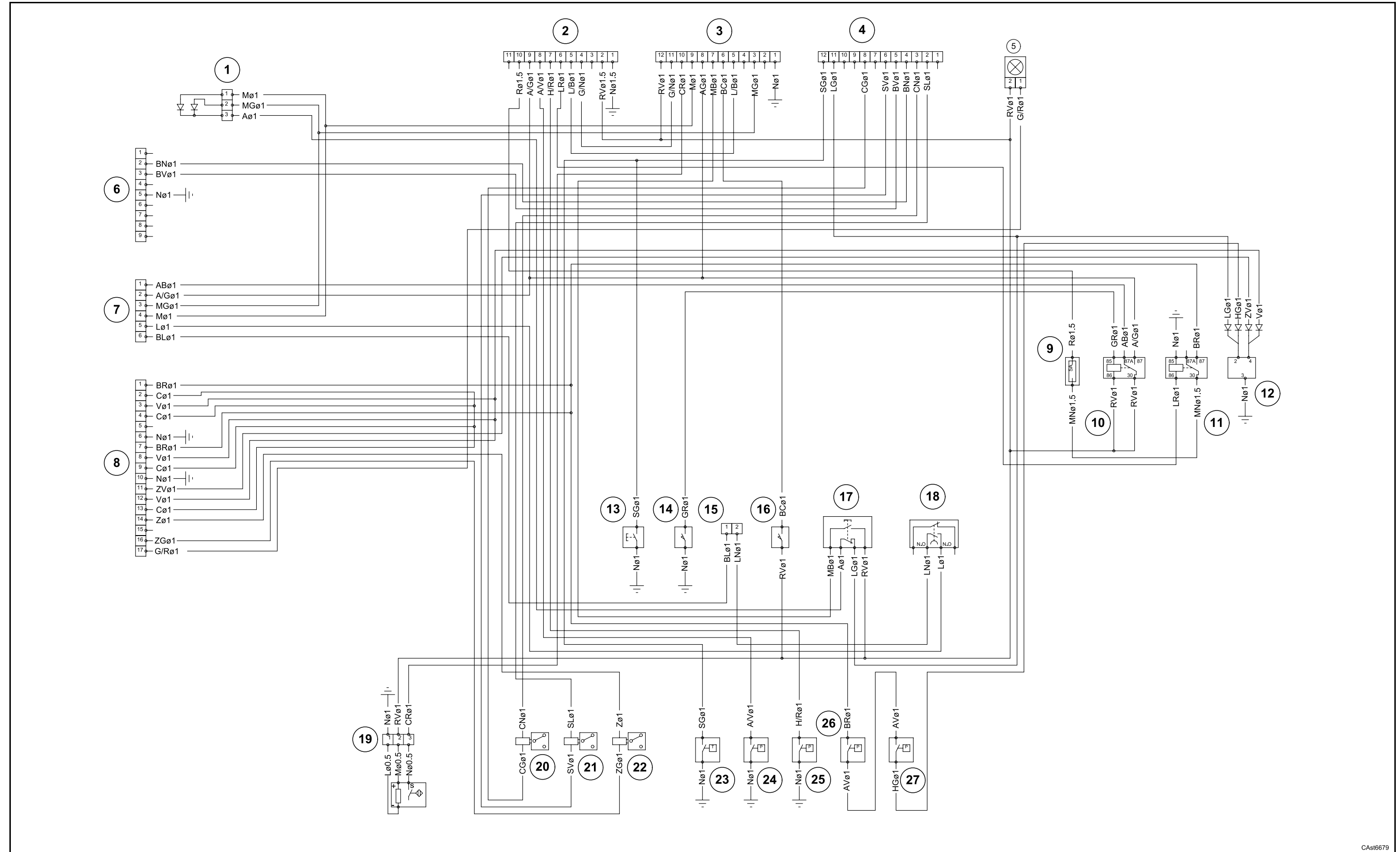


## Electrical Diagrams

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## V2.0 Powershuttle harness



CAst6679

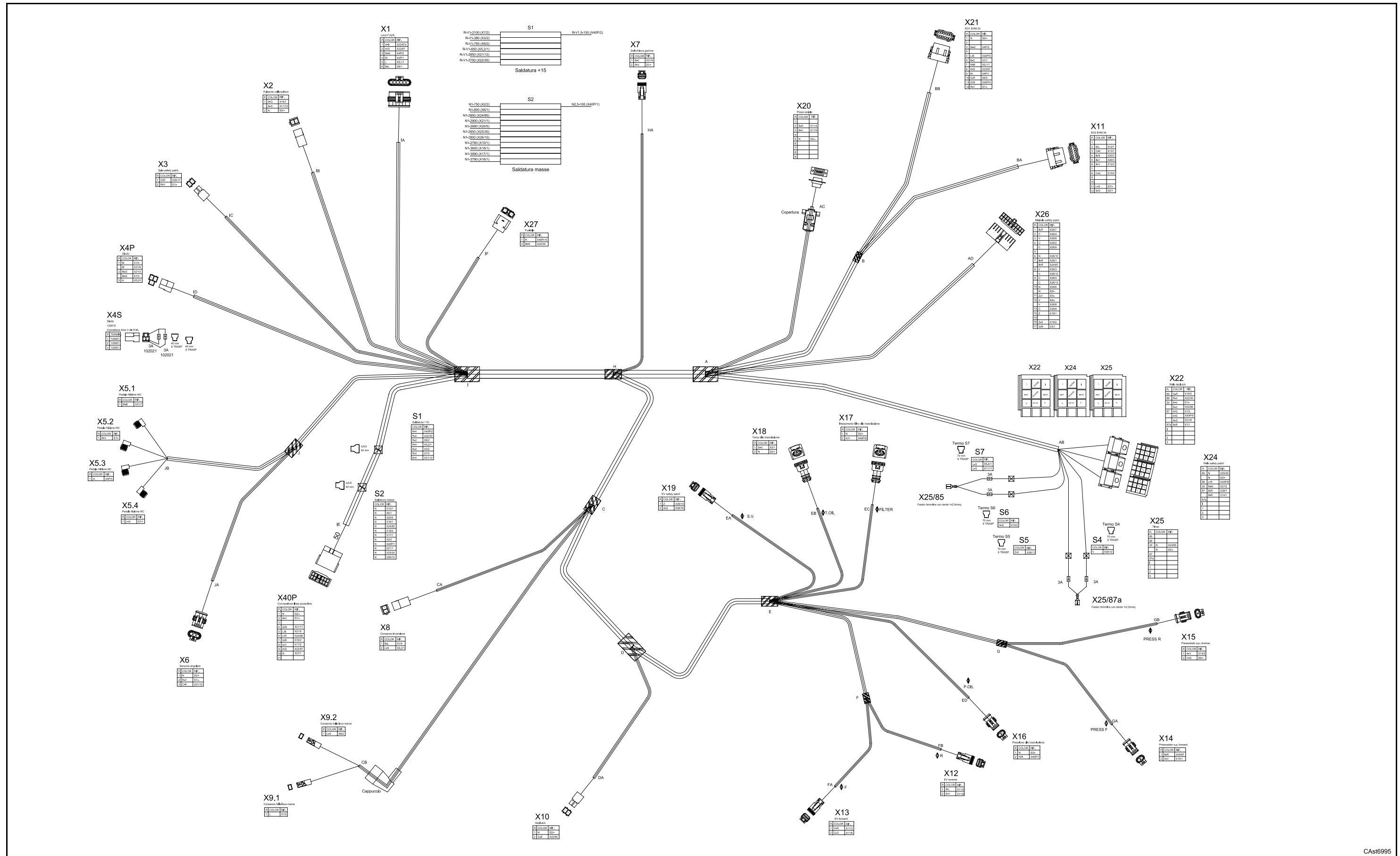
# Electrical Diagrams

---

- 1. Diodes connector
- 2. Platform line connection
- 3. S01 EHM 24 control unit connection
- 4. S02 EHM 24 control unit connection
- 5. Safety area indicator
- 6. Serial connection socket
- 7. F.N.R. lever
- 8. Safety mini relay connector
- 9. Movements protection fuse
- 10. Declutch relay
- 11. Safety relay
- 12. Safety timer
- 13. Calibration push-button
- 14. Declutch
- 15. Reverse enable
- 16. Range lever switch
- 17. Clutch pedal
- 18. Speeds idle lever enable
- 19. Angular sensor
- 20. Forward run solenoid valve
- 21. Reverse runs solenoid valve
- 22. Safety solenoid valve
- 23. Transmission oil temperature sensor
- 24. Transmission oil filter clogging sensor
- 25. Transmission oil pressure sensor
- 26. Forward run s.p. pressure
- 27. Reverse run s.p. pressure

## Electrical Diagrams

## V2.0 Powershuttle harness

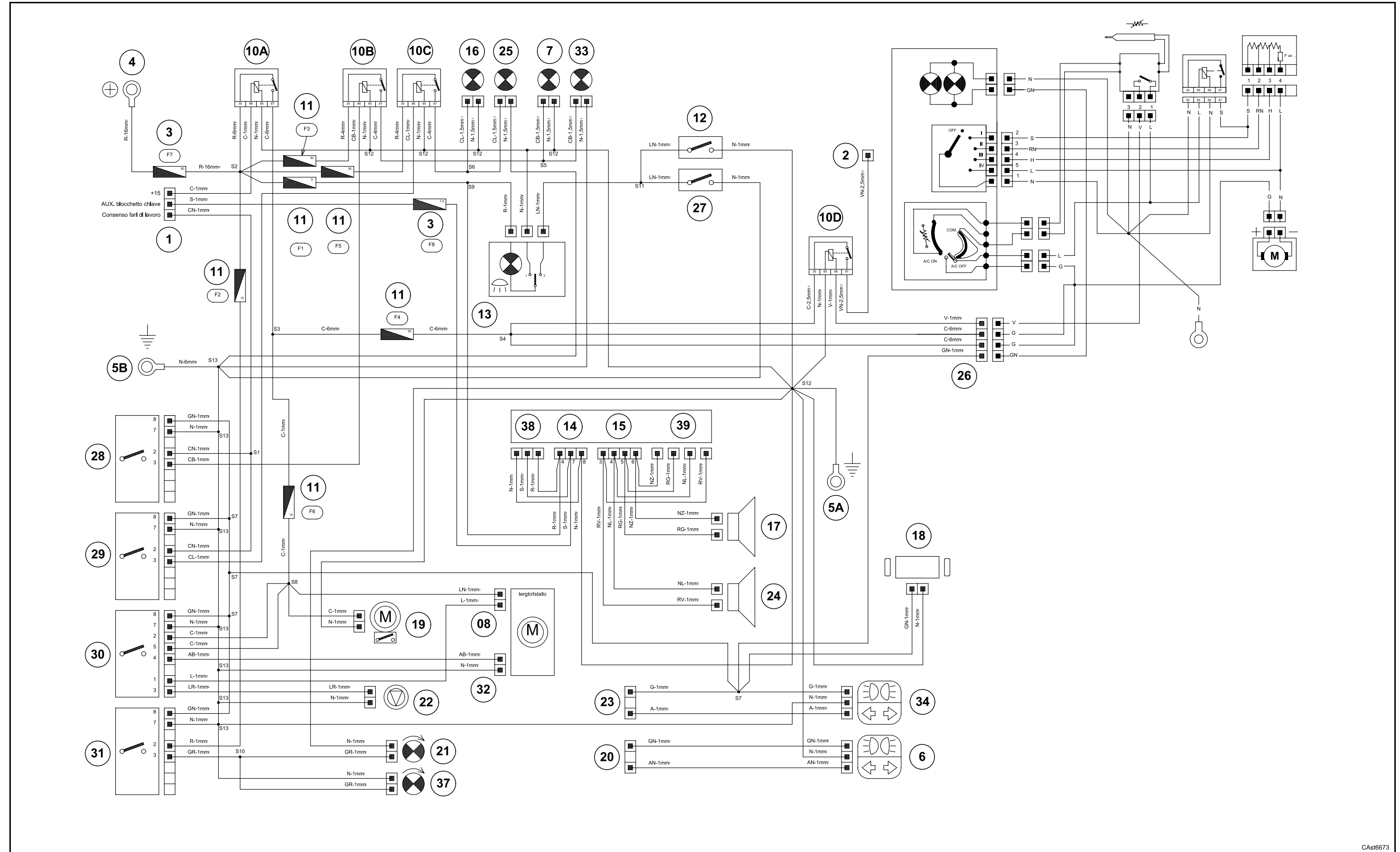


# Electrical Diagrams

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## Cab electric system



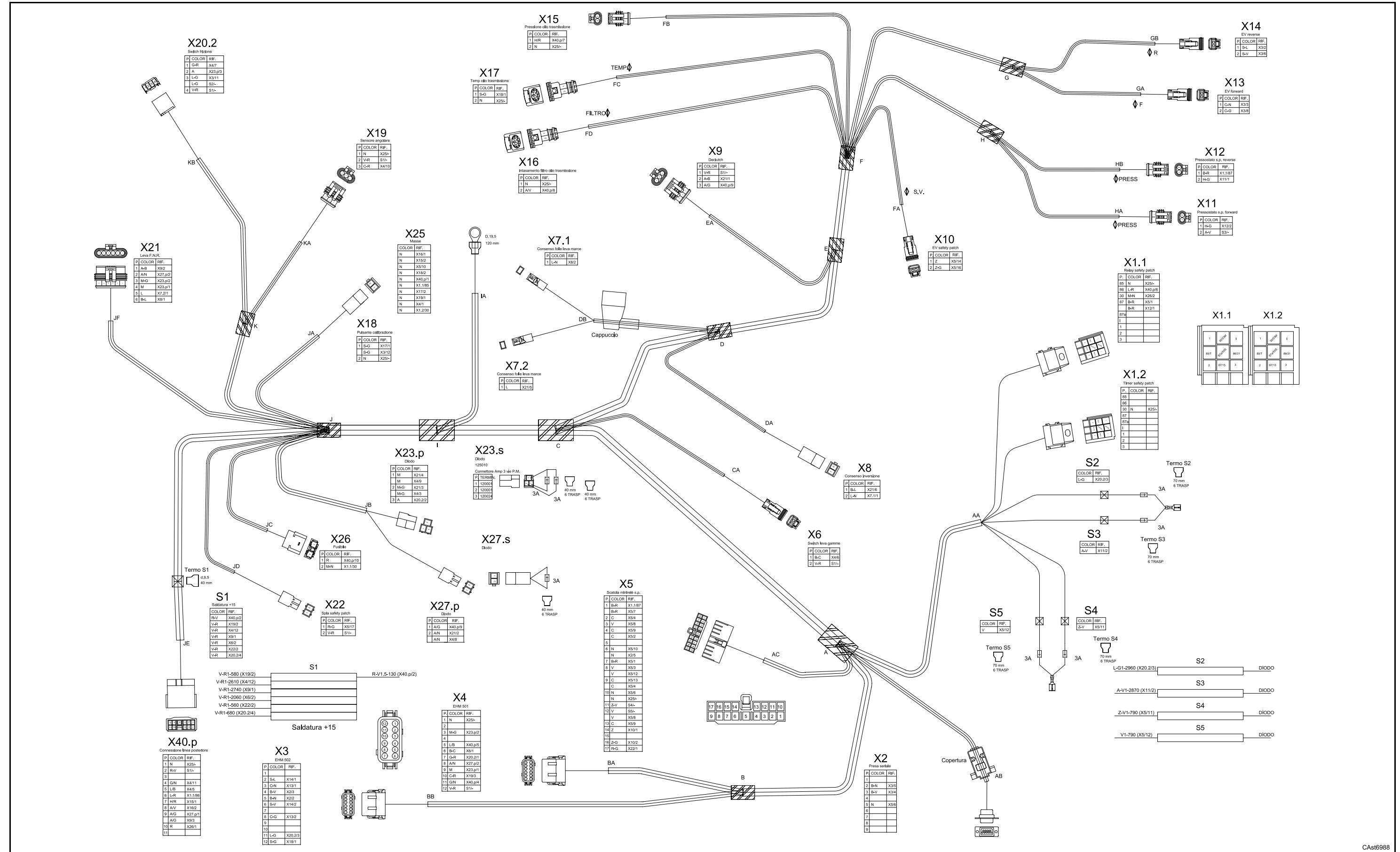
CAst6673



# Electrical Diagrams

1. Key cylinder
2. Harness splitting (feed A/C for compressor)
3. 50 A (F7) maxi fuse + (F8) radio fuse
4. (+30) Start-up
5. Ground
6. Left front beam
7. Left front working light
8. Windscreen wiper (front left)
9. n/a
10. Auxiliary relay (A), front/rear working lights (B/C), compressor (D)
11. (F1+F2+F3+F4+F5+F6) fuses
12. Interior light microswitch
13. Ceiling light with relevant switch
14. Radio (supply) (Europe prearrangement)
15. Radio antenna (Europe prearrangement)
16. Left rear working light
17. Left-hand connector (prearrangement)
18. License plate light (optional)
19. Rear windscreen wiper motor (optional)
20. Left rear beam signal socket
21. Left swinging beam (optional)
22. Windscreen wipers pump
23. Socket for right rear signals beam
24. Right loudspeaker (prearrangement)
25. Right rear working light
26. Air conditioning unit harness connection
27. Dome light microswitch (optional)
28. Front working lights switch
29. Rear working lights switch
30. Windscreen wipers and windscreen washer pump switch
31. Swinging beam switch
32. Right front windscreen wiper
33. Right front working light
34. Right front beam
35. n/a
36. n/a
37. Right swinging beam (optional)
38. Radio (supply) (North America prearrangement)
39. Radio (sound boxes collector) (North America prearrangement)

## Powershuttle line



CAst6988

# Electrical Diagrams

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# Electrical Diagrams

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## Electrical Diagrams

### Section 2

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# Electrical Diagrams

## BEACON LIGHT LINE

### X1.1

Connessione linea piattaforma

| COLOR | RIF.   |
|-------|--------|
| N     | X2.1/1 |

### X1.2

Connessione linea piattaforma

| COLOR | RIF.   |
|-------|--------|
| C-R   | X2.2/1 |

### X2.1

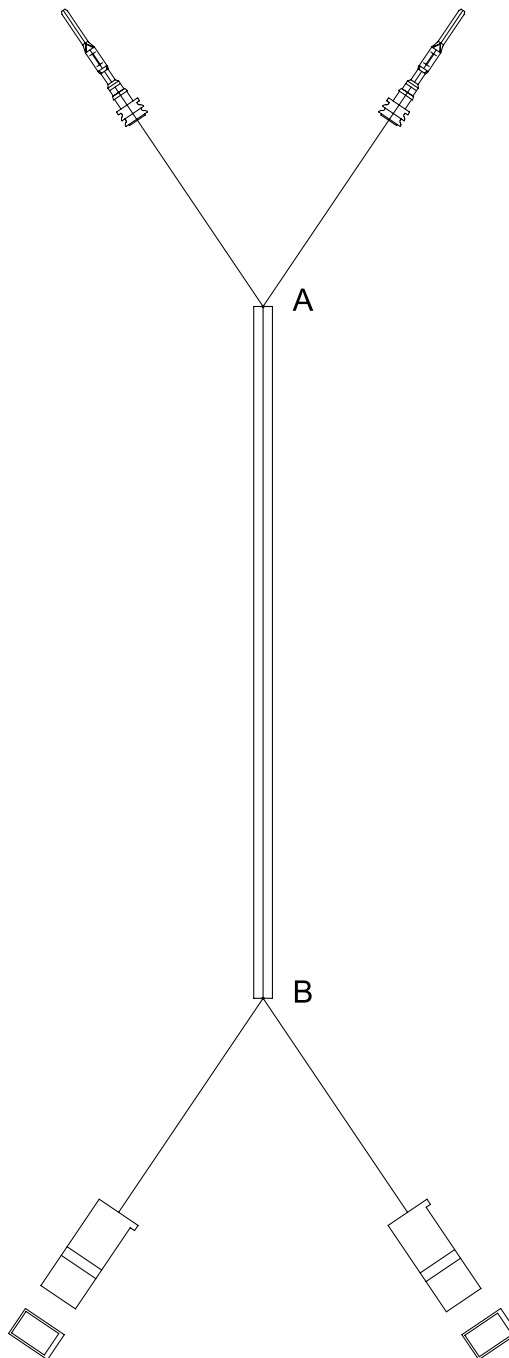
Lampada rotante

| P. | COLOR | RIF.   |
|----|-------|--------|
| 1  | N     | X1.1/- |

### X2.2

Lampada rotante

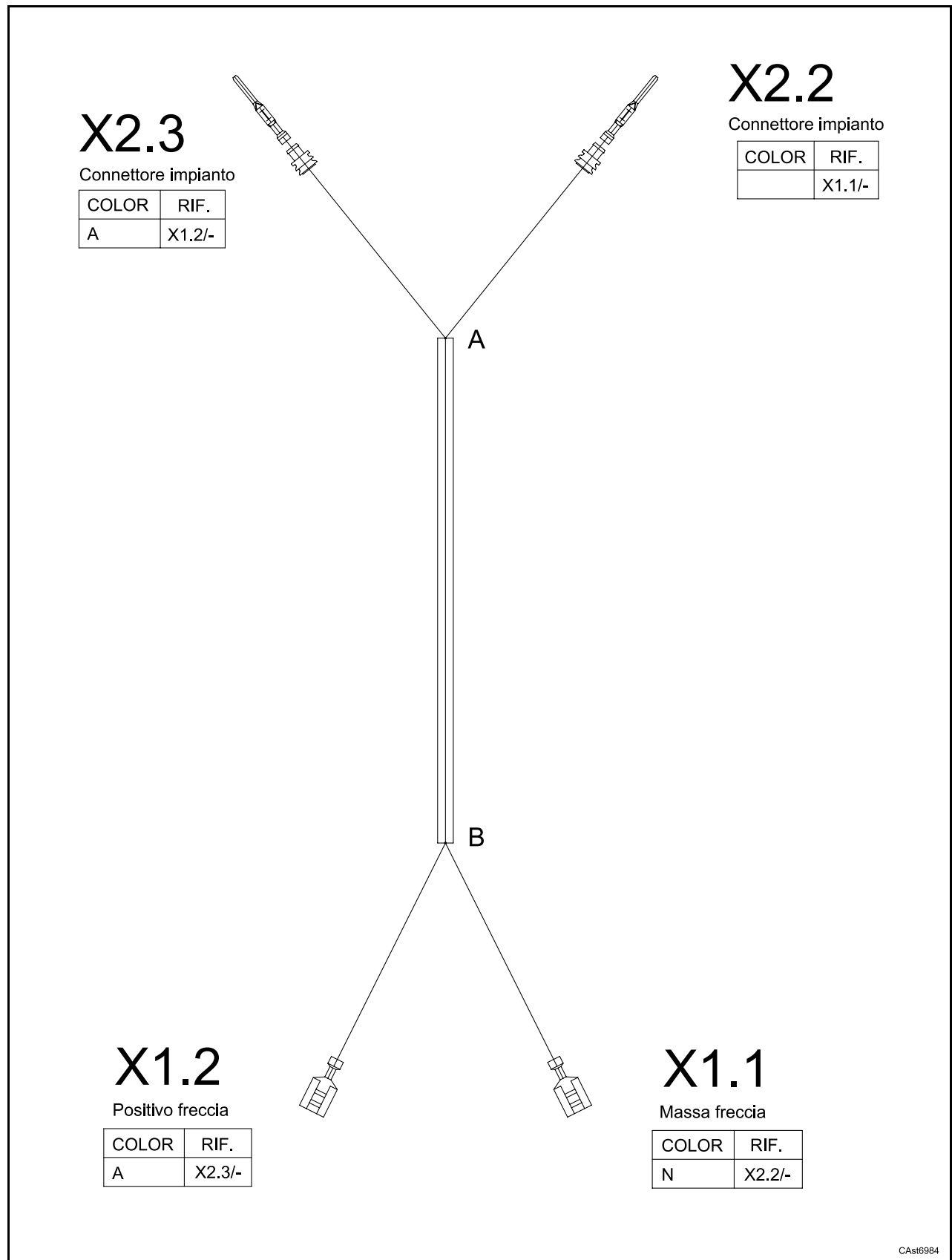
| P. | COLOR | RIF.   |
|----|-------|--------|
| 1  | C-R   | X1.2/- |



CAst6983

## Electrical Diagrams

## NA RIGHT TURN SIGNAL LIGHT LINE





# Electrical Diagrams

## NA LEFT TURN SIGNAL LIGHT LINE

### X2.2

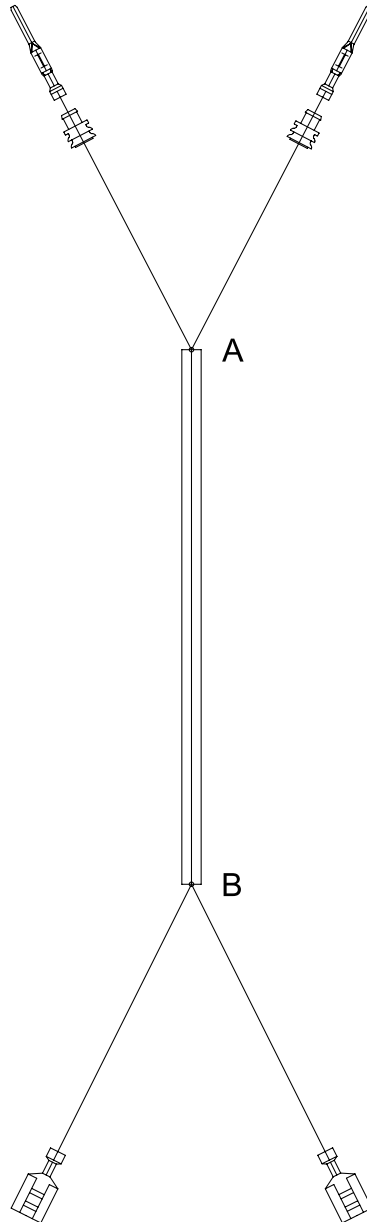
Connettore linea piattaforma

| COLOR | RIF.   |
|-------|--------|
| N     | X1.1/- |

### X2.3

Connettore linea piattaforma

| COLOR | RIF.   |
|-------|--------|
| A-N   | X1.2/- |



### X1.2

Positivo freccia

| COLOR | RIF.   |
|-------|--------|
| A-N   | X2.3/- |

### X1.1

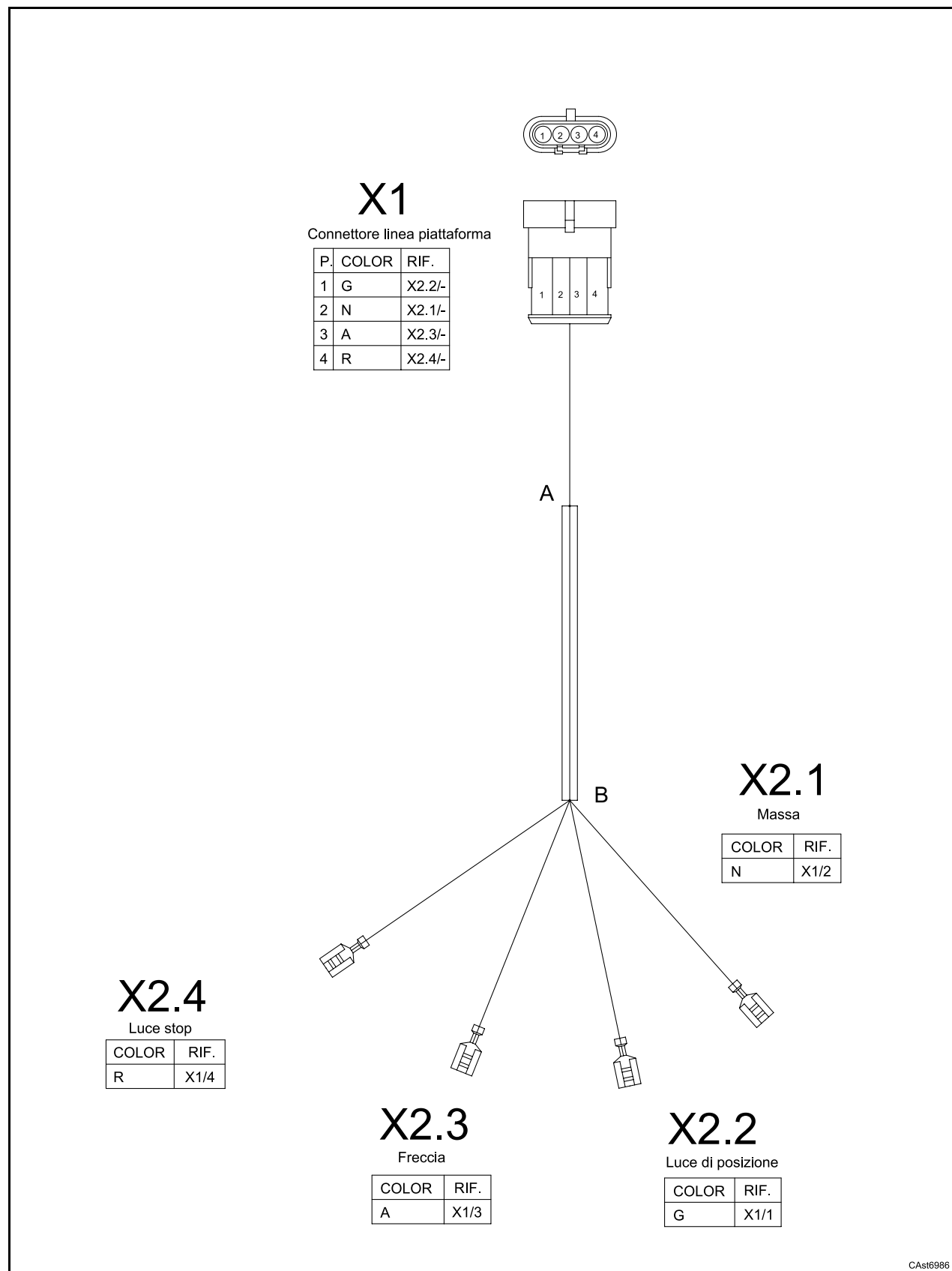
Massa freccia

| COLOR | RIF.   |
|-------|--------|
| N     | X2.2/- |

CAst6985

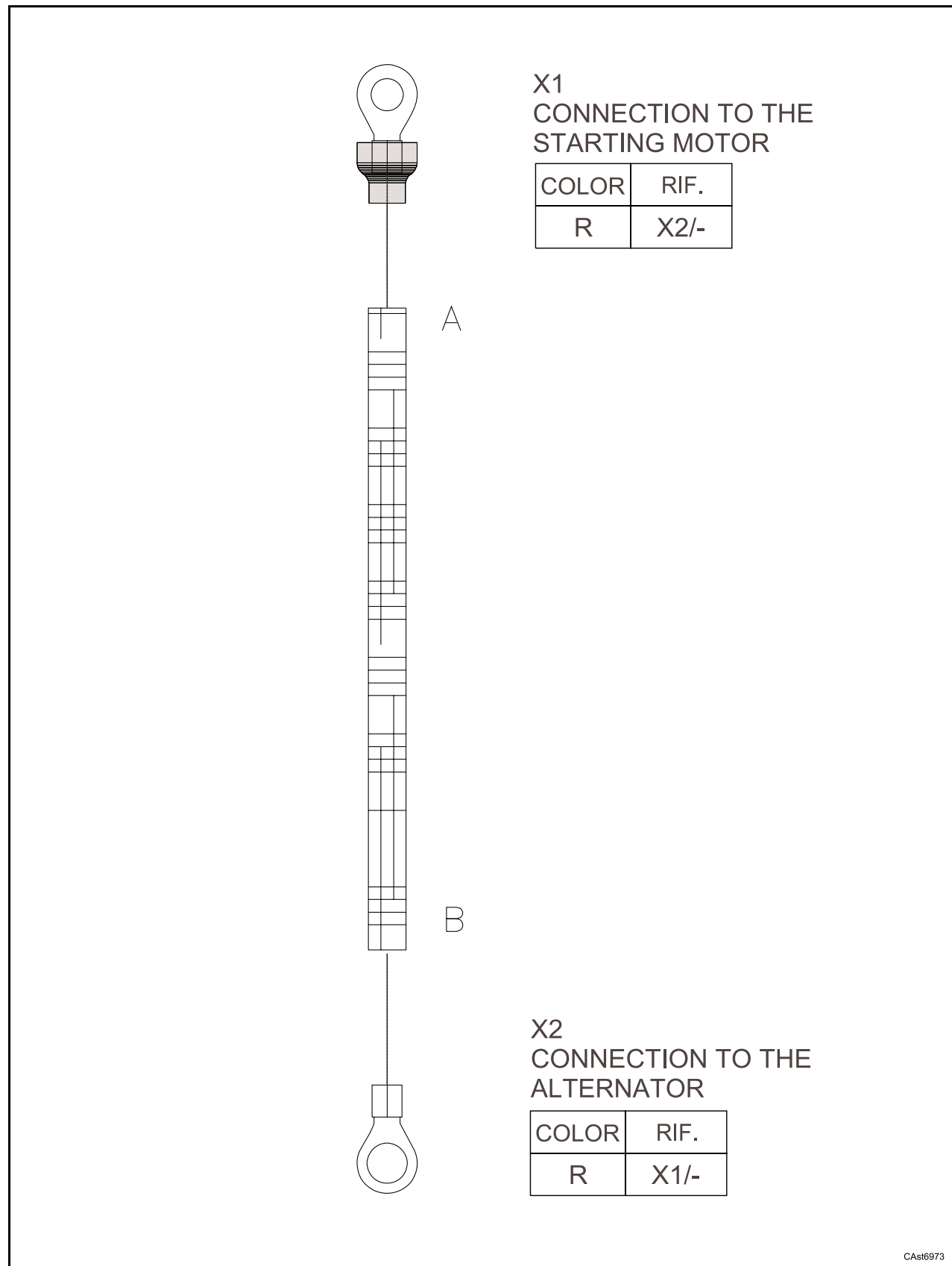
# Electrical Diagrams

## CAB REAR BEAM LINE



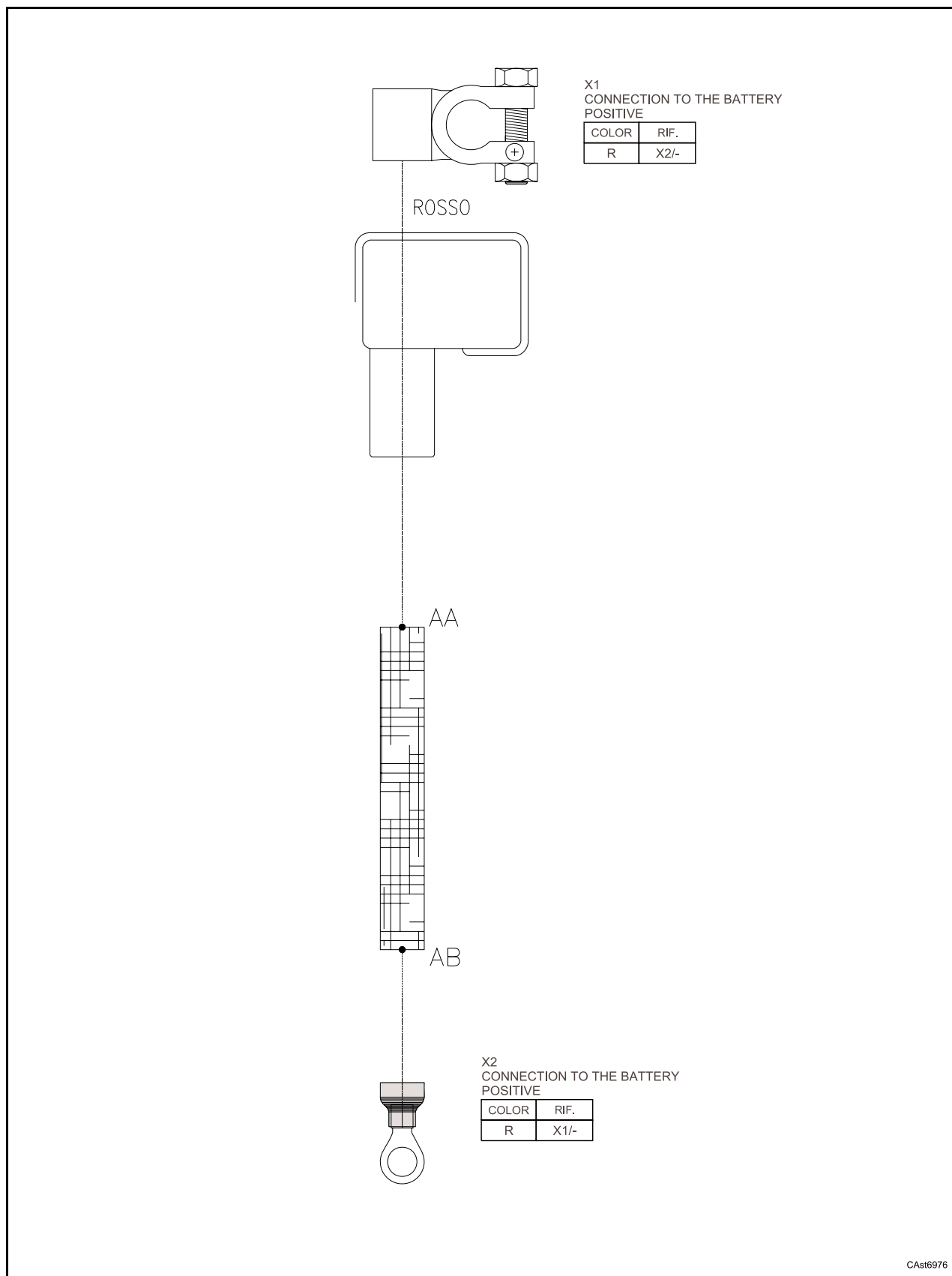
# Electrical Diagrams

## ALTERNATOR CABLE



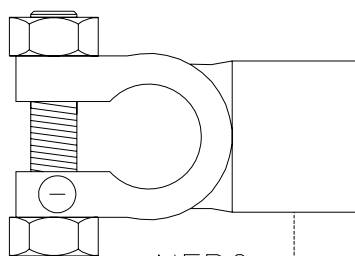
# Electrical Diagrams

## BATTERY POSITIVE

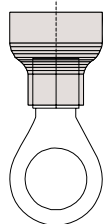
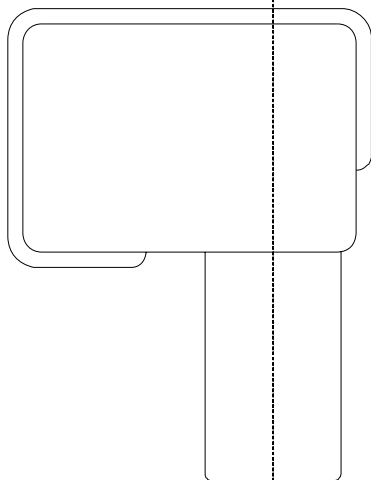


# Electrical Diagrams

## BATTERY NEGATIVE



NERO



X1  
CONNECTION TO THE BATTERY  
NEGATIVE

| COLOR | RIF. |
|-------|------|
| N     | X2/- |

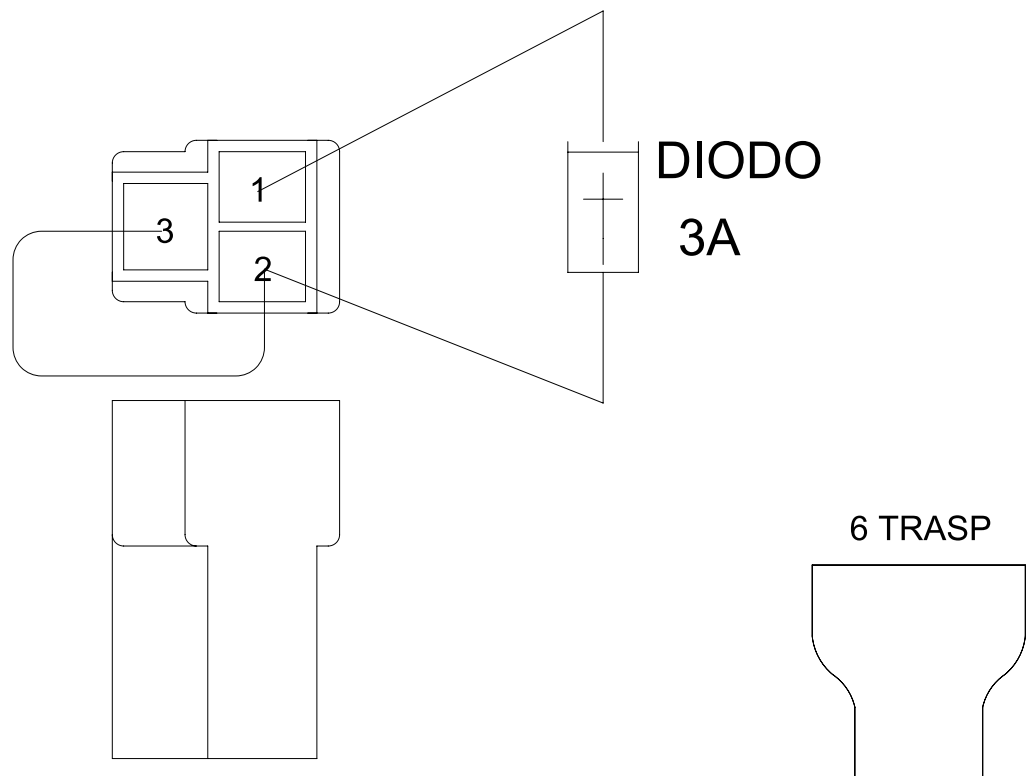
X2  
CONNECTION TO THE BATTERY  
NEGATIVE

| COLOR | RIF. |
|-------|------|
| N     | X1/- |

CAst6977

# Electrical Diagrams

## GROUND CONNECTOR



# X18

Connettore diodo

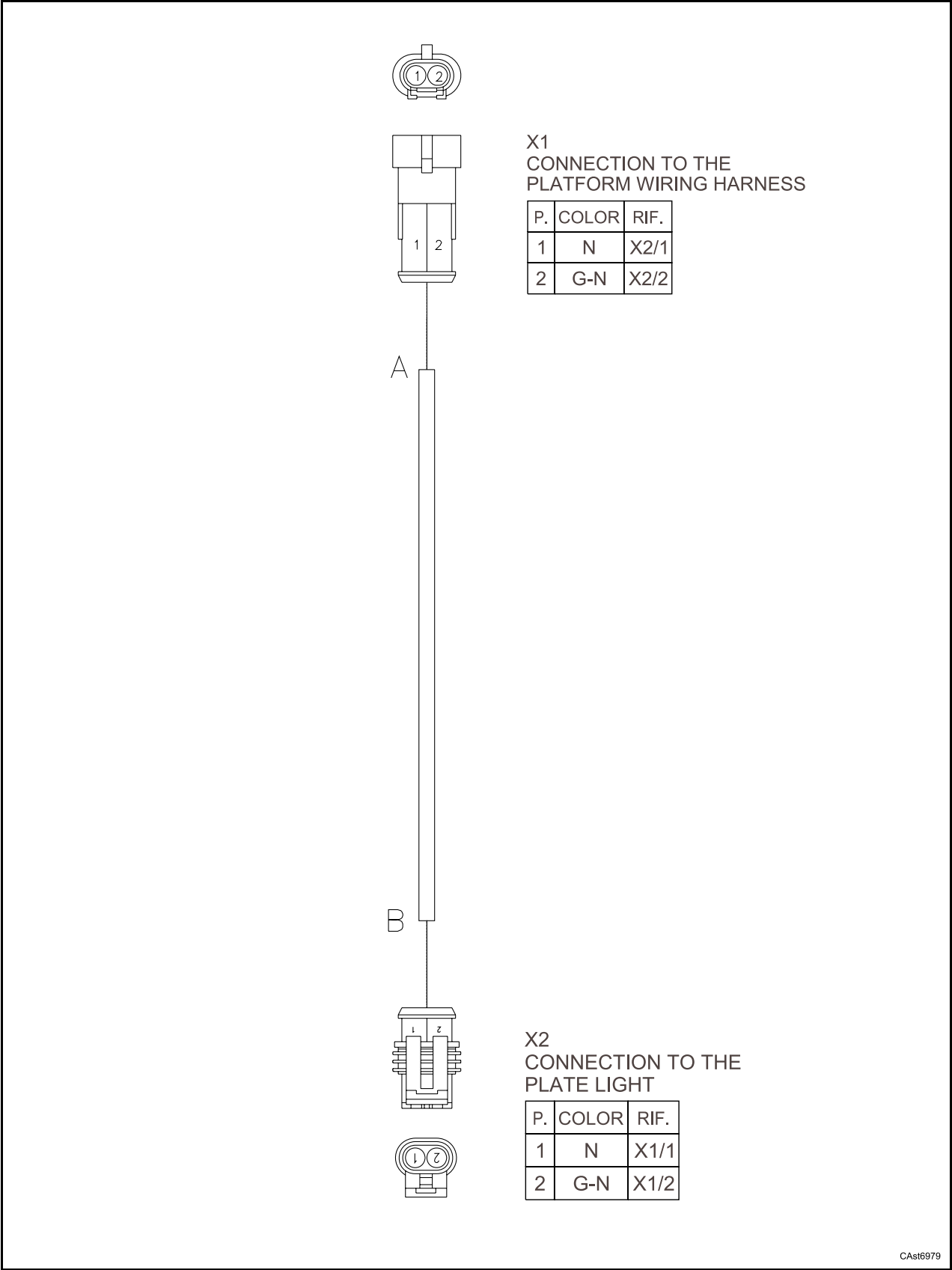
| P | COLOR | RIF.  |
|---|-------|-------|
| 1 |       |       |
| 2 | S-N   | X18/3 |
| 3 | S-N   | X18/2 |

CAst6978



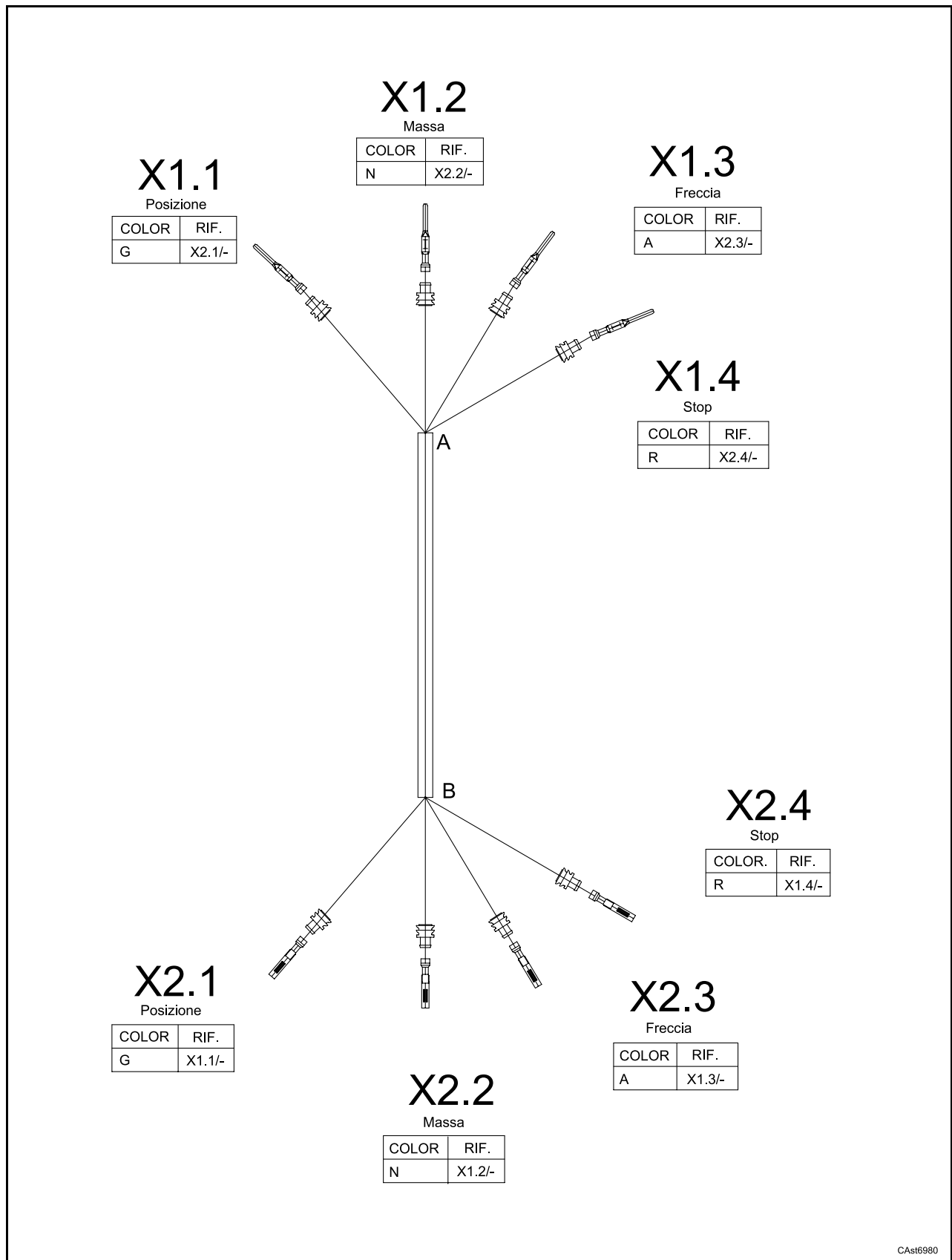
# Electrical Diagrams

## LICENSE PLATE LIGHT EXTENSION



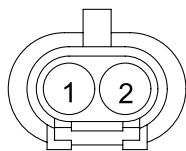
## Electrical Diagrams

## BEAMS EXTENSION



# Electrical Diagrams

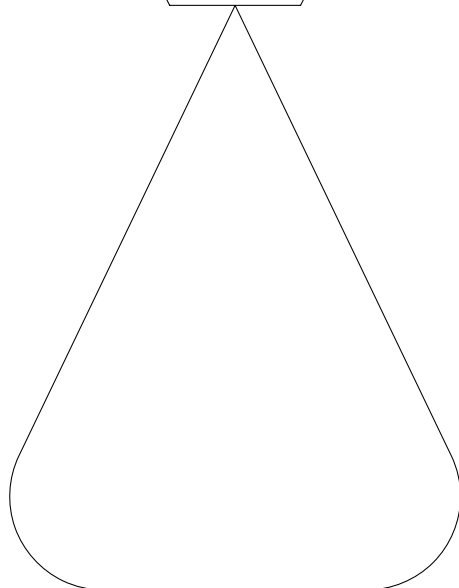
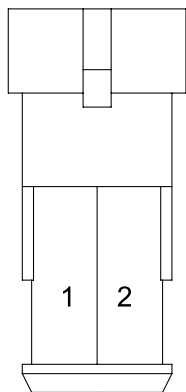
## CONNECTOR PTO 540 ONLY



**X1**

Connettore P.T.O

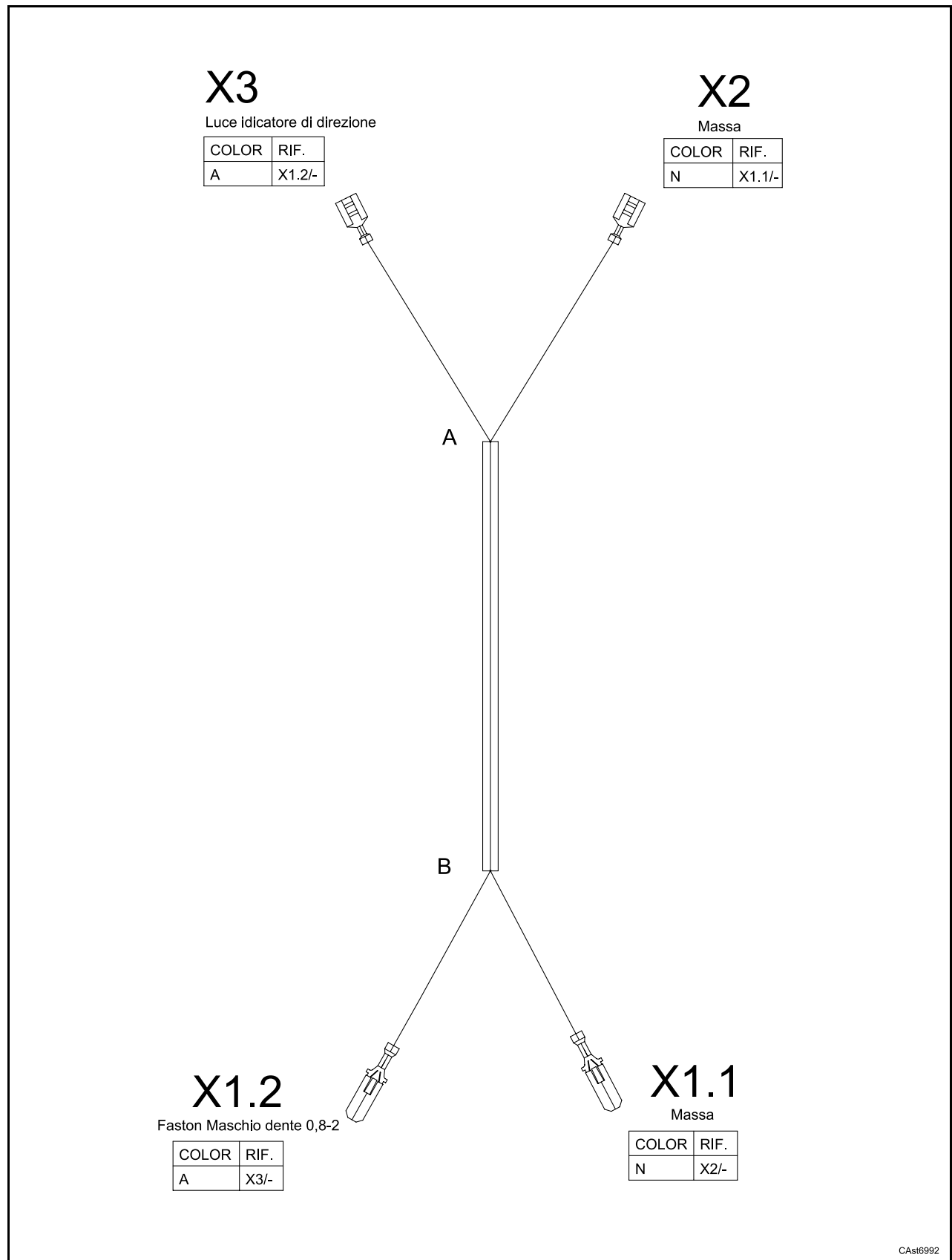
| P. | COLOR | RIF. |
|----|-------|------|
| 1  | R-N   | X1/2 |
| 2  | R-N   | X1/1 |



CAst6990

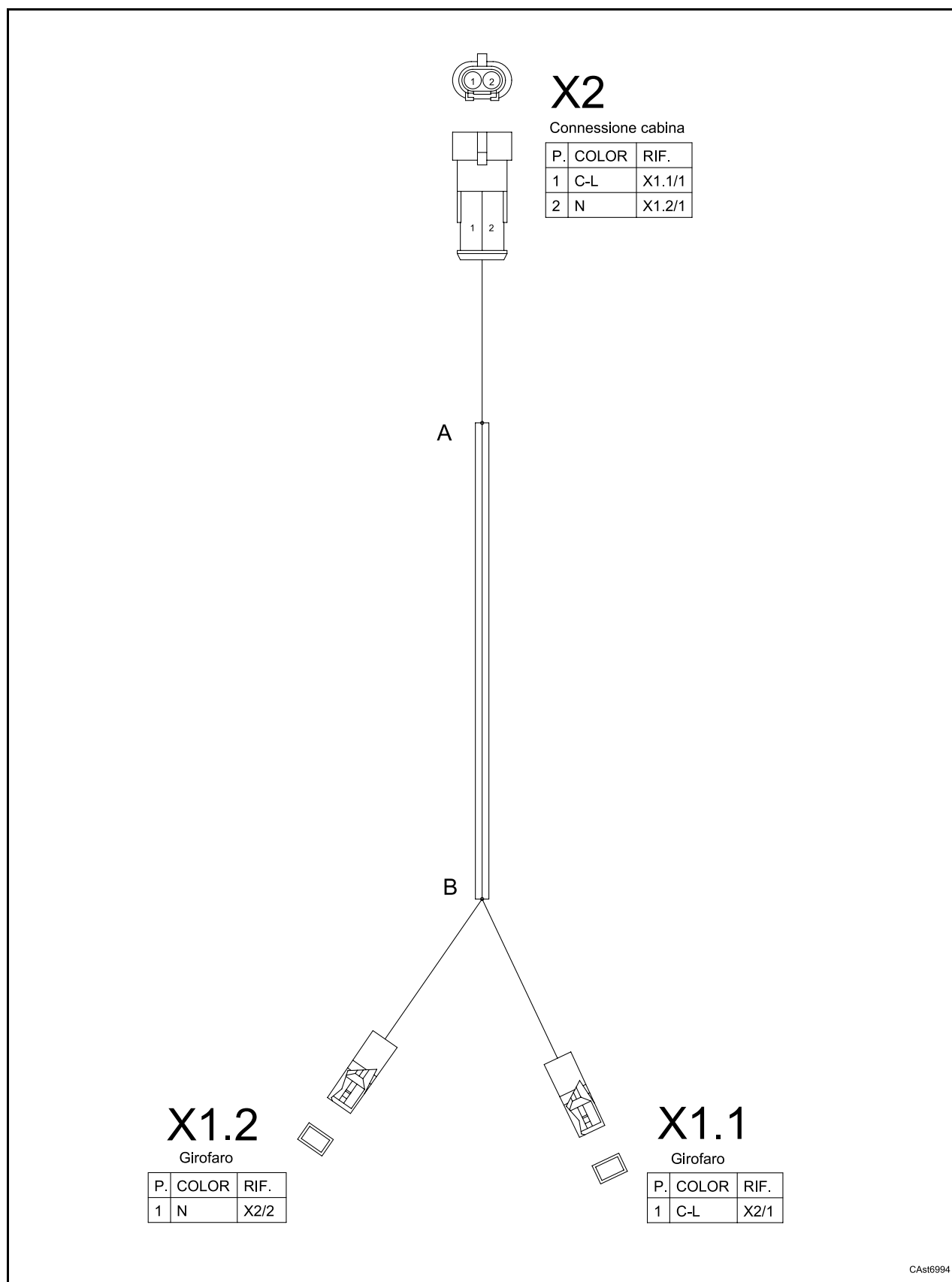
# Electrical Diagrams

## NA CAB FRONT BEAM LINE



# Electrical Diagrams

## CAB SWINGING BEAM EXTENSION



# Hydraulic System

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## Hydraulic System

### Section 2

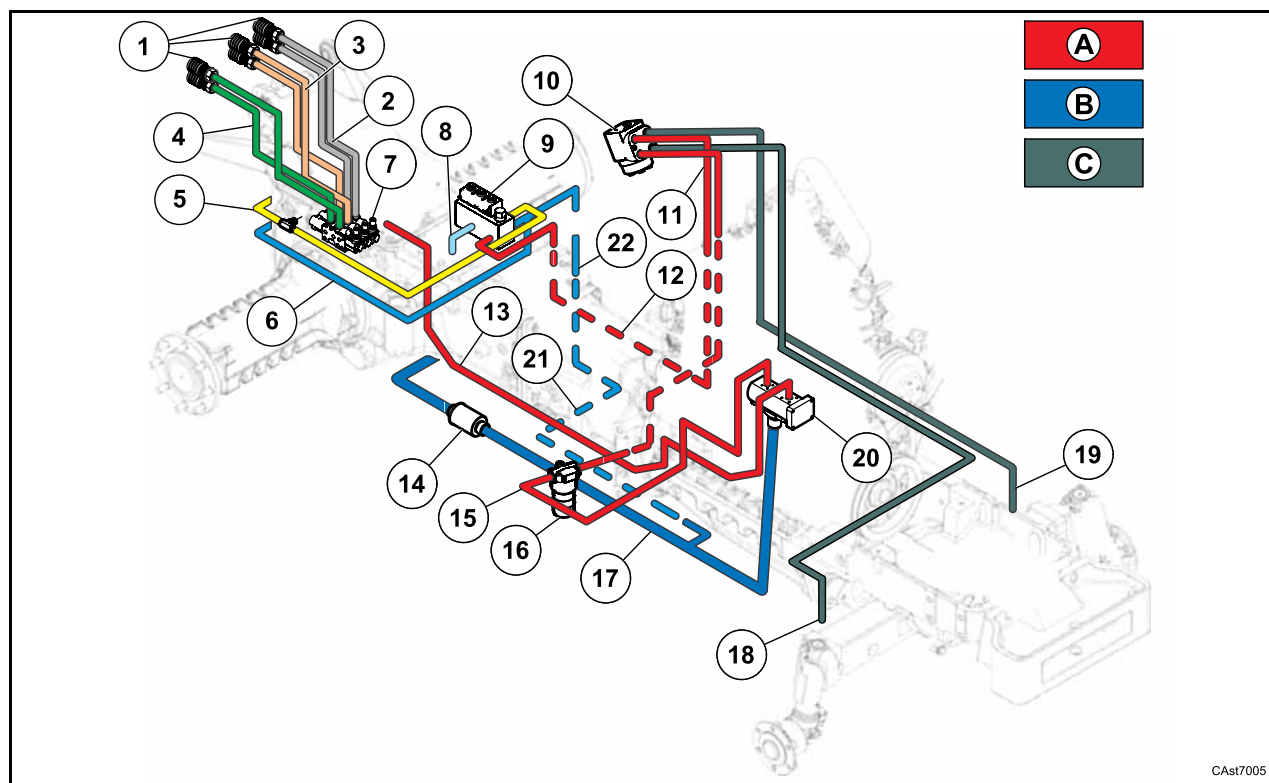
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# Hydraulic System

## HYDRAULIC SYSTEM COMPONENTS



A. High pressure oil

B. Suction oil

C. Trapped oil

### Major components:

1. Quick couplers
2. 1st auxiliary distributor lines
3. 2nd auxiliary distributor lines
4. 3rd auxiliary distributor lines
5. Rear PTO hydraulic line
6. Rear PTO lubrication line
7. Auxiliary distributors
8. Return to sump
9. Block valve
10. Steering valve
11. Supply line to steering valve
12. Hydraulic oil return line
13. Supply line to rockshaft
14. Oil suction line filter
15. Oil supply line to oil filter
16. Oil filter steering line
17. Oil suction line
18. Right steering cylinder line
19. Left steering cylinder line

20. Hydraulic pump

21. Return to sump line

22. Check valve

The above diagram refers to a 2WD tractor with mechanical transmission (not Powershuttle) equipped with hydraulic system without "oil cooler" and without hydraulic differential lock (mechanical differential lock).

The hydraulic system is equipped with an outer gears pump. The pump delivery is following:

- type a) Tandem 28+11 cc/rev
- type b) Tandem 22+11 cc/rev

The hydraulic pump (20) sucks oil from the gearbox through the suction line (17), that contains a suction filter with metallic net (14) filtering capacity of 160 micron.

The hydraulic system is "open centre".

The low pressure part of the pump supplies the power-steering (10) with a displacement of 100 cc/rev through lines (16) and (11). The filter (16)  $\beta_{16}>1000$  is located between the pump (20) and the power steering (10).

The power-steering action allows to deviate the oil flow to the front axle jacks through lines (18) (right jack) and (19) (left jack). The unused oil is conveyed to the transmission control block (9) by means of line (12). The transmission control block (9) activates, by means of a three-way ON-OFF valve the concurrent engagement of the PTO and the release of brake (line 5).

From the same valve (9) by means of line (6) oil flows for PTO clutch lubrication.

# Hydraulic System

---

Line (8) delivers the pilot signal to the main relief valve, installed on block (9).

Oil flowing out from block (9) flows through safety valve (22) and flows back through line (21) to pump (20) suction.

The pump larger stage (20) supplies through line (13) distributors (7) and rockshaft.

Through the hydraulic distributors (7), oil is set in contact with the quick couplers (1) by means of lines:

(2) - first distributor

(3) - second distributor

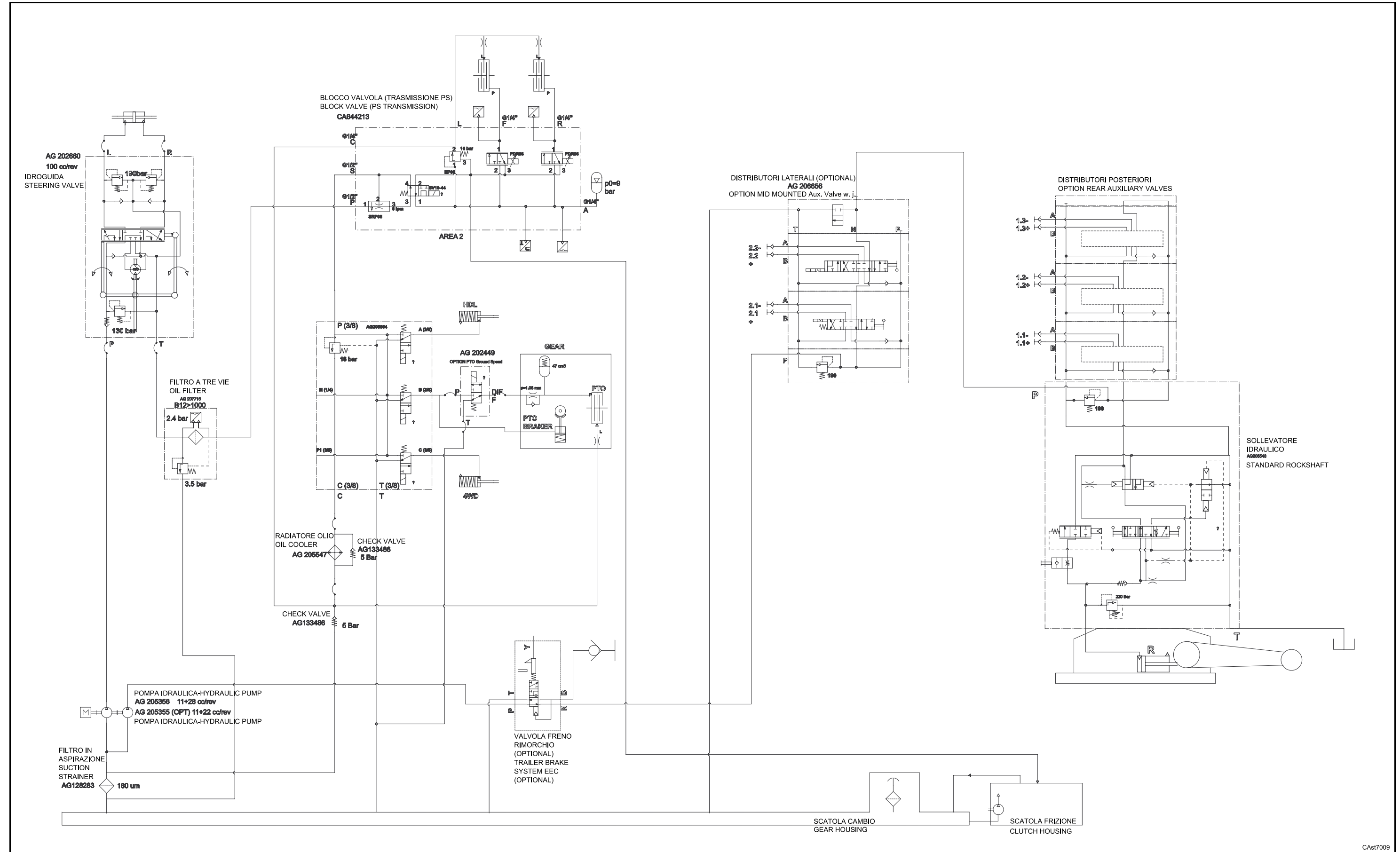
(4) - third distributor.

# Hydraulic System

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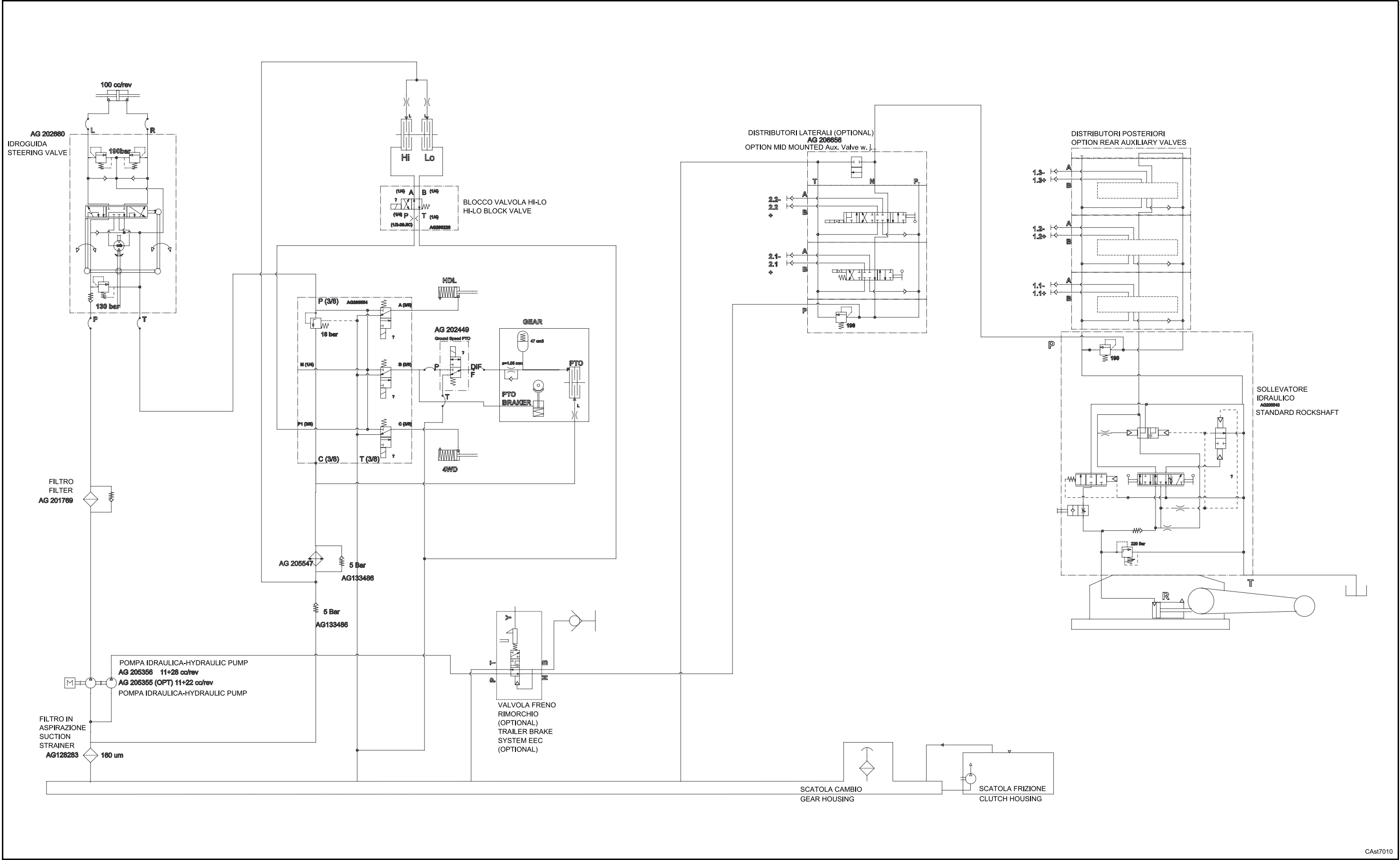
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# Powershuttle Syncro HI-LO 30-40 kph



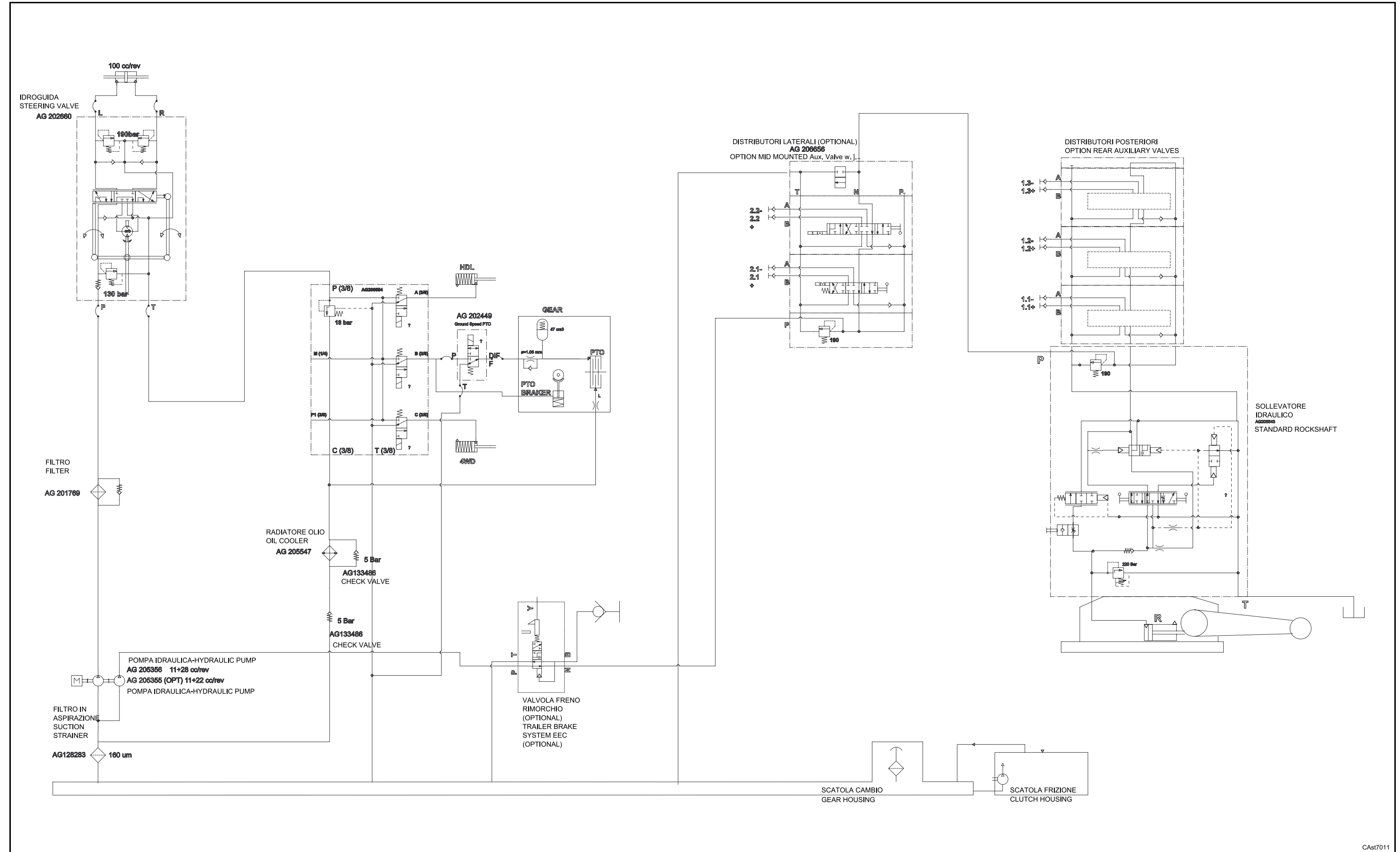
CAst7009

Hydraulic diagram 24+24 Syncro Powershuttle HI-LO



CAst7010

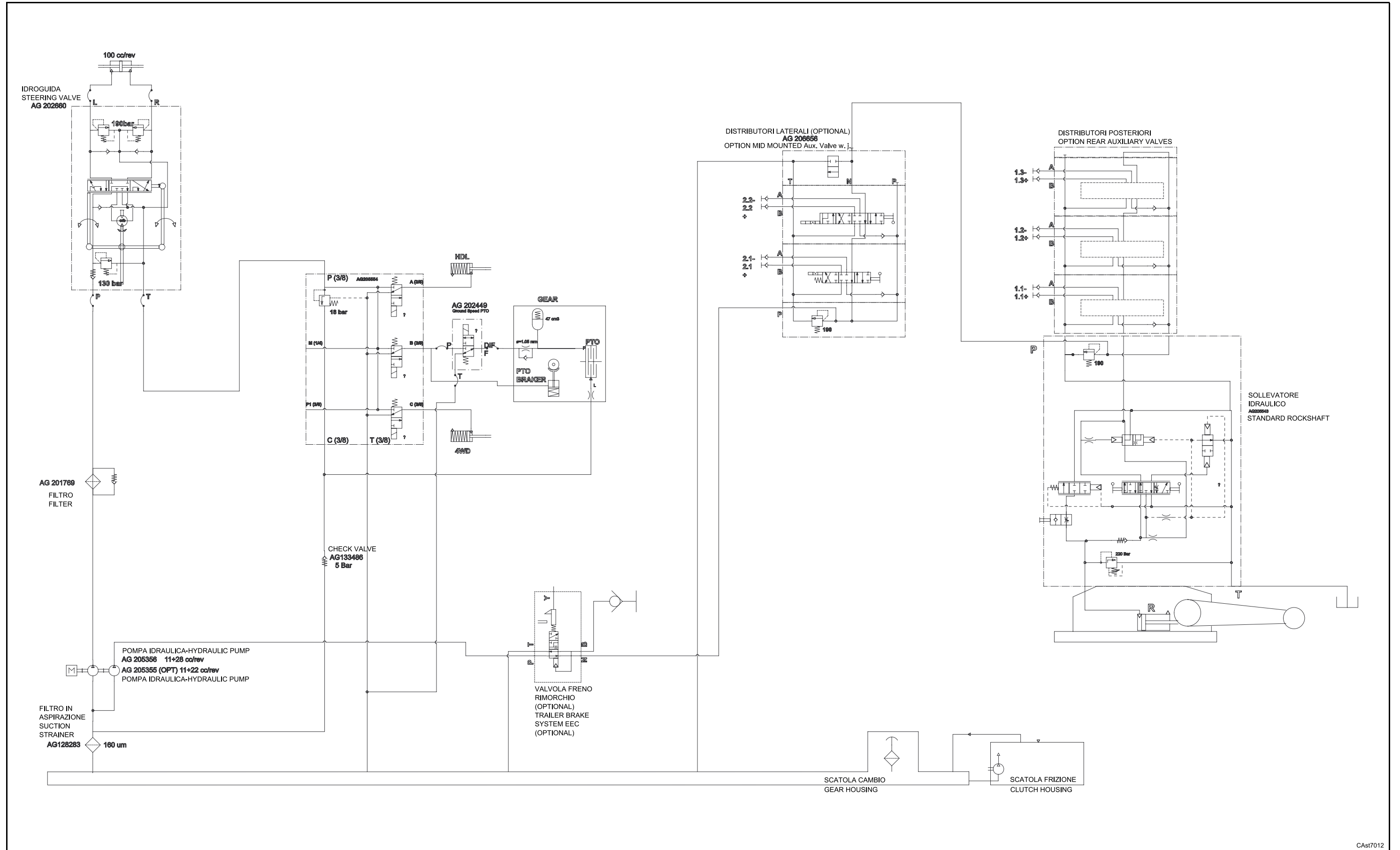
# Hydraulic diagram 24+24 Mechanical Shuttle 40 kph



CAst7011



# Hydraulic diagram 8+8/12+12 Syncro Shuttle 30 kph



CAst7012

# Troubleshooting

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## Troubleshooting Section 2

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# Troubleshooting

| PROBLEMS                                                                                                                                                                                                                                                                                                                                                               | POSSIBLE CAUSES                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|----|----|
|                                                                                                                                                                                                                                                                                                                                                                        | 1                                                                                                                                                                                                                                                                                                                                                 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Wheel vibration; front tyre resistance; half shaft breakage.                                                                                                                                                                                                                                                                                                           | 1                                                                                                                                                                                                                                                                                                                                                 | 1 | 1 |   | 1 |   |   |   |   |    | 1  |
| Steering is difficult; vehicle goes straight while its turning.                                                                                                                                                                                                                                                                                                        | 1                                                                                                                                                                                                                                                                                                                                                 | 1 | 1 | 1 |   |   |   |   |   |    | 1  |
| No differential action; jamming while steering.                                                                                                                                                                                                                                                                                                                        | 1                                                                                                                                                                                                                                                                                                                                                 |   |   | 1 | 1 |   |   |   |   |    | 1  |
| No differential action; jamming while steering.                                                                                                                                                                                                                                                                                                                        | 1                                                                                                                                                                                                                                                                                                                                                 | 1 | 1 | 1 | 1 |   | 1 |   | 1 |    | 1  |
| Uneven wear of tyre.                                                                                                                                                                                                                                                                                                                                                   | 1                                                                                                                                                                                                                                                                                                                                                 | 1 | 1 | 1 | 1 | 1 | 1 |   |   |    | 1  |
| Friction noise.                                                                                                                                                                                                                                                                                                                                                        | 1                                                                                                                                                                                                                                                                                                                                                 |   |   | 1 | 1 |   |   | 1 | 1 | 1  | 1  |
| Vibration during forward drive, intermittent noise.                                                                                                                                                                                                                                                                                                                    | 1                                                                                                                                                                                                                                                                                                                                                 | 1 | 1 |   | 1 |   |   |   |   |    | 1  |
| 1. Incorrect installation / defective axle<br>Correct installation or repair or replace the differential in case it does not survive any one of the test phases.                                                                                                                                                                                                       | <p>Look for foreign particles. Check assembly of the various parts of the axle.</p> <p>10. Incorrect adjustment of bevel gear set: Parts of the transmission worn out (transmission gears, U joints, etc.)<br/>Replace or adjust as required.</p> <p>11. Incorrect use of the product<br/>See the vehicle producer's instructions once again.</p> |   |   |   |   |   |   |   |   |    |    |
| 2. Overloading / incorrect weight distribution<br>Remove excessive weight and redistribute load, following instructions related to the vehicle.                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |
| 3. Different rotation radius of the tyres<br>If one tyre has a smaller radius, it will cause partial wheel slipping when force is applied. The other tyre with bigger radius will have to support all the work. Replace the tyre or adjust pressure to have same radius on both tyre.                                                                                  |                                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |
| 4. Broken half shaft<br>It is not advisable to operate the vehicle with a broken half shaft. It is acceptable to move the vehicle (engine off unloaded) a few meters away only.                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |
| 5. Bent half shaft<br>Replace half shaft.                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |
| 6. Blocked differential<br>Abnormal functioning of the differential or breakage/ blockage of command device. Verify assembly and all components.<br>Vehicles with wide steering angle may proceed with kicks, have steering difficulty or cause pneumatic wearing at sharp turns. Reduce the steering angle to minimum and decelerate when the vehicle begins to kick. |                                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |
| 7. Incorrect wheel adjustment<br>Verify group integrity and wheel side bearings.<br>Adjusting accordingly.                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |
| 8. Spoiled or worn out axle parts<br>Check the condition of ring gear, pinion gear, bearings etc. Replace when ever necessary.                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |
| 9. Contamination in the axle box or incorrect assembly of parts                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |

# Troubleshooting

## TROUBLESHOOTING

This chapter is a descriptive and explanatory guide to common axle problems. This guide suggests the correct repair procedures to be followed.

| Problem                                                                                             | Cause                                                                                                                                                                                                                                                                                           | Action                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ring gear tooth broken on the outer side                                                            | <ol style="list-style-type: none"> <li>1. Excessive gear load compared to the one foreseen</li> <li>2. Incorrect gear adjustment (excessive backlash)</li> <li>3. Pinion nut loose</li> </ol>                                                                                                   | <p>Replace bevel gear set</p> <p>Follow carefully the recommended operations for the adjustment of bevel gear set backlash</p>                                                                                                                |
| Ring gear tooth broken on the inner side                                                            | <ol style="list-style-type: none"> <li>1. Load bump</li> <li>2. Incorrect gear adjustment (insufficient backlash)</li> <li>3. Pinion nut loose</li> </ol>                                                                                                                                       | <p>Replace bevel gear set</p> <p>Follow carefully the recommended operations for the adjustment of bevel gear set backlash.</p>                                                                                                               |
| Pinion or ring gear teeth worn                                                                      | <ol style="list-style-type: none"> <li>1. Insufficient lubrication</li> <li>2. Contaminated oil</li> <li>3. Incorrect lubrication or depleted additives</li> <li>4. Worn out pinion bearings that cause an incorrect pinion axle backlash and wrong contact between pinion and ring.</li> </ol> | <p>Replace bevel gear set.</p> <p>Follow carefully the recommended operations for the adjustment of bevel gear set backlash.</p> <p>Use correct lubricants, fill up to the right levels and replace according to the recommended program.</p> |
| Overheated ring and pinion teeth. See if gear teeth have faded                                      | <ol style="list-style-type: none"> <li>1. Prolonged functioning at high temperatures</li> <li>2. Incorrect lubrication</li> <li>3. Low oil level</li> <li>4. Contaminated oil</li> </ol>                                                                                                        | <p>Replace bevel gear set.</p> <p>Use proper lubrication, fill up to right level and replace at recommended program.</p>                                                                                                                      |
| Pinion teeth pitting                                                                                | <ol style="list-style-type: none"> <li>1. Excessive use</li> <li>2. Insufficient lubrication</li> </ol>                                                                                                                                                                                         | <p>Replace bevel gear set.</p> <p>Use correct lubrication, fill up to the right level and substitute at recommended intervals</p>                                                                                                             |
| Axle beam body bent                                                                                 | <ol style="list-style-type: none"> <li>1. Vehicle over loaded</li> <li>2. Vehicle's accident</li> <li>3. Load bump</li> </ol>                                                                                                                                                                   | <p>Replace axle beam body</p>                                                                                                                                                                                                                 |
| Worn out or pitted bearings                                                                         | <ol style="list-style-type: none"> <li>1. Insufficient lubrication</li> <li>2. Contaminated oil</li> <li>3. Excessive use</li> <li>4. Normal wear out</li> <li>5. Pinion nut loose</li> </ol>                                                                                                   | <p>Replace bearings.</p> <p>Use correct lubrication fill up, to the right level and replace at recommended intervals</p>                                                                                                                      |
| Oil leakage form gaskets and seals                                                                  | <ol style="list-style-type: none"> <li>1. Prolonged functioning at high temperature of the oil</li> <li>2. Oil gasket assembled incorrectly</li> <li>3. Seal lip damaged</li> <li>4. Contaminated oil</li> </ol>                                                                                | <p>Replace the gasket or seal and matching surface if damaged.</p> <p>Use correct lubrication and replace at recommended intervals.</p>                                                                                                       |
| Excessive wearing out of input flange spline                                                        | <ol style="list-style-type: none"> <li>1. Exhaustive use</li> <li>2. Pinion nut loose</li> <li>3. Pinion to ring gear backlash.</li> </ol>                                                                                                                                                      | <p>Replace the flange.</p> <p>Check that the pinion spline is not excessively worn out.</p> <p>Replace bevel gear set if required.</p>                                                                                                        |
| Fatigue failure of pinion teeth<br>See if the fracture line is well defined<br>(wave lines, ridges) | <ol style="list-style-type: none"> <li>1. Exhaustive use</li> <li>2. Continuous overload</li> </ol>                                                                                                                                                                                             | <p>Replace bevel gear set</p>                                                                                                                                                                                                                 |
| Pinion and ring teeth breakage                                                                      | <ol style="list-style-type: none"> <li>1. Crash load of differential components</li> </ol>                                                                                                                                                                                                      | <p>Check and/or replace other differential components.</p>                                                                                                                                                                                    |

# Troubleshooting

| Problem                                                                             | Cause                                                                                                        | Action                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Side gear spline worn out.<br>Replace all scratched washers<br>(Excessive backlash) | Excessive use                                                                                                | Replace differential gear group.<br>Replace half shaft if required                                                                                                                         |
| Thrust washer surface worn out<br>or scratched.                                     | 1. Insufficient lubrication<br>2. Incorrect lubrication<br>3. Contaminated oil                               | Use correct lubrication and fill up to right<br>level.<br>Replace at intervals recommended.<br>Replace all scratched washers and those<br>with 0,1mm thickness lower than the<br>new ones. |
| Inner diameter of tapered roller<br>bearing worn out.                               | 1. Excessive use<br>2. Excessive pinion axial backlash<br>3. Insufficient lubrication<br>4. Contaminated oil | Replace bearing.<br>Check pinion axial backlash.<br>Use proper lubrication, fill up to right<br>level and replace at recommended<br>intervals.                                             |
| Bent or broken half shaft                                                           | Vehicle intensively operated or<br>overloaded                                                                | Replace                                                                                                                                                                                    |
| Half shaft broken at wheel side                                                     | 1. Wheel support loose<br>2. Beam body bent                                                                  | Replace<br>Check that wheel support is not worn<br>out or wrongly adjusted.                                                                                                                |

# Troubleshooting

## AXLE PROBLEMS AND DIAGNOSIS

| Problem                        | Cause                                                                                                                | Action                           |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Noise while driving            | 1. Excessive backlash between pinion and ring gear                                                                   | 1. Adjust                        |
|                                | 2. Worn out pinion and gear ring                                                                                     | 2. Replace                       |
|                                | 3. Worn out pinion bearings                                                                                          | 3. Replace                       |
|                                | 4. Pinion bearings loose                                                                                             | 4. Adjust                        |
|                                | 5. Excessive axial pinion backlash                                                                                   | 5. Adjust                        |
|                                | 6. Worn out differential bearings                                                                                    | 6. Replace                       |
|                                | 7. Differential bearings loose                                                                                       | 7. Adjust                        |
|                                | 8. Ring gear out of roundness                                                                                        | 8. Replace                       |
|                                | 9. Low lubricant level                                                                                               | 9. Oil level                     |
|                                | 10. Poor or wrong lubricant                                                                                          | 10. Replace                      |
|                                | 11. Bent half shaft                                                                                                  | 11. Replace                      |
| Noise while driving in neutral | 1. Noise coming from axle are usually heard when vehicle moves in neutral gear but are not loud.                     | 1. Replace or adjust (see above) |
|                                | 2. Incorrect backlash between pinion and ring (sound heard while decelerating disappears while increasing the speed) | 2. Replace                       |
|                                | 3. Pinion or input flange worn out                                                                                   | 3. Adjust                        |
| Intermittent noise             | 1. Ring gear damaged                                                                                                 | 1. Replace bevel gear set        |
|                                | 2. Differential box bolts loose                                                                                      | 2. Tighten to torque             |
| Constant noise                 | 1. Ring gear teeth or pinion damaged                                                                                 | 1. Replace bevel gear set        |
|                                | 2. Worn out bearings                                                                                                 | 2. Replace                       |
|                                | 3. Pinion spline worn out                                                                                            | 3. Replace                       |
|                                | 4. Bent half shaft                                                                                                   | 4. Replace                       |
| Noise while steering           | 1. Worn out differential gears                                                                                       | 1. Replace                       |
|                                | 2. Worn out differential box or spider                                                                               | 2. Replace                       |
|                                | 3. Differential thrust washers worn out                                                                              | 3. Replace                       |
|                                | 4. Half shaft spline worn out                                                                                        | 4. Replace                       |



# Troubleshooting

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# Hydraulic Lift

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## Hydraulic Lift

### Section 2

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# Hydraulic Lift

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## SPECIFICATIONS

### TECHNICAL FEATURES

- Operation with draft and position control
- Operation sensibility adjusting
- Lowering speed adjustment of lifting arms
- Safety transport lock on control valve
- Automatic hydraulic limit stop of angular excursion of lifting arms
- Sector control with two levers: one lever for the position and one for the draft control
- Rockshaft functions with transmission oil
- Oil filter not built-in
- Required degree of filtering 20-25  $\mu\text{m}$
- Maximum functioning temperature 90° C

### DIMENSIONAL FEATURES

|                                                       |                     |
|-------------------------------------------------------|---------------------|
| Piston diameter                                       | 110 mm              |
| Working stroke                                        | 102 mm.             |
| Piston displacement                                   | 969 cm <sup>3</sup> |
| Angular excursion of lifting arms in position control | 70° - 72°           |
| Intervention of automatic hydraulic limit stop        | 73° - 74°           |
| Internal mechanical limit stop                        | 76° - 78°           |
| Angular excursion of control position lever           | 68°                 |

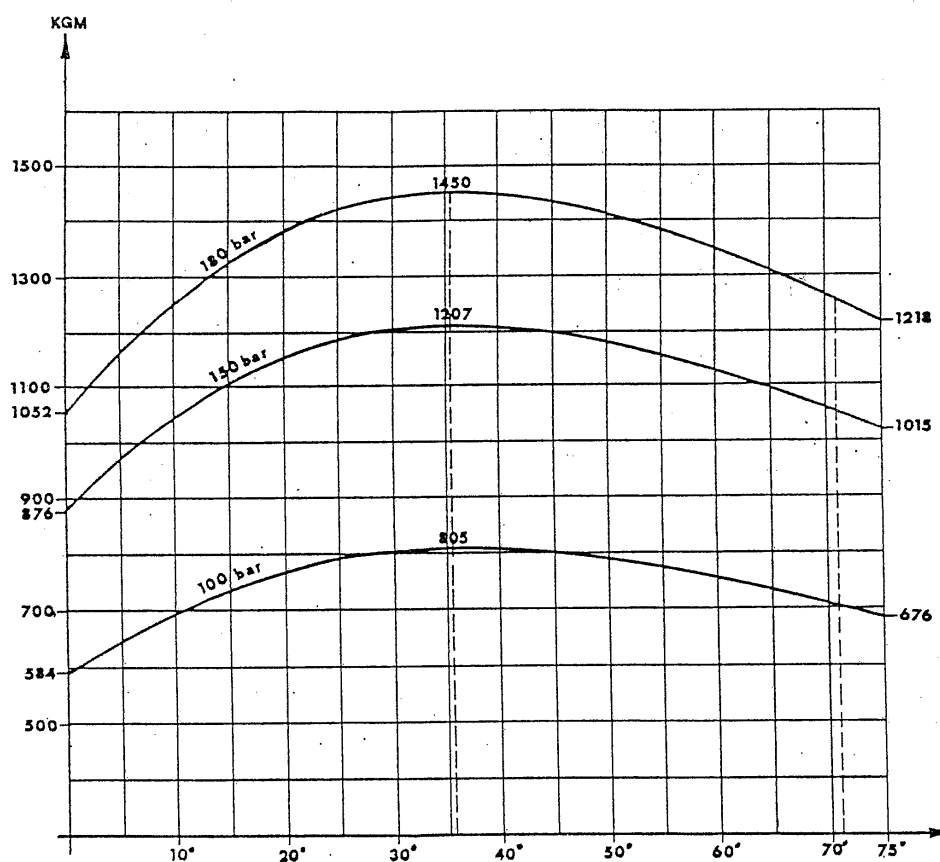
### CALIBRATION SETTINGS OF CONTROL VALVE

|                          |             |
|--------------------------|-------------|
| Relief valve calibration |             |
| Dynamic with 15-20 L/min | 190~195 bar |
| Safety valve calibration |             |
| Static with 2-3 L/min    | 220~225 bar |

# Hydraulic Lift

## DIAGRAM

DIAGRAM OF THEORETICAL TORQUE FLOW PERFORMANCE (Kgm) AS TO ANGULAR EXCURSION  
(sexagesimal degrees) OF LIFTING ARMS

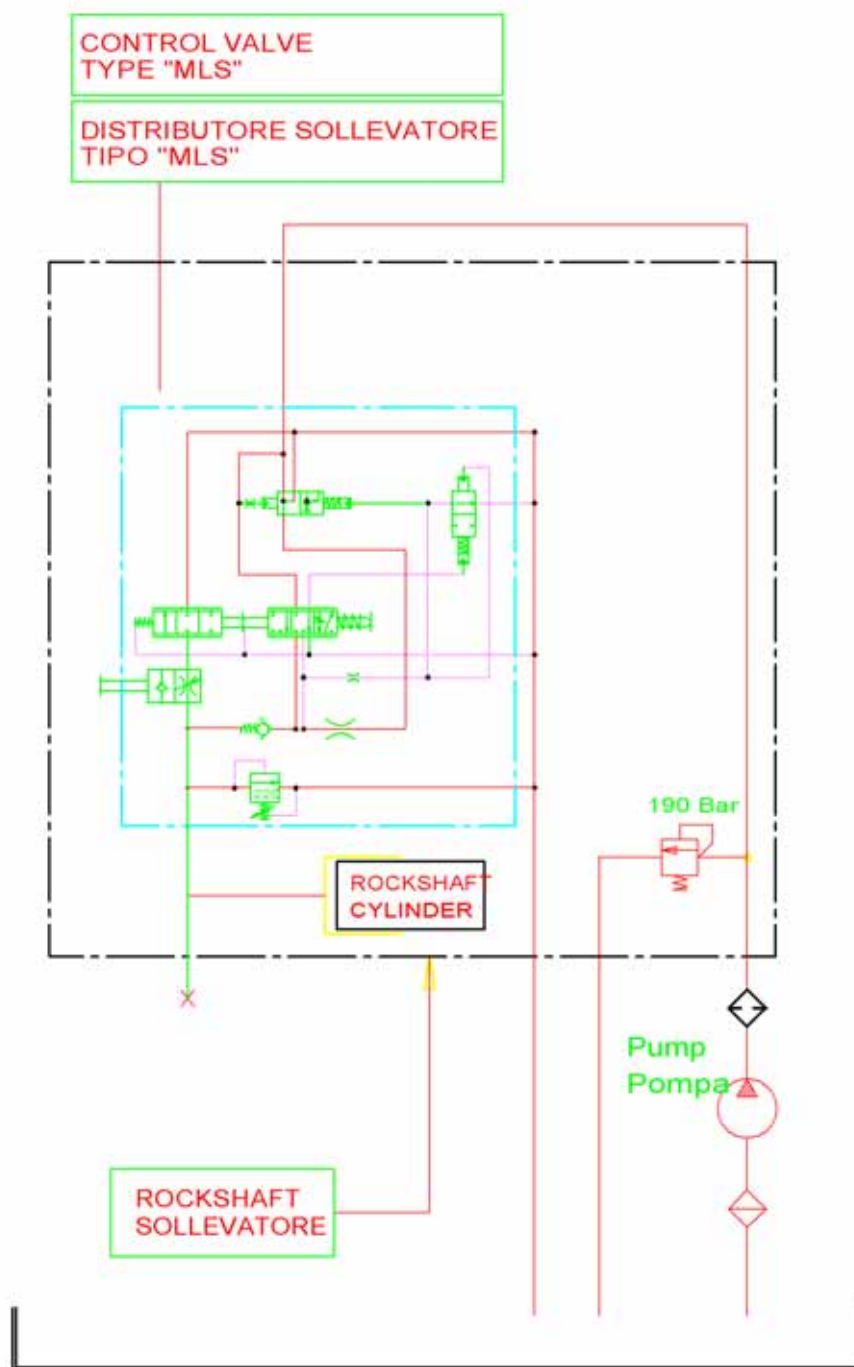


|                                       |          |
|---------------------------------------|----------|
| THEORETICAL WORK DELIVERED AT 100 bar | 969 Kgm  |
| THEORETICAL WORK DELIVERED AT 150 bar | 1453 kgm |
| THEORETICAL WORK DELIVERED AT 180 bar | 1744 kgm |

THE ABOVE 180 bar CURVE REPRESENTS THE MAXIMUM PERFORMANCE SUPPLIED BY THE LIFTING DEVICE

# Hydraulic Lift

## CIRCUIT DIAGRAM OF HYDRAULIC LIFTING DEVICE



# Hydraulic Lift

## FUNCTIONING OF CONTROL VALVE

The Control Valve has three distinct functioning phases:

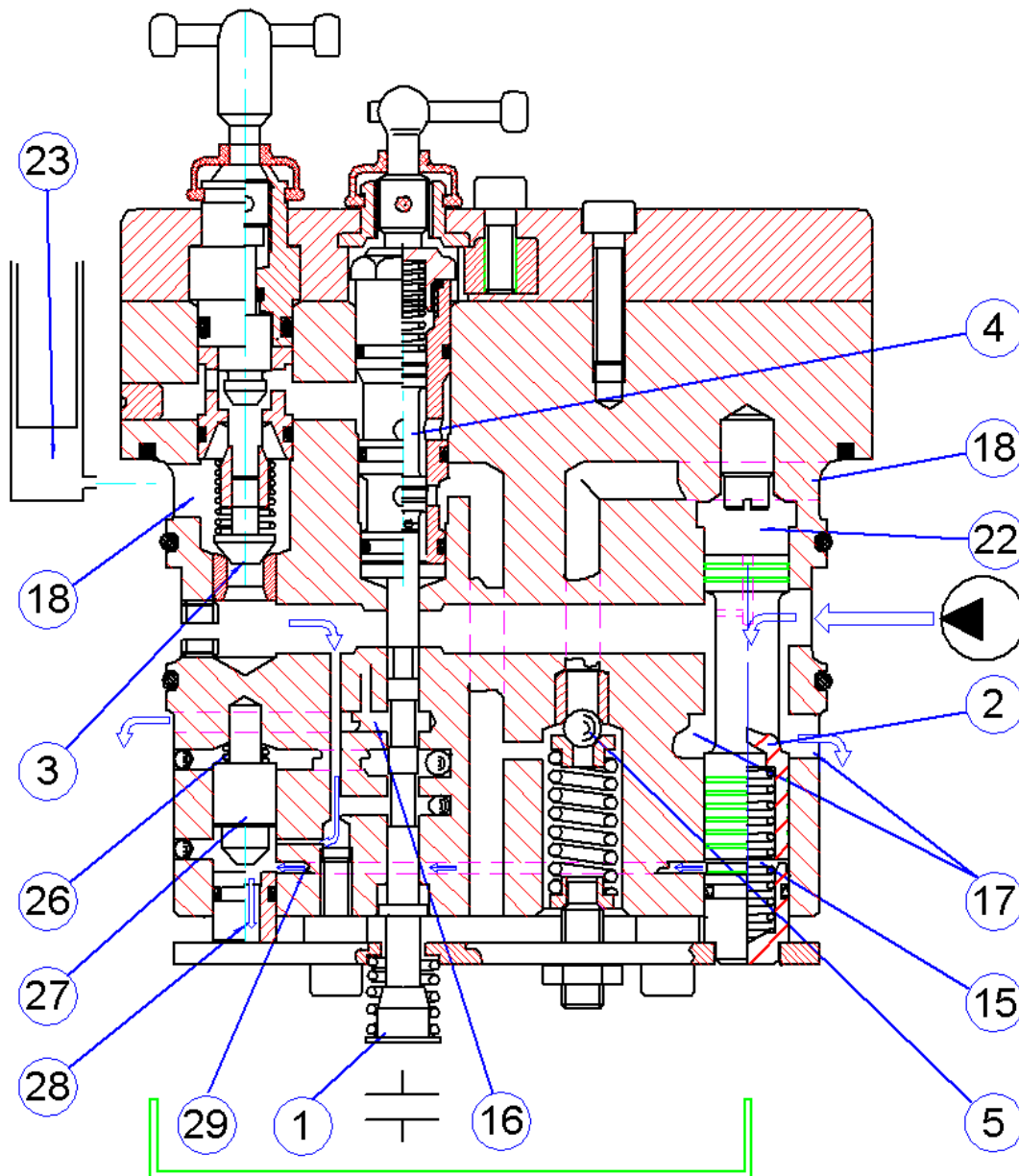
### Neutral Phase

In this phase the control valve keeps under pressure the oil in the cylinder bearing the load while the oil coming from the pump flows freely into the tank.

The control spool "1" is in the position to connect chamber "26" of the pilot valve "27" directly to the discharge through hole "16". Thus allowing the same valve to open hole "28" which discharges chamber "15" by means of the duct "29" of the regulator piston "2". Thus the oil coming from the pump feeds chamber "22" and allows the regulator piston "2" to open the holes "17" and the oil flows to the tank.

The oil contained in the cylinder (chamber "23") remains under pressure by means of the check valve "3", by the discharge valve "4" and by the safety valve «5» which are connected to the cylinder by the annular duct "18" and thus sustains the load applied to the lifting arms.

The safety valve "5" protects the cylinder from the possibility of eventual over-pressure due to the oscillation of the load during road transport.





# Hydraulic Lift

## Delivery Phase

During this phase the Control Valve supplies oil under pressure to the cylinder (chamber "23") and this consequently lifts the arms.

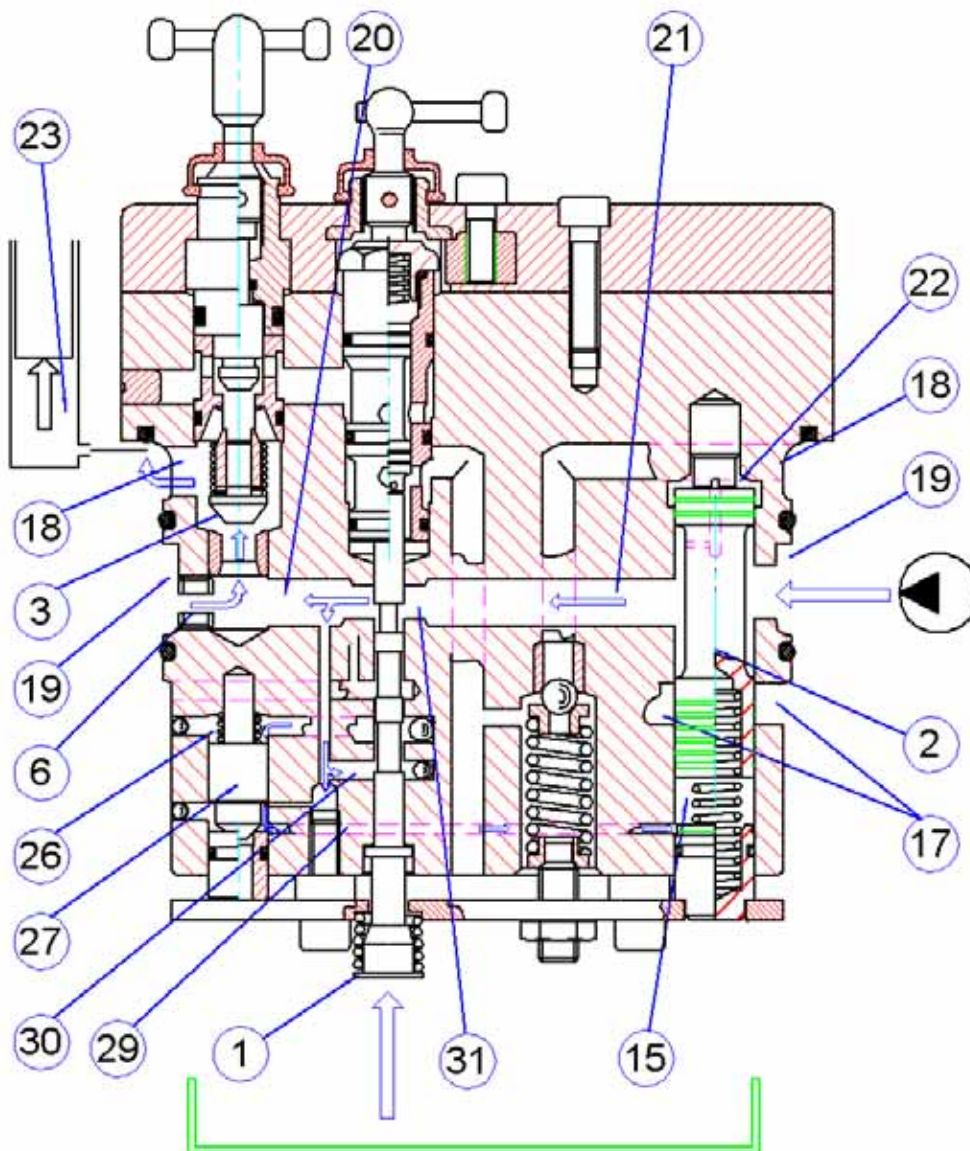
The control spool "1" is in the position to connect chamber "26" of the pilot valve "27" with the oil coming from the pump through the annular duct "19" and the holes "20", "21" and "30"; thus allowing the pilot valve to close itself. The oil coming from the pump feeds at the same pressure chamber "22" and chamber "15" (through duct "29") of the regulator piston "2" that closes the discharge holes "17" due to the upward push of the return spring.

The oil under pressure flows to the cylinder through the annular duct "19"; enters in hole "20" through the fixed throat "6" and the variable throat made by the control spool "1" with the hole "21", opens the check valve "3", enters in the annular duct "18" and feeds chamber "23" of the cylinder.

The regulator piston "2" regulates the oil flow of the cylinder because chambers "15" and "22" are subject to the difference in pressure created by the oil in the passage through the variable throat "31" which is opened or closed by the control spool "1", in function of its movement caused by internal levers of the CR100 group.

The excessive flow is deviated on the rising pressure from holes "17", thus regulating the maximum lifting speed and allowing a slow and smooth starting and arrival of the lifting arms.

The maximum lifting pressure is controlled by a relief valve placed on the body of rock shaft connected to the inlet port of oil coming from the pump.



## Hydraulic Lift

### Discharge Phase

During this phase the Control Valve supplies to the discharge both the oil coming from the pump as well as the oil coming from chamber "23" of the cylinder, with the consequential lowering of the lifting arms.

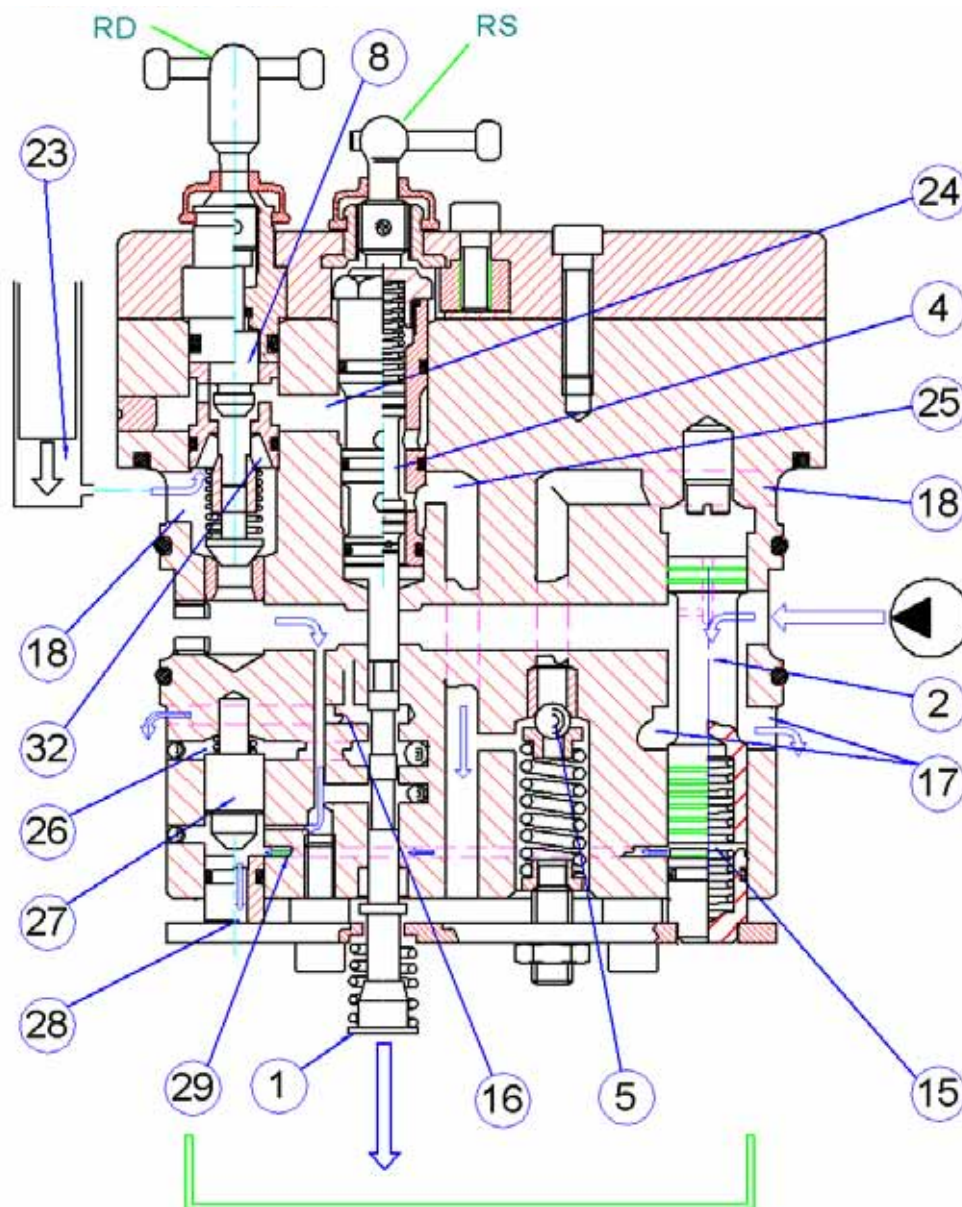
The control spool "1" is in the position to connect chamber "26" of the pilot valve "27" directly to the discharge through hole "16"; thus allowing the same valve to open hole "28" that allows flow to discharge through duct "29" from chamber "15" of the regulator piston "2". The oil moves the piston "2", which opens discharge holes "17", allowing oil to flow back to the tank.

At the same time the oil from the lift cylinder "23" enters via the hole "18" and passes through holes "32" and rate of drop regulator "8". It then passes through holes "24" into the discharge valve "4" and back to the tank via hole "25", allowing the lift arms to drop.

In this phase the lowering speed of the arms can be regulated by the manual lever "RD" (by screwing the lever clockwise the lowering speed decreases).

For road transport, in order to avoid the accidental lowering of the rockshaft arms due to the movement of the levers, screw shut the lever "RD"; this completely closes the valve "8" in its seat in order to close the passage between the chamber "23" of the cylinder and the discharge valve "4".

When the safety mechanism is inserted, the cylinder is always protected by accidental over-pressure by the safety valve "5".



# Hydraulic Lift

---

## HOW THE INTERNAL LEVERAGE SYSTEM FUNCTIONS

Functioning with position control (Fig. page 5.2)

By positioning the draft control lever "2" against the backstop "E" (Fig. page 8.1) the roller "11", which slides on the flywheel "7" of draft cam "12", will be moved away completely.

In this way the draft levers will not in any way interfere with the operation of the position control.

The arms are raised by moving the position control lever "1" upward, and the leverage system will act in the following way:

Crank "4" being an integral part of shaft "3" turns in a clockwise direction and causes roller "5" to slide on the position cam "6", in turn causing the clockwise rotation of flywheel "7". The flywheel will transmit an anticlockwise rotation, by means of friction shock absorber "8", to the transmission lever "9" that will bring distributor shaft "21" into delivery position "C", thus causing the arms to be lifted.

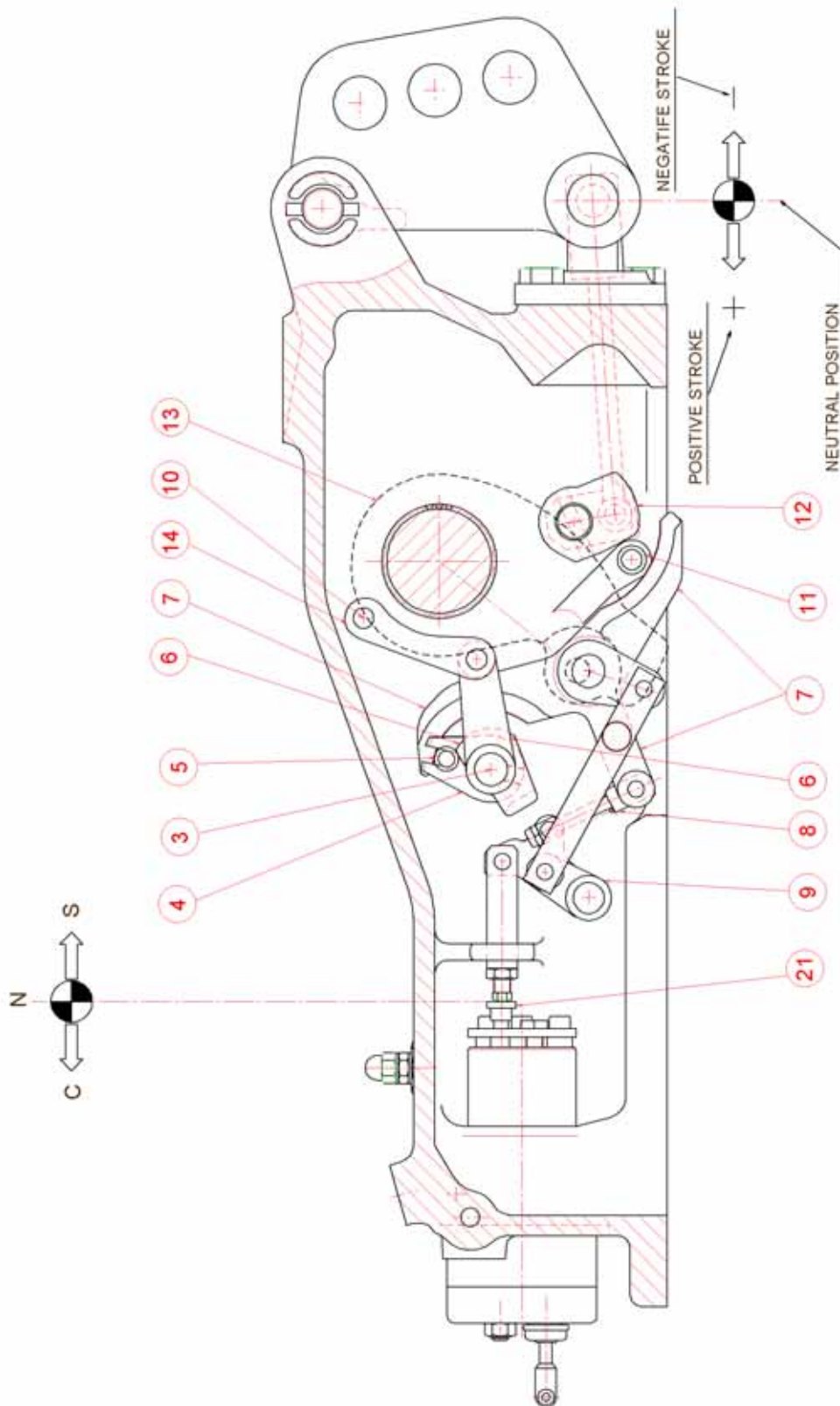
During the lifting movement of the arms, crank "13" with pin "10" will rotate in an anti-clockwise direction, and by means of the link "14" will cause position cam "6" to rotate clockwise.

When the roller "5" meets the inclined plane of the cam "6", it allows the anti-clockwise rotation of the flywheel "7" that by means of a friction shock absorber "8" rotates the lever "9" in a clockwise direction, which is pushed by the spring of the control valve shaft "21" which moves to position "N" (neutral phase) and thus blocking the movement of the lifting arms.

During the lowering phase of the arms the movements of the levers indicated above will occur in the opposite sense.

The position of the arms, during lifting and lowering, correspond to a specific position of the position control lever "1".

## Hydraulic Lift





# Hydraulic Lift

---

## Functioning of Draft Control (Fig. page 5.2 – 5.4)

By positioning the control lever "1" for position control against the backstop "E", the crank "4" (Fig. page 5.2) reaches its maximum position of anti-clockwise rotation. In said position the roller "5" is totally lowered from the inclined plane of position cam "6" allowing the anti-clockwise rotation of flywheel "7" as well as the clockwise rotation of the transmission lever "9" that is pushed by the spring of shaft "21" which in turn will position itself for the discharge position "S". In this way the position levers will not interfere with the functioning of the draft control levers.

By positioning the draft control lever "2" against backstop "F" (Fig. page 8.1), draft control shaft "16" is caused to rotate clockwise.

The crank "15" being an integral part of shaft "16", will reach its extreme position of clockwise rotation, and by means of tension rod "17" will move roller "11", the latter acting on the draft cam "12". This causes flywheel "7" to rotate clockwise which by means of friction shock absorber "8" produces the anti-clockwise rotation of transmission lever "9" thus setting the distributor shaft "21" in delivery position "C" and consequently lifting the arms.

The arms will come to a stop only as soon as the piston comes into contact with the pin of the limit stop "22".

This limit stop, by means of tension rod "23" causes lever "9" to rotate clockwise, thereby compressing the spring of friction shock absorber "8" and thus releasing shaft "21" which now can move to the neutral position "N" where it is pushed outward by its spring.

Moving the draft control lever "2" toward backstop "E", the leverage system will function in the following manner:

The crank "15", being an integral part of the draft shaft "16", rotates counter-clockwise and by means of tension rod "17" causes roller "11" to slide on flywheel "7".

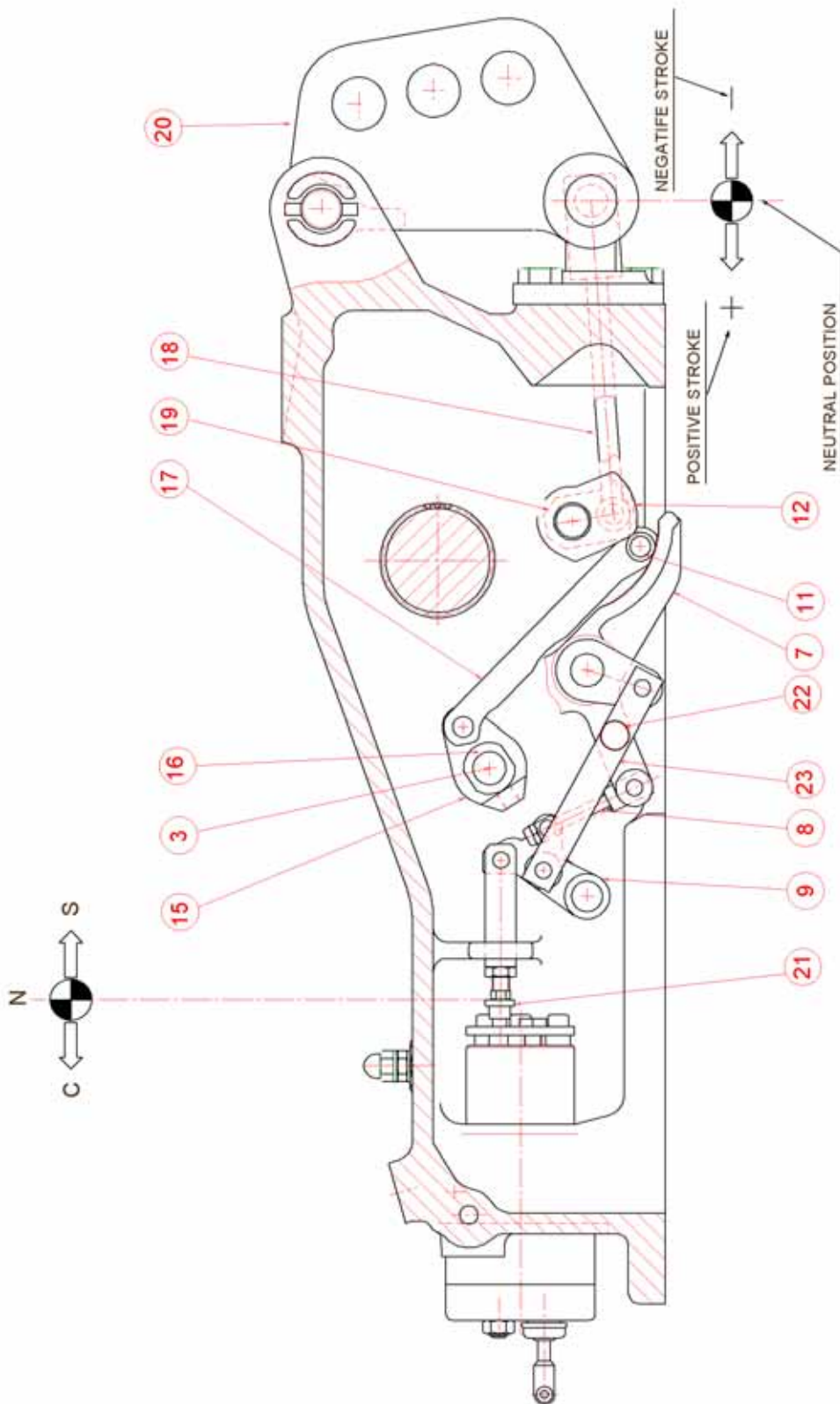
The roller "11", when it meets the inclined plane of the draft cam "12", permits the counter-clockwise rotation of flywheel "7" which by means of shock absorber "8" will rotate transmission lever "9" in a clockwise manner thus leaving distributor shaft "21" free to move into neutral position "N" and continuing the movement of lever '2', in the discharge position "S", causing the arms to lower.

In fact, during the initial part of the movement toward backstop "E", of draft control lever "2" the corresponding lowering of the arms does not happen yet.

The traction force on the top link point "20" acts on tension rod "18" in the direction indicated by the arrow  $\oplus$  "positive" causing flywheel "19" to rotate clockwise together with draft cam "12" which is fastened to the same pin.

When the inclined plane of draft cam "12" meets roller "11", a clockwise rotation of flywheel "7" is achieved which by means of shock absorber "8" will cause transmission lever "9" to rotate counter-clockwise thereby moving the distributor shaft "21" into neutral position "N" and stopping the movement of the arms.

# Hydraulic Lift



As the traction force is increased, draft cam "12" will further move roller "11" thus incrementing the movement as described above.

The distributor shaft "21" will move from neutral position "N" to delivery position "C" causing the arms to be lifted. When the traction force diminishes, shaft "21" will return to the neutral position or to the lowering position which will mean an inverse movement of the leverage systems to what is described above.

# Hydraulic Lift

---

## Combined Functioning of Position and Draft Control (Fig. page 5.2-5.4)

To utilise the lifting device in this condition it is necessary to observe the following instructions:

Move the position control lever "1" upwards with respect to the backstop "E" (Fig. page 8.1) until the maximum working depth has been attained.

Determine the desired minimum working depth by operating the draft control lever and raising it from its zero position so that roller "11", acting on the draft cam "12", will move the distributor shaft "21" into the lifting position "C" and causing a further upward movement of the lifting arms.

Due to the position previously established by position control lever "1", flywheel "7", roller "4" and position cam "6", the distributor shaft "21" is prevented from entering the lowering position "S" and therefore the arms cannot sink even though the traction force acting on the top link point "20" will tend to diminish and putting stress on the tension rod "18" in the direction of arrow  "negative".

This condition will not prevent the rockshaft from operating with the draft control when, in the presence of more consistent soil, the traction force on the top link "20" will tend to increase, exerting pressure on the tension rod "18" in the direction of arrow  "positive".

Consequently the combined operation of position and draft control will limit variations in height toward the ground, as happens during the use of the draft control, and at the same time ensuring the maximum possible depth desirable.



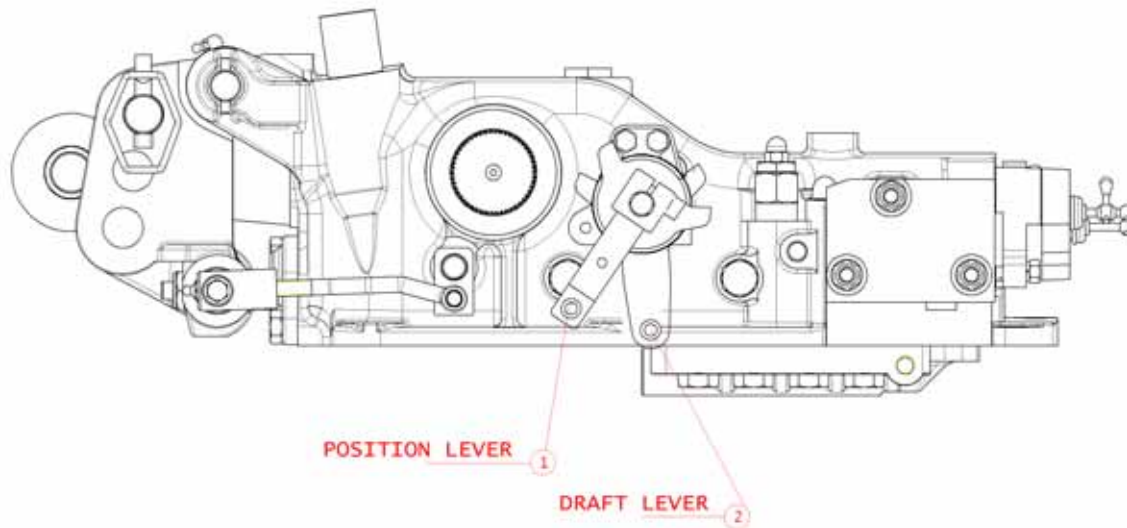
# Hydraulic Lift

## USE OF CONTROL LEVERS

The two control levers carry out following operations:

- Position control.
- Draft control.
- Combined operation for position and draft control.

The above operations may be chosen in consideration of the work to be carried out, the implement type and the soil superficial hardness.



### Position Control (lever 1)

Move the draft control lever 2 fully down. Fix the implement position, inside or outside the soil, by moving the lever 1 up for raising and down for lowering. The implement movement is proportional to the movement range fixed by means of lever 1.

### Draft Control (lever 2)

Move the position control lever 1 fully down, have the implement penetrated into the ground till reaching the desired depth by gradually moving the lever 2 down. The implement depth reached is proportional to the draft determined by soil hardness.

In this condition the rockshaft keeps the draft required automatically constant.

Once the draft is regulated, it is possible to lift the implement with position lever 1 without moving draft lever 2.

During last movement stroke of lever 2 a floating function is obtained and the rockshaft does not control the draft.

### Combined Operation for Position and Draft Control

In case of workings carried out under draft control on not-homogeneous soils, during which excessive implement penetration may occur, it is convenient to use the combined position and draft control.

Have the implement penetrated into the ground and search for the desired working depth in the way described for the draft control.

When the desired depth is reached, gradually move up the lever 1 till the lower links slightly start raising.

The rockshaft operates under controlled draft, but at the same time it prevents the implement from excessively penetrating into the ground causing a not very uniform work, when coming up against a less hard ground.

For raising and having the implement penetrated at the end and beginning of each pas, acting on position lever 1 only.

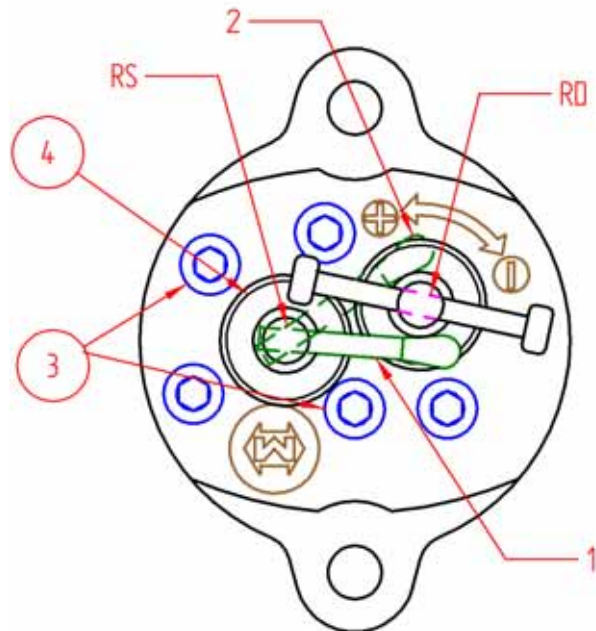
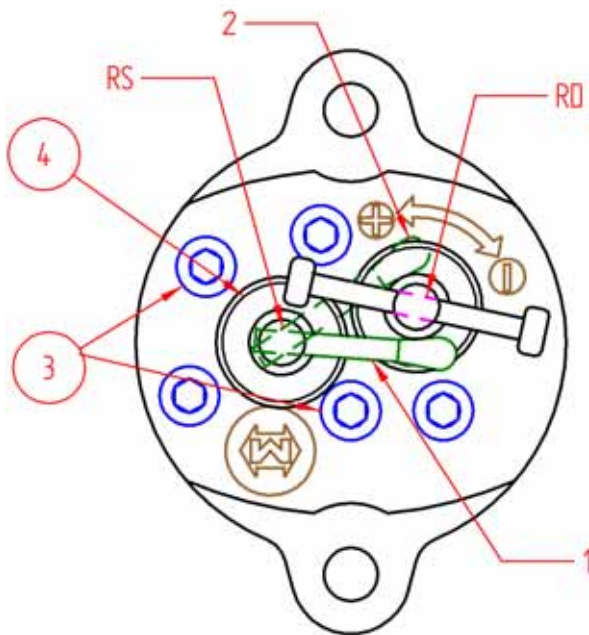
**IMPORTANT:** It is not correct to find the position with the draft lever 2 because the lifting and lowering of arms with this lever changes with the top link position.

This can be on neutral –positive –negative – position depending on the draft force, or to the changing of force on the top link bracket depending on the implement weight.

# Hydraulic Lift

## ADJUSTMENT OF CONTROL VALVE SENSITIVITY

### Functioning of the Sensitivity of the Control Valve



Place the rockshaft arms, with a weight applied, at about the middle of their stroke so that the control valve is in the neutral phase.

Operate the control valve, turning in an anti-clockwise direction the sensitivity regulator "RS" until the rockshaft arms begin to jerk.

If the lever "RS" is in position "1" and the rockshaft arms are still jerky, lower the weight and unscrew the screws "3" so that the lever "RS" can rotate freely anti-clockwise together with the threaded bushing for the adjustment of the sensitivity up to position "2"; the bushing is covered with a plastic cap "4". Block the movement of the threaded bushing by tightening the screws "3", raise the load, and find again the position in which the arms jerk by slowly rotating anti-clockwise the lever "RS".

N.B.: Repeat the operation described above until the objective has been reached. Once the position in which the arms vibrate has been determined turn the lever "RS" clockwise until the arms stop moving and from that position rotate clockwise for  $\frac{1}{4}$  of a turn. Lower the load and loosen the screws "3" so that the lever "RS" can turn clockwise, together with the threaded bushing, until the lever "RS" reaches position "1" against the stop "RD".

Block the sensitivity bushing, covered with the plastic cap "4", with the screws "3".

In this way the control valve is adjusted at its maximum sensitivity.

To reduce the level of sensitivity turn the lever "RS" clockwise until the desired effect is achieved.

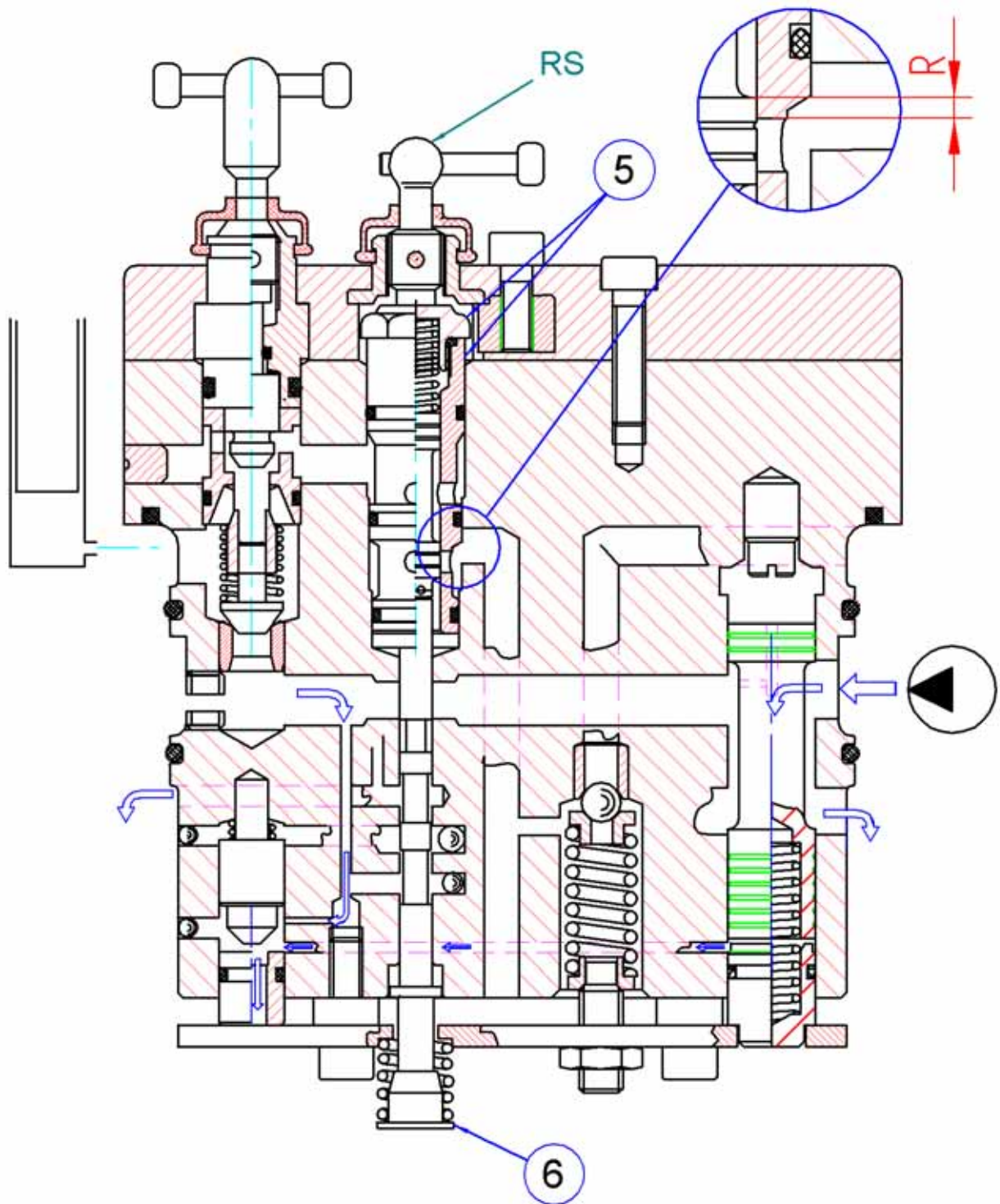
The external lever RS (Regulator of Sensitivity) rotated gradually clockwise from position "1" towards position "2" (shaded) moves the valve body "5" towards the inside increasing in this way the contact "R" between the body and the shaft of the discharge valve.

The increase in contact means that there is a longer stroke of the control shaft "6" to allow a delivery and discharge of the control valve.

The top link bracket, which by means of the internal levers, moves the control shaft, will have to make a longer stroke in order to raise and lower the rockshaft arms during the functioning of the draft control.

The more the lever RS is moved in a clockwise direction the more the sensitivity of the top link bracket is reduced which otherwise, in hard ground conditions, has the tendency to vibrate and thus the rockshaft does not function correctly.

## Hydraulic Lift



# Hydraulic Lift

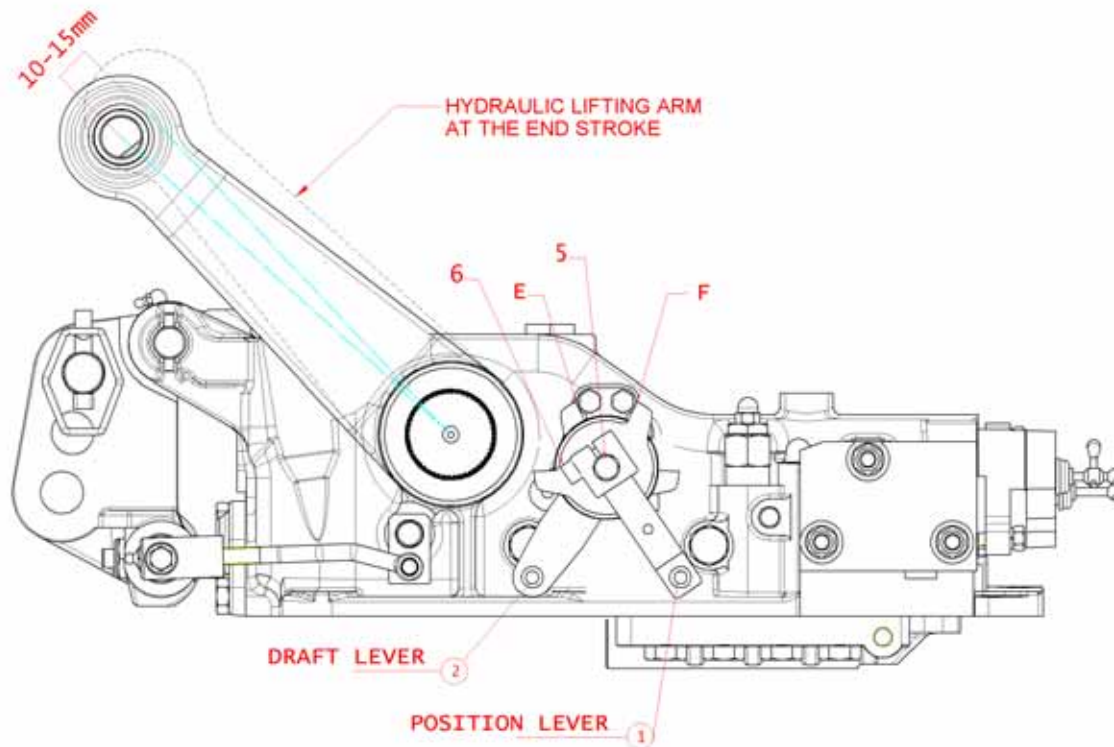
## ADJUSTMENT OF POSITION CONTROL LEVER

Completely lower the arms and apply a light weight.

The adjustment is carried out in order to establish the maximum raised position of the rockshaft's lifting arms.

Loosen the fastening screw "6" so as to free the position control lever "1" from the shaft "5".

With the draft control lever "2" against the backstop "E" bring the position control lever "1" against the backstop "F" without rotating the shaft "5".



Maintaining fixed the levers "1" and "2" and with a 13 mm. open end wrench rotate slowly in an anticlockwise direction the position control shaft "5" so as to raise the arms to their maximum raised position which is determined by the internal hydraulic limit stop. Since during the functioning of the position control the hydraulic limit stop must not be triggered it is necessary to have a safety margin of ~ 10 mm. In order to do this, rotate slowly in a clockwise direction the shaft "5" until the arms are lowered by the required safety margin.

At this point keep the shaft "5" fixed and with lever "1" against the backstop "F" keep the lever fixed with the shaft by tightening fully the fastening screw "6".

To control, raise and lower the arms by moving the position control lever "1" and control that the arms always reach the same position at their highest position.

Then by raising also the draft lever "2" and lifting the arms the hydraulic limit stop is acting and is possible to check the additional stroke upwards of the arms that should be kept in 10-15mm.



# Hydraulic Lift

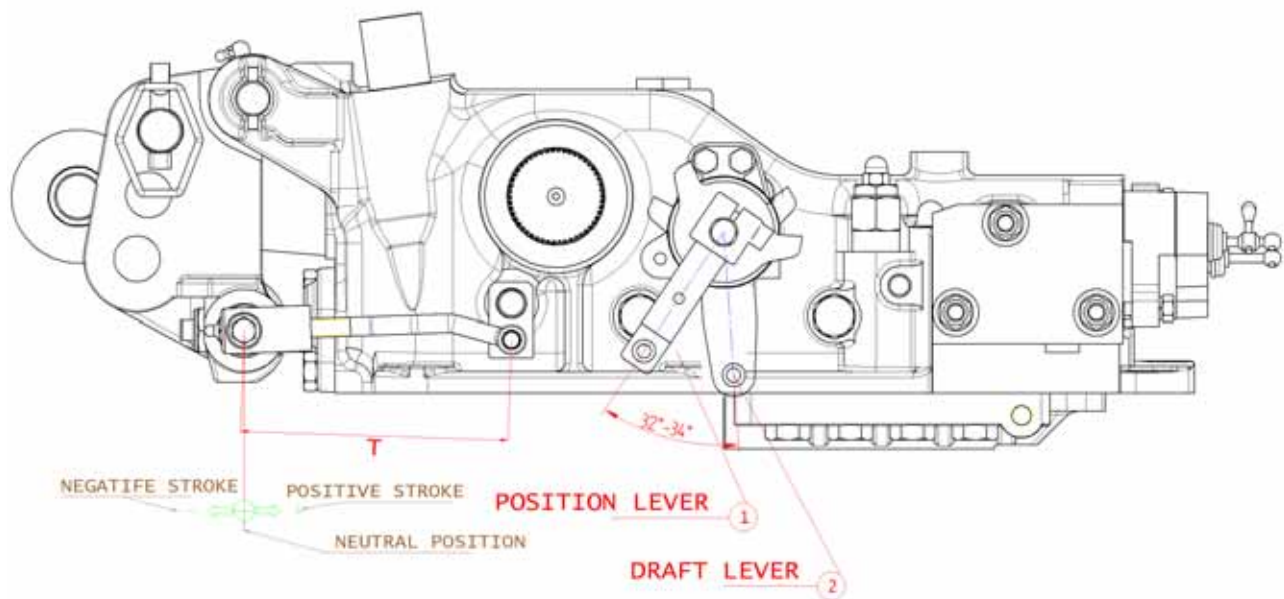
## ADJUSTMENT OF DRAFT CONTROL LEVER

This adjustment guarantees the raising of the lifting arms to their maximum raised position by moving the draft control lever "2" in the last part of its travel towards the backstop "F" also when the three point linkage is against the negative backstop (-).

The adjustment must be carried out without implements or loads applied to the three point linkage "20".

Position the lever commands "1" and "2" against the backstop "E" and bring the three point linkage "20" by means of specific extractor against the negative backstop (-).

With the motor running at minimum RPM slowly move the draft control lever "2" towards the backstop "F". The adjustment of the draft lever "2" is correct when the arms are raised and come to about 3÷4 mm. from the backstop "F".



With the engine speed at the minimum slowly lift the draft lever "2".

With the position control set so that arms do not interfere with the draft feedback rod "T", set the draft lever to the neutral position that corresponds to the angle of 32°-34° degrees on the rockshaft controls "1" and "2".

Adjust the yoke on the draft feedback rod "t" one revolution at a time until the precise location where the arms raise is found.

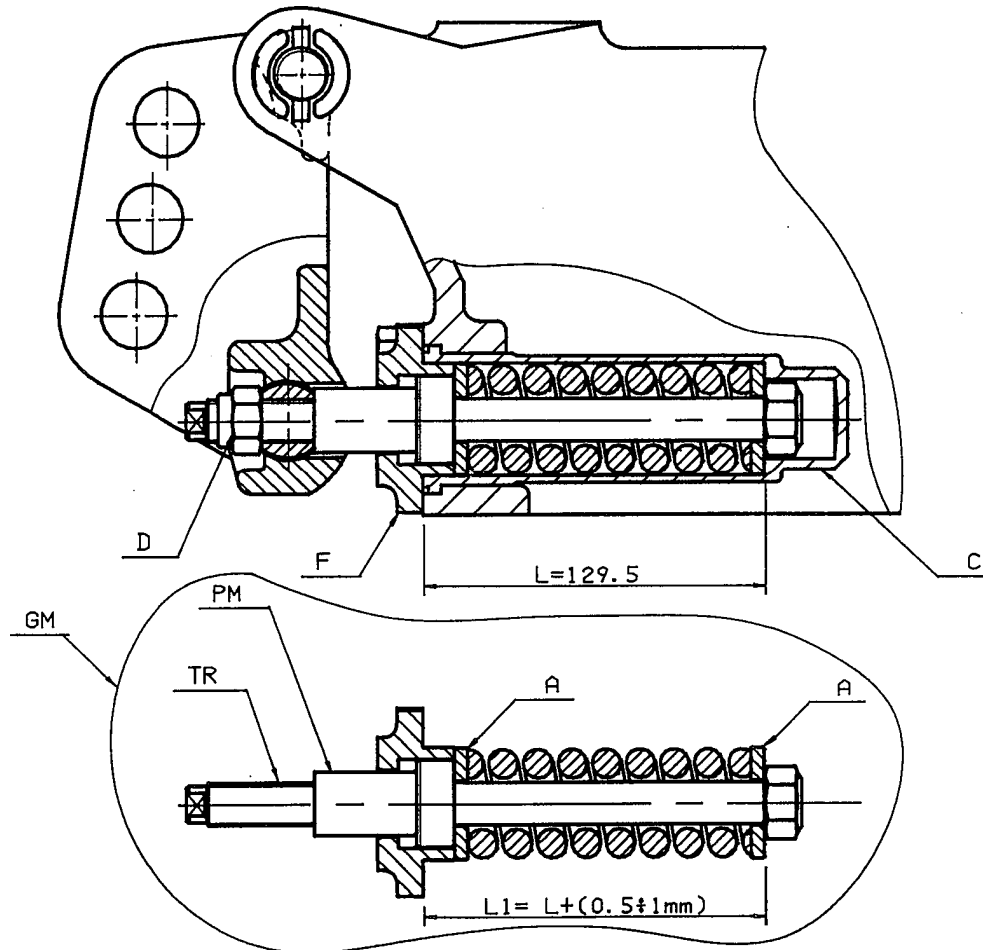
Tighten the yoke on the draft feedback rod "t2 and set the locking nut.

# Hydraulic Lift

## CONTROL OF ASSEMBLY OF REACTION SPRING

Before assembly, check that the pre-assembled components satisfy the measurement LI. This permits a pre-loading of the reaction spring of  $0.5 \pm 1$  mm.

If this measurement is not correct then the washer "A" should be substituted with one which has an adequate width.



The spring-loader "PM" must be assembled on the rod "TR" with loctite thread locking glue nr.243 so as to not pre-load the reaction spring.

Assemble the group "GM" on the cover "C", which is inserted in the body of the rockshaft, and tighten with two hexagonal head screws M12 which block the flange "F" to the body.

One will note, by moving the rod "TR", an axial play. This play must be eliminated for the correct assembly of the group as follows:

Keep the rod "TR" fixed and gradually rotate the spring-loader in a clockwise direction until the axial play is eliminated.

Complete the assembly of the Top Link Bracket taking care to not rotate the rod "TR" during the tightening of the self-locking nut "D".



# Hydraulic Lift

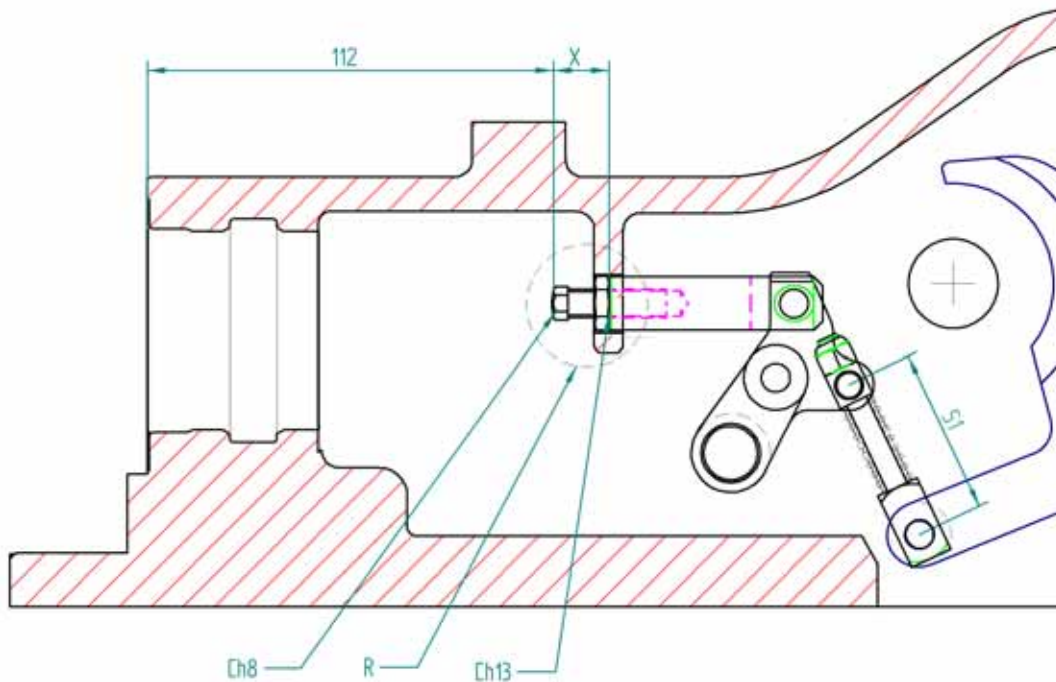
## MEASUREMENT CONTROL OF PUSH ROD

If the rockshaft is disassembled and if the regulator "R" must be changed it is advisable to check the measurement "X" ( $12.5 \pm 0.1$  mm) in order to re-assemble the push rod in the same position.

Ensure also that the measurement between the two pins 0 8 of the push rod is  $51 -0/+0.2$  mm.

The control of the measurement of the push rod with respect to the control valve face is carried out after making all the adjustments (sensitivity of control valve - position control lever - draft control lever).

With the rockshaft's arms completely lowered and without loads or implements on the three point linkage (neutral position); position the two control levers "1 R" and "2R" against the backstop "E".



In this position, pushing the internal push rod, verify with the appropriate gauge that the distance of 112 is correct.

N.B.: If the measurement "X" is changed it is obligatory to re-adjust the position control lever and the draft control lever.

# Hydraulic Lift

## DIAGNOSTIC

| DRAWBACKS                                                                                                                                       | CAUSES                                                                                                                                                                   | REMEDIES                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The Rockshaft lifts jerkily.                                                                                                                    | Insufficient oil level in the tank.<br>Pump inlet filter clogged.<br>Infiltration of air into the pump inlet pipe.                                                       | Top up the level.<br>Clean or replace the filter.<br>Check the inlet pipe and any coupling and gasket.                                                                       |
| Rockshaft does not operate.                                                                                                                     | Differential Valve blocked or dirty (Page 4.2 pos.2)                                                                                                                     | Remove the control valve and unblock the regulator piston                                                                                                                    |
| The rockshaft does not descend over its entire travel.                                                                                          | Faulty adjustment of the position control lever "1"<br>Sensibility adjusted badly                                                                                        | Adjust position control lever (page 8.1)<br>Adjust sensitivity of Control Valve (Page 7.1)                                                                                   |
| The rockshaft does not descend.                                                                                                                 | Discharge Valve blocked (page 4.2 pos.4)<br>Lever RD closed                                                                                                              | Remove Control Valve and unblock or clean discharge valve<br>Turn lever RD in anti-clockwise.                                                                                |
| Lifting capacity does not match that prescribed.                                                                                                | Deterioration of the Control Valve seal rings.<br>Relief and Safety valves out of calibration.<br>Poor pump efficiency.                                                  | Remove Control Valve and replace the external seal rings.<br>Control calibration of the valves.<br>Replace the pump.                                                         |
| The rockshaft supports loads with difficulty;<br>there is a rhythmic oscillation when the motor is on; the load descends when the motor is off. | Piston gasket worn.<br>Discharge Valve not adjusted (page 4.2, pos.4)<br>Oil leakage from Safety Valve (page 4.2 Pos.10)<br>Oil leakage from Check Valve (pag.4.2 Pos.3) | Replace the gasket.<br>Adjust the sensitivity of Control Valve or substitute the valve<br>Remove Control Valve and adjust valve<br>Remove the Control Valve and adjust valve |

# Hydraulic Lift

| DRAWBACKS                                                                                                                                      | CAUSES                                                                                                                              | REMEDIES                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| With the arms raised at back-stop and with the engine on, we have verified a rhythmic oscillation; with the engine off the load does not lower | Incorrectly adjusted of position control lever which, at maximum raised height, causes the internal automatic back-stop to function | Adjust the position control lever (page 8.1)          |
| The position control does not function; the rockshaft raises and lowers only with the draft lever                                              | Position control lever is adjusted badly                                                                                            | Adjust the position control lever (Page8.1)           |
|                                                                                                                                                | Internal levers damaged                                                                                                             | Overhaul the rockshaft                                |
| The rockshaft starts to lift, but it stops as soon as it feels the load, without the functioning of the overpressure valve                     | Tension rod measurement "T" is not correct (page 15)                                                                                | Adjust the draft control lever (page 15)              |
| Working with the draft control, the implement drops too much or doesn't stay in the groove                                                     | Sensitivity of the Control Valve is badly adjusted                                                                                  | Adjust the sensitivity of the Control Valve (page 13) |
| The draft control does not function; the rockshaft raises and lowers only with the position lever                                              | Draft control lever is adjusted badly                                                                                               | Adjust the draft control lever (pages 15)             |

# Hydraulic Lift

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# Differential Assembly

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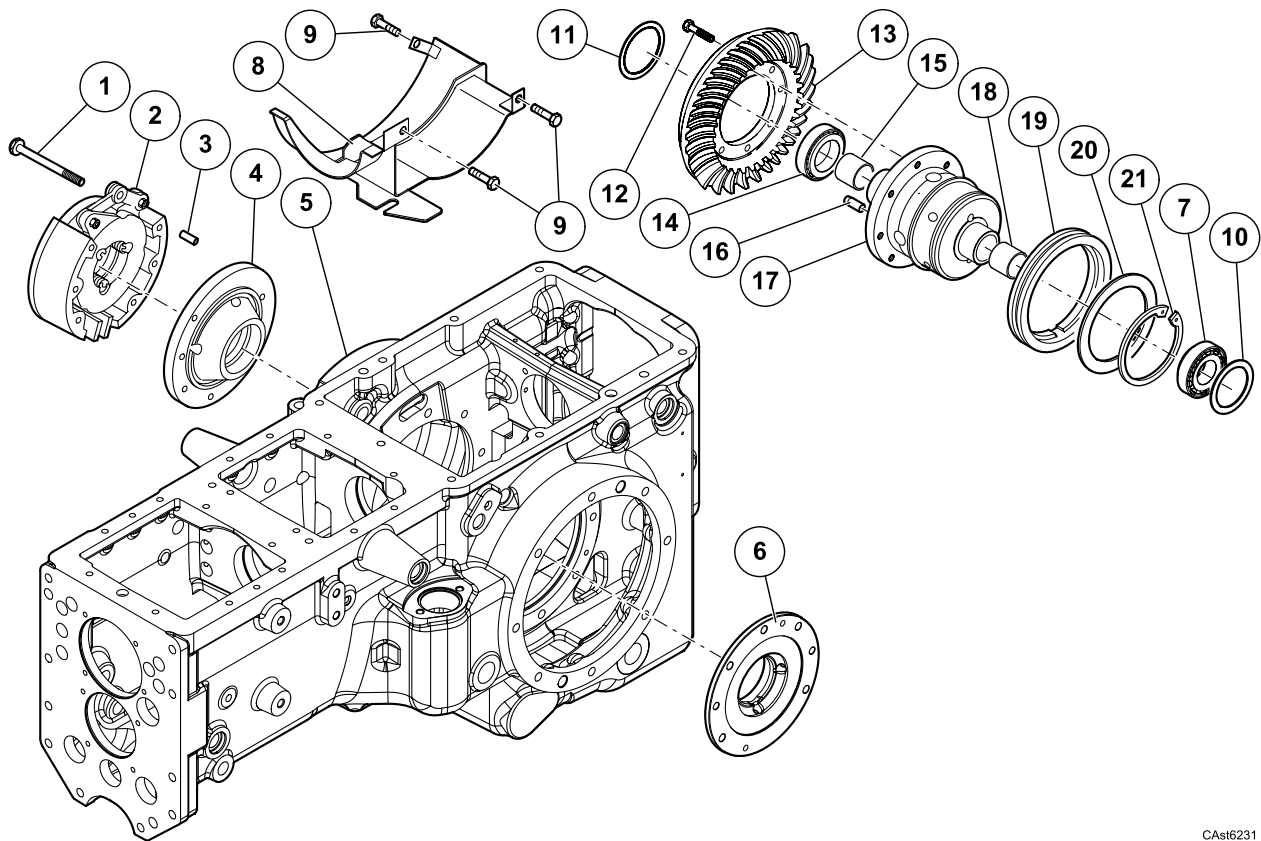
## Differential Assembly

### Section 3

#### Table of Contents

|                   |   |
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| DISASSEMBLY ..... | 3 |
| ASSEMBLY .....    | 4 |

# Differential Assembly



CAst6231

**8+8  
synchro  
reverser**

**12+12  
synchro  
reverser**

**24+24  
synchro  
reverser and  
synchro splitter**

**24+24  
synchro reverser  
and power  
splitter**

**12+12  
power  
reverser**

**24+24  
power reverser  
and synchro  
splitter**

For models

|

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|



# Differential Assembly

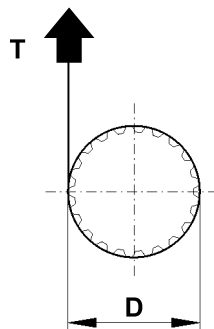
## DISASSEMBLY

1. Before starting the disassembly, use a dynamometer whose cord is wound on the pinion ring nut with diameter  $D = 80$  mm to check for bearing preload. If during assembly the bearings are not changed, the expected load will have a value 40-50% lower than the expected for new bearings.

Refer to: figures 1 and 2.



Figure 1



CAst6287

Figure 2

2. Disconnect brake control.
  3. Disassembly screws (1).
  4. Remove brake (2).
- Refer to: section D.XX.
5. Remove flange (4).
  6. Remove bearing cup (14) from flange (4).
  7. Repeat the same operations from the other side.
  8. Remove bearings cones (14) and (7) from differential box (17).
  9. Remove screws (12) and disassemble bevel gear crown (13).
  10. Remove screws (9).
  11. Remove guard (8).

# Differential Assembly

## ASSEMBLY

1. Assemble guard (8).
2. Assemble screws (9) to requested torque.

Refer to: section C.4

3. Check guard adjustment (it must not chatter).
4. Assemble differential box (17) as in the figure.

Refer to: figure 3

5. Before matching surfaces, make sure that they are perfectly clean, degrease and clean them with appropriate detergents.
6. Place bevel gear crown (13) on differential half box (17).
7. Apply the prescribed sealant on the thread and tighten screws (12) to the requested torque.

Refer to: figure 4

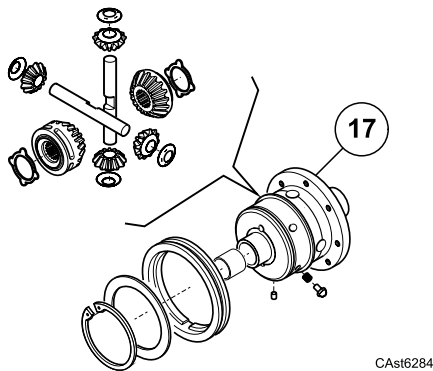


Figure 3

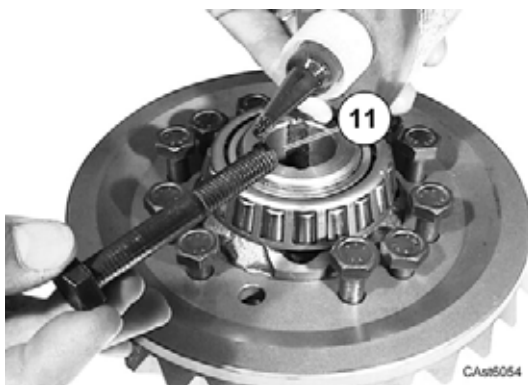


Figure 4

8. Assemble cones of bearings (14) and (7) on the differential box (17) with the special tool CA715093.

**NOTE:** calculate quantity (11) and (10) of shims required if the flanges (4) and (6) or the differential (17) are replaced.

If parts (4), (6) or (17) are not replaced, use shims collected during disassembly.

9. Choose shims (11) and (10) with total thickness of 1.0 mm (necessary for first check), among the available shims range. Assemble into flanges (4) and (6) shims (11) and (10).

Refer to: figure 5

### SHIMS RANGE

| Thickness - mm | 0.05 | 0.10 | 0.30 | 0.50 |
|----------------|------|------|------|------|
| Quantity       | ---  | ---  | ---  | ---  |

10. Assemble bearings cups (14) and (7) to differential support flanges. If necessary use special tool CA715583.

Refer to: figure 6



Figure 5



Figure 6

11. Assemble differential group.

Refer to: figure 7

12. Assemble flanges (4) and (6).

Refer to: figure 8

# Differential Assembly

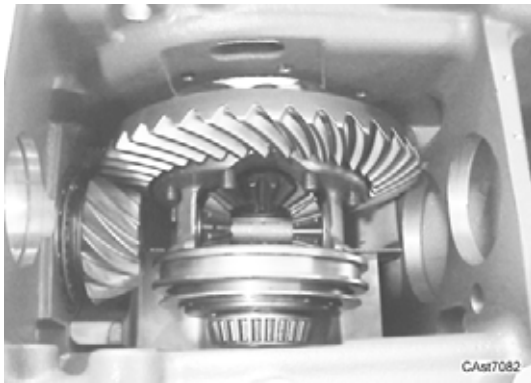


Figure 7



Figure 10

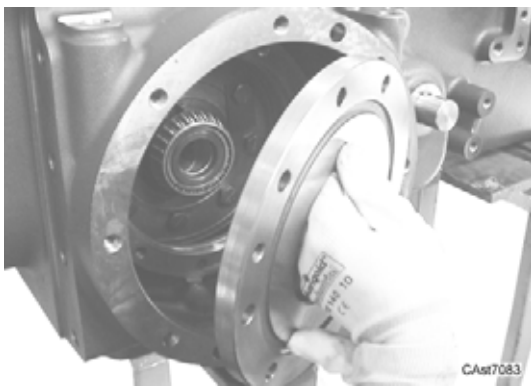


Figure 8

13. Assemble brake flange without brake assy. Tighten 5 screws (1).

Refer to: figure 9

14. Measure bevel gears backlash.  
The measured backlash value must be within the prescribed range:

0.10÷0.30 mm

Refer to: figure 10

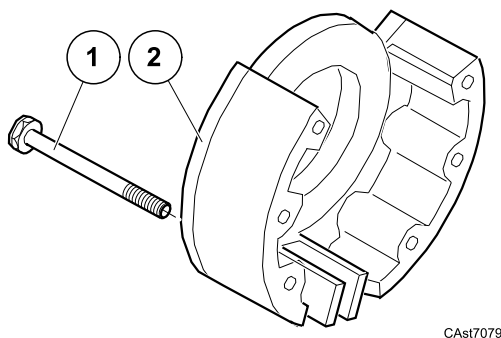


Figure 9

15. Choose shims (11) and (10) among the range available.

## SHIMS RANGE

|                |      |      |      |      |
|----------------|------|------|------|------|
| Thickness - mm | 0.05 | 0.10 | 0.30 | 0.50 |
| Quantity       | ---  | ---  | ---  | ---  |

Refer to: figure 11

16. Adjust shims (11) and (10), remembering that:

- [a] if the measured backlash is less than the given tolerance range, increase shims (10) from the side opposite to bevel gear crown and decrease shims (11) of the same measure;  
[b] if the measured backlash is greater than the given tolerance range, increase shims (11) from the side of bevel gear crown and decrease shims (10) of the same measure.

Refer to: figure 12

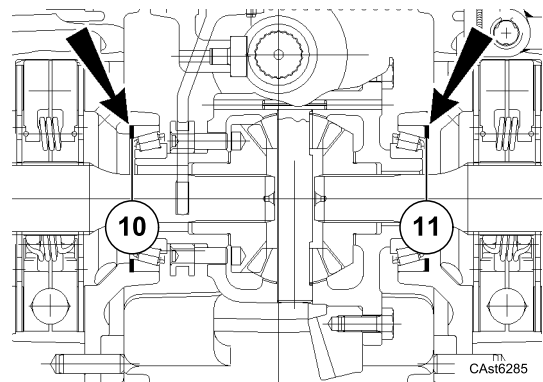


Figure 11

# Differential Assembly

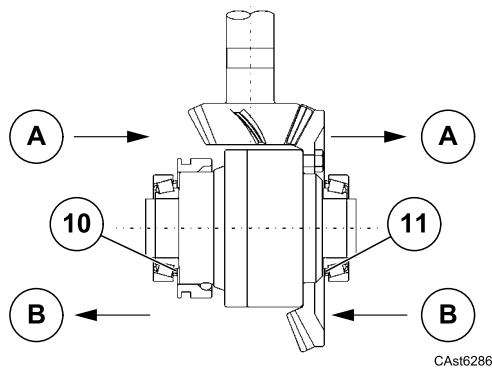


Figure 12

17. Once pinion-bevel gear crown backlash has been established, measure the total preloading  $T$  of bearings (pinion-bevel gear crown system). Use a dynamometer whose cord is wound on the pinion ring nut with diameter  $D = 80$  mm. The measured value should be within the following range:

$$T = (P + 5.8) \div (P + 8.8) \text{ N}$$

*Warning: values for new bearings.*

Refer to: figures 13 and 14



Figure 13

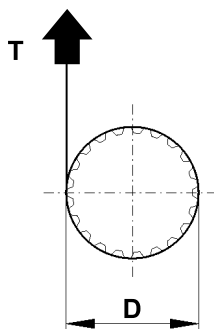


Figure 14

18. If the measurement is not within the requested range, check well the assembly of each component and operate on the shims (11) and (10) remembering that:  
[c] if the total preloading is less than the given range, increase shims (11) and (10) by the same measure, keeping pinion-ring gear backlash value unchanged;  
[d] if the total preloading is greater than the given range, decrease shims (11) and (10) by the same measure, keeping pinion-ring gear backlash value unchanged.

Refer to: figure 13

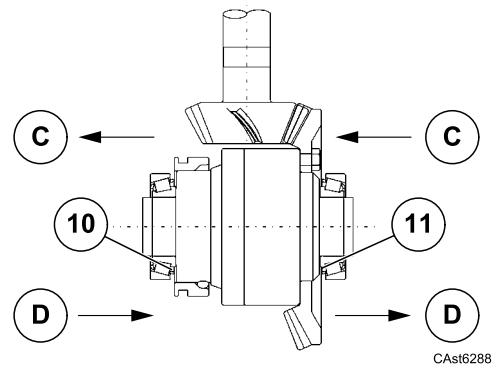


Figure 15

19. Remove screws (1) and brake flange (2).  
20. Fasten with screws the differential support flange (4).  
21. Assemble with tool 2 pins (3).  
Refer to: figure 16  
22. Remove screws.  
Refer to: figure 17

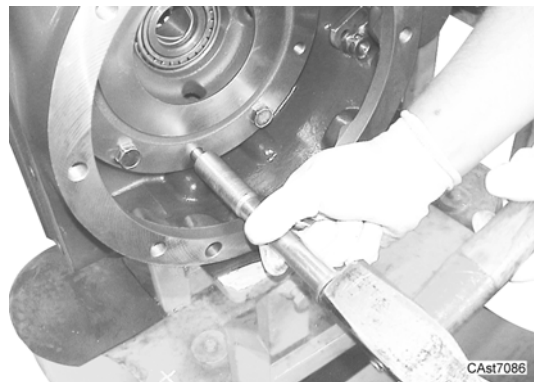


Figure 16

## Differential Assembly

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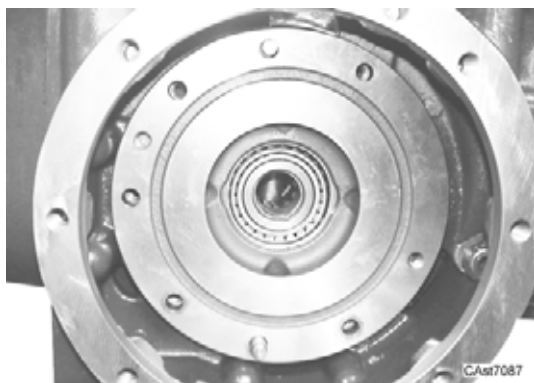


Figure 17

23. Assemble preassembled brake (2).

Refer to: figure 18

24. Look for the position of screw holes.

25. Assemble 5 screws (1) and tighten to the requested torque.

Refer to: figure 19 and section C.4

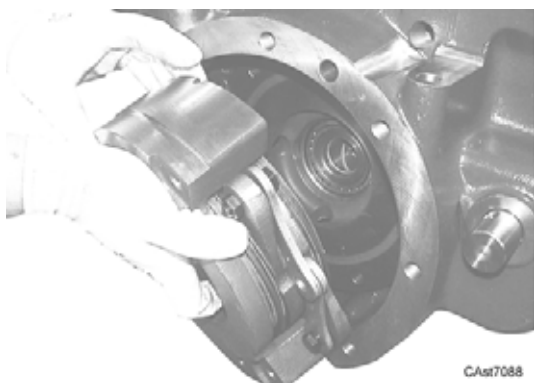


Figure 18

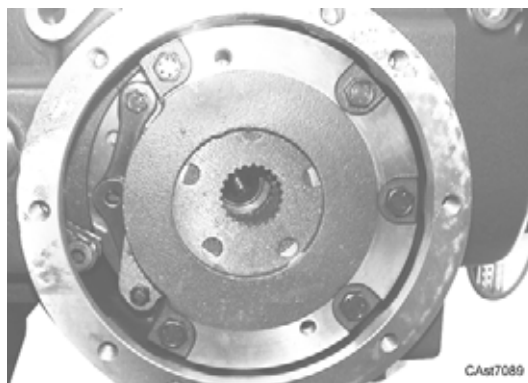


Figure 19

26. Check bevel gear crown backlash.

27. Connect brake control.

Refer to: figure 20

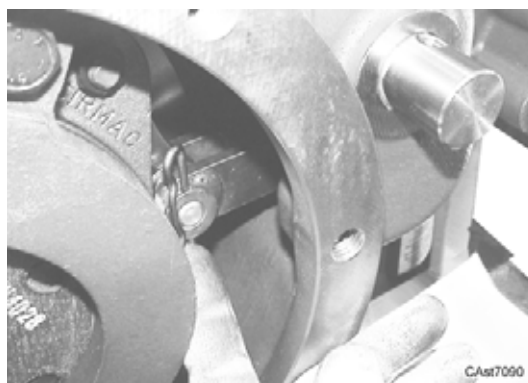


Figure 20

# Differential Assembly

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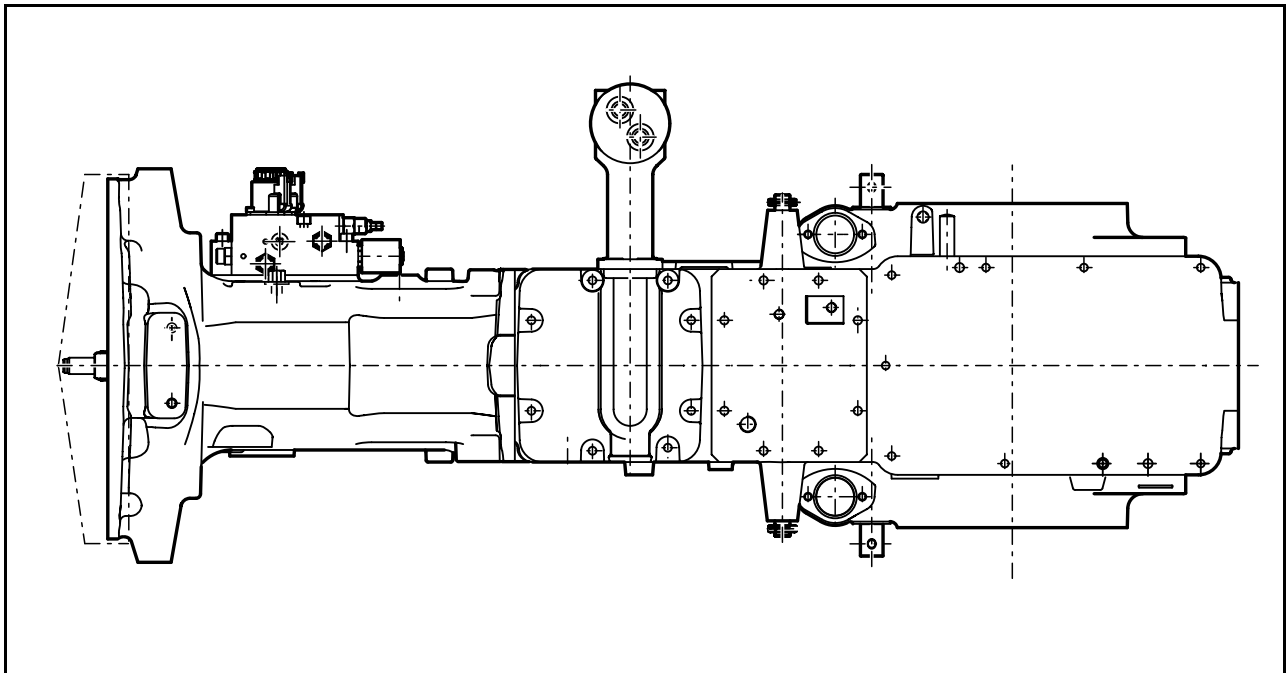
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## Transmission 506 HTR

### Transmission 506 HTR

#### Section 4A



# Transmission 506 HTR

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# General Specifications

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## General Specifications

### Section 4A

#### Table of Contents

|                                                           |    |
|-----------------------------------------------------------|----|
| INTENDED USE .....                                        | 4  |
| PRODUCT IDENTIFICATION .....                              | 4  |
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# General Specifications

## INTENDED USE

This transmission has been designed and manufactured to be mounted on agricultural machines.

The transmission is a component that transmits the power from the engine to the wheels with an assigned transmission ratio.

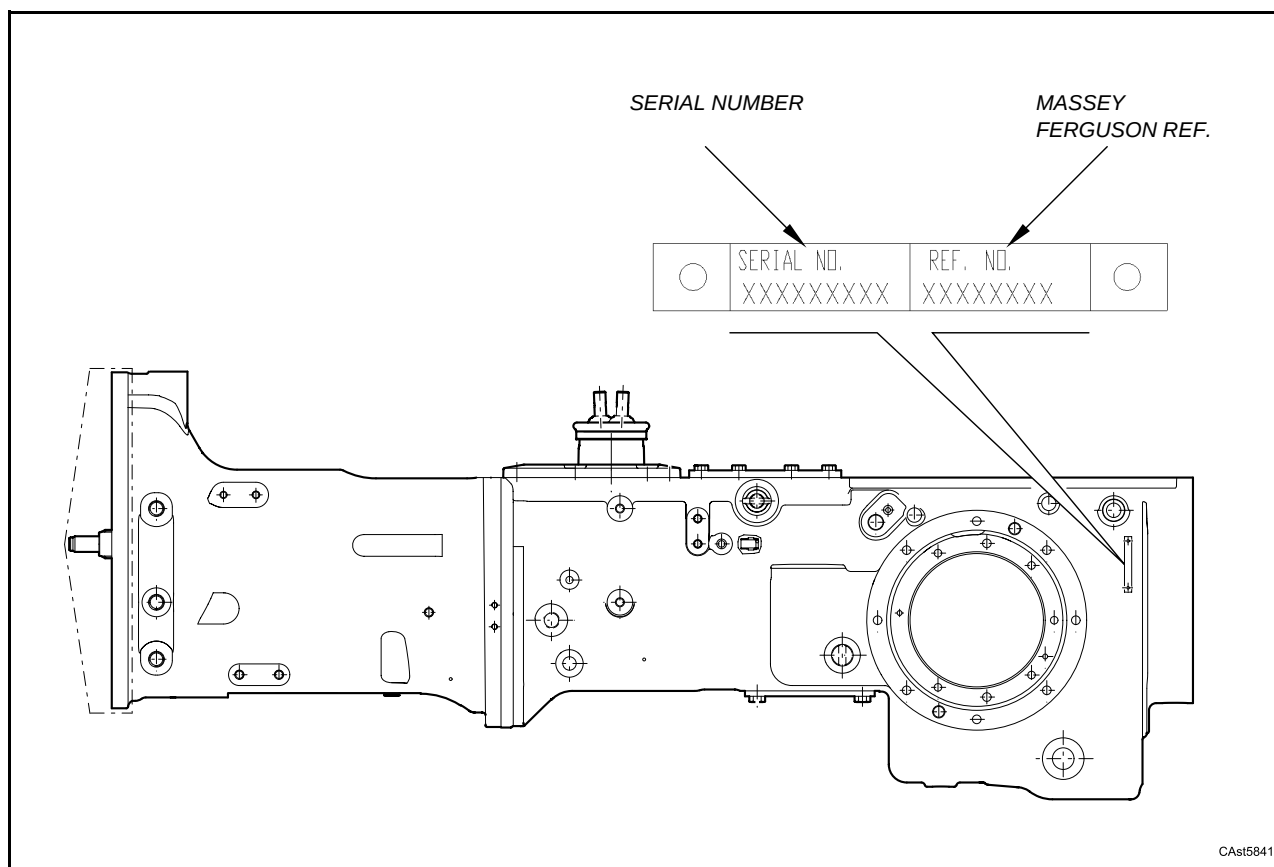
Never mount this transmission on machines different from the ones for which it has been designed and manufactured

If the transmission is used for any other purpose than the one foreseen, Massey Ferguson Limited declines any responsibility regarding damages or accidents caused by it. All consequences will be at the expense of the customer.

However, when used as foreseen, operational formalities as well as regular maintenance repair specifications given by Massey Ferguson Limited are to be observed strictly.

## PRODUCT IDENTIFICATION

Transmission tag



# General Specifications

## TECHNICAL FEATURES

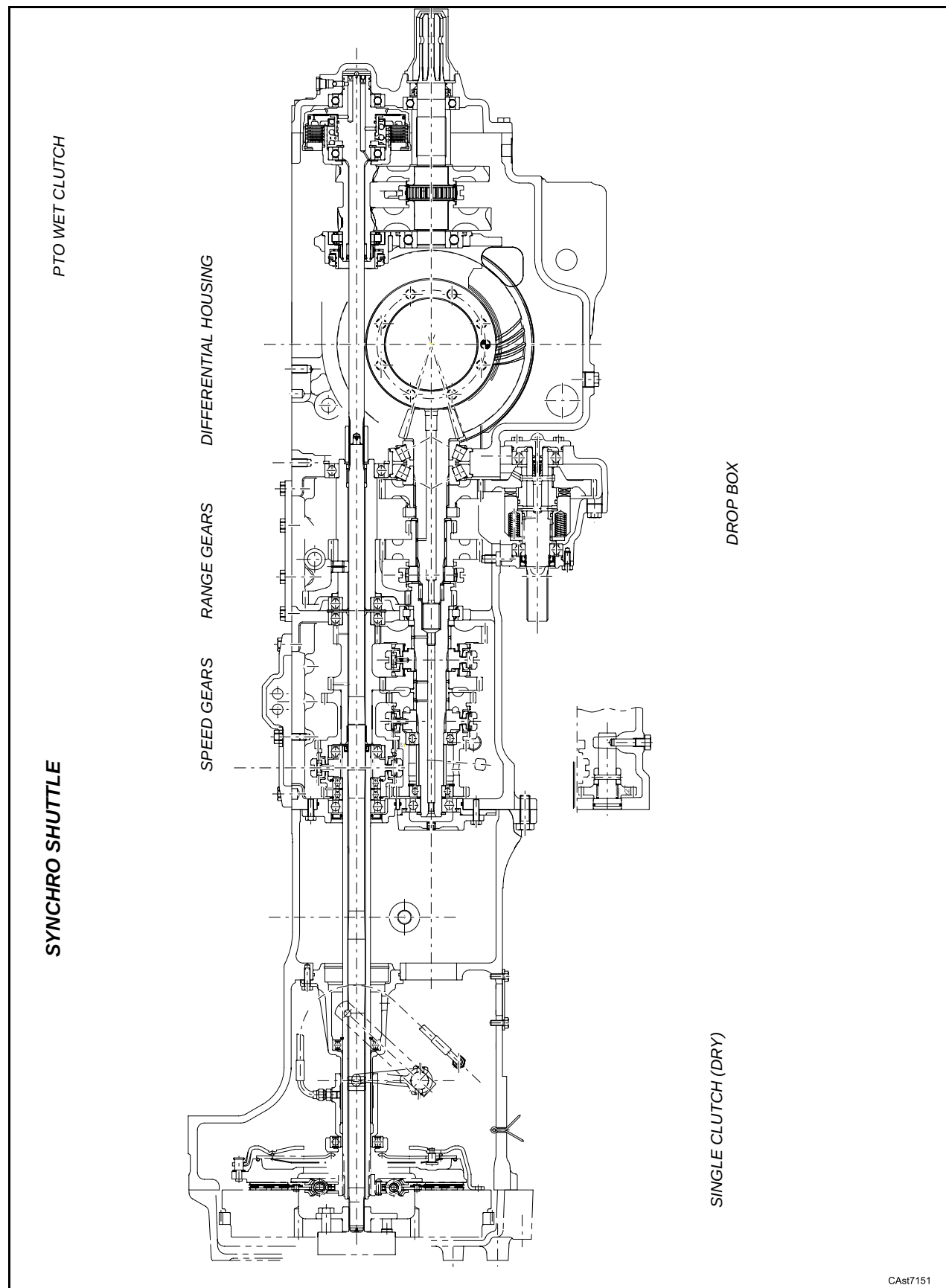
|                   |                             |
|-------------------|-----------------------------|
| MACHINE           | Transmission                |
| CODE              | CA643681                    |
| MODEL             | 8 + 8 synchro shuttle       |
| PTO MODEL         | 540 or 540/540E or 540/1000 |
| DIFFERENTIAL TYPE | 100% Mechanical lock        |

### Main features

| DESCRIPTION                                                                                                       | VALUES                                                                 |
|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| Bevel gear ratio                                                                                                  | 3.416/1 (12/41)                                                        |
| Epicyclic reduction gears ratio (STD/UP)                                                                          | 6/1 (14/70)                                                            |
| Total (b.g.+e.r.g.) ratio                                                                                         | 20.496/1                                                               |
| GRD-PTO ratio                                                                                                     | not available                                                          |
| Forward speed number                                                                                              | 8                                                                      |
| Reverse speed number                                                                                              | 8                                                                      |
| Reverser                                                                                                          | Synchro                                                                |
| Splitter                                                                                                          | not present                                                            |
| Bevel gear set end float                                                                                          | 0.10÷0.30 mm                                                           |
| Pinion bearings preloading P<br>(measured without seal rings on ring nut $\varnothing_{est} = 80$ mm)             | P= 4÷6 daN                                                             |
| Total pinion-crown bearings preloading T<br>(measured without seal rings on ring nut $\varnothing_{est} = 80$ mm) | T=(P+0.58)÷(P+0.88) daN                                                |
| Transmission oil capacity<br>with reduction groups                                                                | see vehicle manual                                                     |
| Final drive oil capacity                                                                                          | - common with gear box<br>POLYMER 400/L<br>DIN=KHER1R<br>ISO-I-XMR-XM2 |
| Grease specification                                                                                              |                                                                        |
| Final drive bearings preloading, UP version<br>(measured on wheel shaft $\varnothing_{est} = 245$ mm)             | 13÷2 daN                                                               |
| Brakes                                                                                                            | see page 7                                                             |
| Controls                                                                                                          | see section "Controls"                                                 |

# General Specifications

8+8 synchro shuttle

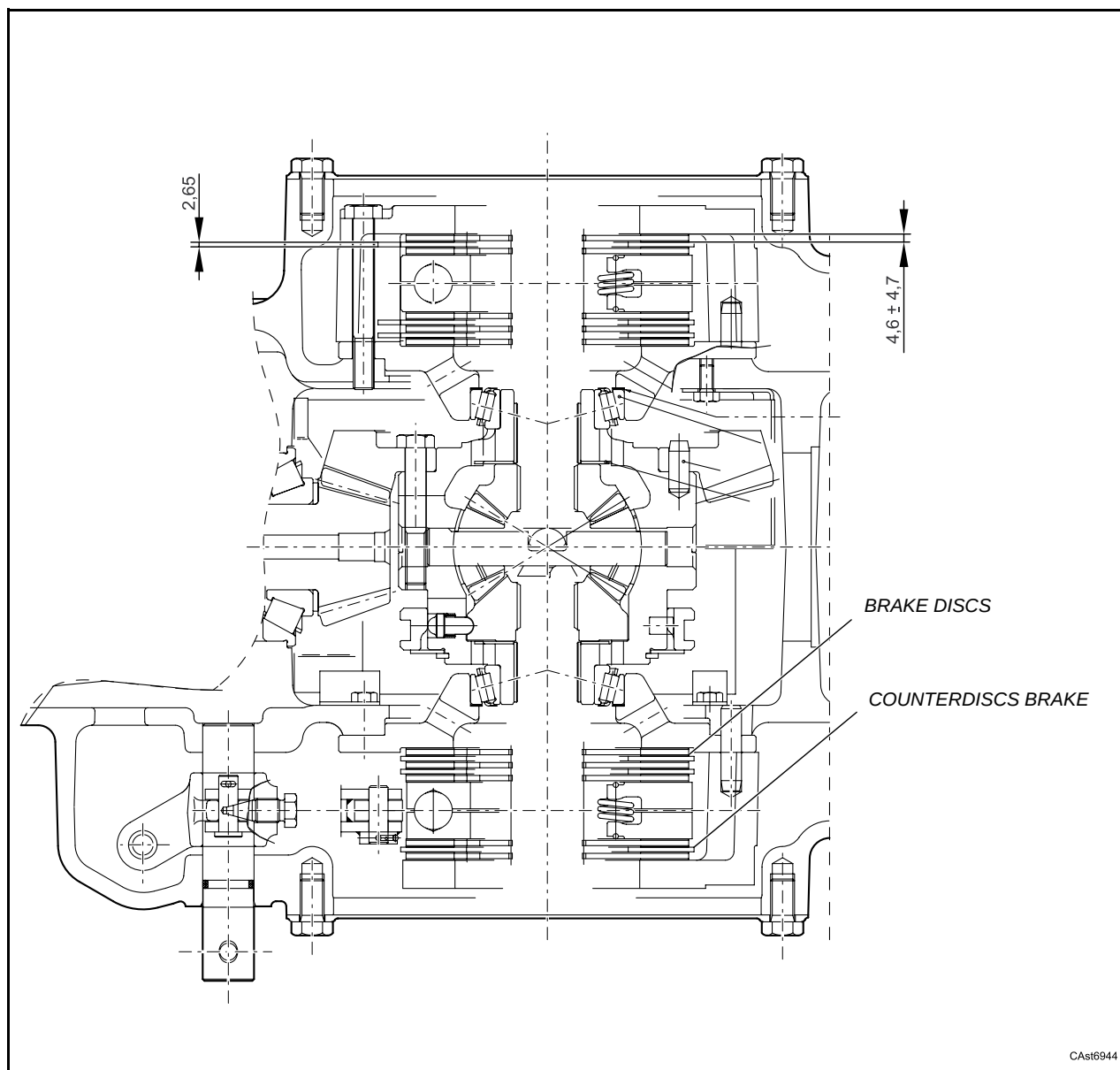




## General Specifications

### Mechanical controlled brakes features

|                                        |                  |
|----------------------------------------|------------------|
| Number of brake discs each side        | 5                |
| Number of brake counterdiscs each side | 3                |
| Nominal brake disc thickness           | $4.6 \pm 4.7$ mm |
| Nominal brake counterdisc thickness    | 2.65 mm          |
| Warn brake disc minimum thickness      | 3.9 mm           |



# General Specifications

## Technical features

|                   |                             |
|-------------------|-----------------------------|
| MACHINE           | Transmission                |
| CODE              | CA643683                    |
| MODEL             | 12 + 12 synchro shuttle     |
| PTO MODEL         | 540 or 540/540E or 540/1000 |
| DIFFERENTIAL TYPE | 100% Mechanical lock        |

## Main features

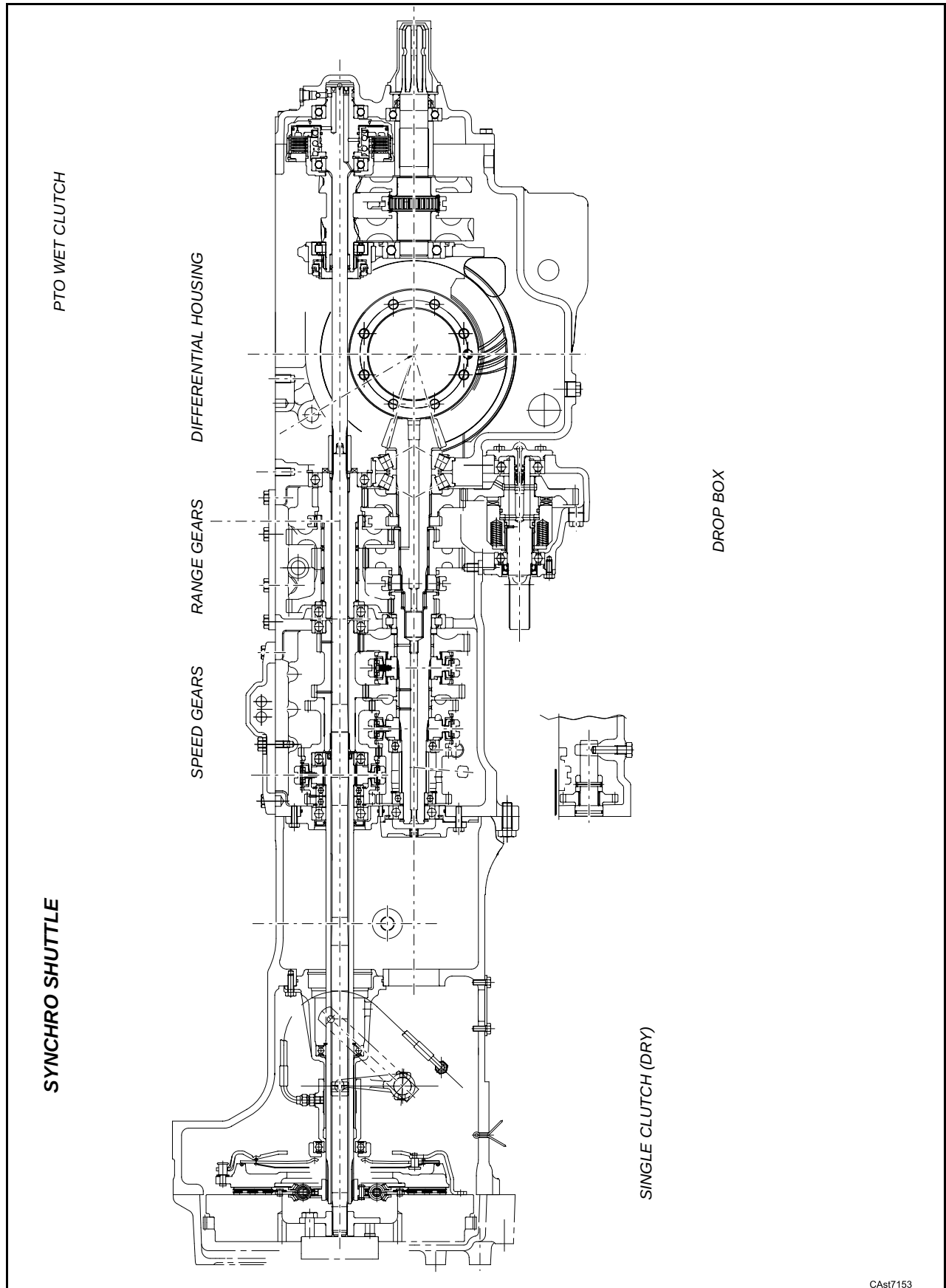
| DESCRIPTION                                                                                                       | VALUES                                                                 |
|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| Bevel gear ratio                                                                                                  | 3.416/1 (12/41)                                                        |
| Epicyclic reduction gears ratio (STD/UP)                                                                          | 6/1 (14/70)                                                            |
| Total (b.g.+e.r.g.) ratio                                                                                         | 20.496/1                                                               |
| GD-PTO ratio (optional)                                                                                           | see page 8                                                             |
| Forward speed number                                                                                              | 12                                                                     |
| Reverse speed number                                                                                              | 12                                                                     |
| Reverser                                                                                                          | Synchro                                                                |
| Splitter                                                                                                          | not present                                                            |
| Bevel gear set end float                                                                                          | 0.10÷0.30 mm                                                           |
| Pinion bearings preloading P<br>(measured without seal rings on ring nut $\varnothing_{est}$ = 80 mm)             | $P = 4 \div 6$ daN                                                     |
| Total pinion-crown bearings preloading T<br>(measured without seal rings on ring nut $\varnothing_{est}$ = 80 mm) | $T = (P + 0.58) \div (P + 0.88)$ daN                                   |
| Transmission oil capacity<br>with reduction groups                                                                | see vehicle manual                                                     |
| Final drive oil capacity                                                                                          | - common with gear box<br>POLYMER 400/L<br>DIN=KHER1R<br>ISO-I-XMR-XM2 |
| Grease specification                                                                                              |                                                                        |
| Final drive bearings preloading, UP version<br>(measured on wheel shaft $\varnothing_{est}$ = 245 mm)             | 13÷2 daN                                                               |
| Brakes                                                                                                            | see page 7                                                             |
| Controls                                                                                                          | see section "Controls"                                                 |

## GD PTO total ratio

|      | Epicyclic reduction gear | Bevel ratio | Speed gears |       | GD PTO total ratio |
|------|--------------------------|-------------|-------------|-------|--------------------|
| 540  | 6                        | 41/12       | 52/26       | 17/61 | 11.426             |
| 540E | 6                        | 41/12       | 52/26       | 19/58 | 13.431             |
| 1000 | 6                        | 41/12       | 52/26       | 26/51 | 20.902             |
|      | Epicyclic reduction gear | Bevel ratio | Speed gears |       | GD PTO total ratio |
| 540  | 6                        | 38/14       | 52/26       | 17/61 | 9.077              |
| 540E | 6                        | 38/14       | 52/26       | 19/58 | 10.67              |
| 1000 | 6                        | 38/14       | 52/26       | 26/51 | 16.605             |

## General Specifications

12+12 synchro shuttle



# General Specifications

## Technical features

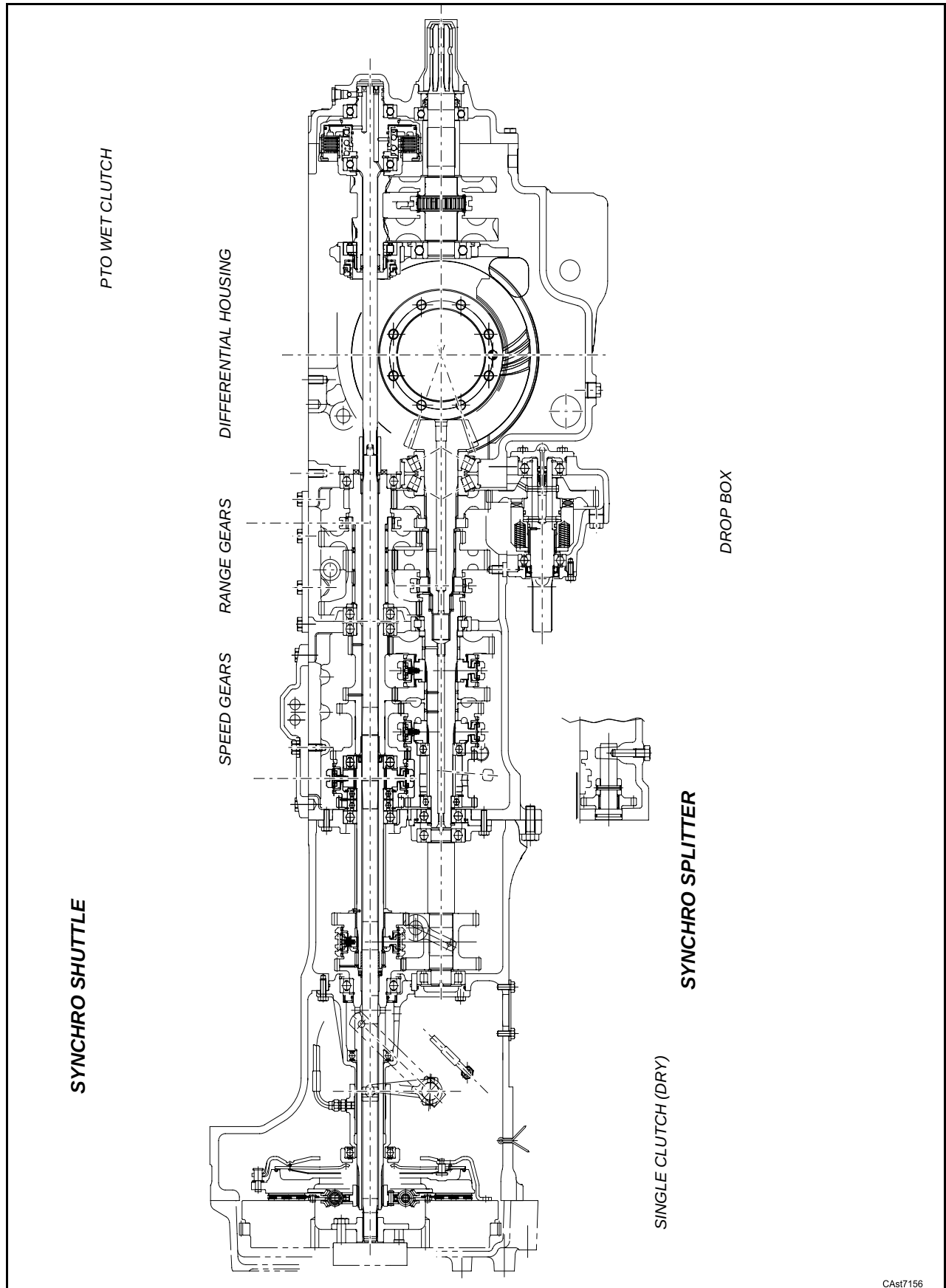
|                   |                                              |
|-------------------|----------------------------------------------|
| MACHINE           | Transmission                                 |
| CODE              | CA643687                                     |
| MODEL             | 24 + 24 synchro shuttle and synchro splitter |
| PTO MODEL         | 540 or 540/540E or 540/1000                  |
| DIFFERENTIAL TYPE | 100% Mechanical lock                         |

## Principal characteristics

| DESCRIPTION                                                                                                       | VALUES                                       |
|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| Bevel gear ratio                                                                                                  | 2.714/1 (14/38)                              |
| Epicyclic reduction gears ratio (STD/UP)                                                                          | 6/1 (14/70)                                  |
| Total (b.g.+e.r.g.) ratio                                                                                         | 16.284/1                                     |
| GD-PTO ratio (optional)                                                                                           | see page page 8                              |
| Forward speed number                                                                                              | 24                                           |
| Reverse speed number                                                                                              | 24                                           |
| Reverser                                                                                                          | Synchro                                      |
| Splitter                                                                                                          | Synchro                                      |
| Bevel gear set end float                                                                                          | 0.10÷0.30 mm                                 |
| Pinion bearings preloading P<br>(measured without seal rings on ring nut $\varnothing_{est} = 80$ mm)             | $P = 4 \div 6$ daN                           |
| Total pinion-crown bearings preloading T<br>(measured without seal rings on ring nut $\varnothing_{est} = 80$ mm) | $T = (P + 0.58) \div (P + 0.88)$ daN         |
| Transmission oil capacity<br>with reduction groups                                                                | see vehicle manual                           |
| Final drive oil capacity                                                                                          | - common with gear box                       |
| Grease specification                                                                                              | POLYMER 400/L<br>DIN=KHER1R<br>ISO-I-XMR-XM2 |
| Final drive bearings preloading, UP version<br>(measured on wheel shaft $\varnothing_{est} = 245$ mm)             | $13 \div 2$ daN                              |
| Brakes                                                                                                            | see page 7                                   |
| Controls                                                                                                          | see section "Controls"                       |

## General Specifications

24+24 synchro shuttle and synchro splitter



# General Specifications

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## Technical features

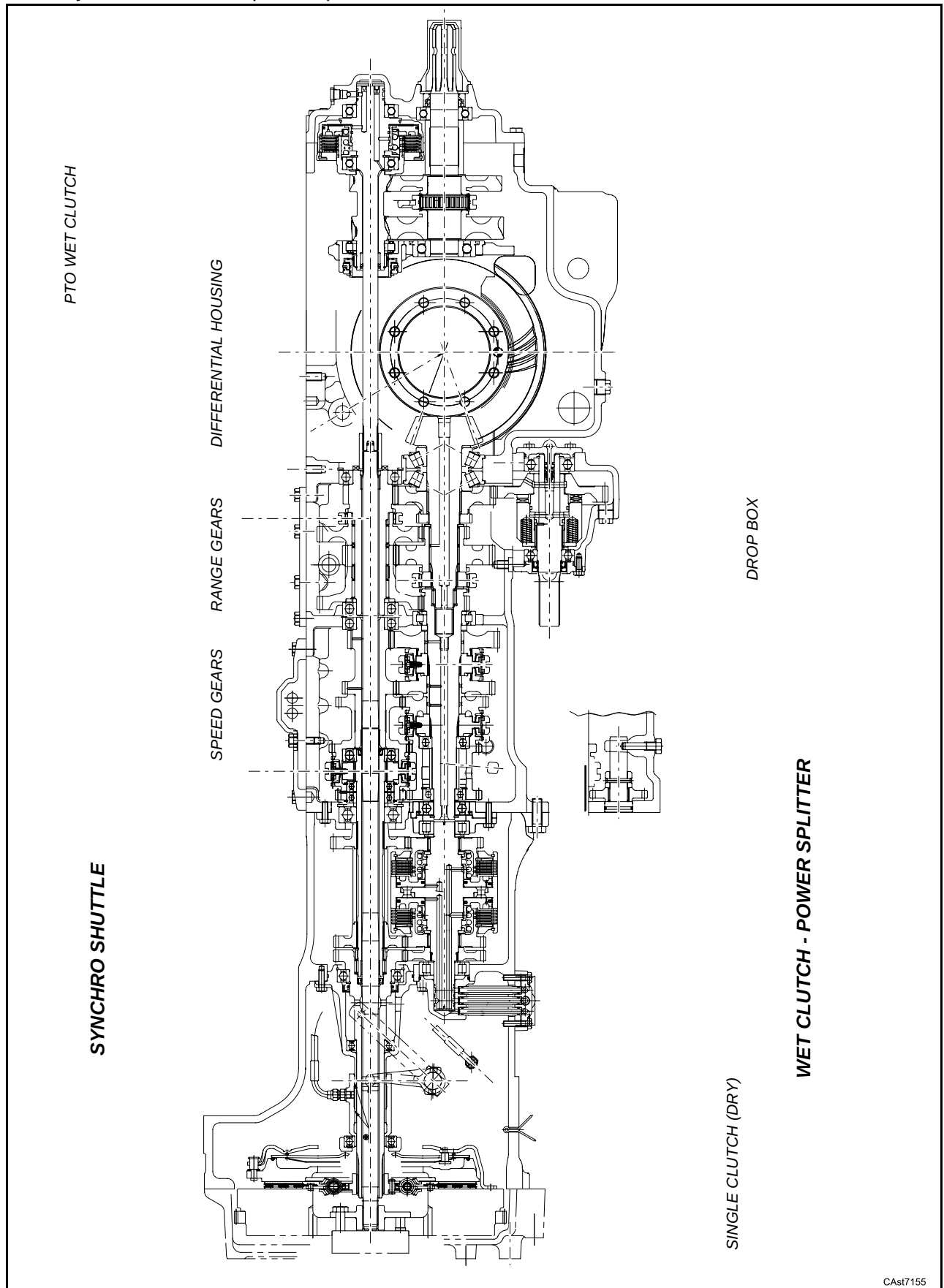
|                   |                                            |
|-------------------|--------------------------------------------|
| MACHINE           | Transmission                               |
| CODE              | CA643689                                   |
| MODEL             | 24 + 24 synchro shuttle and power splitter |
| PTO MODEL         | 540 or 540/540E or 540/1000                |
| DIFFERENTIAL TYPE | 100% Mechanical lock                       |

## Main features

| DESCRIPTION                                                                                                       | VALUES                                                                 |
|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| Bevel gear ratio                                                                                                  | 2.714/1 (14/38)                                                        |
| Epicyclic reduction gears ratio (STD/UP)                                                                          | 6/1 (14/70)                                                            |
| Total (b.g.+e.r.g.) ratio                                                                                         | 16.284/1                                                               |
| GD-PTO ratio (optional)                                                                                           | see page page 8                                                        |
| Forward speed number                                                                                              | 24                                                                     |
| Reverse speed number                                                                                              | 24                                                                     |
| Reverser                                                                                                          | Synchro                                                                |
| Splitter                                                                                                          | Power                                                                  |
| Bevel gear set end float                                                                                          | 0.10÷0.30 mm                                                           |
| Pinion bearings preloading P<br>(measured without seal rings on ring nut $\varnothing_{est}$ = 80 mm)             | P = 4÷6 daN                                                            |
| Total pinion-crown bearings preloading T<br>(measured without seal rings on ring nut $\varnothing_{est}$ = 80 mm) | T = (P+0.58)÷(P+0.88) daN                                              |
| Transmission oil capacity<br>with reduction groups                                                                | see vehicle manual                                                     |
| Final drive oil capacity                                                                                          | - common with gear box<br>POLYMER 400/L<br>DIN=KHER1R<br>ISO-I-XMR-XM2 |
| Grease specification                                                                                              |                                                                        |
| Final drive bearings preloading, UP version<br>(measured on wheel shaft $\varnothing_{est}$ = 245 mm)             | 13÷2 daN                                                               |
| Brakes                                                                                                            | see page 7                                                             |
| Controls                                                                                                          | see section "Controls"                                                 |

## General Specifications

24+24 synchro shuttle and power splitter





# General Specifications

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## Technical features

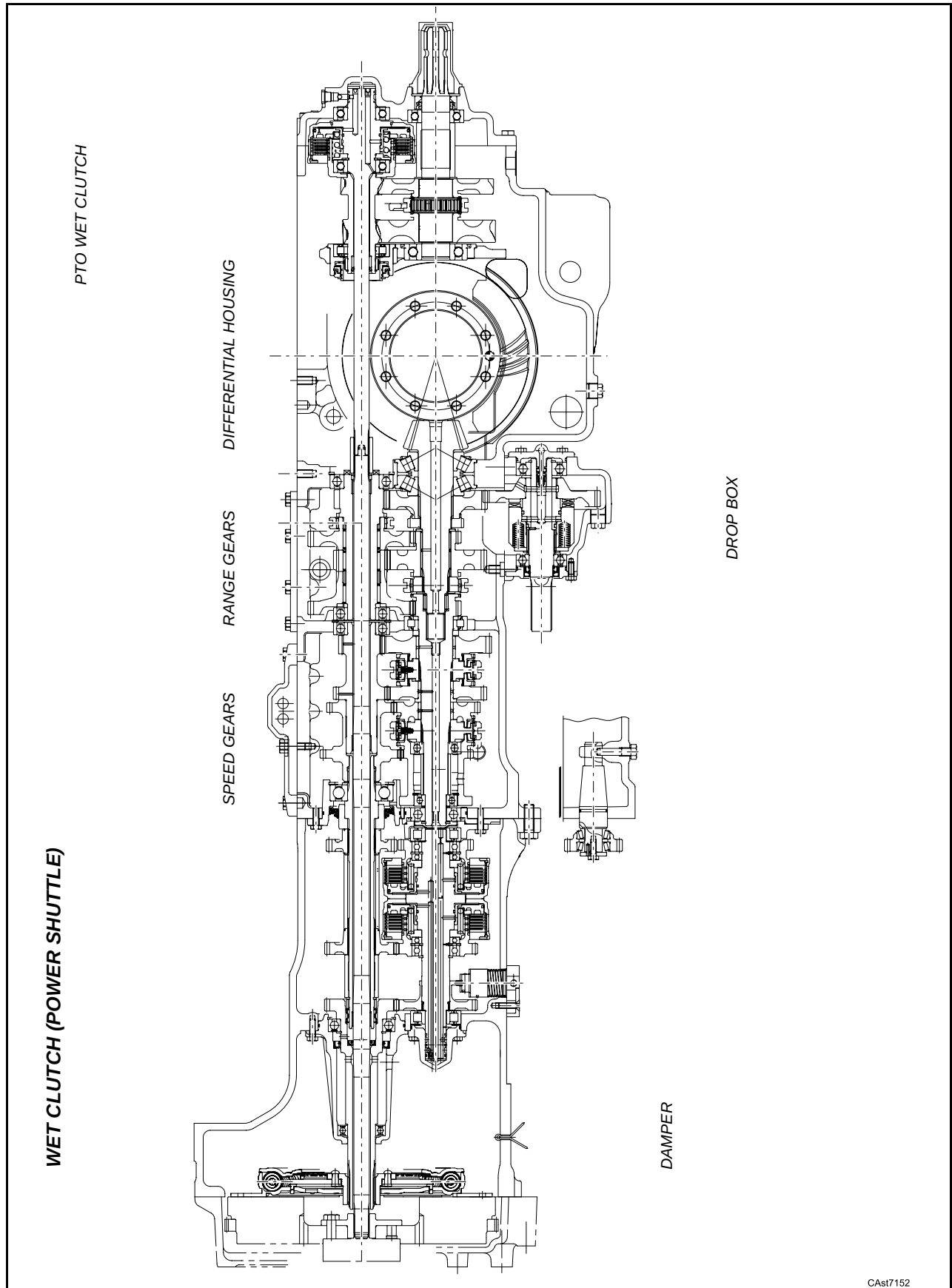
|                   |                             |
|-------------------|-----------------------------|
| MACHINE           | Transmission                |
| CODE              | CA643685                    |
| MODEL             | 12 + 12 power shuttle       |
| PTO MODEL         | 540 or 540/540E or 540/1000 |
| DIFFERENTIAL TYPE | 100% Mechanical lock        |

## Main features

| DESCRIPTION                                                                                                       | VALUES                                                                 |
|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| Bevel gear ratio                                                                                                  | 3.416/1 (12/41)                                                        |
| Epicyclic reduction gears ratio (STD/UP)                                                                          | 6/1 (14/70)                                                            |
| Total (b.g.+e.r.g.) ratio                                                                                         | 20.496/1                                                               |
| GD-PTO ratio (optional)                                                                                           | see page page 8                                                        |
| Forward speed number                                                                                              | 12                                                                     |
| Reverse speed number                                                                                              | 12                                                                     |
| Reverser                                                                                                          | Power shuttle                                                          |
| Splitter                                                                                                          | not present                                                            |
| Bevel gear set end float                                                                                          | 0.10÷0.30 mm                                                           |
| Pinion bearings preloading P<br>(measured without seal rings on ring nut $\varnothing_{est}$ = 80 mm)             | P = 4÷6 daN                                                            |
| Total pinion-crown bearings preloading T<br>(measured without seal rings on ring nut $\varnothing_{est}$ = 80 mm) | T = (P+0.58)÷(P+0.88) daN                                              |
| Transmission oil capacity<br>with reduction groups                                                                | see vehicle manual                                                     |
| Final drive oil capacity                                                                                          | - common with gear box<br>POLYMER 400/L<br>DIN=KHER1R<br>ISO-I-XMR-XM2 |
| Grease specification                                                                                              |                                                                        |
| Final drive bearings preloading, UP version<br>(measured on wheel shaft $\varnothing_{est}$ = 245 mm)             | 1.3÷2 daN                                                              |
| Brakes                                                                                                            | see page 7                                                             |
| Controls                                                                                                          | see section "Controls"                                                 |

## General Specifications

12 + 12 power shuttle



CAst7152

# General Specifications

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## Technical features

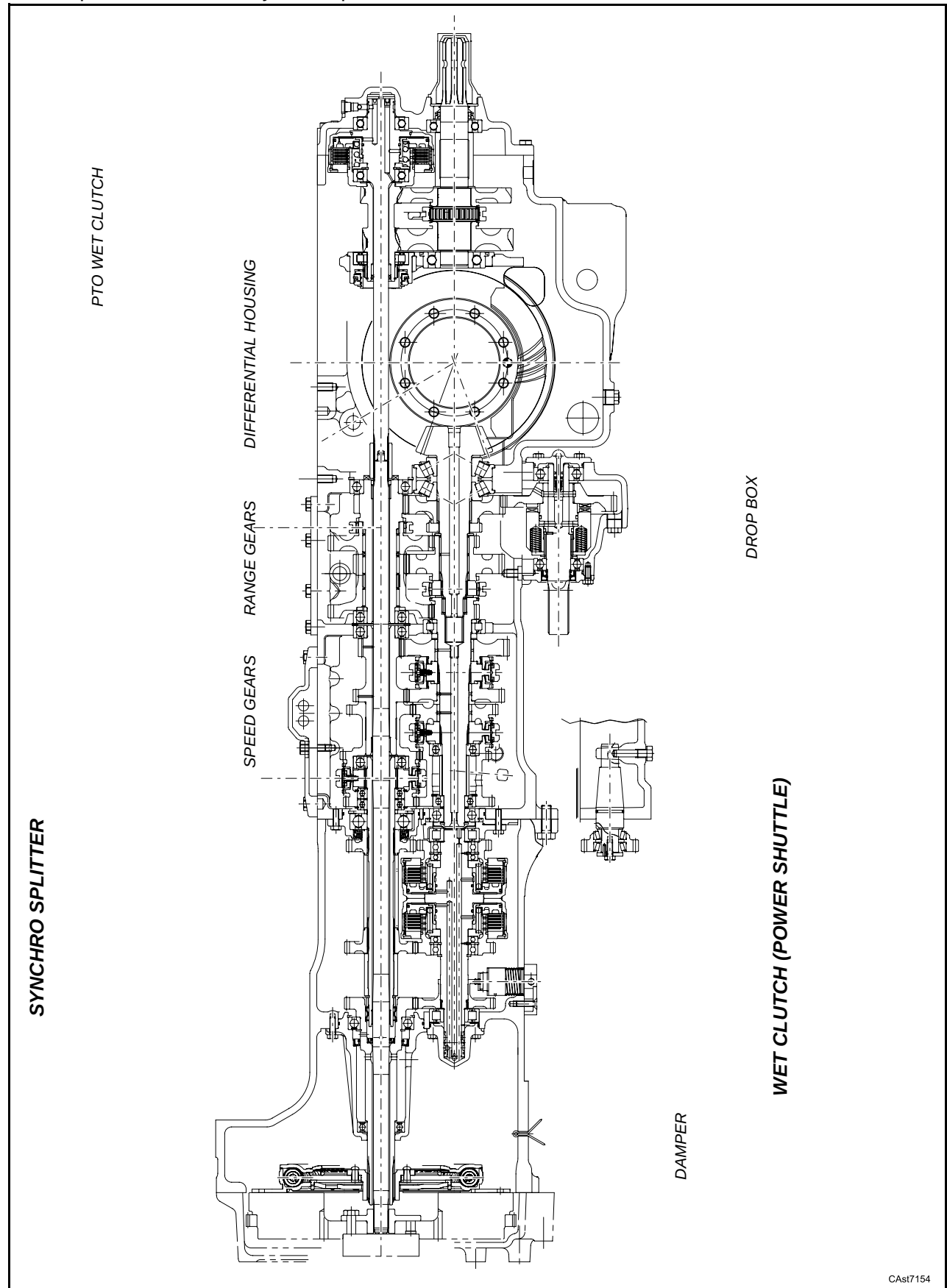
|                   |                                            |
|-------------------|--------------------------------------------|
| MACHINE           | Transmission                               |
| CODE              | CA643691                                   |
| MODEL             | 24 + 24 power shuttle and synchro splitter |
| PTO MODEL         | 540 or 540/540E or 540/1000                |
| DIFFERENTIAL TYPE | 100% Mechanical lock                       |

## Main features

| DESCRIPTION                                                                                                       | VALUES                                                                 |
|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| Bevel gear ratio                                                                                                  | 2.714/1 (14/38)                                                        |
| Epicyclic reduction gears ratio (STD/UP)                                                                          | 6/1 (14/70)                                                            |
| Total (b.g.+e.r.g.) ratio                                                                                         | 16.284/1                                                               |
| GD-PTO ratio (optional)                                                                                           | see page page 8                                                        |
| Forward speed number                                                                                              | 24                                                                     |
| Reverse speed number                                                                                              | 24                                                                     |
| Reverser                                                                                                          | Power                                                                  |
| Splitter                                                                                                          | Synchro                                                                |
| Bevel gear set end float                                                                                          | 0.10÷0.30 mm                                                           |
| Pinion bearings preloading P<br>(measured without seal rings on ring nut $\varnothing_{est}$ = 80 mm)             | P = 4÷6 daN                                                            |
| Total pinion-crown bearings preloading T<br>(measured without seal rings on ring nut $\varnothing_{est}$ = 80 mm) | T = (P+0.58)÷(P+0.88) daN                                              |
| Transmission oil capacity<br>with reduction groups                                                                | see vehicle manual                                                     |
| Final drive oil capacity                                                                                          | - common with gear box<br>POLYMER 400/L<br>DIN=KHER1R<br>ISO-I-XMR-XM2 |
| Grease specification                                                                                              |                                                                        |
| Final drive bearings preloading, UP version<br>(measured on wheel shaft $\varnothing_{est}$ = 245 mm)             | 13÷2 daN                                                               |
| Brakes                                                                                                            | see page 7                                                             |
| Controls                                                                                                          | see section "Controls"                                                 |

## General Specifications

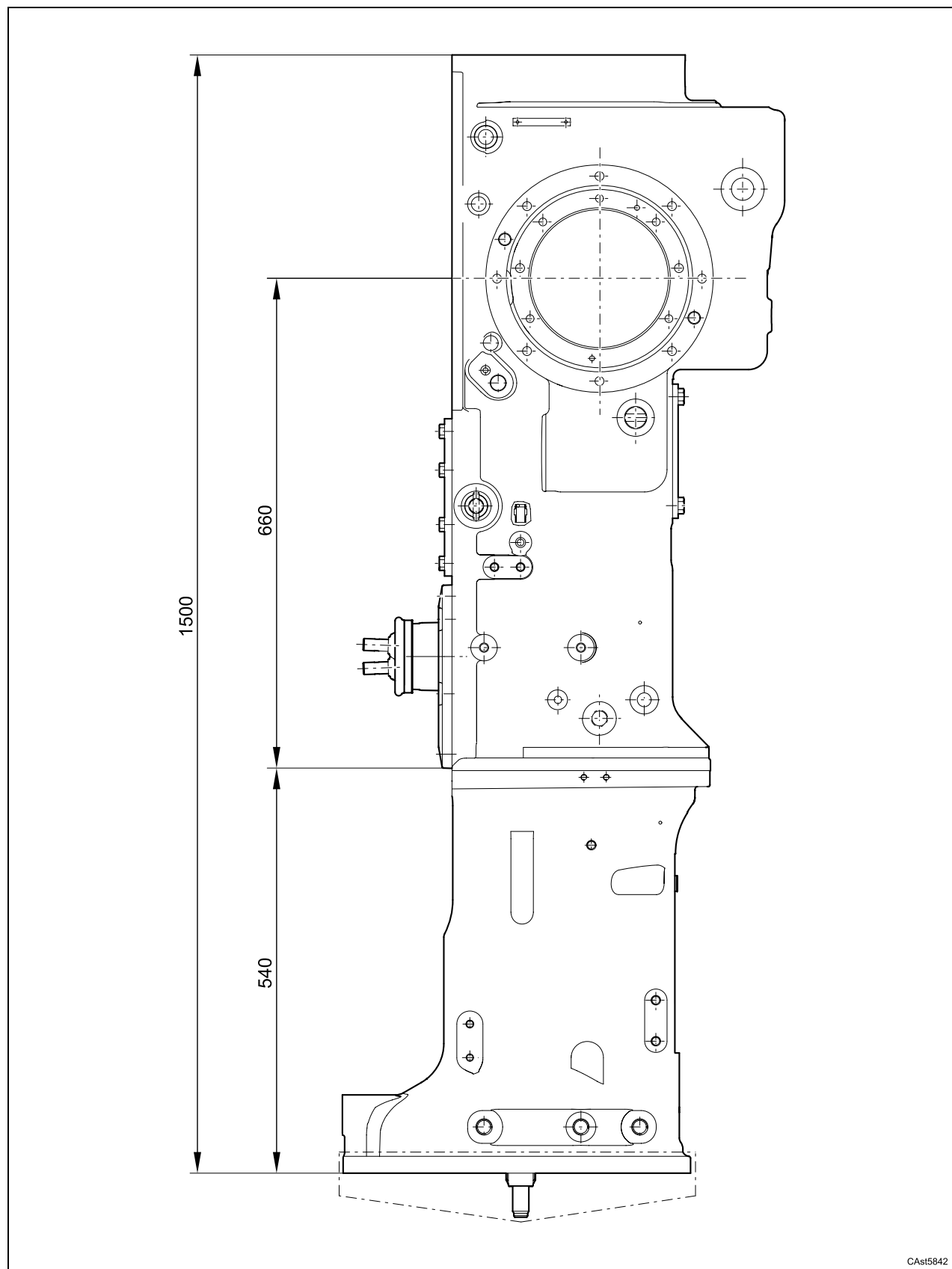
24 + 24 power shuttle and synchro splitter



# General Specifications

Main dimensions (millimeters)

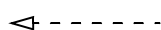
Left side view (see: main view)



# General Specifications

## TIGHTENING TORQUES, SEALANTS AND GREASE APPLICATION

### Adhesive / Sealant Application



Apply on the contact surfaces



Apply on bolts thread/on pins

### Gasket sealant

| Ref. | Presence | Adhesive make and type         | Technical characteristics                                 | Strength |
|------|----------|--------------------------------|-----------------------------------------------------------|----------|
|      | ●        | Loctite® 510<br>Superbond® 529 | Flat surface sealing                                      | High     |
|      | ○        | Loctite® 573<br>Superbond® 519 | Flat surface sealing                                      | Low      |
|      | ○        | Loctite® 518<br>Superbond® 539 | Uneven surface sealing                                    | High     |
|      | ●        | Loctite® 5205                  | Even surfaces sealing with possibility of micro-movements | High     |

### Thread parts sealant

| Ref. | Presence | Adhesive make and type             | Technical characteristics | Strength            |
|------|----------|------------------------------------|---------------------------|---------------------|
|      | ●        | Loctite® 542<br>Superbond® 321     | Locking of threaded parts | Medium              |
|      | ●        | Loctite® 270<br>Superbond® 331     | Locking of threaded parts | High                |
|      | ○        | Loctite® 986/AVX<br>Superbond® 438 | Locking of threaded parts | High, special appl. |

### Fixing parts sealant

| Ref. | Presence | Adhesive make and type                | Technical characteristics | Strength    |
|------|----------|---------------------------------------|---------------------------|-------------|
|      | ○        | Loctite® 405<br>Superbond® instant 25 | Fixing adhesive           | Medium bond |
|      | ●        | Loctite® 638<br>Superbond® 433        | Fixing adhesive           | Strong bond |
|      | ○        | Loctite® 542<br>Superbond® 321        | Fixing adhesive           | Medium bond |
|      | ○        | Loctite® 496<br>Superbond® SB14       | Rubber fixing adhesive    | Strong bond |

### Grease application in assembly

Tecnolube®  
POLYMER 400

Apply on the indicated surfaces

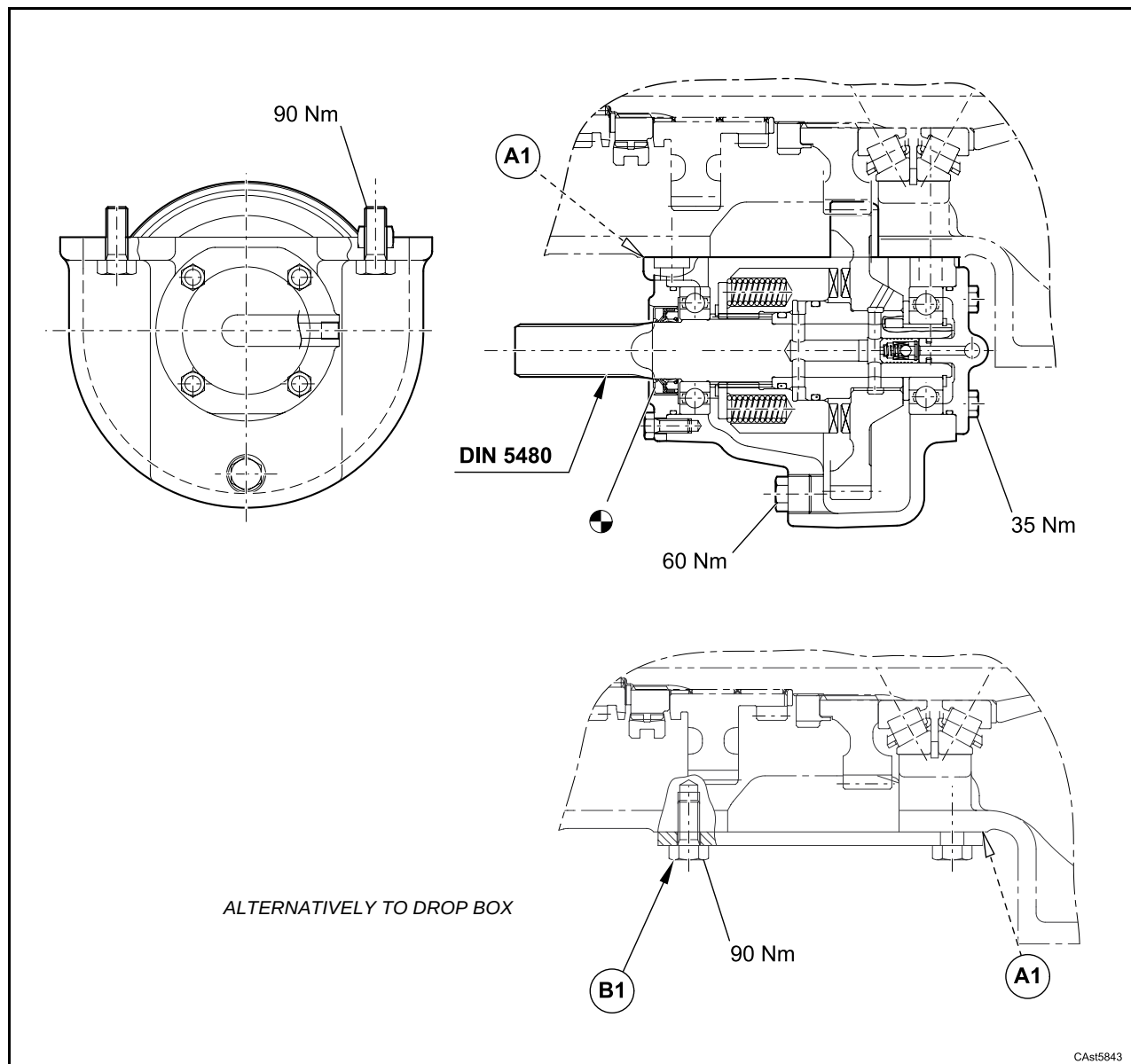


AGIP®  
MU/EP2

Fill / Apply in excess

# General Specifications

## Drop box



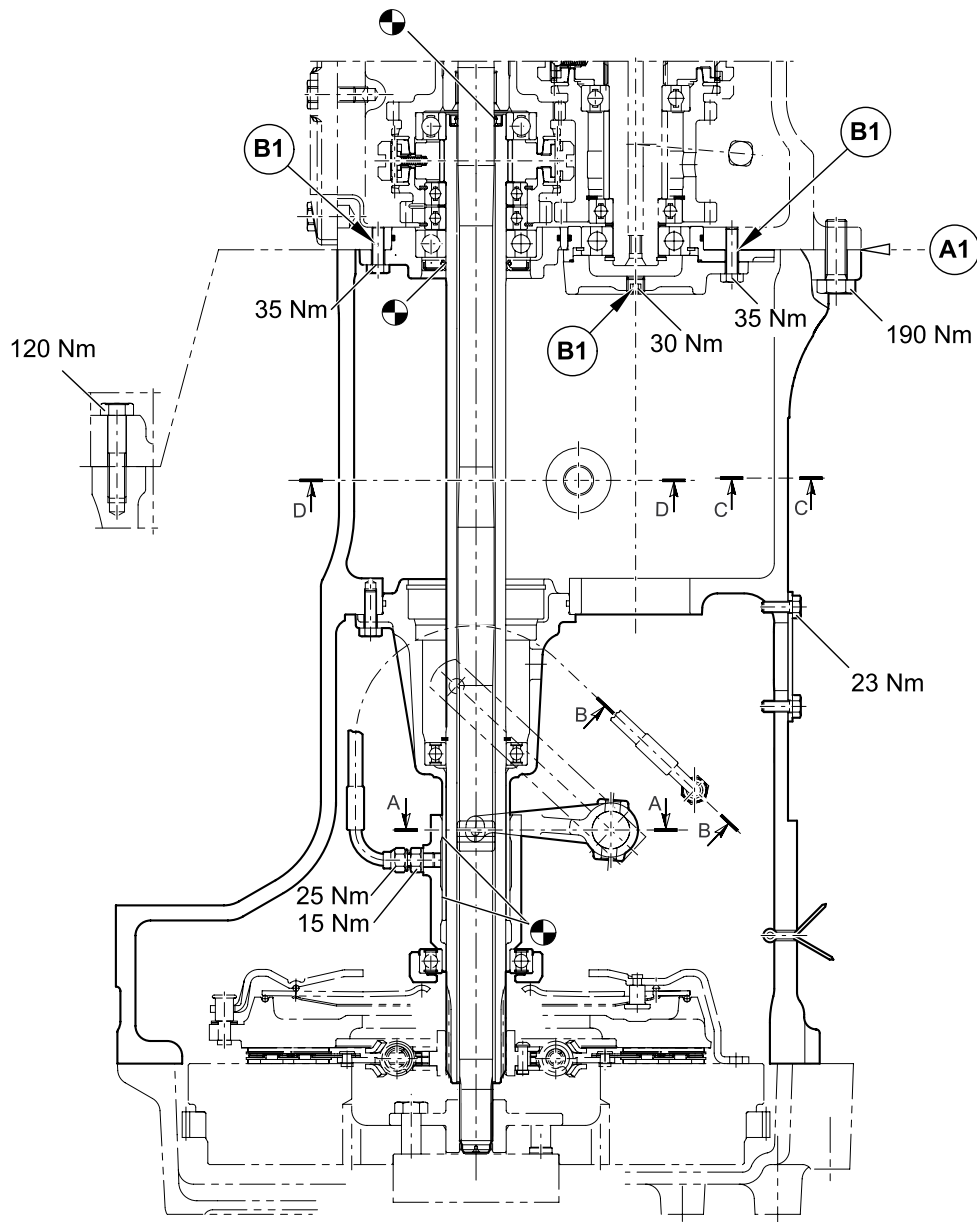


## General Specifications

### Front gear box

8+8 SYNCHRO SHUTTLE

12+12 SYNCHRO SHUTTLE



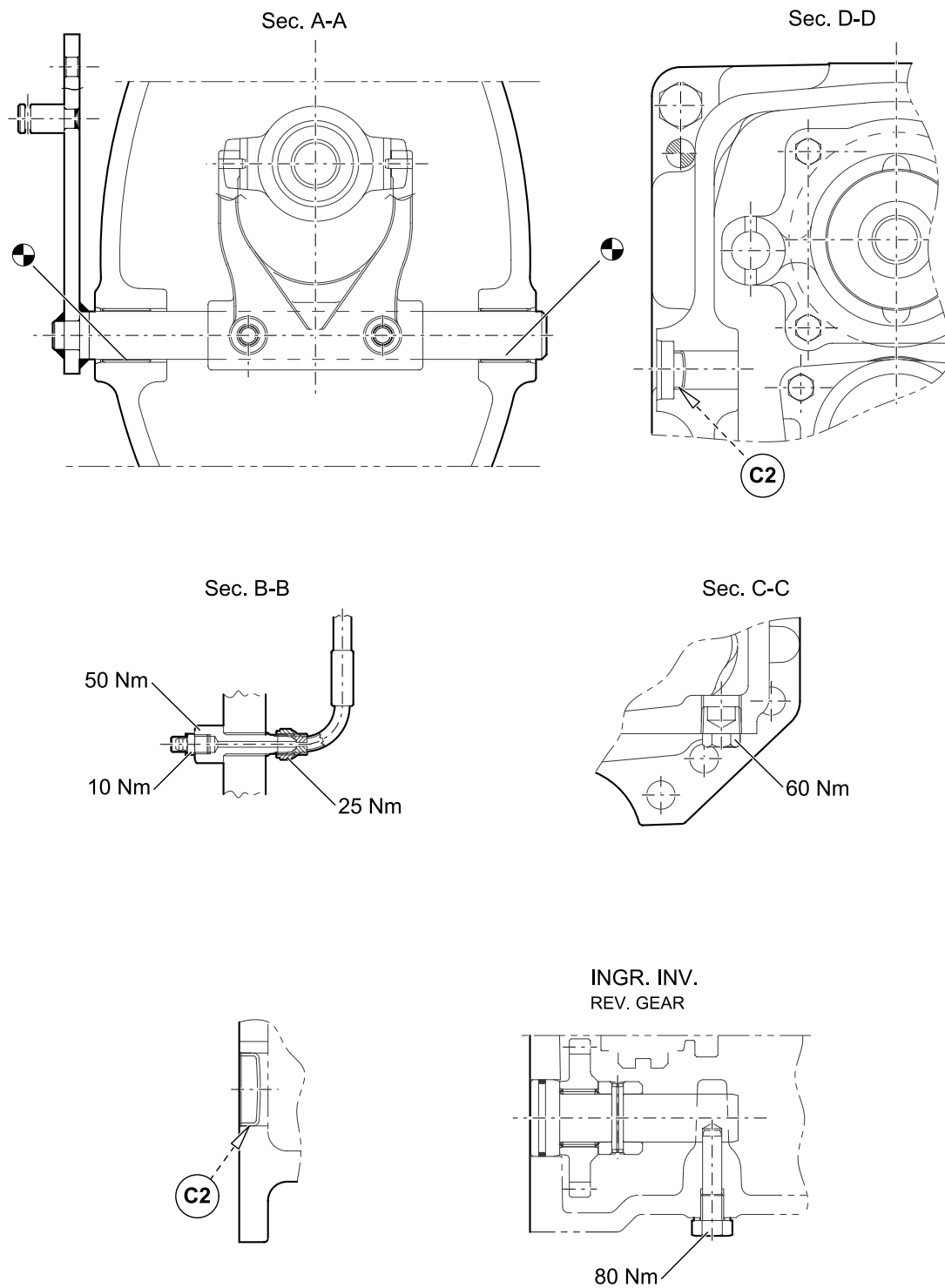
CAst6936

# General Specifications

## Details

8+8 SYNCHRO SHUTTLE

12+12 SYNCHRO SHUTTLE

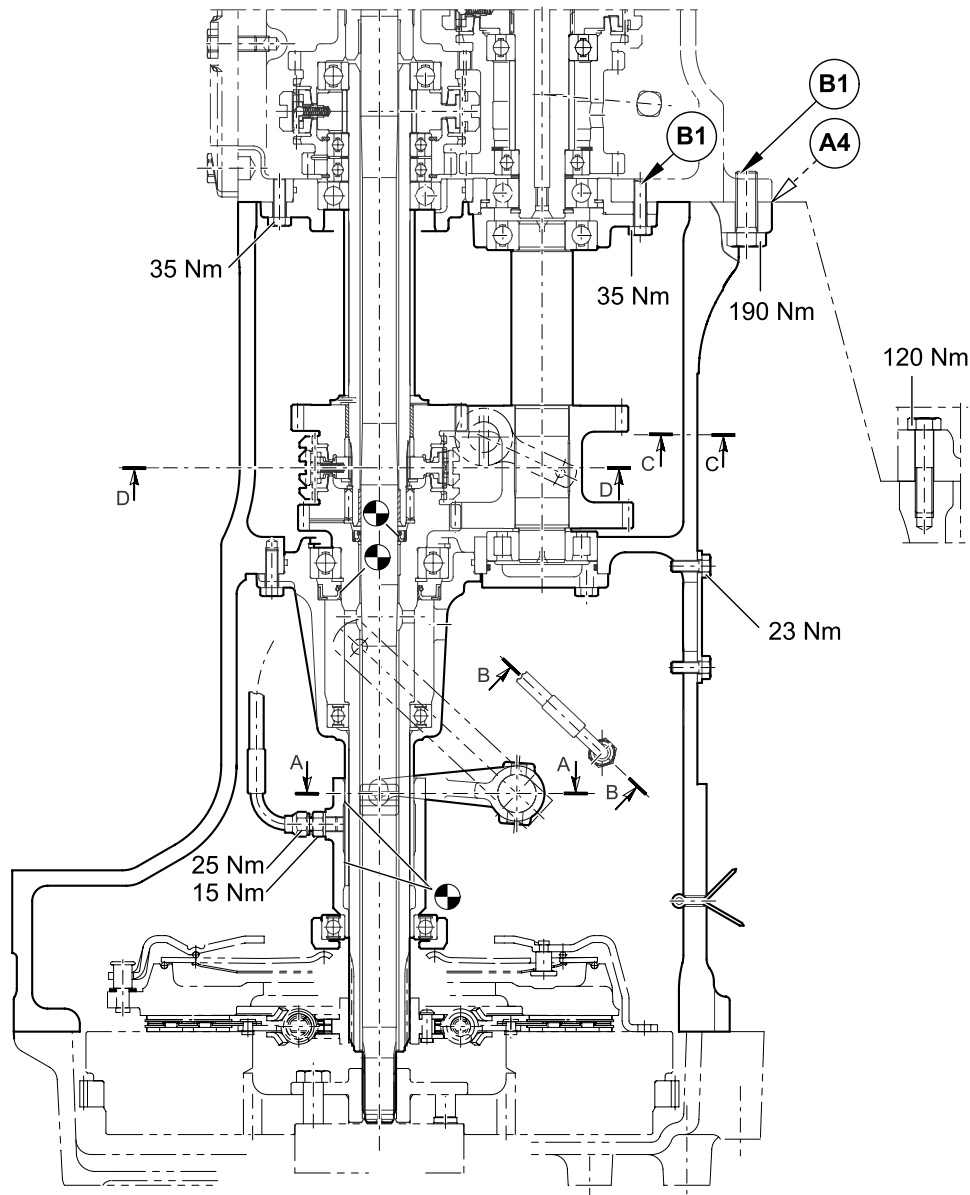


CAst6937

## General Specifications

### Front gear box

#### 24+24 SYNCHRO SHUTTLE AND SYNCHRO SPLITTER



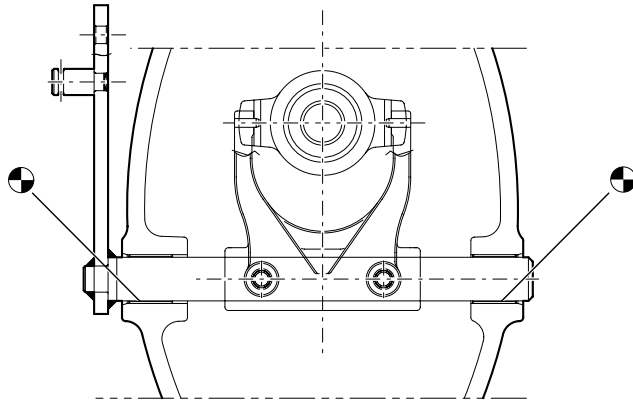
CAst6938

# General Specifications

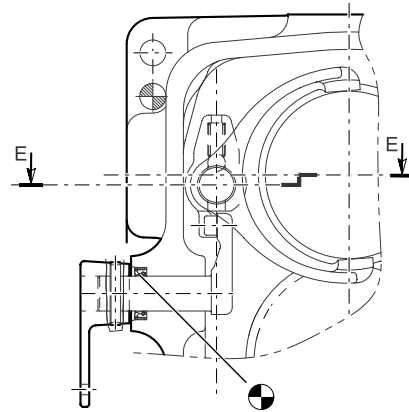
## Details

### 24+24 SYNCHRO SHUTTLE AND SYNCHRO SPLITTER

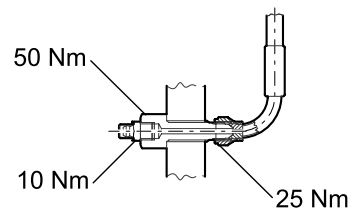
Sec. A-A



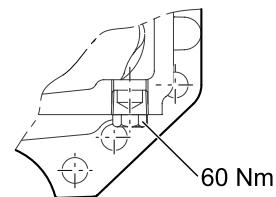
Sec. D-D



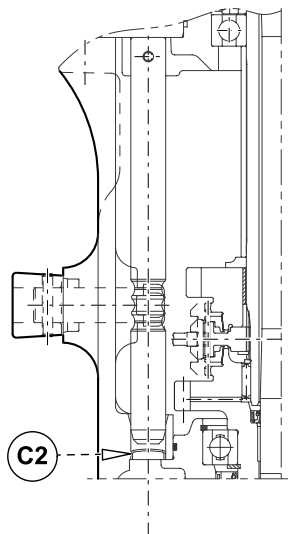
Sec. B-B



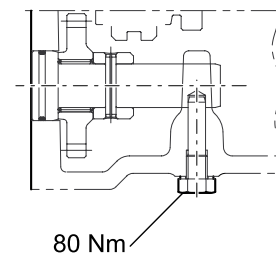
Sec. C-C



Sec. E-E



INGR. INV.  
REV. GEAR

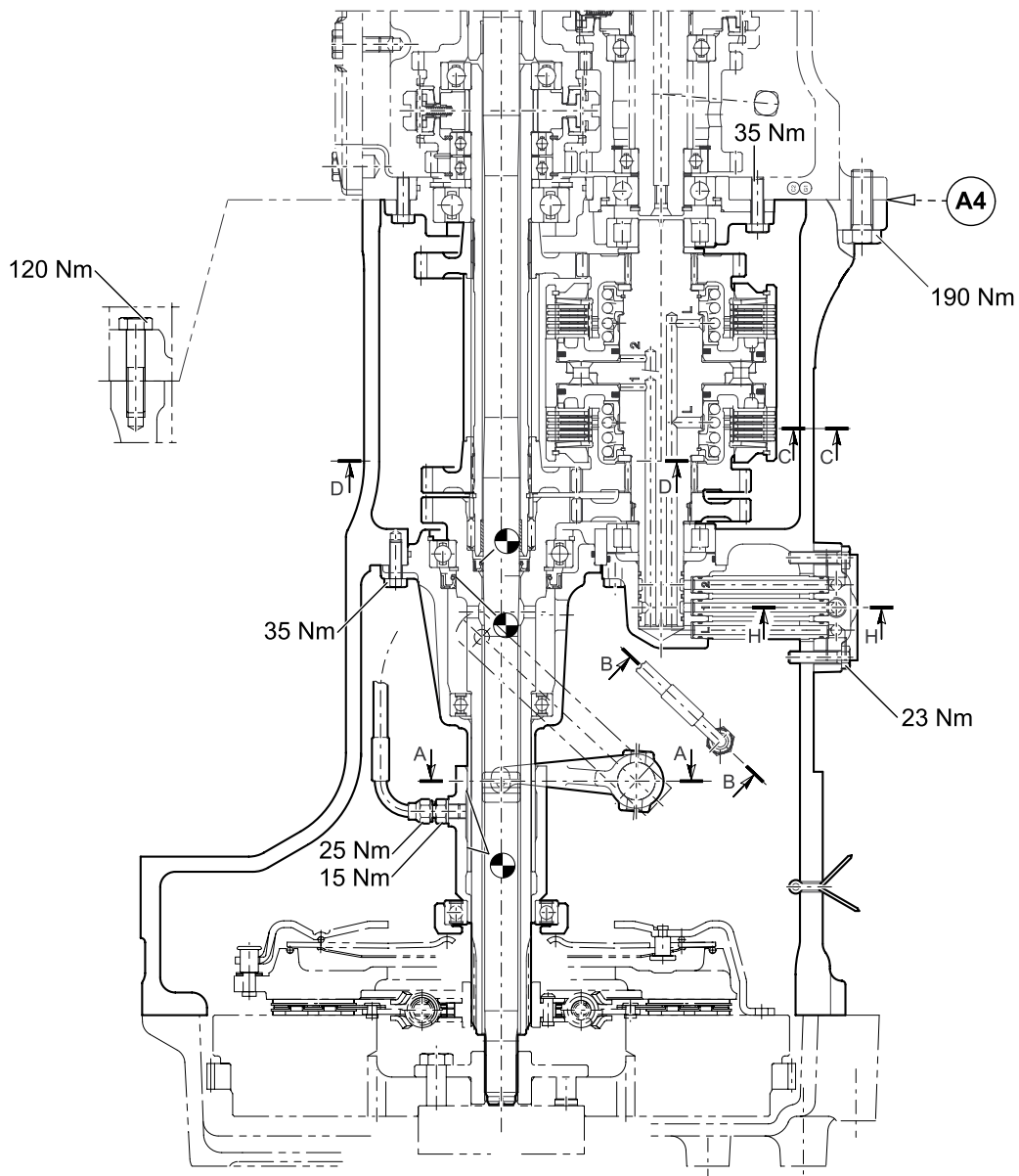


CAst6939

## General Specifications

### Front gear box

24+24 SYNCHRO SHUTTLE AND POWER SPLITTER

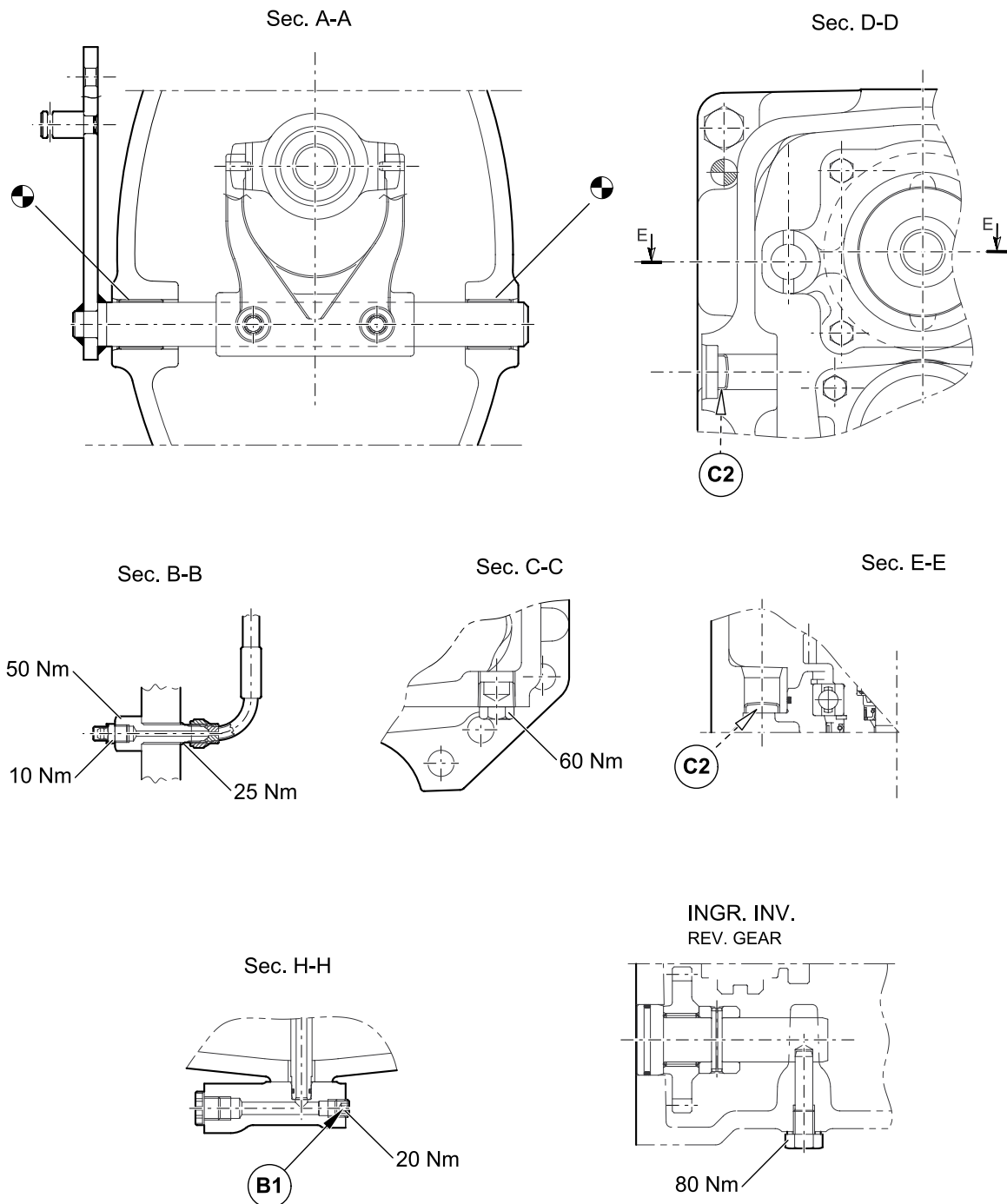


CAst6940

# General Specifications

## Details

### 24+24 SYNCHRO SHUTTLE AND POWER SPLITTER

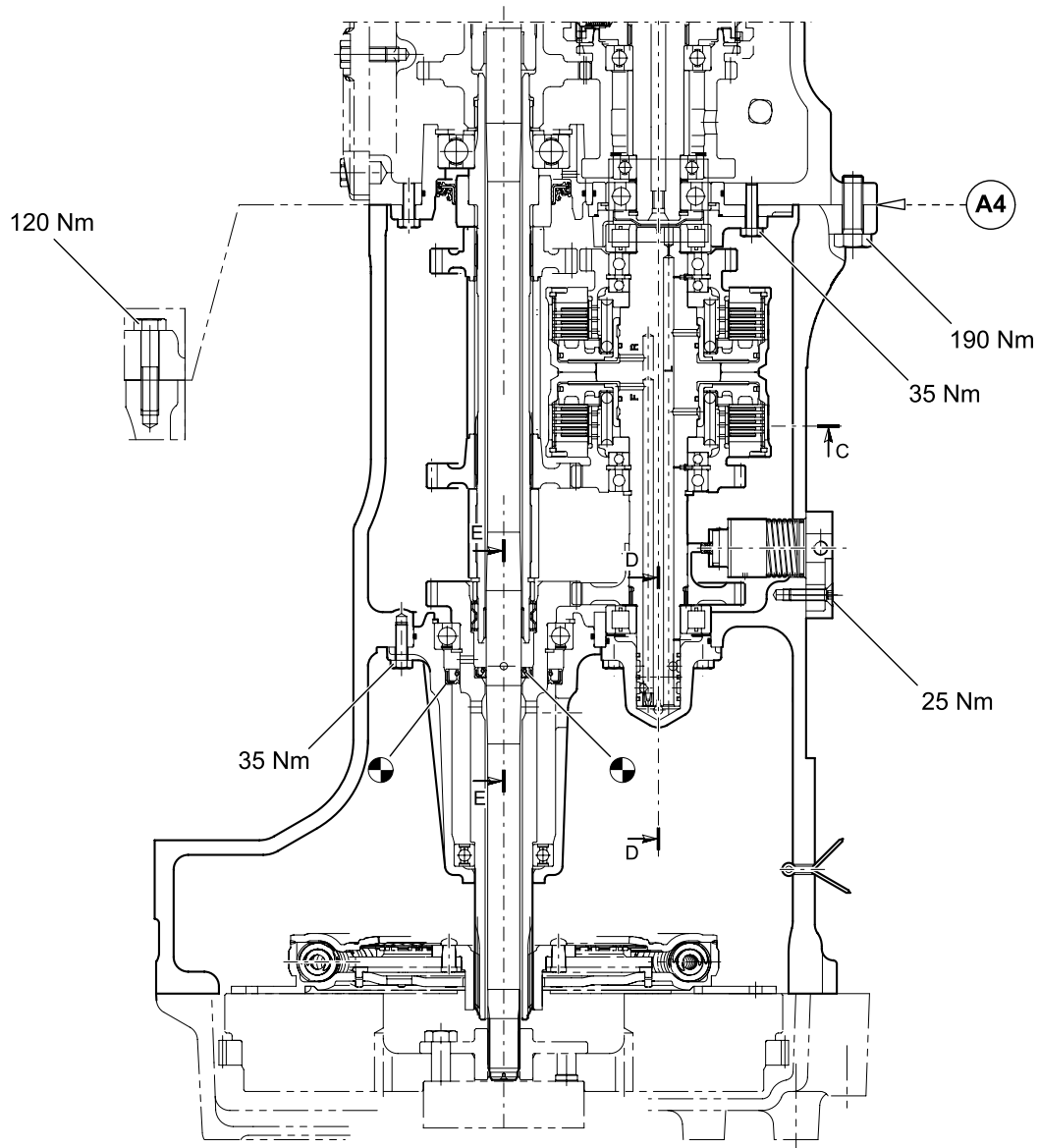


CAst6941

## General Specifications

### Front gear box

12+12 POWER SHUTTLE



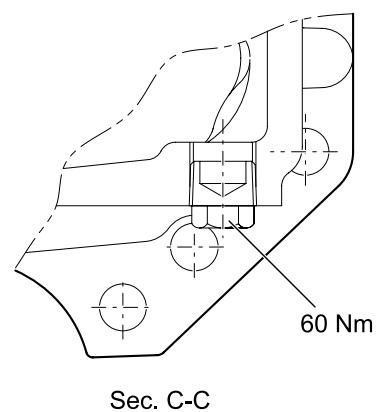
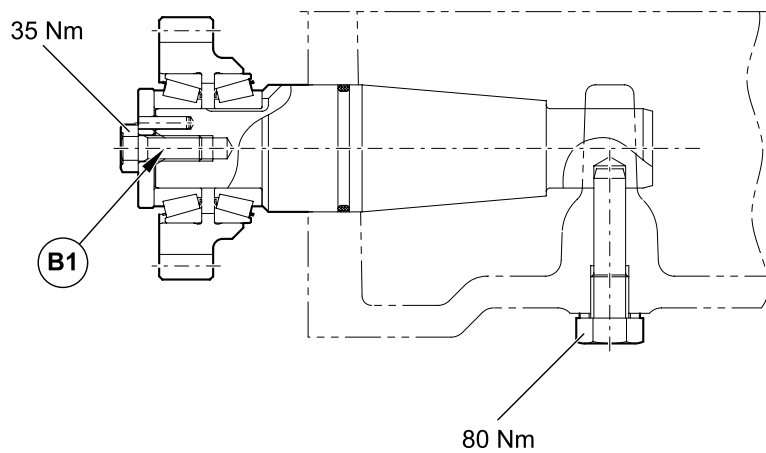
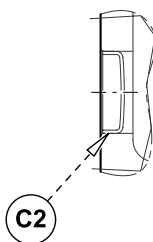
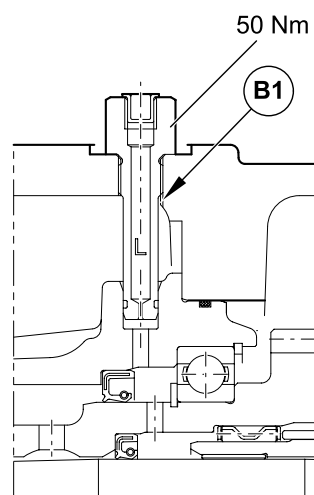
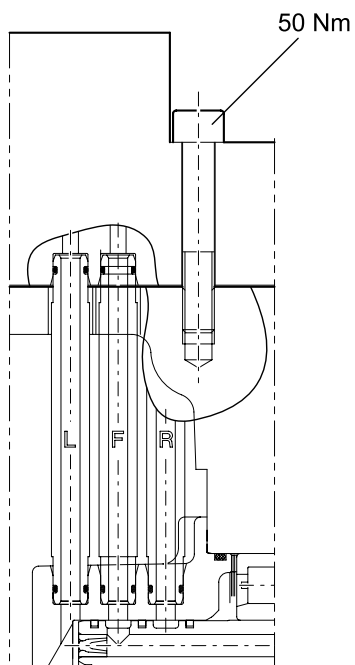
CAst5844



# General Specifications

## Details

### 12+12 POWER SHUTTLE

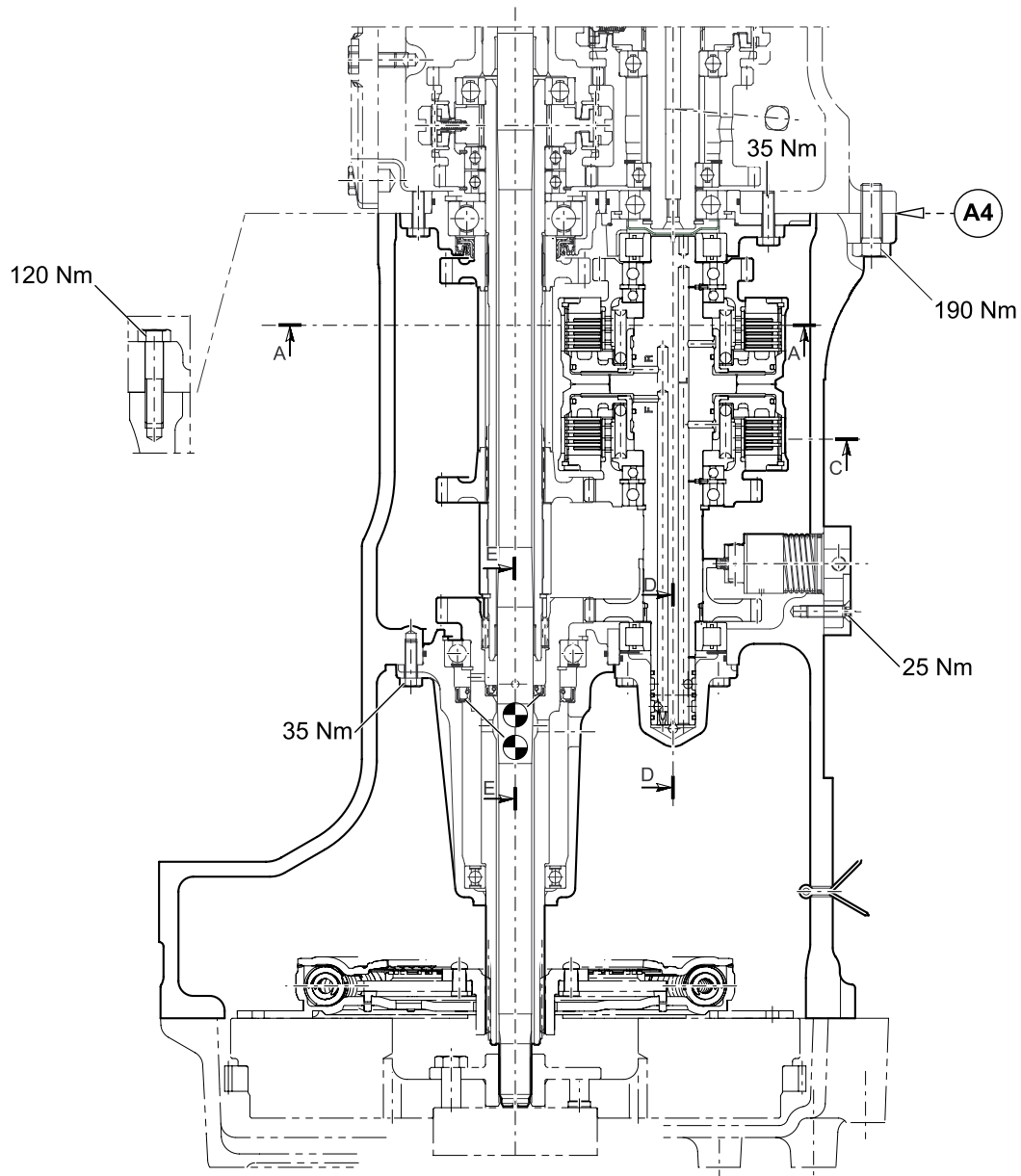


CAst5845

## General Specifications

### Front gear box

24+24 POWER SHUTTLE AND SYNCHRO SPLITTER



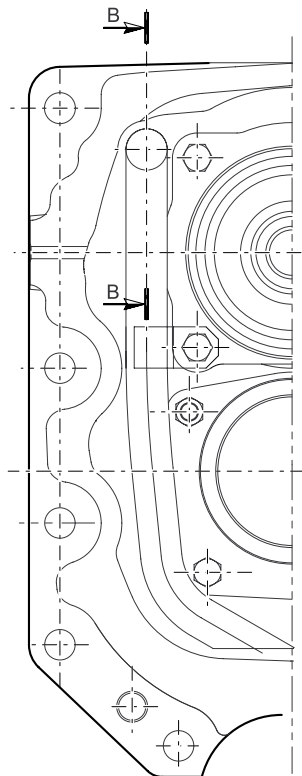
CAst6942

# General Specifications

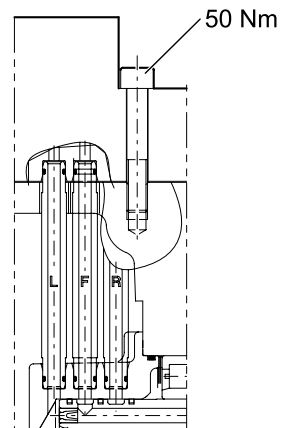
## Details

### 24+24 POWER SHUTTLE AND SYNCHRO SPLITTER

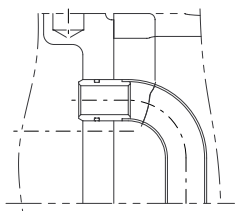
Sec. A-A



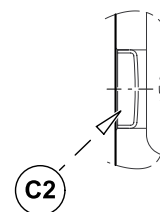
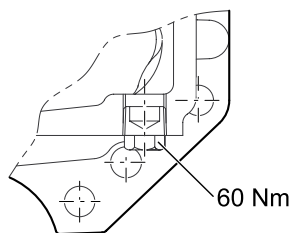
Sec. D-D



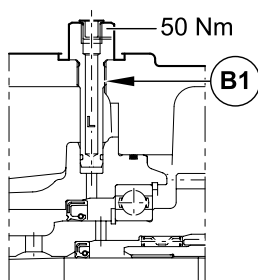
Sec. B-B



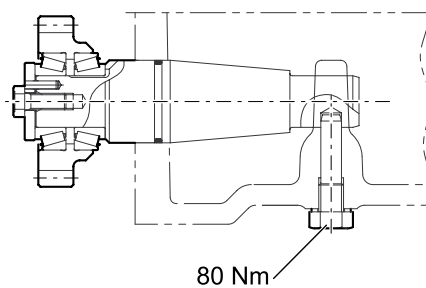
Sec. C-C



Sec. E-E



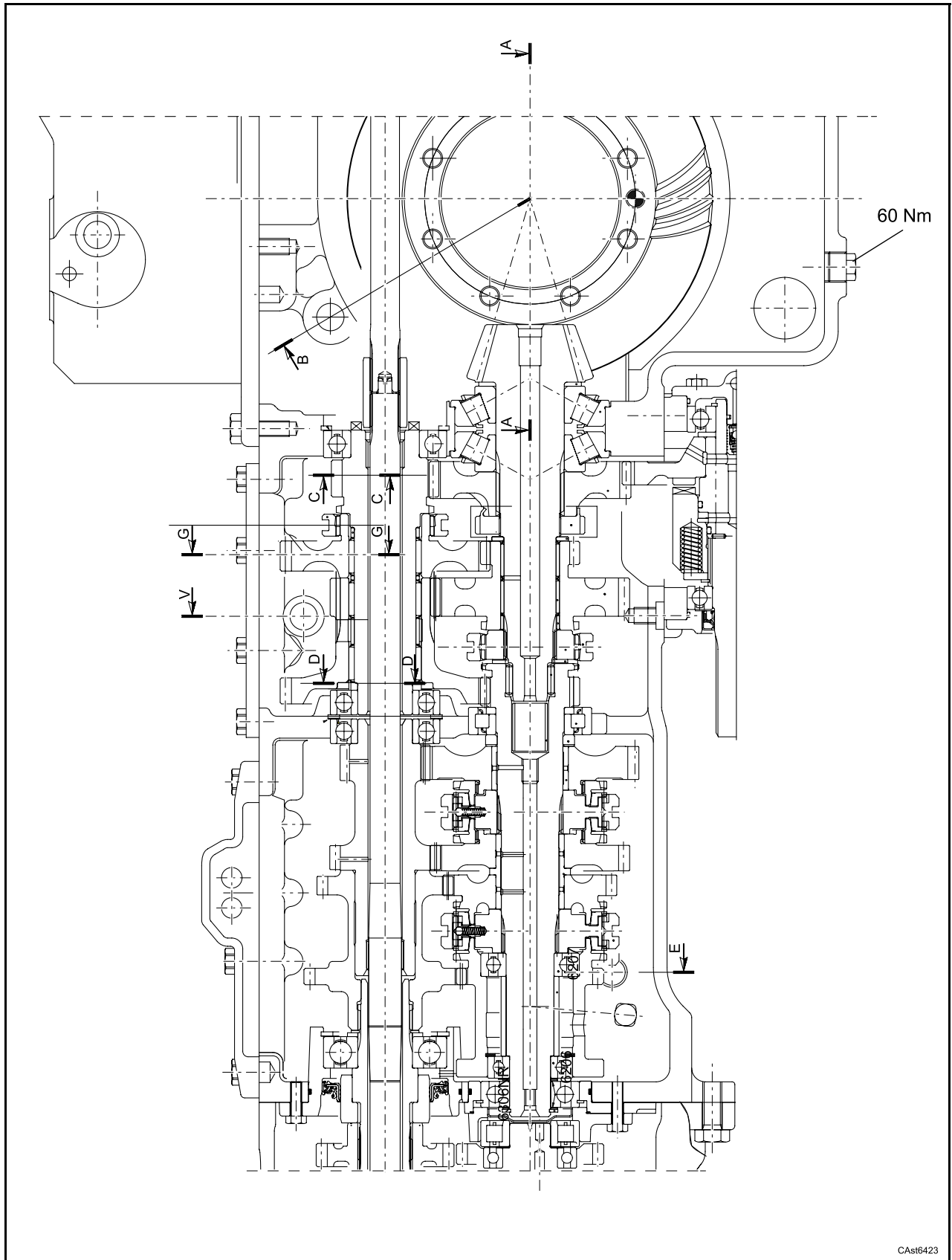
INGR. INV.  
REV. GEAR



CAst6943

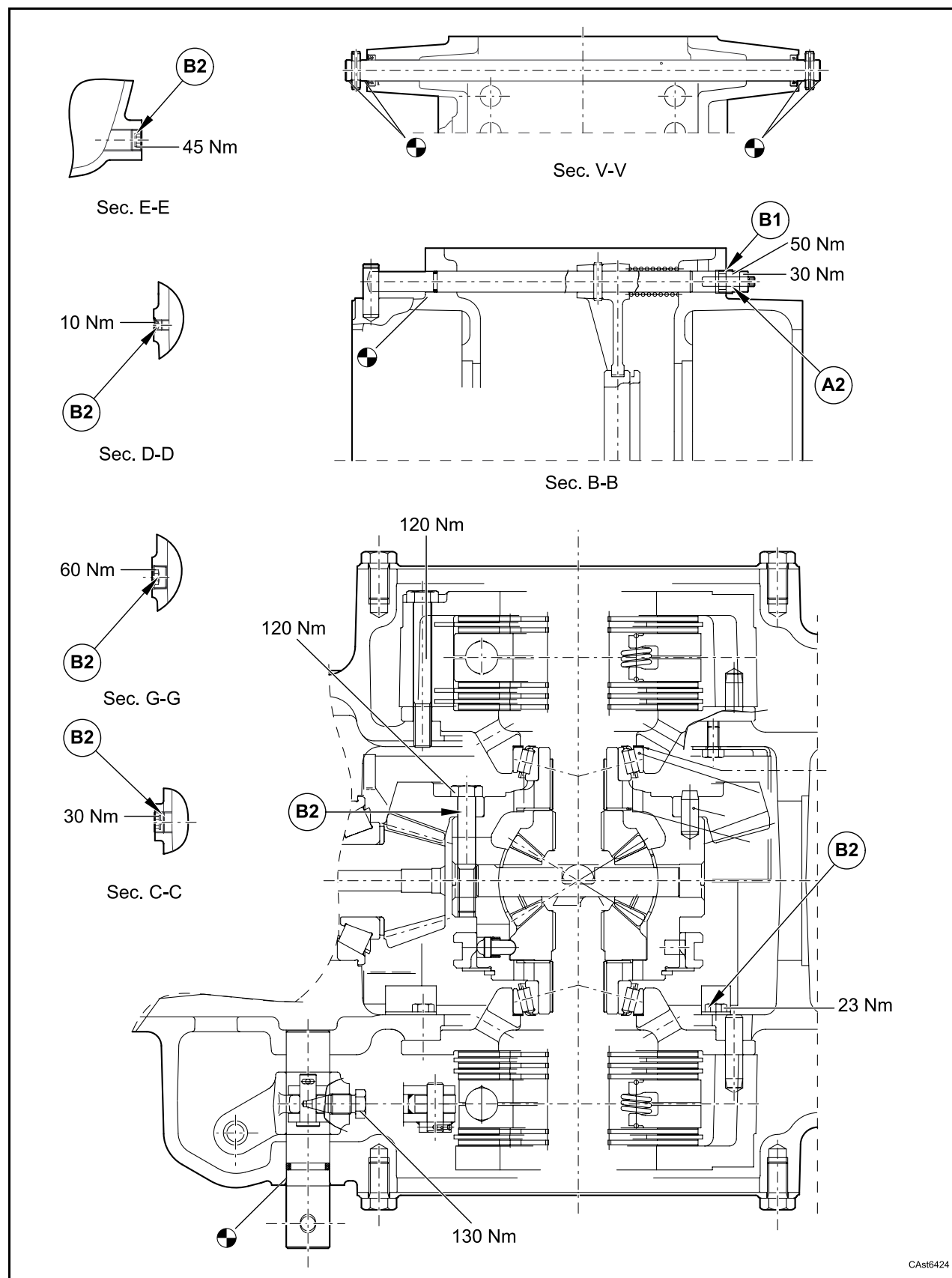
## General Specifications

### Gear box group



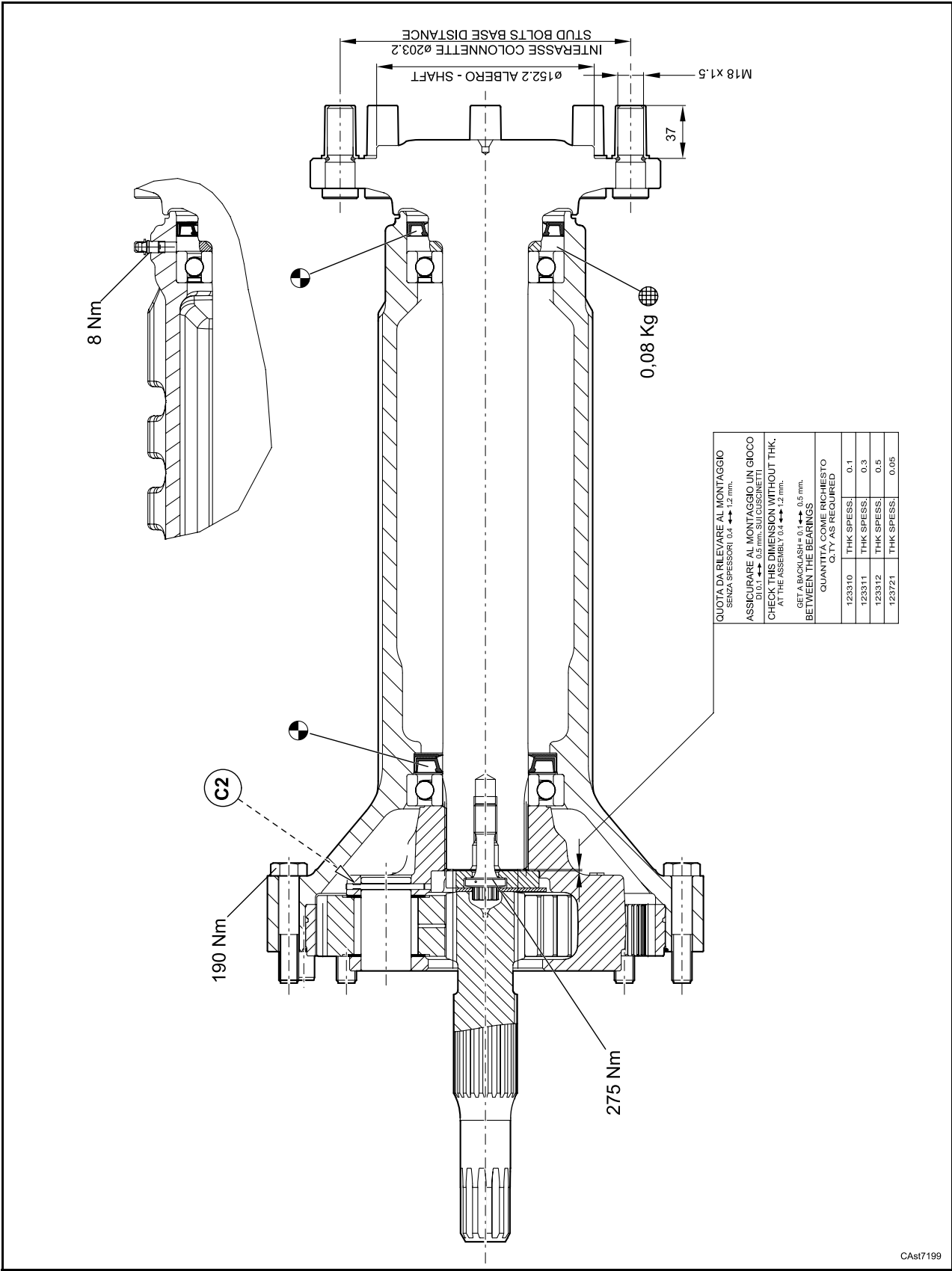
# General Specifications

## Gear box details



# General Specifications

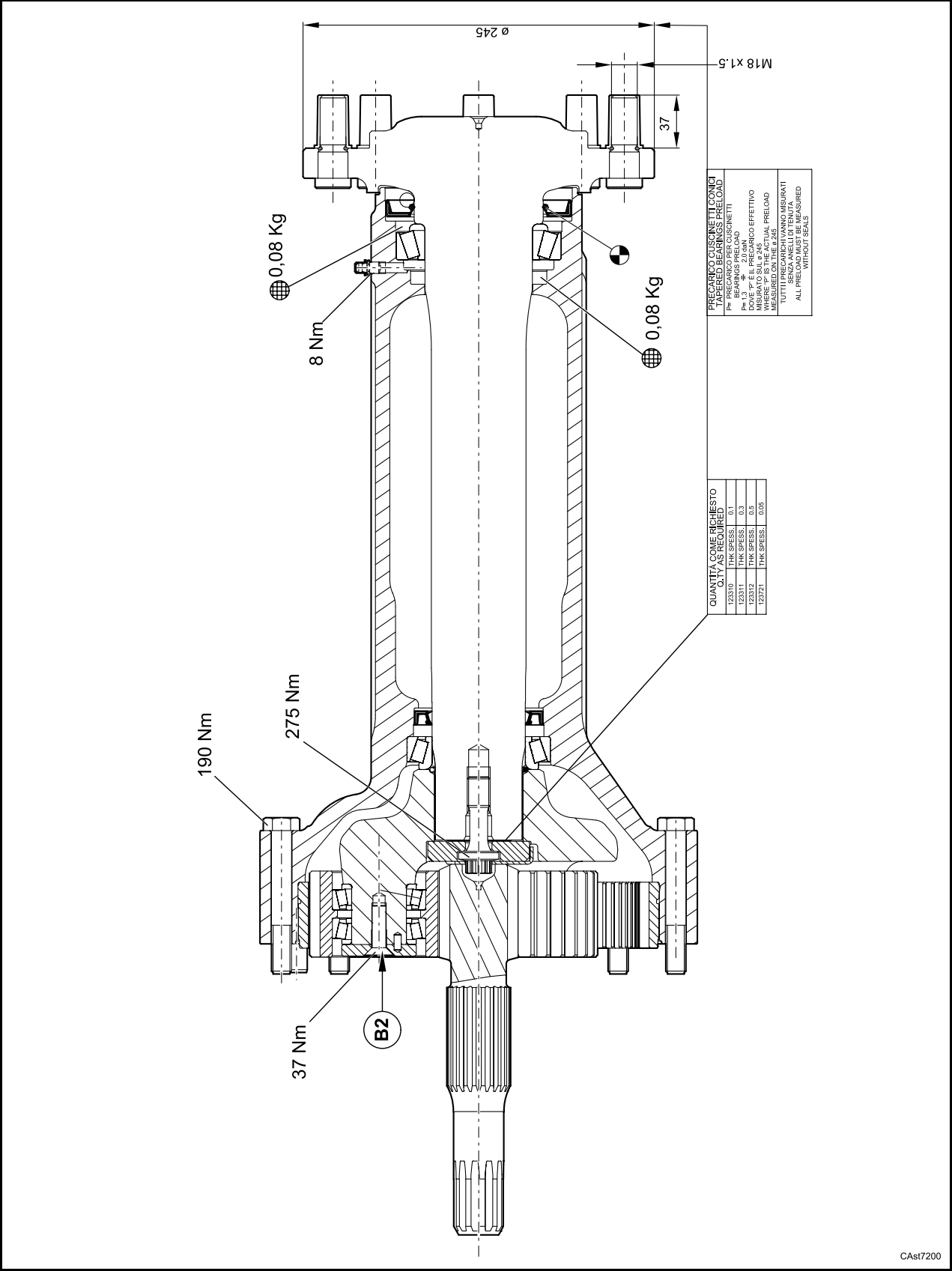
Final drive group (from 55 to 75 HP)



CAst7199

# General Specifications

Final drive group (85 HP)

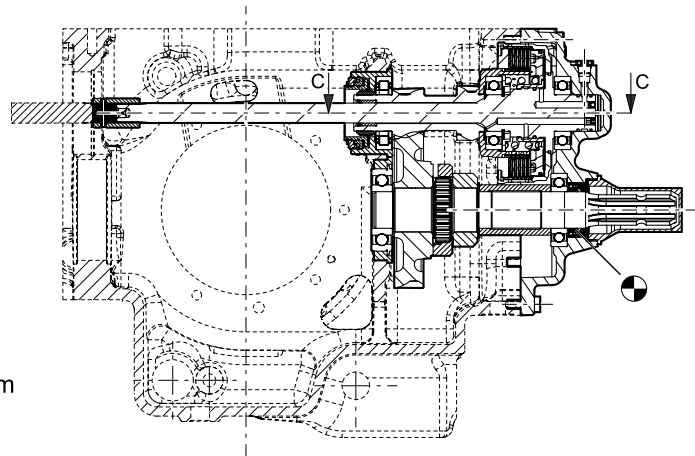
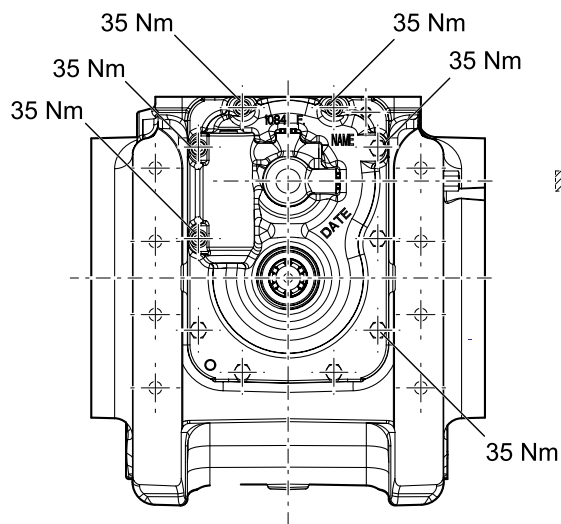


CAst7200

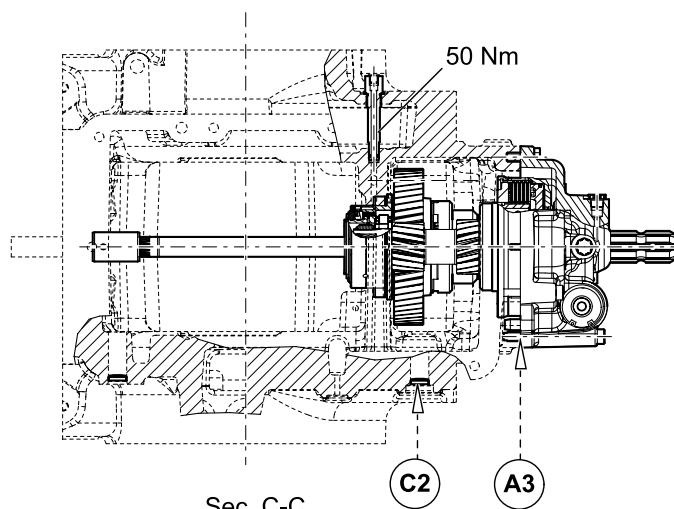


## General Specifications

### PTO shaft assy (540)



Sec. B-B

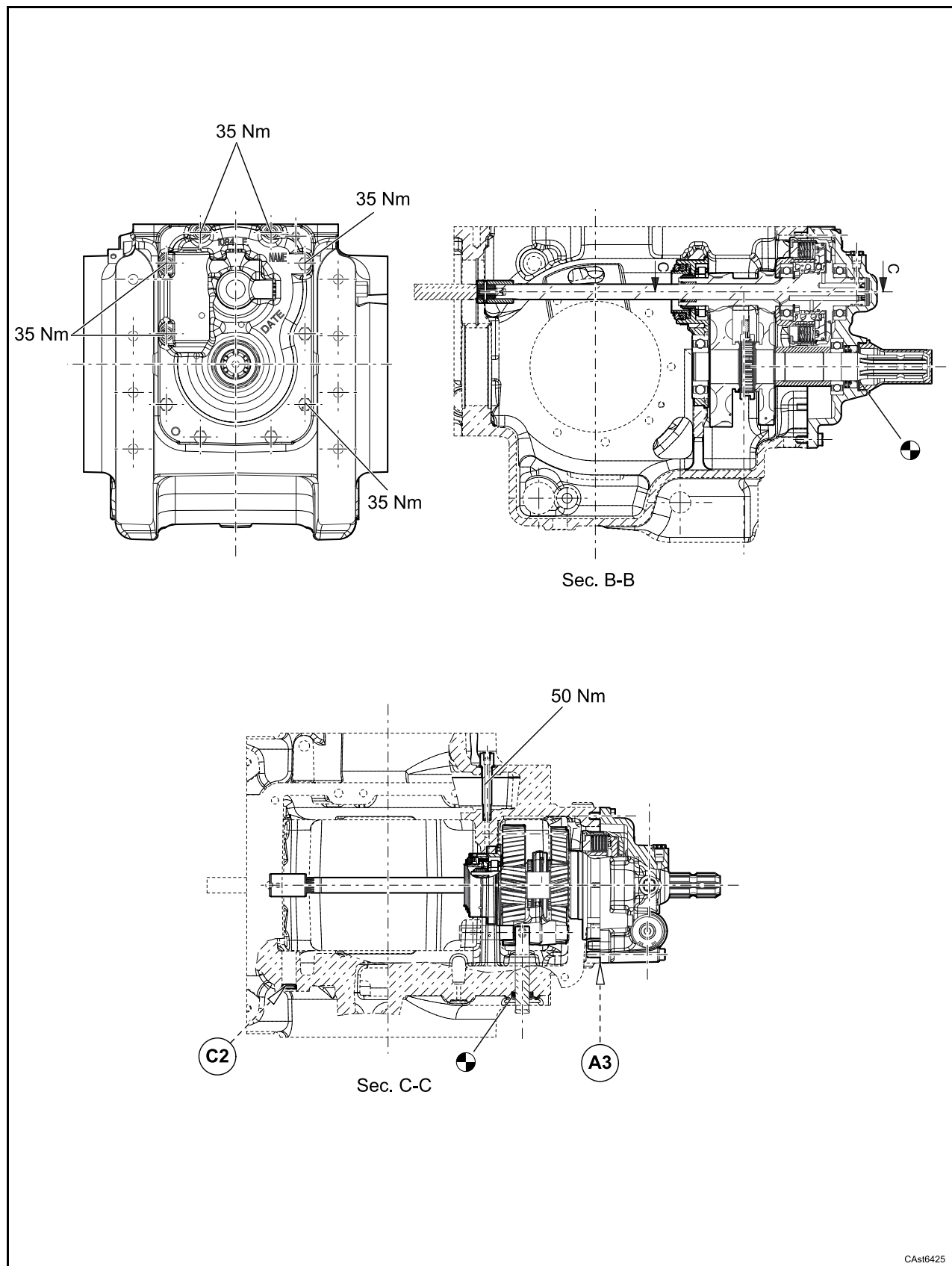


Sec. C-C

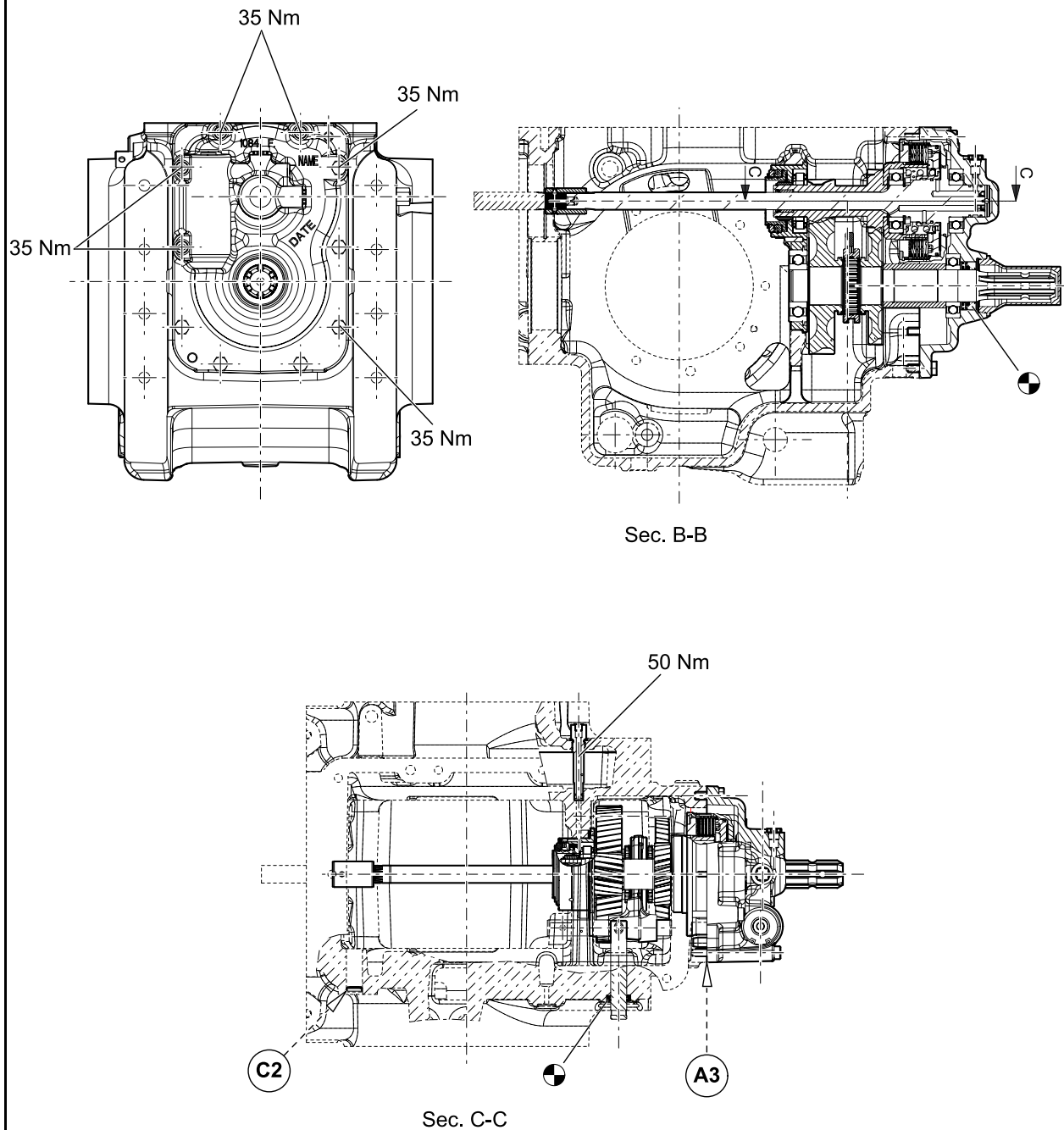
CAst5847

# General Specifications

## PTO shaft assy (540-540E)



PTO shaft assy (540-1000)

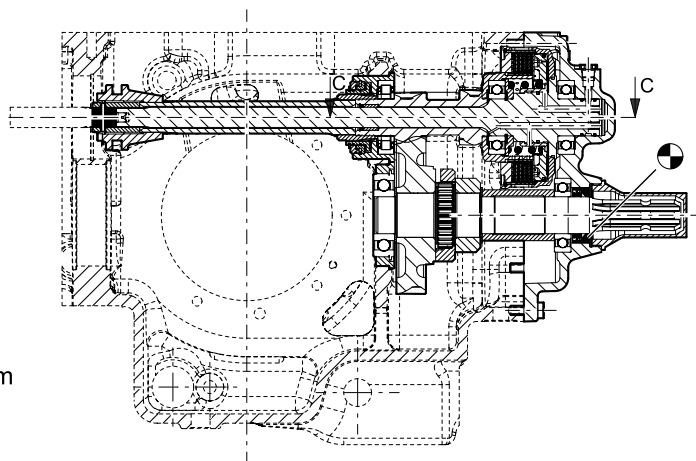
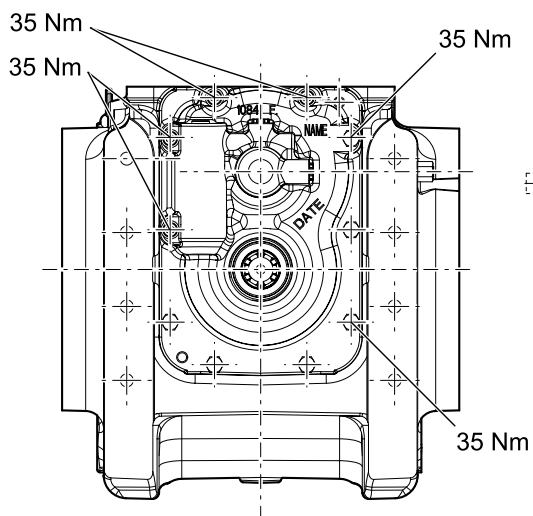


CAst6426

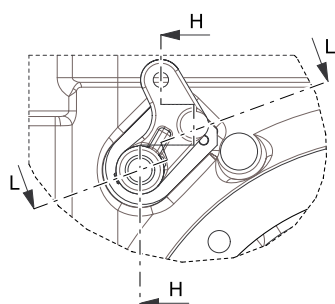
# General Specifications

## GD-PTO and PTO shaft assy (540)

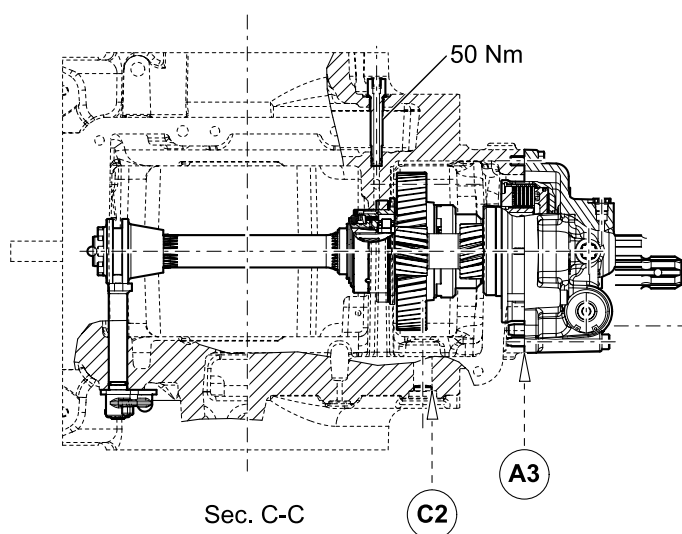
NOT AVAILABLE FOR VERSION 8+8



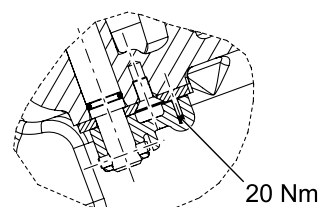
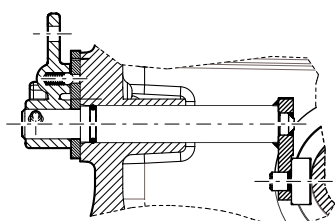
Sec. B-B



Sec. H-H



Sec. C-C



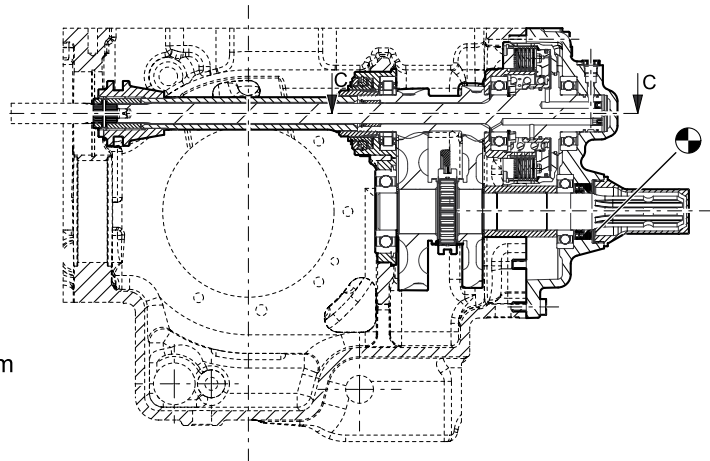
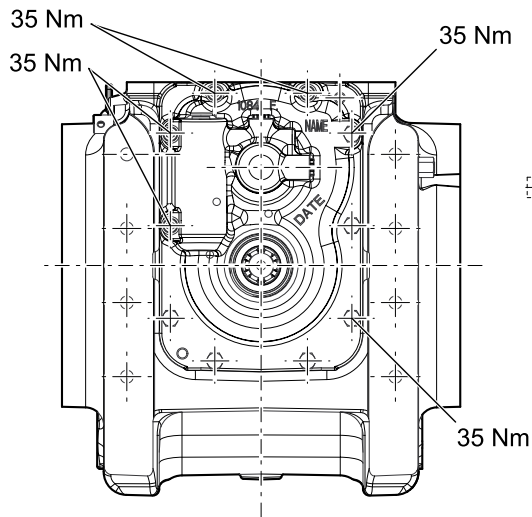
Sec. L-L

CAst7007

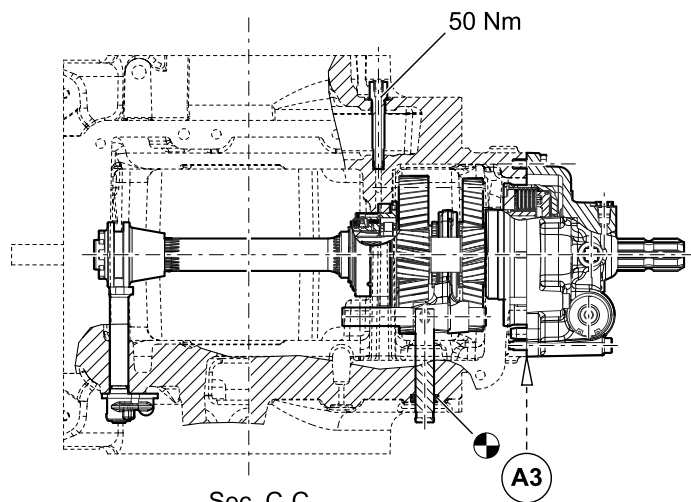
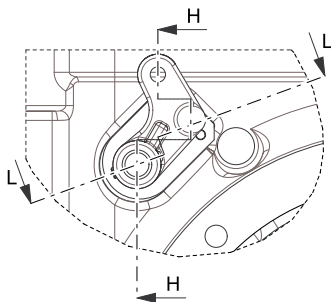
## General Specifications

### GD-PTO and PTO shaft assy (540-540E)

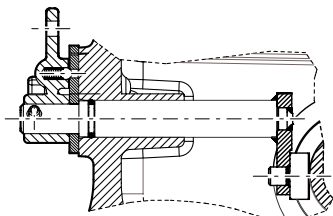
NOT AVAILABLE FOR VERSION 8+8



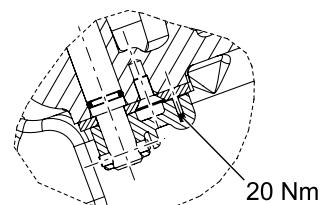
Sec. B-B



Sec. C-C



Sec. H-H



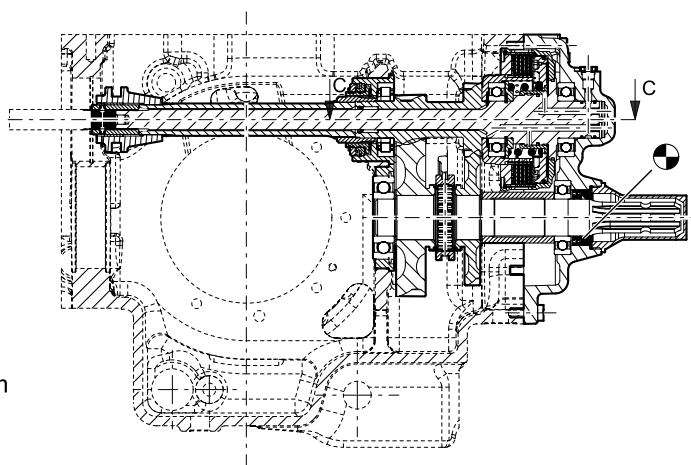
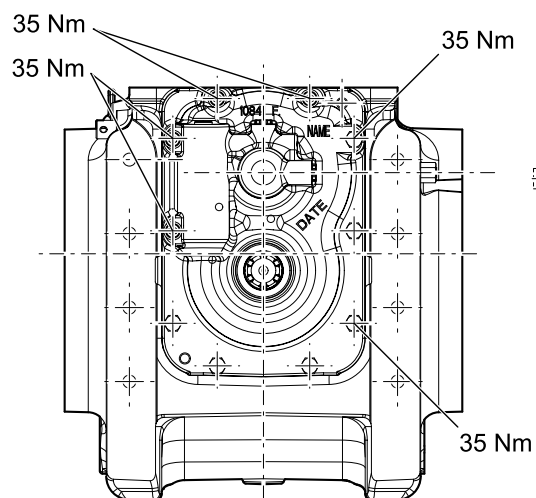
Sec. L-L

CAst7006

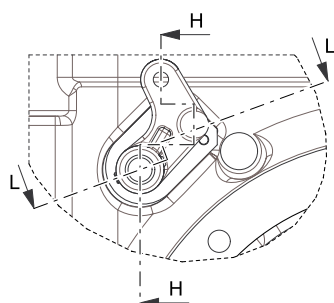
# General Specifications

## GD-PTO and PTO shaft assy (540-1000)

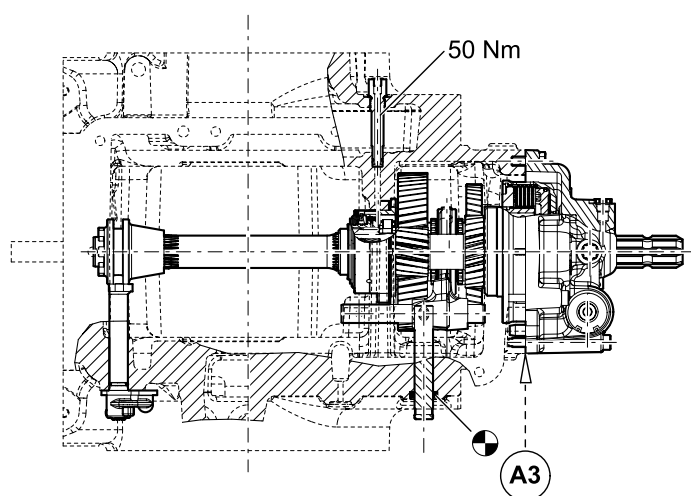
NOT AVAILABLE FOR VERSION 8+8



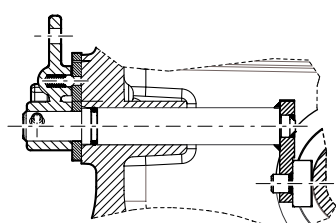
Sec. B-B



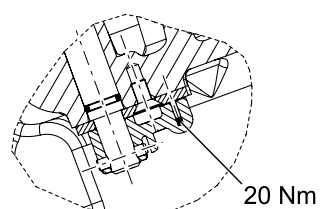
Sec. H-H



Sec. C-C



Sec. H-H

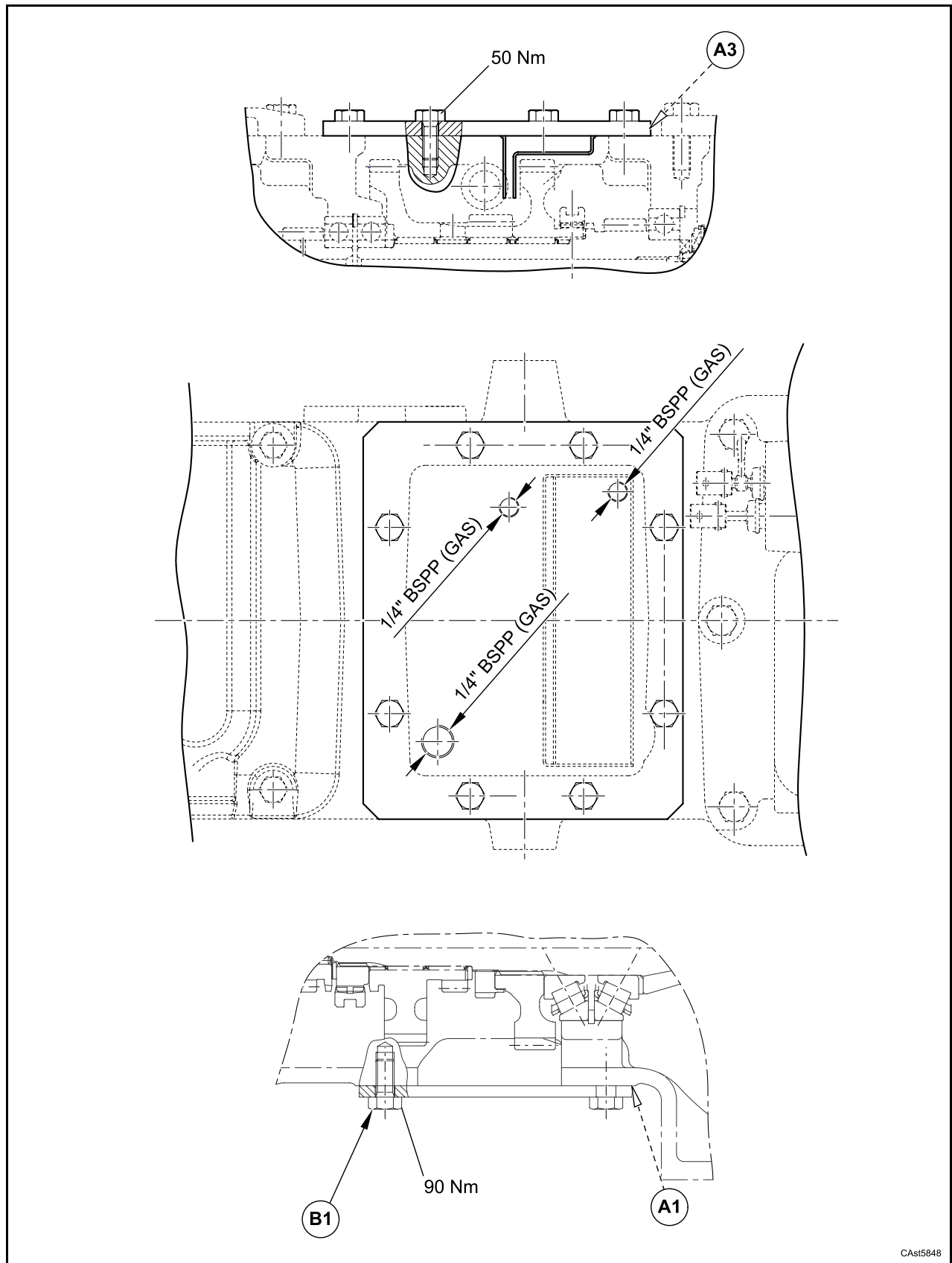


Sec. L-L

CAst7008

## General Specifications

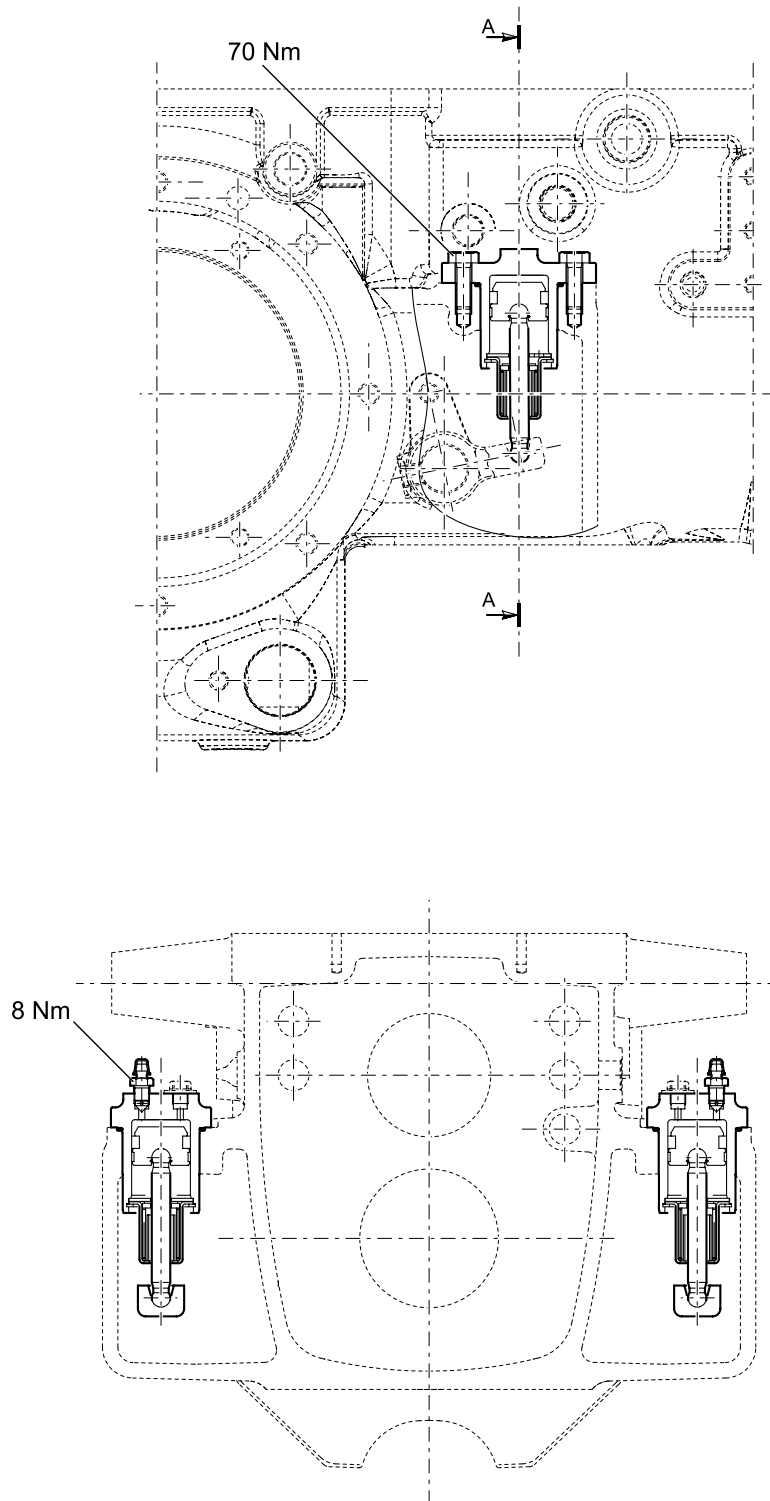
### Upper and lower cover





# General Specifications

## Brake control assy

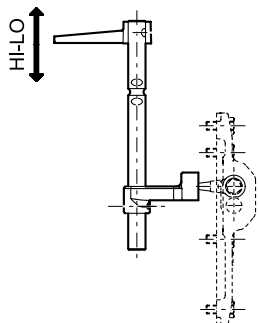


CAst5849

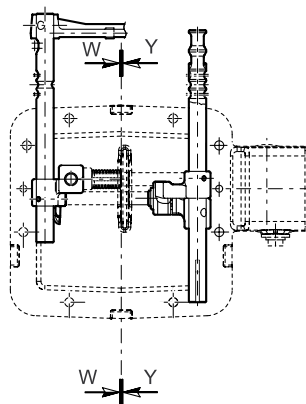
# General Specifications

## Inner speed lever assy

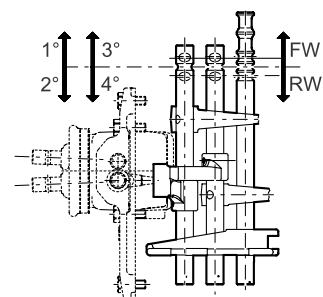
8+8 SYNCHRO SHUTTLE



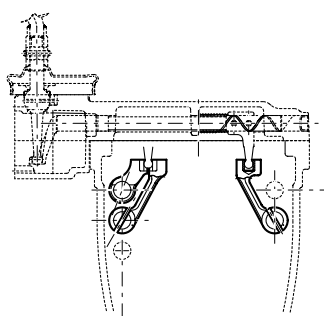
SEC. Y-Y



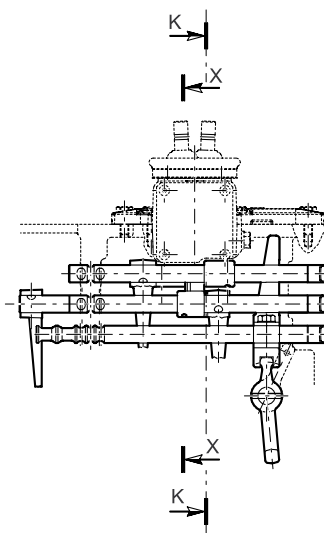
VIEW FROM C



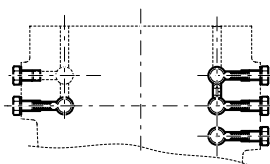
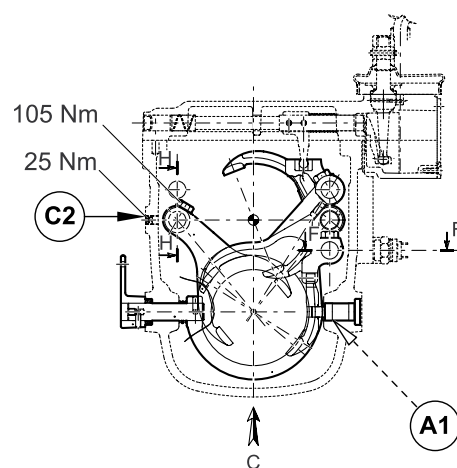
SEC. W-W



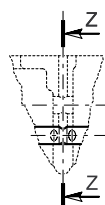
SEC. X-X



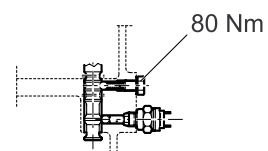
SEC. K-K



SEC. Z-Z



SEC. H-H



SEC. F-F

CAst6964

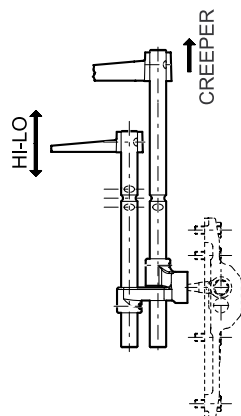
# General Specifications

## Inner speed lever assy

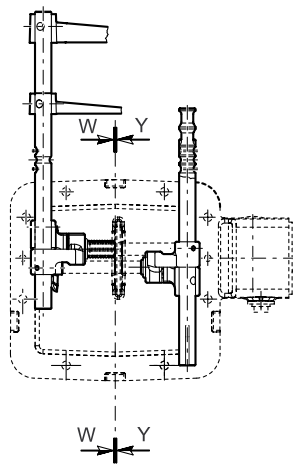
12+12 SYNCHRO SHUTTLE

24+24 SYNCHRO SHUTTLE AND SYNCHRO SPLITTER

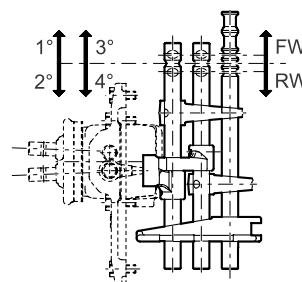
24+24 SYNCHRO SHUTTLE AND POWER SPLITTER



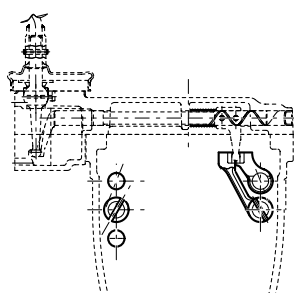
SEC. Y-Y



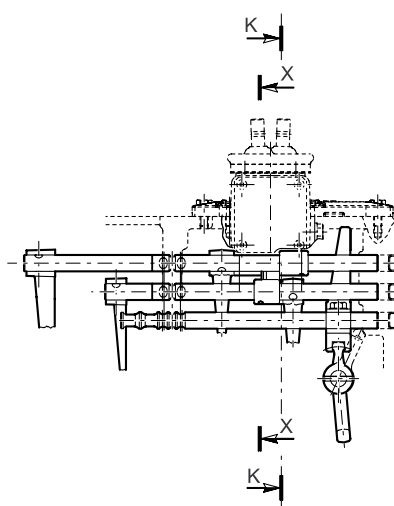
VIEW FROM C



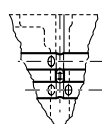
SEC. W-W



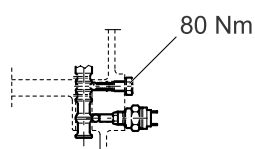
SEC. X-X



SEC. K-K



SEC. H-H



SEC. F-F

CAst6965

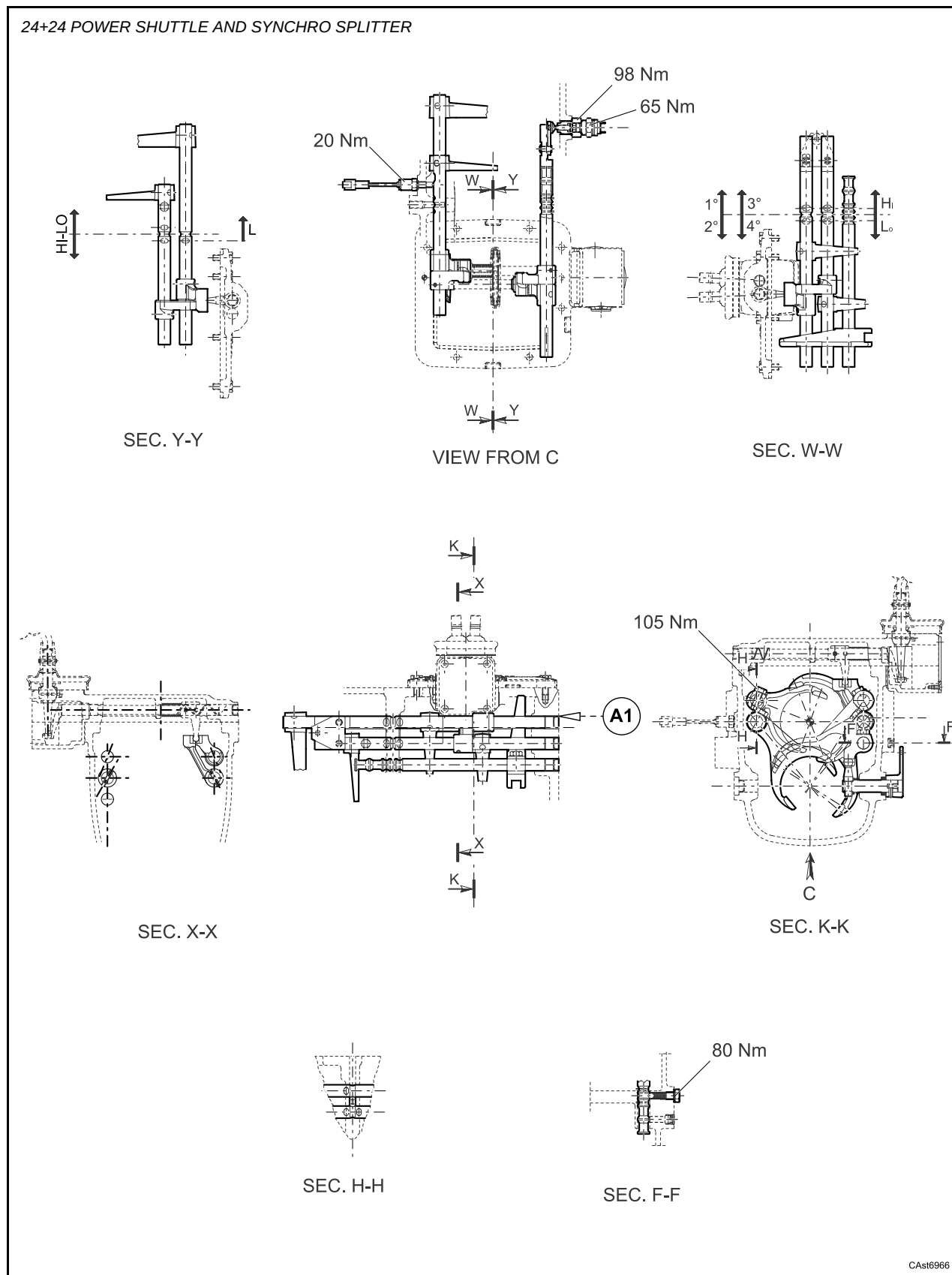
### Inner speed lever assy



# General Specifications

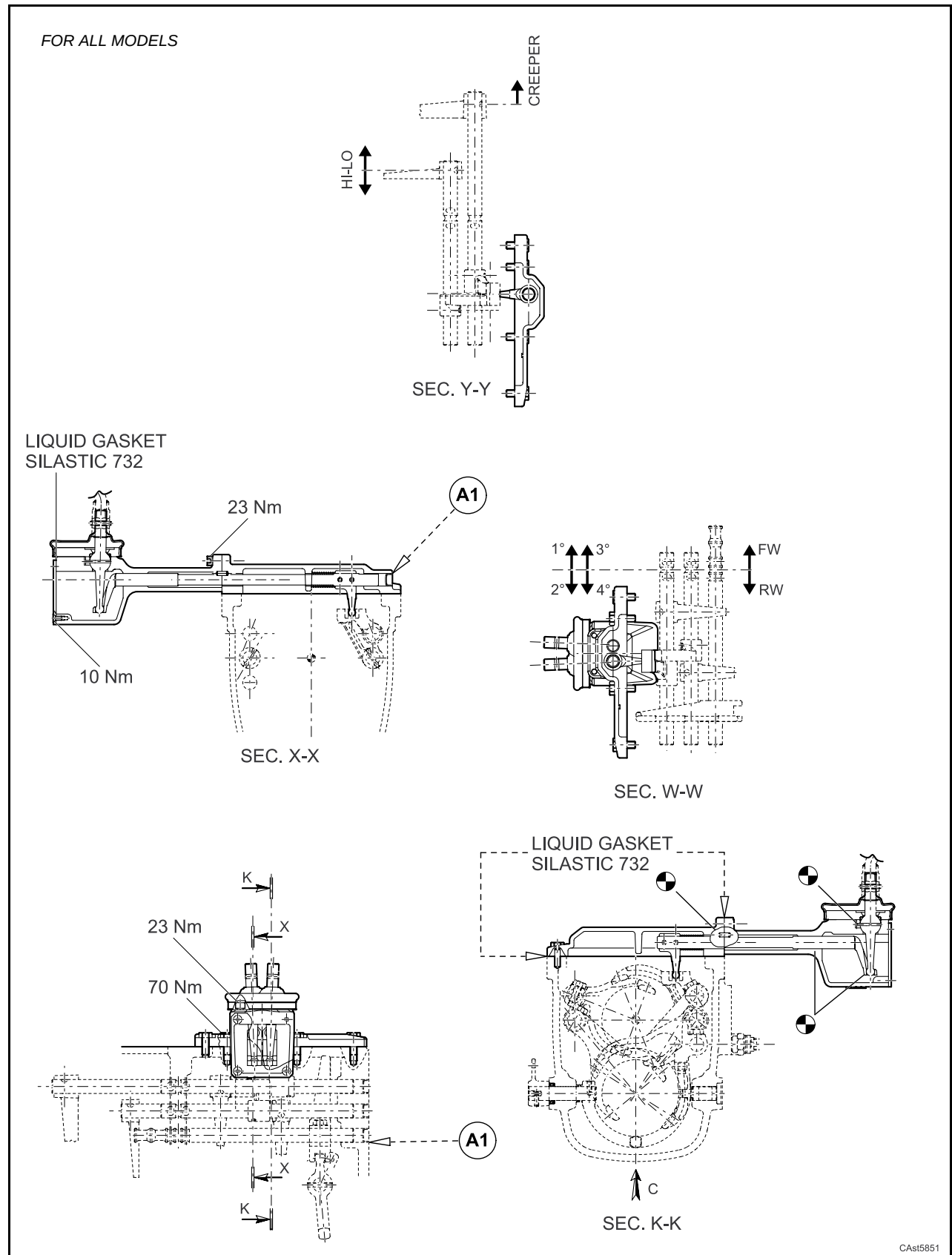
## Inner speed lever assy

### 24+24 POWER SHUTTLE AND SYNCHRO SPLITTER



# General Specifications

## Outer speed lever assy

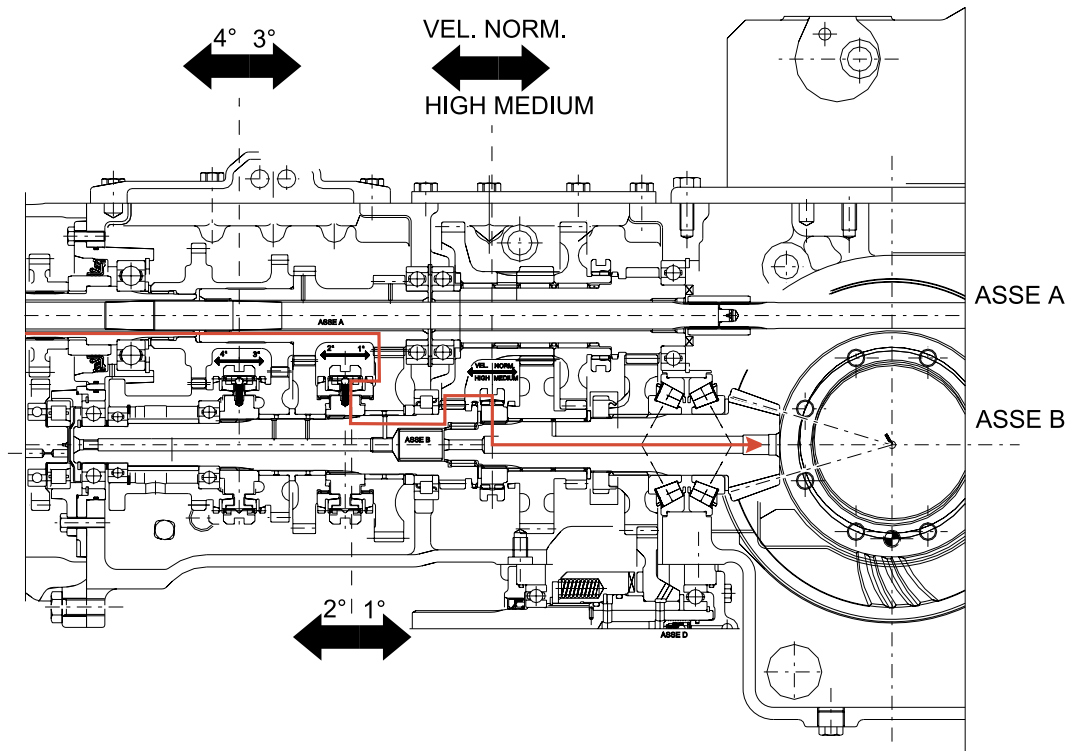


# General Specifications

## HI/LO POWER FLOWS

FRW FIRST SPEED - HIGH

FOR ALL MODELS



CAst5903

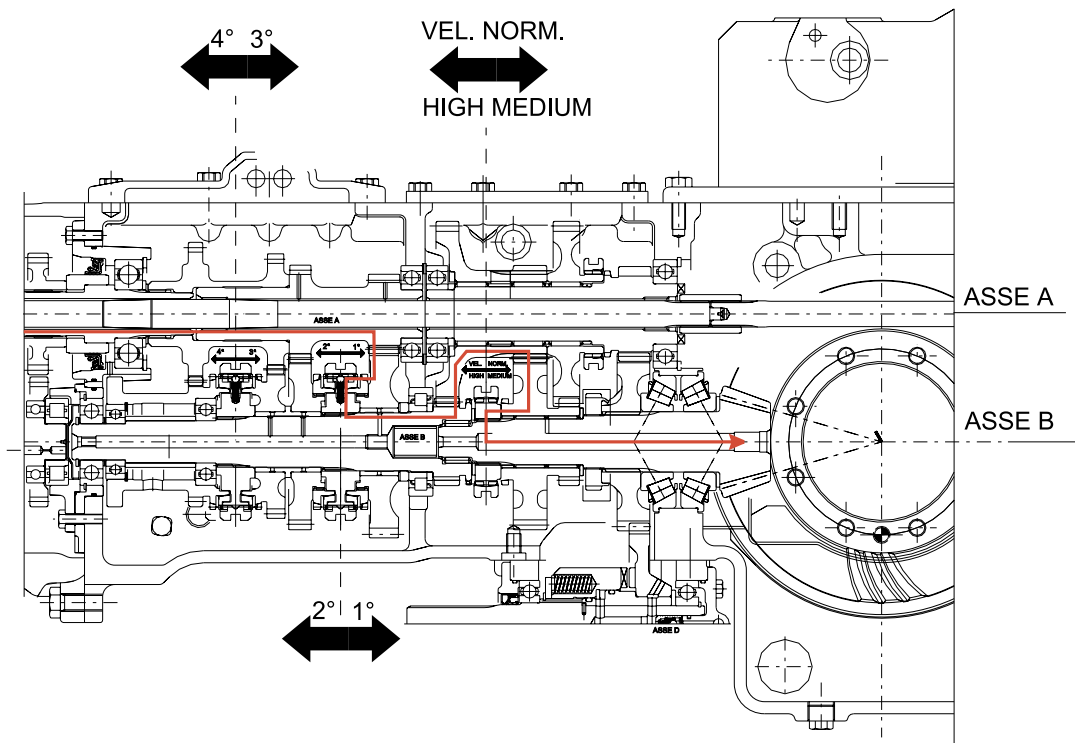


## General Specifications

### Hi/LO Power flows

FRW FIRST SPEED - MEDIUM

FOR ALL MODELS



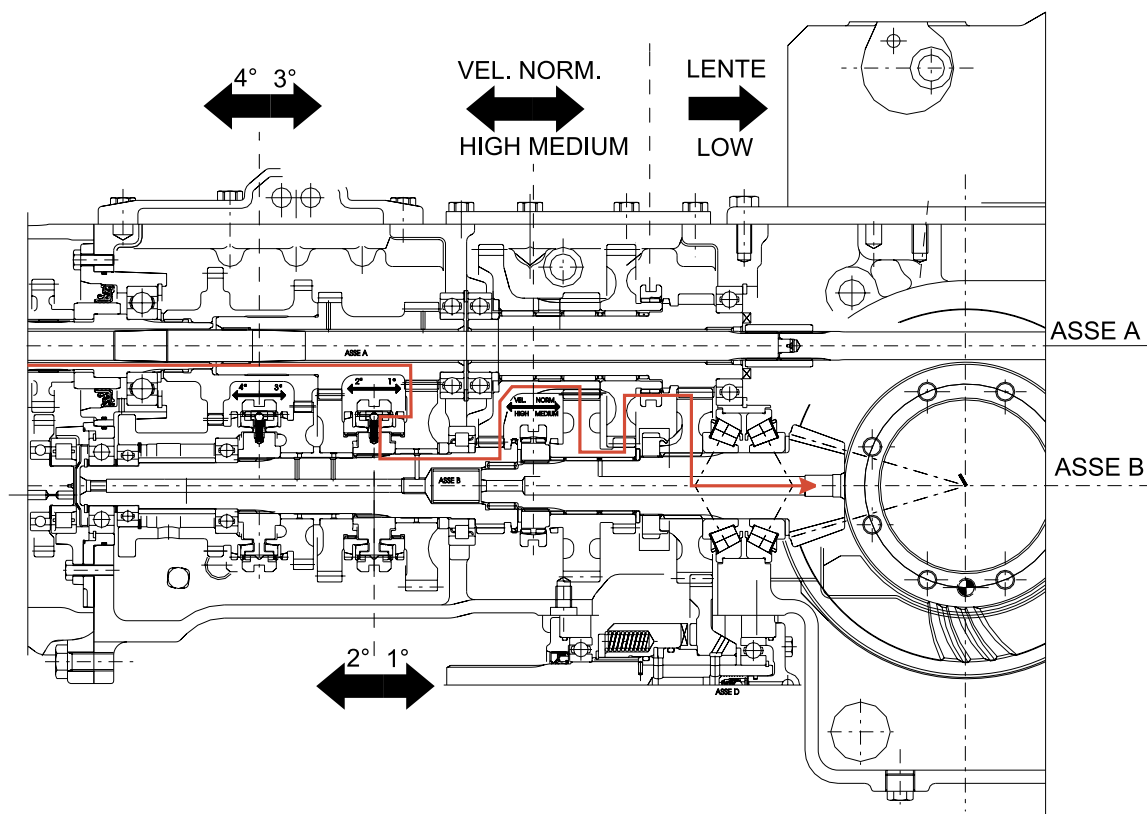
CAst7001

# General Specifications

## Power flows

FRW FIRST SPEED - LOW

NOT PRESENT ON THE 8+8 SYNCHRO SHUTTLE



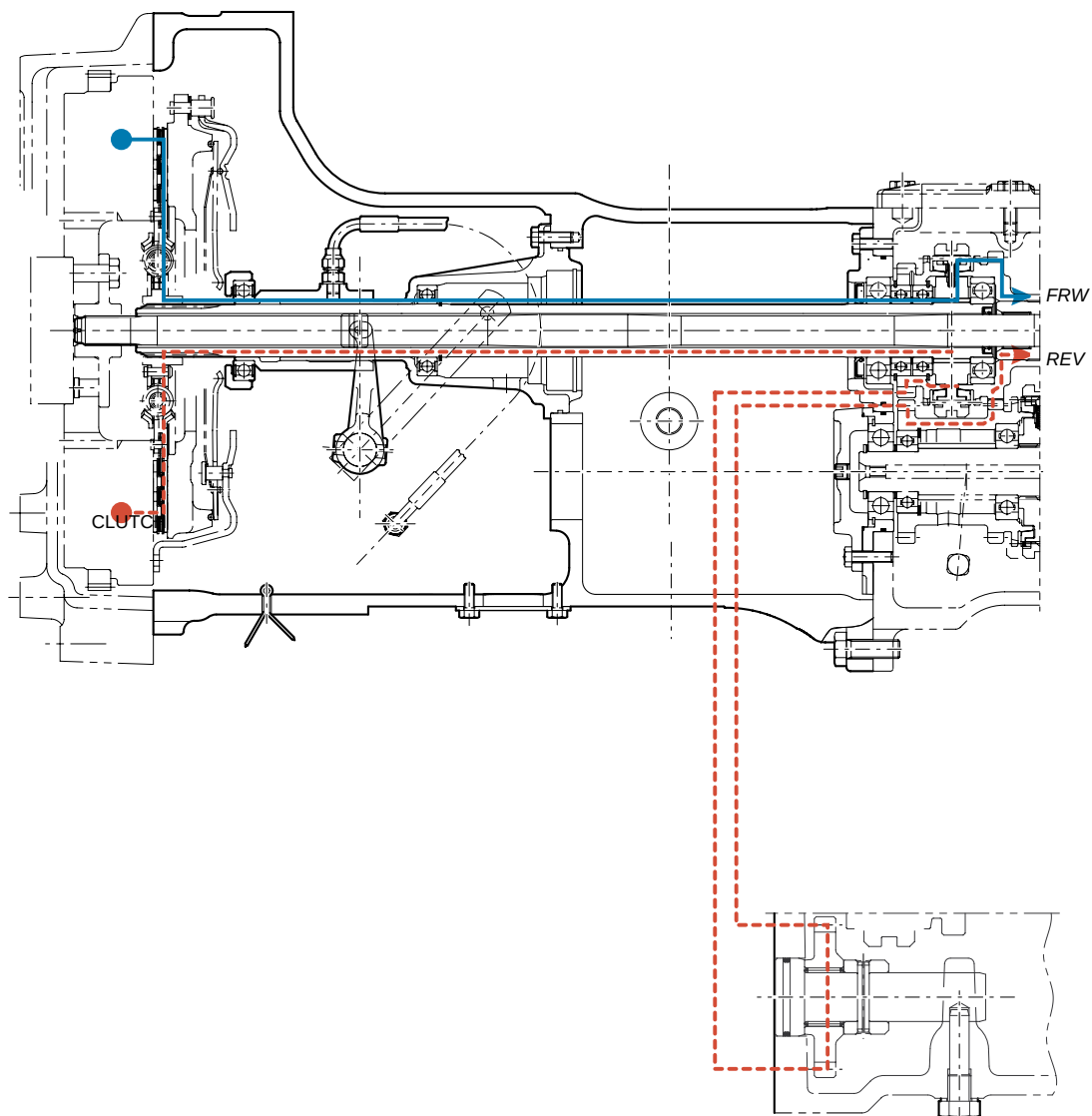
CAs5904

## General Specifications

### Power flows

#### TRANSMISSION POWER FLOW FRW/REV

8+8 SYNCRHO REVERSER  
12+12 SYNCRHO REVERSER



— FRW  
- - - REV

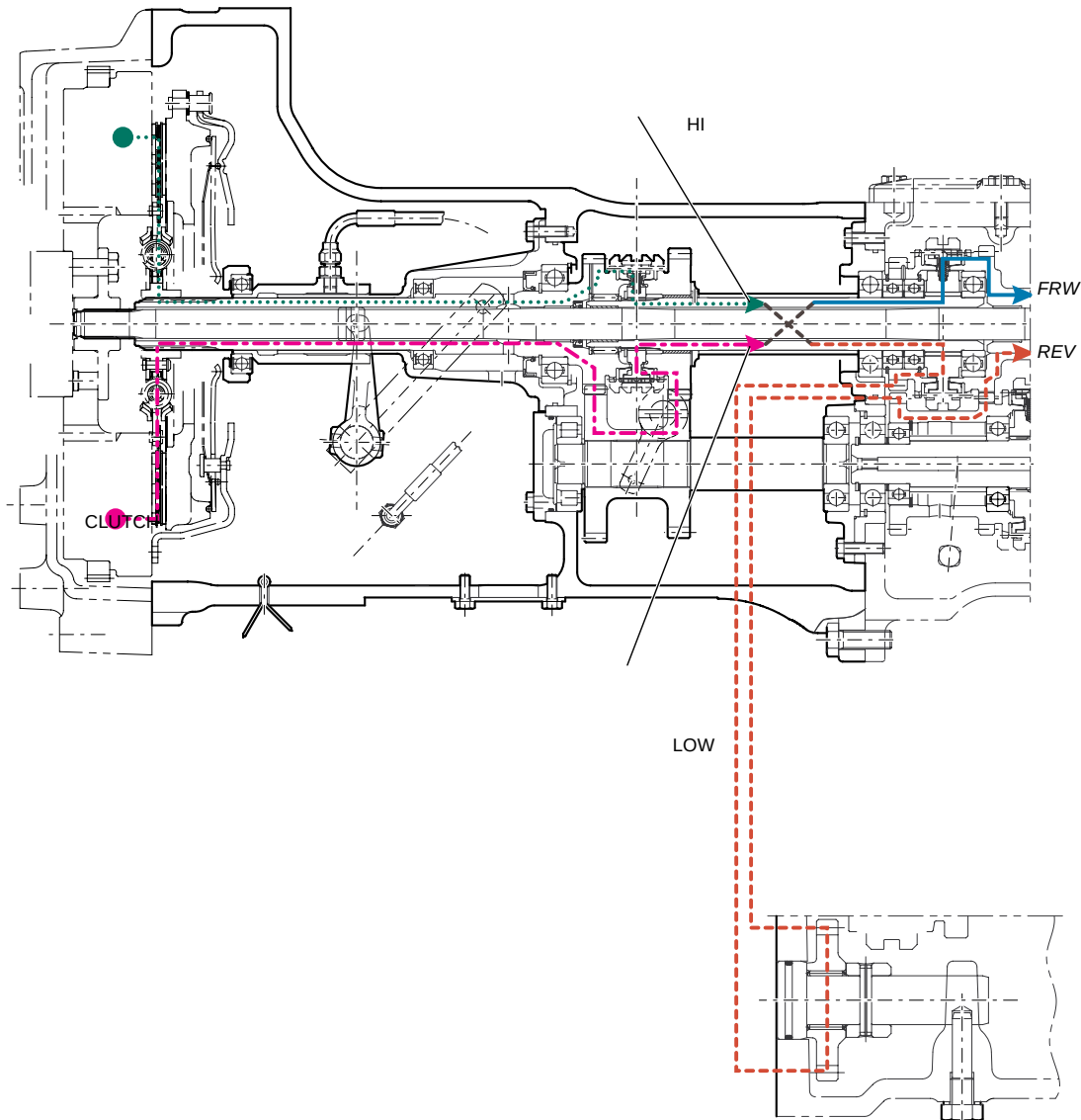
CAst6968

# General Specifications

## Power flows

TRANSMISSION POWER FLOW FRW/REV

24+24 SYNCRHO REVERSER AND SYNCRHO SPLITTER



- LOW
- ... HI
- FRW
- - - REV

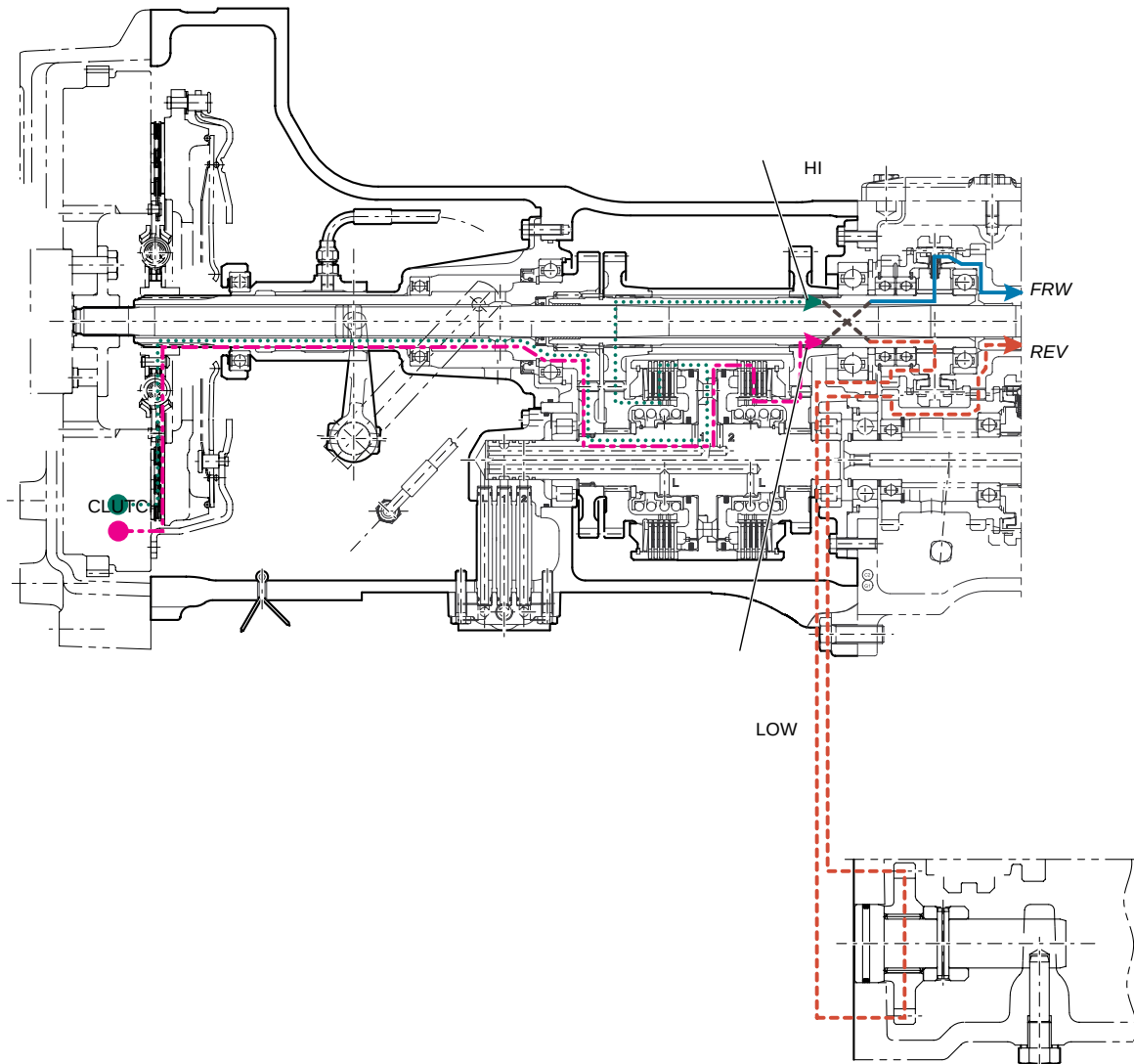
CAst6969

## General Specifications

### Power flows

TRANSMISSION POWER FLOW FRW/REV

24+24 SYNCHRO SHUTTLE AND POWER SPLITTER



- LOW
- ..... HI
- FRW
- - - REV

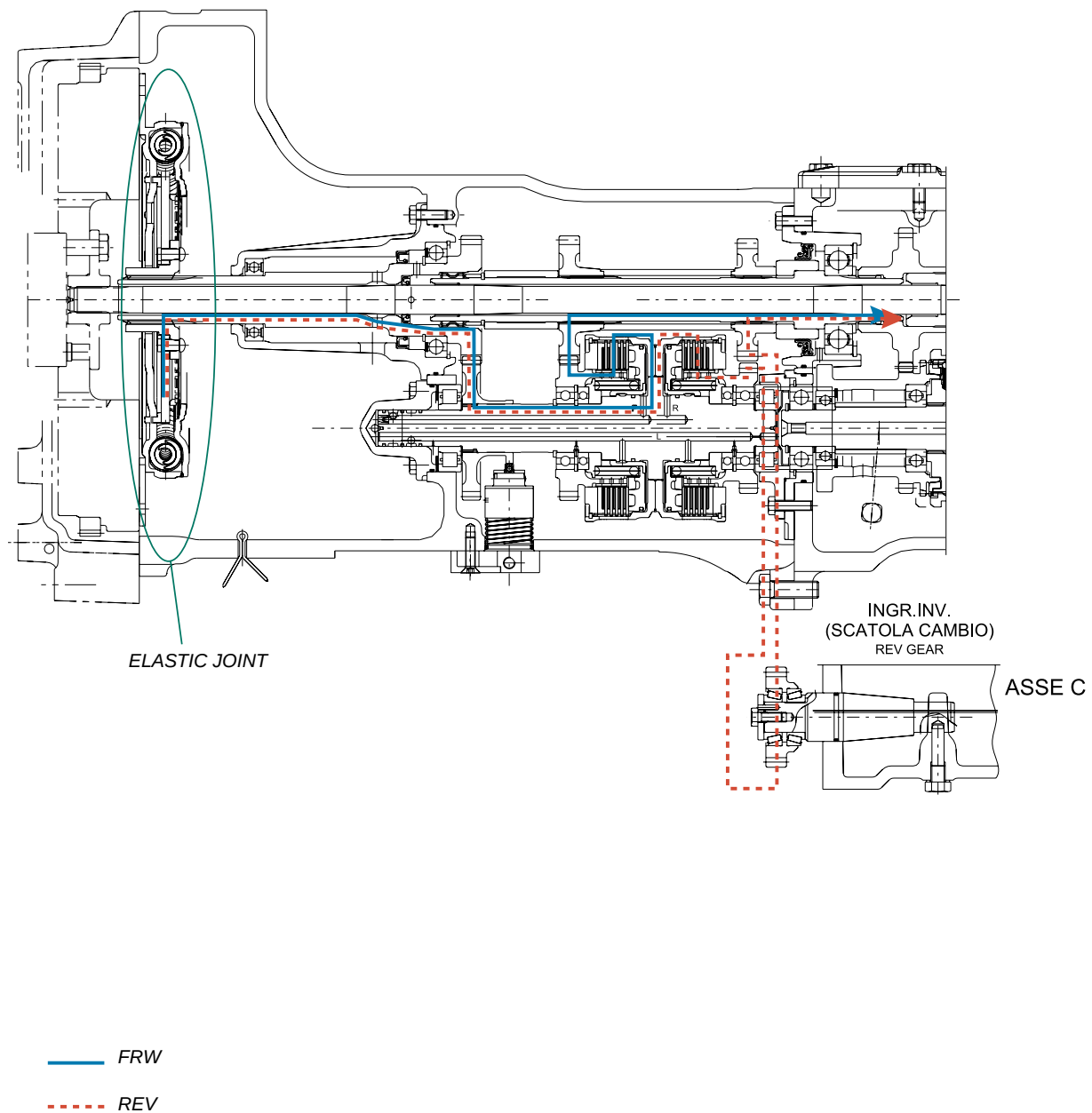
CAst6970

# General Specifications

## Power flows

TRANSMISSION POWER FLOW FRW/REV

12+12 POWER SHUTTLE



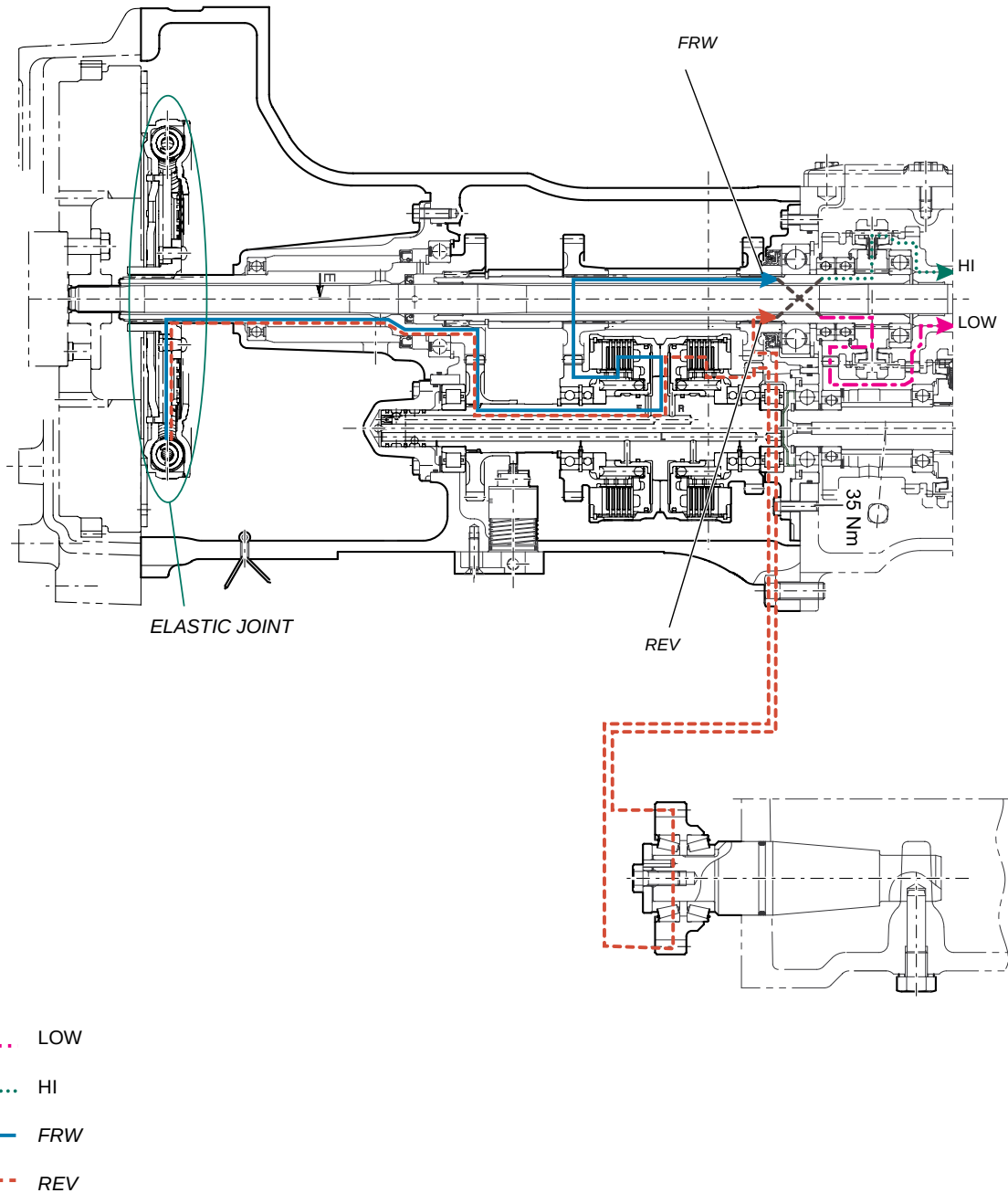
CAst7002

## General Specifications

### Power flows

TRANSMISSION POWER FLOW FRW/REV

24+24 POWER SHUTTLE AND SYNCHRO SPLITTER



CAst6971

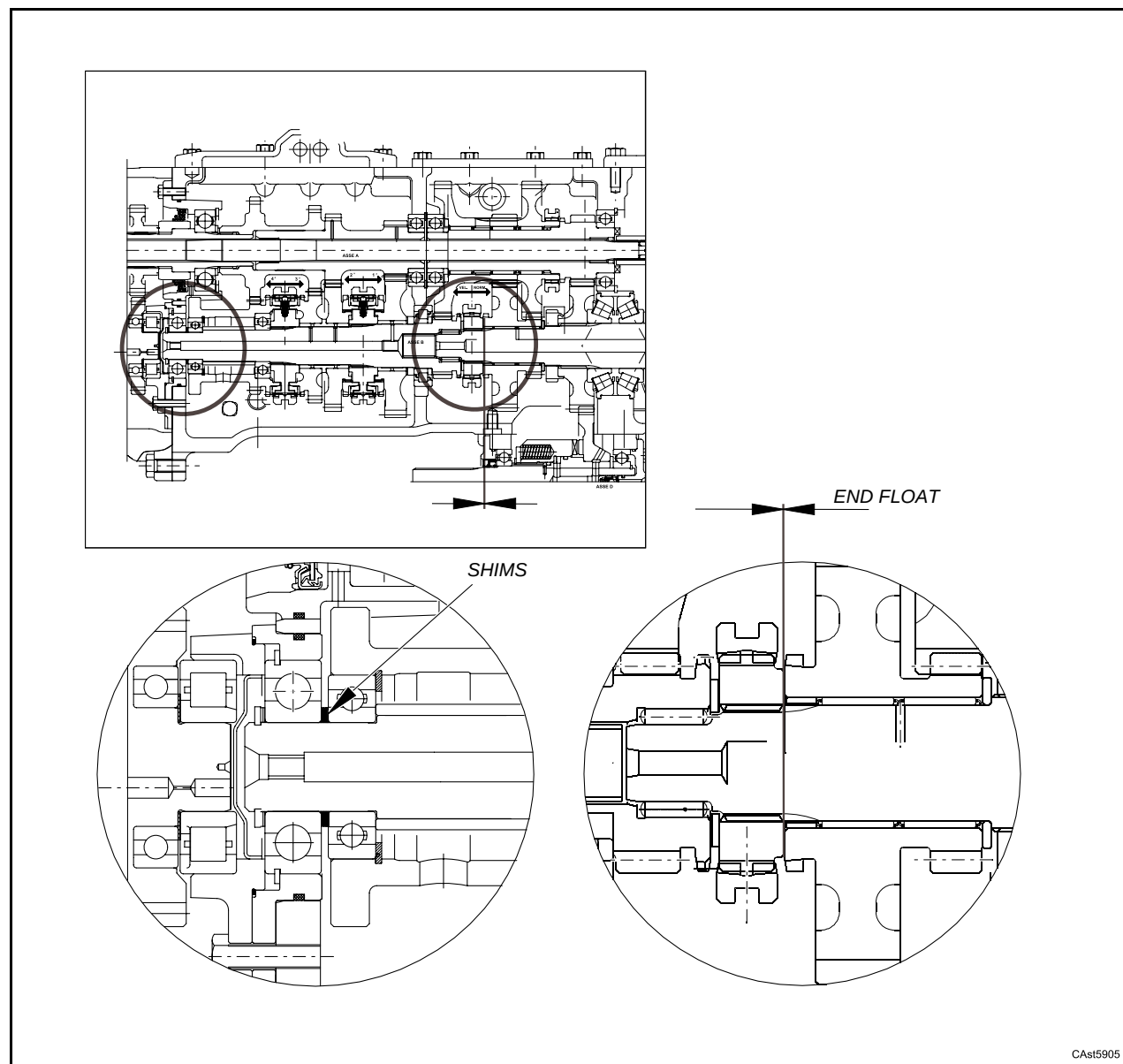


# General Specifications

## ASSEMBLY TYPICAL DATA

Position 1                      End float  
Gear box                      Min 0.20 - Max 0.30 mm

|              | Shims range |      |      |      |
|--------------|-------------|------|------|------|
| Thickness mm | 0.10        | 0.15 | 0.20 | 0.50 |
| Quantity     | ---         | ---  | ---  | ---  |



# General Specifications

Position 2

End float

Gear box

Min 0.00 - Max 0.00 mm

## Shims range

Thickness mm

0.10

0.15

0.20

0.50

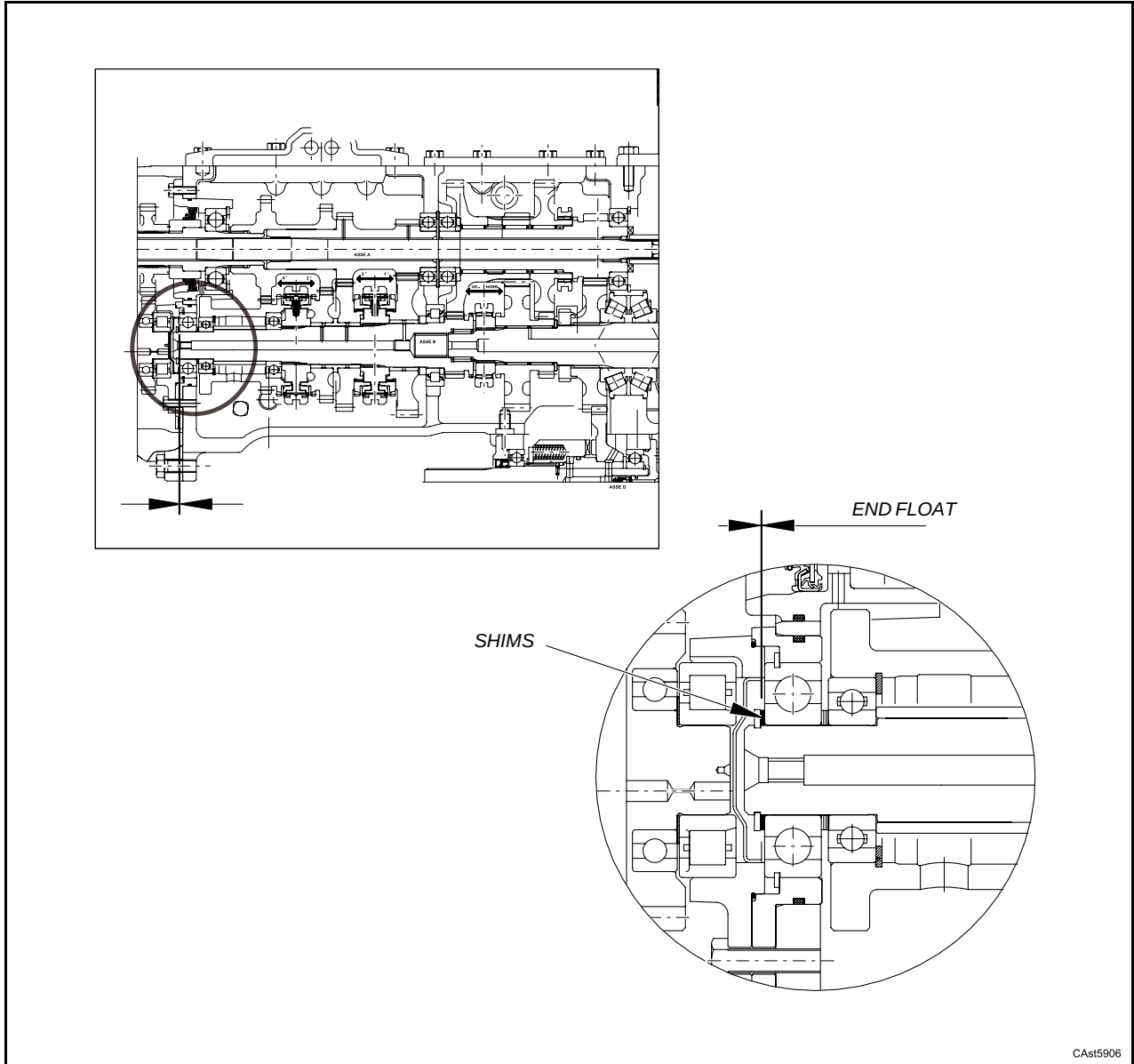
Quantity

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CAst5906

# General Specifications

Position 3

End float

Gear box

Min 0.15 - Max 0.25 mm

## Shims range

Thickness mm

0.05

0.10

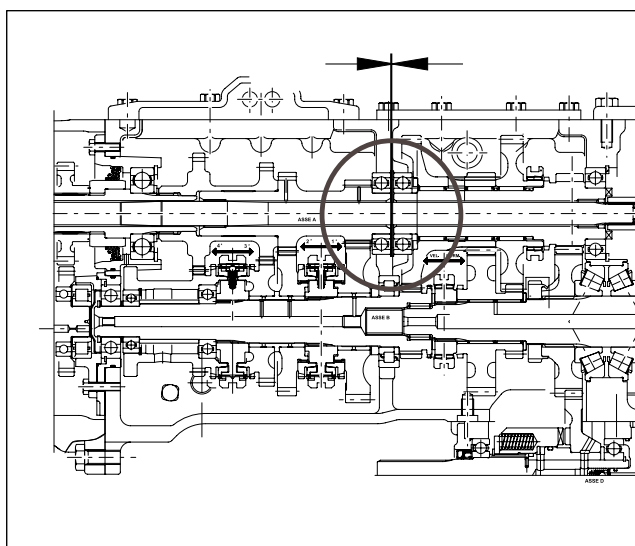
0.30

Quantity

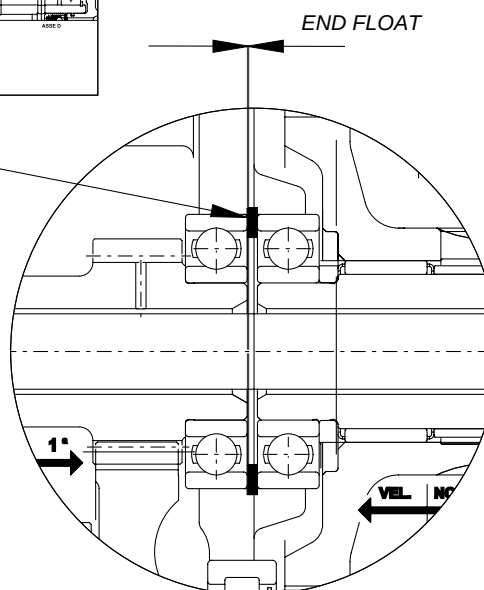
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SHIMS



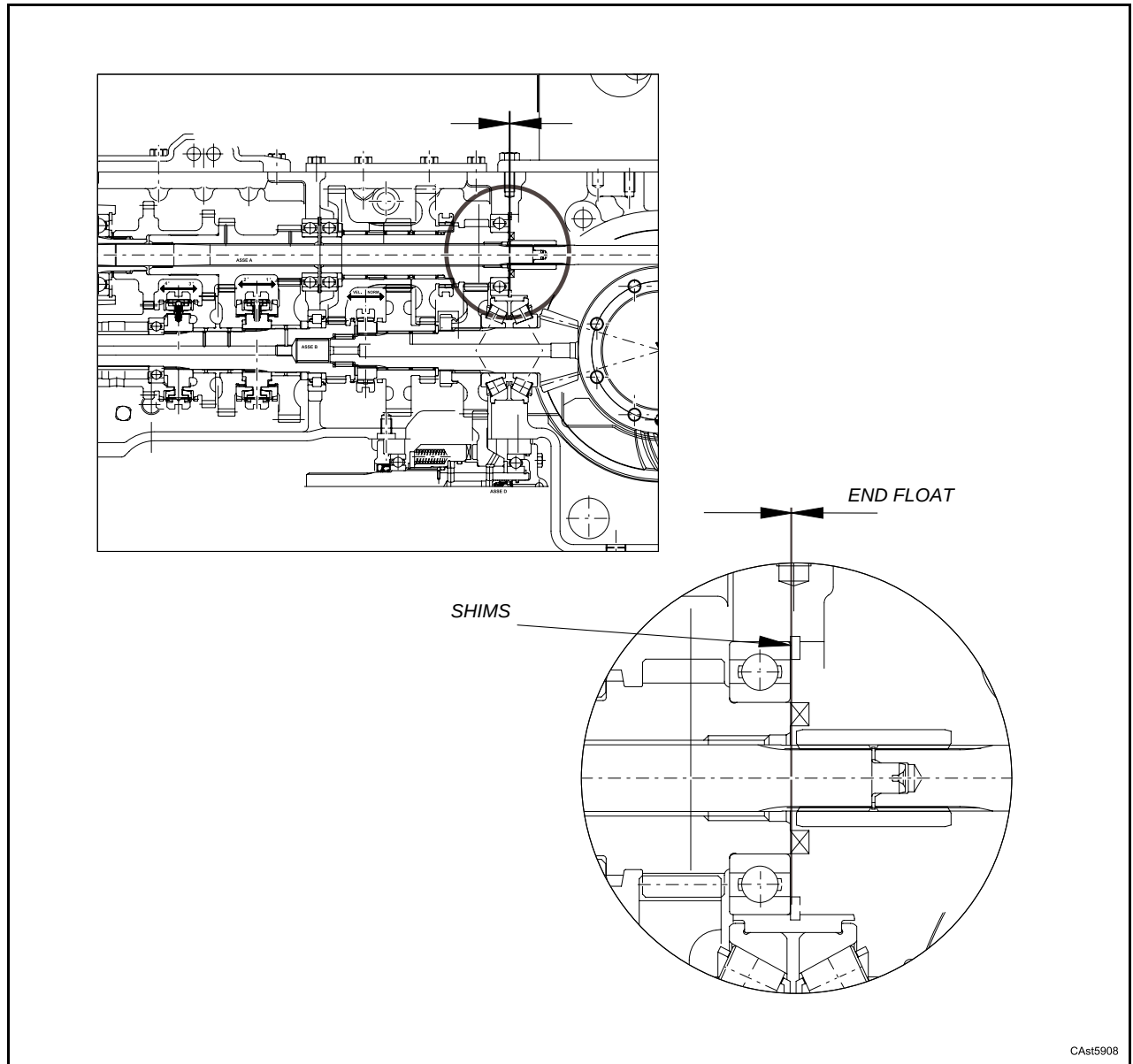
CAst5907

# General Specifications

Position 4                      End float  
Gear box                      Min 0.15 - Max 0.25 mm

## Shims range

| Thickness mm | 0.1 | 0.3 | 0.5 |
|--------------|-----|-----|-----|
| Quantity     | --- | --- | --- |



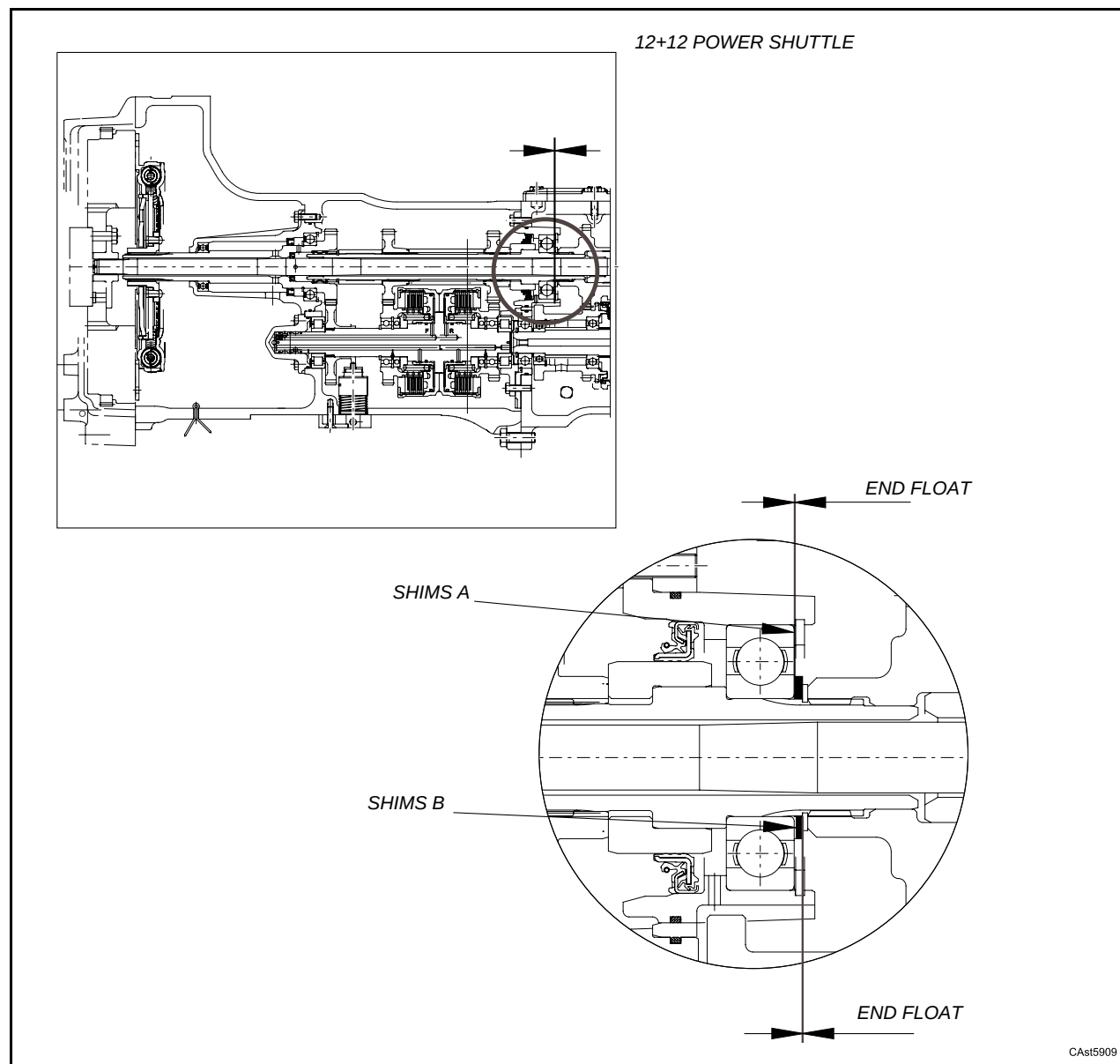
# General Specifications

Position 5  
Clutch

End float  
Min 0.0 - Max 0.1 mm

## Shims range (mm)

|                  |      |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|------|
| Thickness type A |      |      |      |      | 0.10 | 0.30 | 0.50 |
| Quantity         |      |      |      |      | ---  | ---  | ---  |
| Thickness type B | 2.85 | 2.90 | 2.95 | 3.00 | 3.05 | 3.10 | 3.15 |



# General Specifications

Position 5a

End float

Clutch

Min 0.0 - Max 0.1 mm

## Shims range

Thickness mm

0.10

0.30

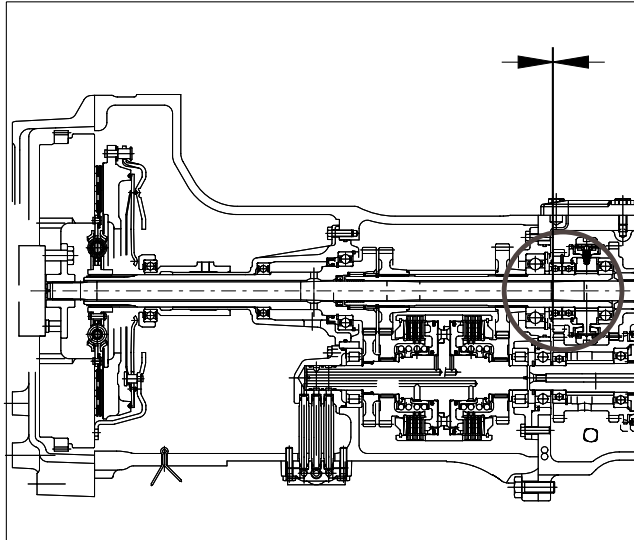
0.50

Quantity

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8+8 SYNCHRO SHUTTLE

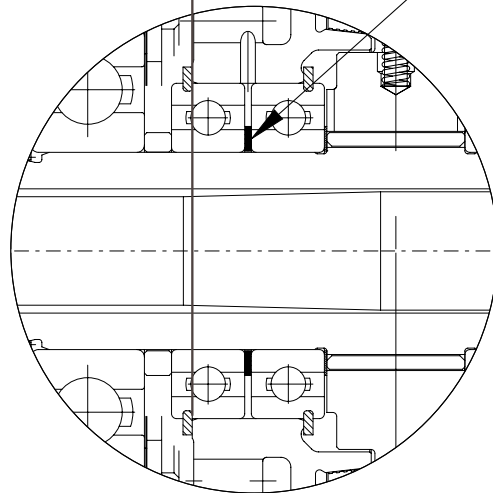
24+24 SYNCHRO SHUTTLE AND SYNCHRO SPLITTE

24+24 SYNCHRO SHUTTLE AND POWER SPLITTER

24+24 POWER SHUTTLE AND SYNCHRO SPLITTER

END FLOAT

SHIMS A



CAst5911

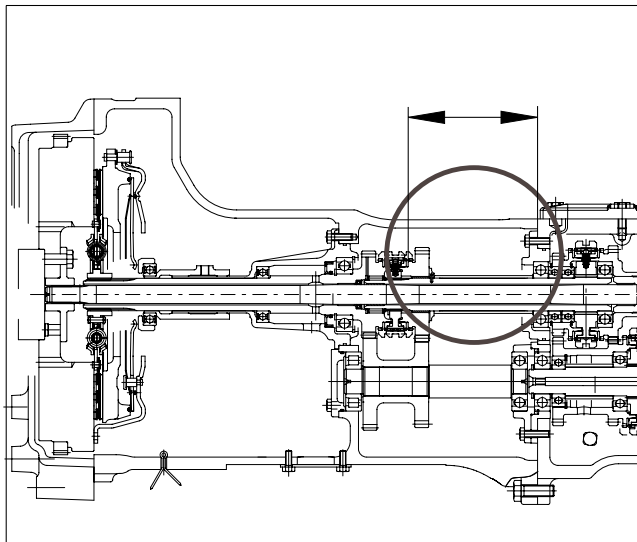
# General Specifications

|            |                  |
|------------|------------------|
| Position 6 | Distance         |
| Clutch     | 157.4 ÷ 157.5 mm |

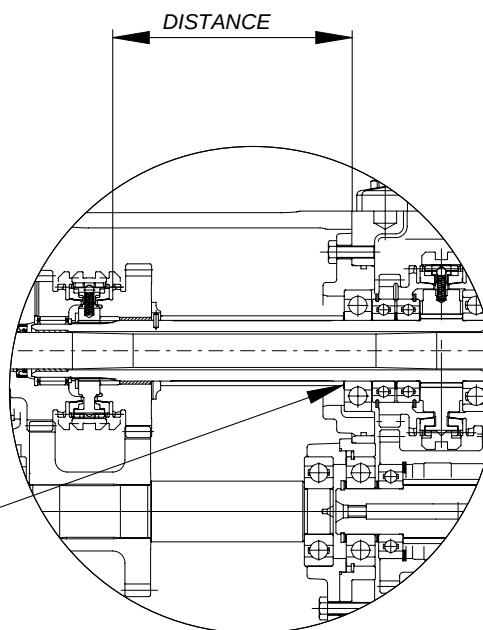
## Shims range

|              |      |      |      |
|--------------|------|------|------|
| Thickness mm | 0.10 | 0.30 | 0.50 |
| Quantity     | ---  | ---  | ---  |

24+24 SYNCHRO SHUTTLE AND SYNCHRO SPLITTER



SHIMS



CAst7025



# General Specifications

Position 6a

End float

Clutch

Min 0.0 - Max 0.1 mm

## Shims range

Thickness mm

0.10

0.30

0.50

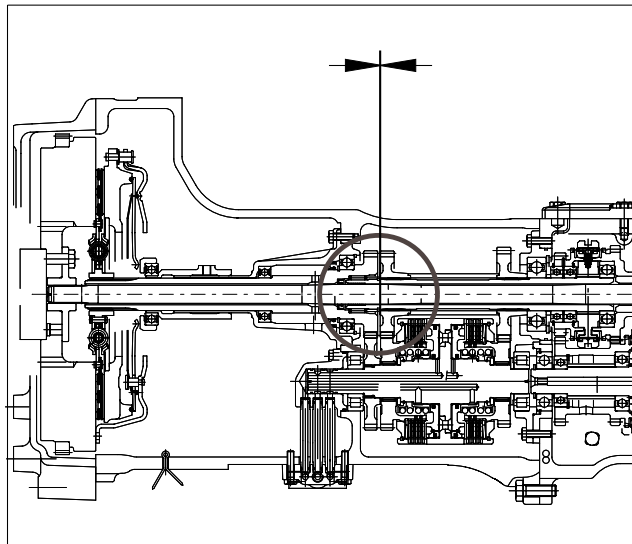
Quantity

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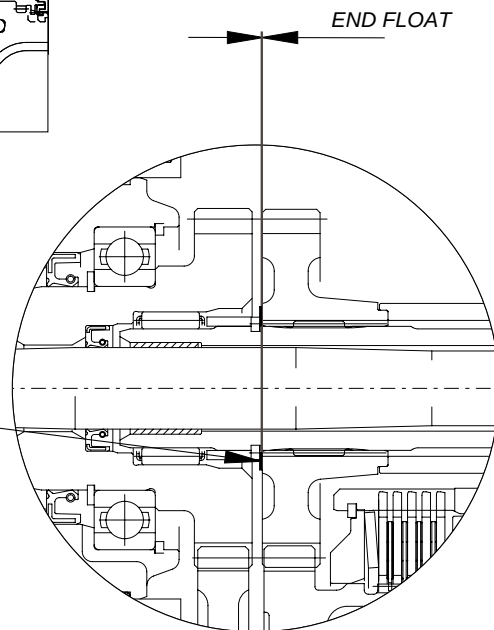
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### 24+24 SYNCHRO SHUTTLE AND POWER SPLITTER



SHIMS



CAst7023

# General Specifications

Position 6b

End float

Clutch

Min 0.0 - Max 0.1 mm

## Shims range

Thickness mm

0.10

0.30

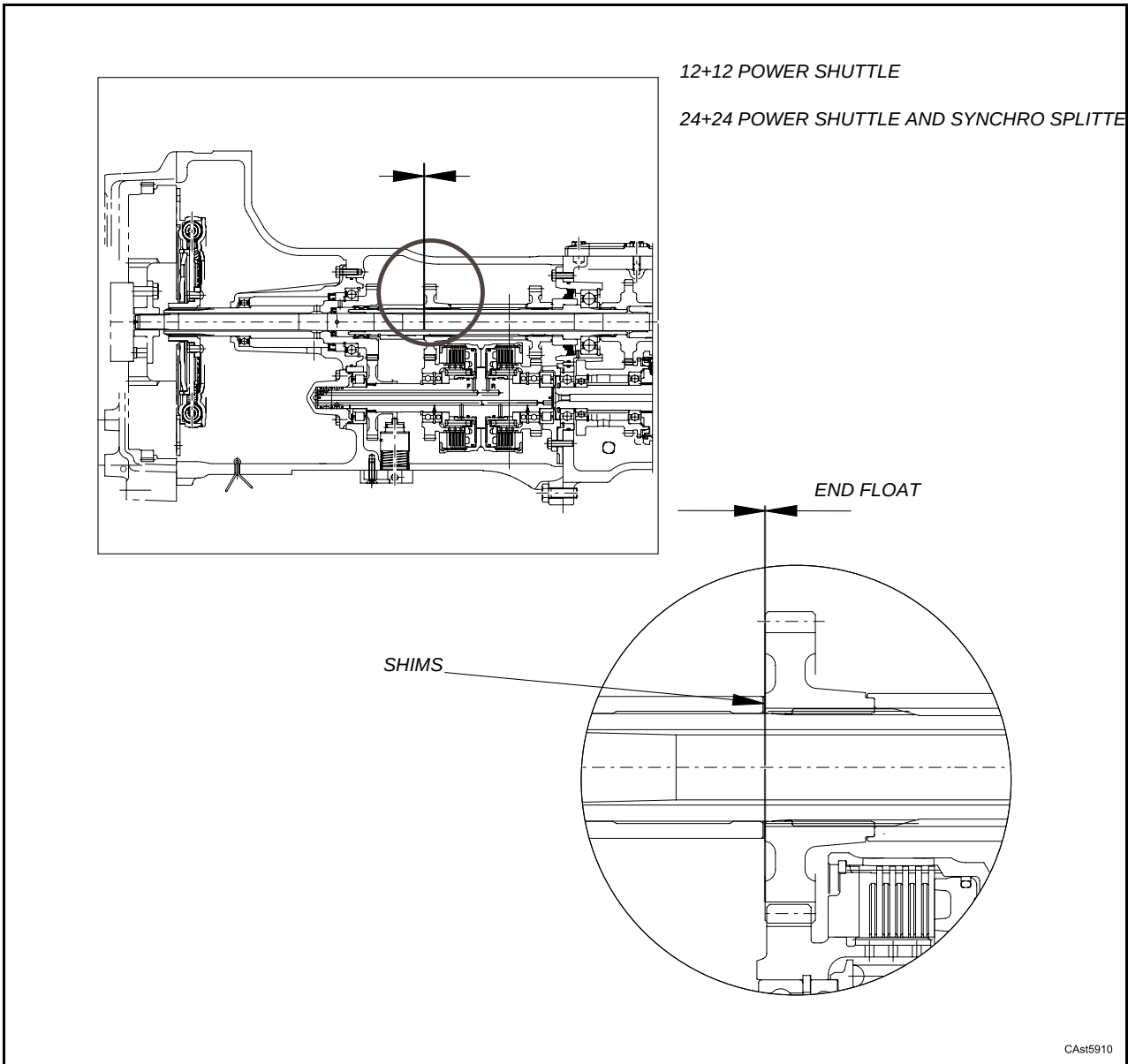
0.50

Quantity

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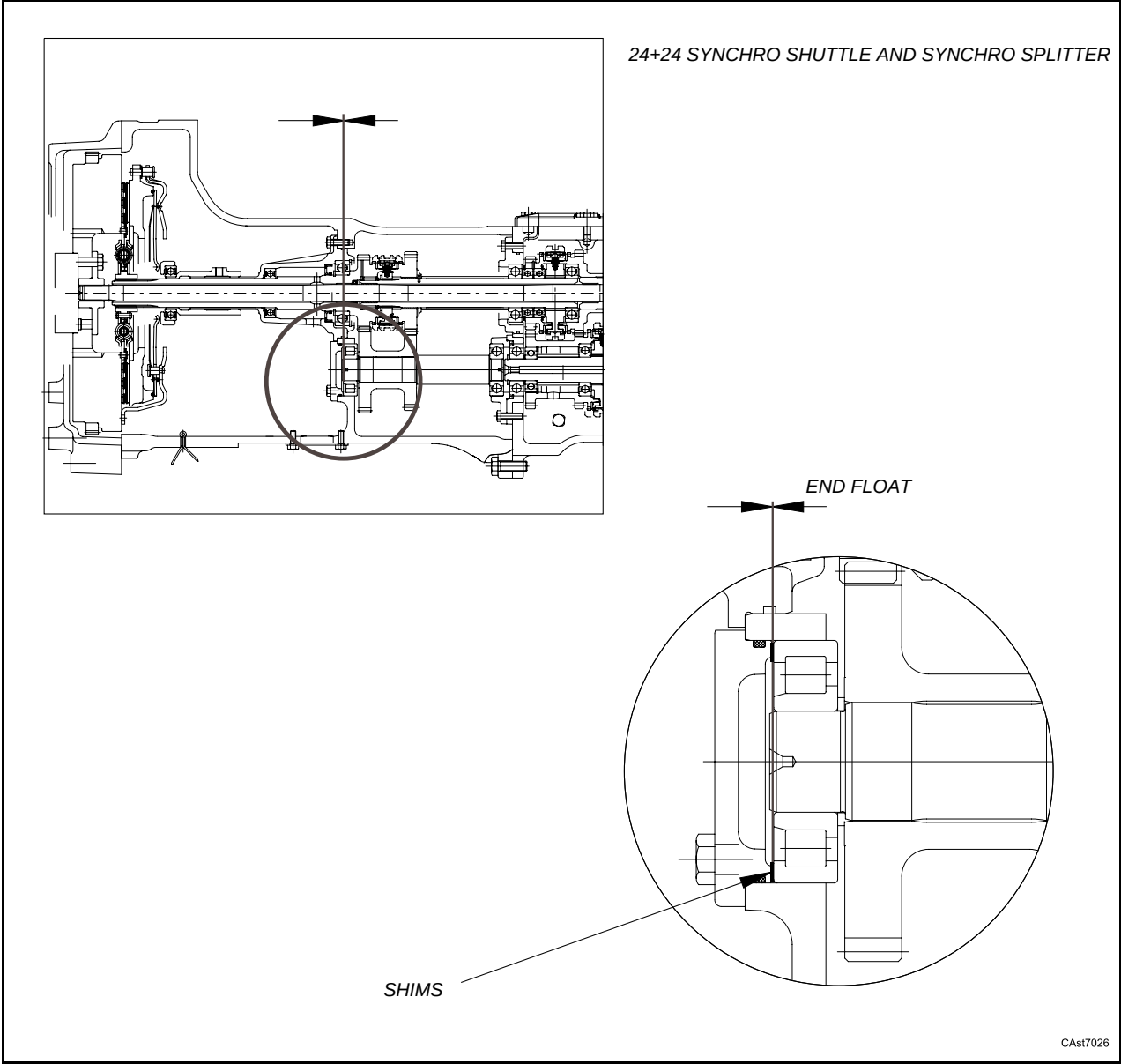


# General Specifications

Position 7  
Clutch

End float  
Min 0.1 - Max 0.2 mm

| Shims range  |      |      |      |
|--------------|------|------|------|
| Thickness mm | 0.10 | 0.30 | 0.50 |
| Quantity     | ---  | ---  | ---  |



# General Specifications

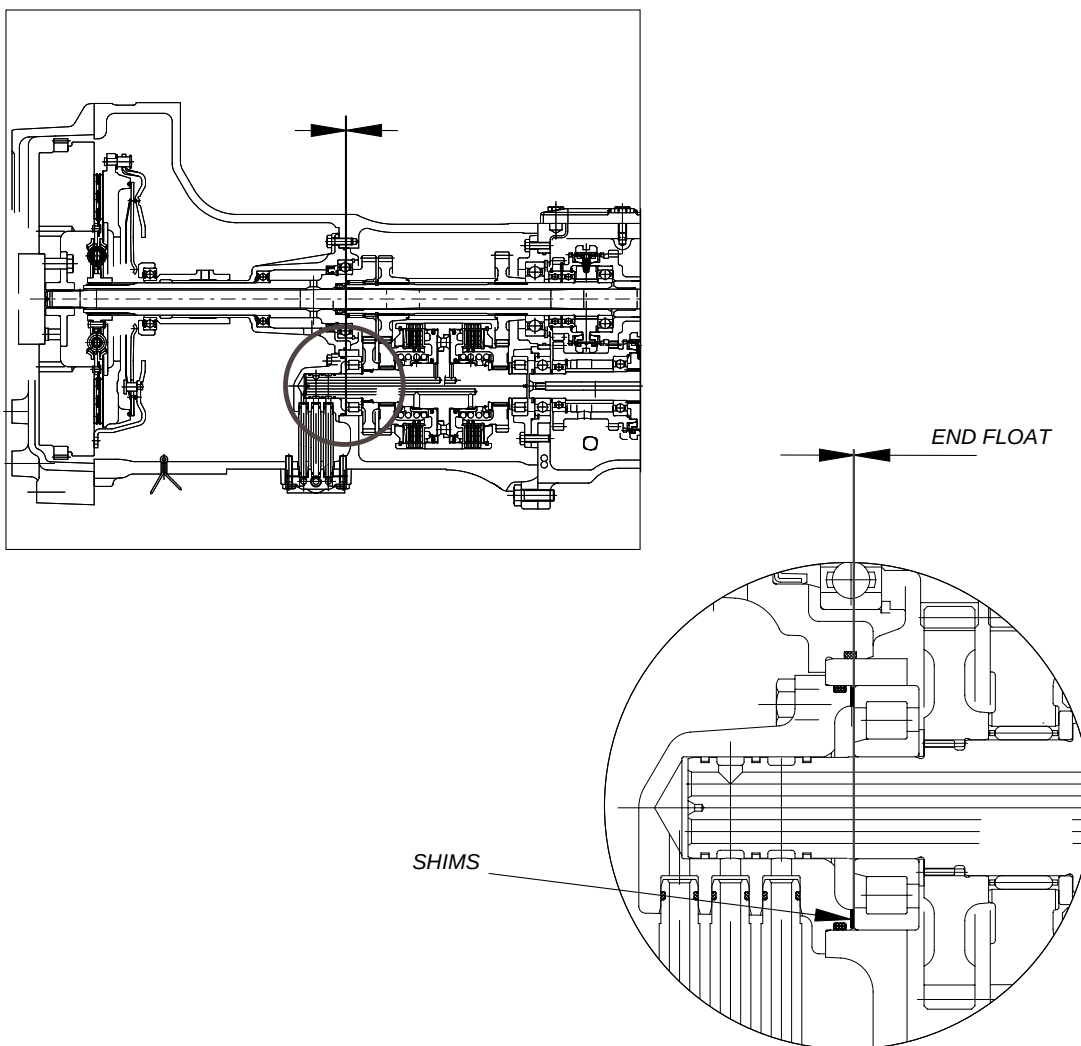
Position 7a  
Clutch

End float  
Min 0.1 - Max 0.2 mm

## Shims range

| Thickness mm | 0.10 | 0.30 | 0.50 |
|--------------|------|------|------|
| Quantity     | ---  | ---  | ---  |

### 24+24 SYNCHRO SHUTTLE AND POWER SPLITTER



CAst7024

## General Specifications

### FILLING AND CHECKS



#### Warning

**To drain and load the oil and to check the oil level the transmission must be horizontal.**

#### Scheduled maintenance oil drain

To drain the oil remove the level plug (1) and the drain plug (2).



#### Danger

**Risk of violent oil ejection, follow carefully all the safety procedures indicated in this manual and in the vehicle manual.**

Refer to: [cap.B - SAFETY INSTRUCTIONS](#)

Drain all oil.

Clean the plug (2) and tighten it to the prescribed torque (sec.C.6).

#### Scheduled maintenance oil filling

Carry out the following instructions:

- Fill the transmission with oil to the maximum level marked on the level dipstick (1).
- Apply the parking brake.
- Keep the speed control in NEUTRAL range.
- Start the engine by keeping the slow running of 800÷1000 rpm until an oil temperature higher than 25 °C is obtained.
- Check that the transmission oil level is in the prescribed range on the level dipstick (1).
- If necessary, top up with oil to keep the level in the prescribed range.

#### Scheduled maintenance oil level check

*Use the oil level dipstick (1) to check the oil level.*



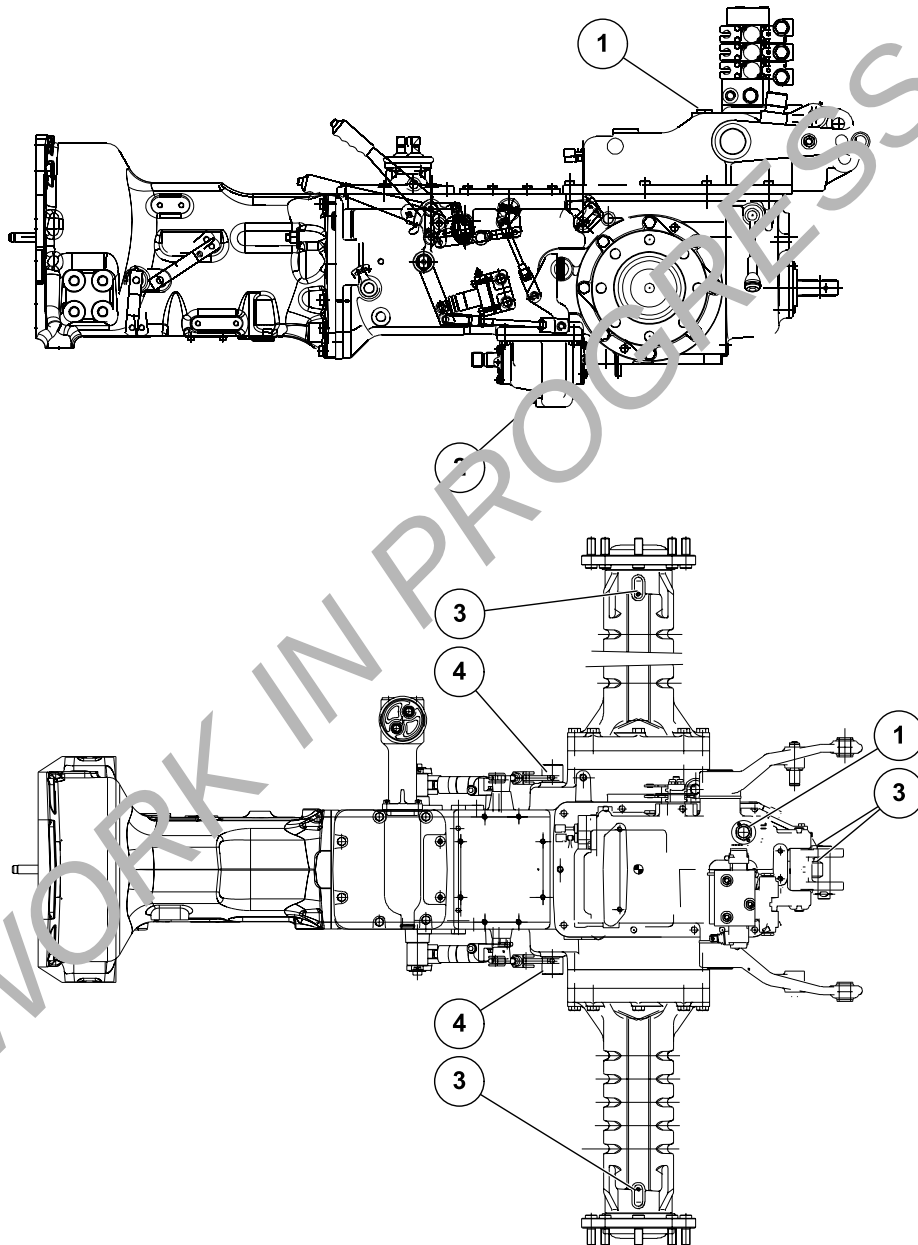
#### Caution

*If leakage or any other factor determining fall in the oil level is found, then it is advisable to check immediately, in order to avoid damages to the mechanical parts.*

| DESCRIPTIONS (next figure)            | POSITION |
|---------------------------------------|----------|
| Oil level dipstick (oil filling port) | 1        |
| Oil filling port                      | 1        |
| Oil drain port                        | 2        |
| Grease points                         | 3        |
| Brakes breather                       | 4        |

# General Specifications

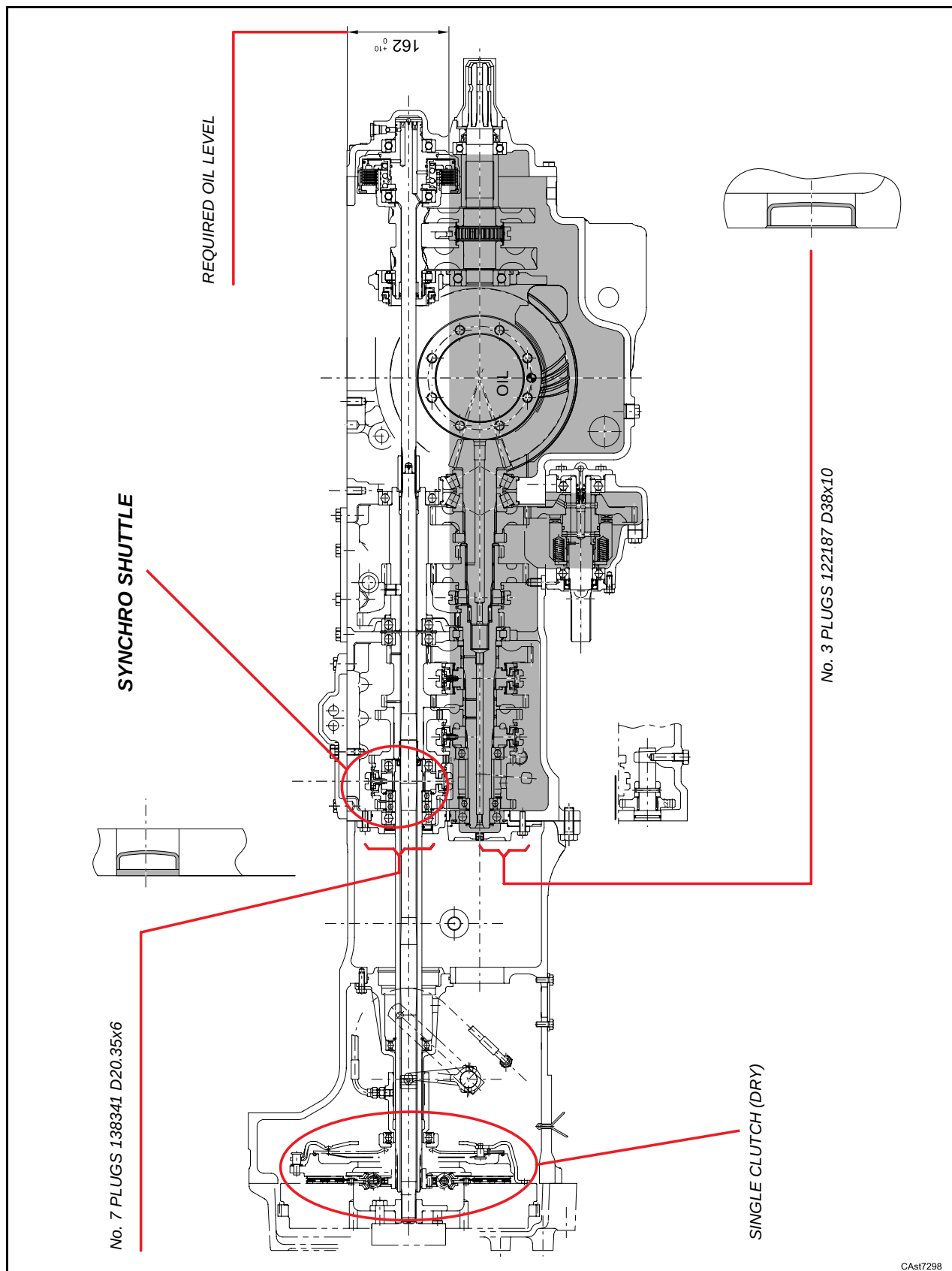
## Filling and check points



CAst05912

# General Specifications

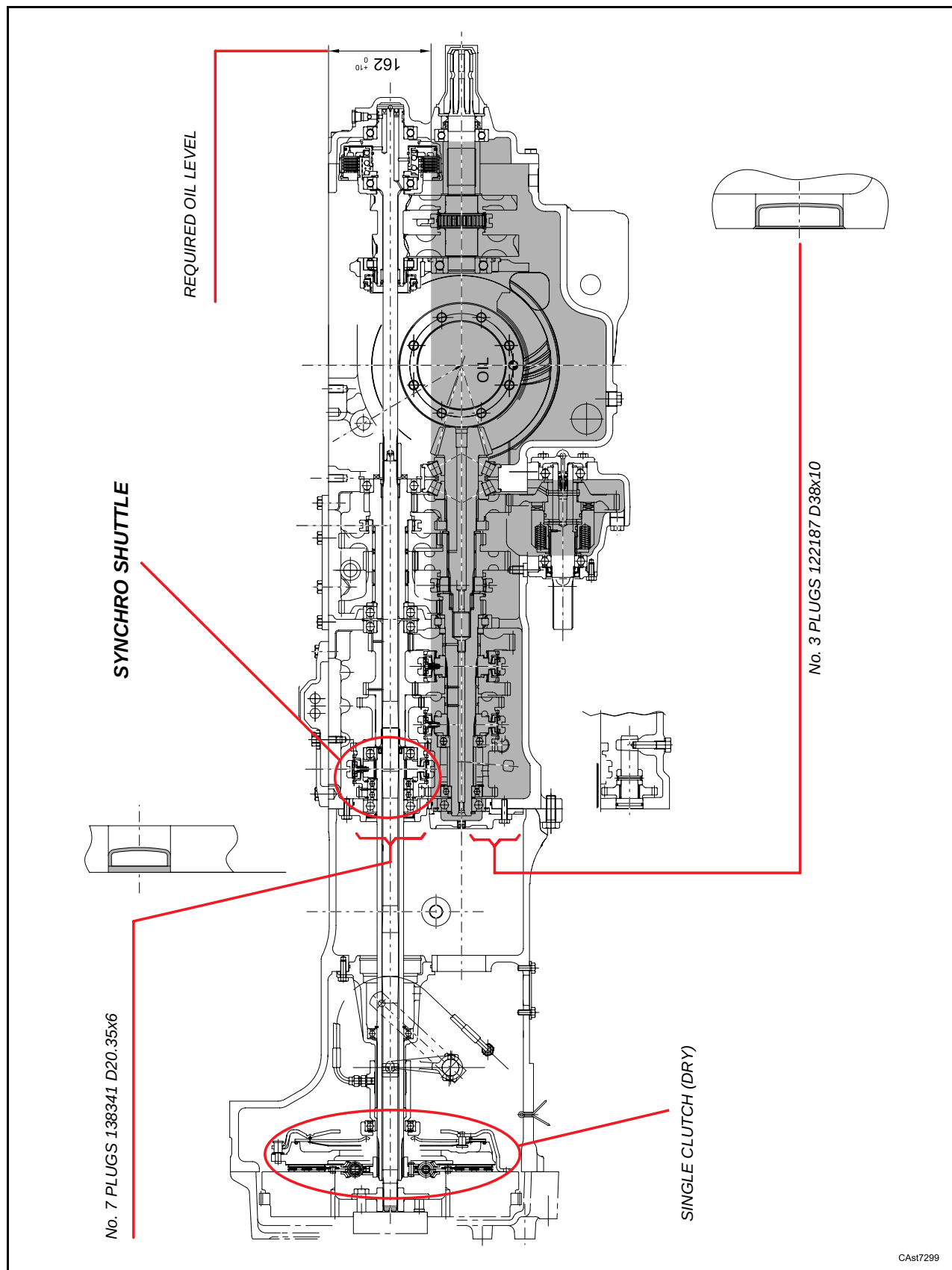
8+8 synchro shuttle





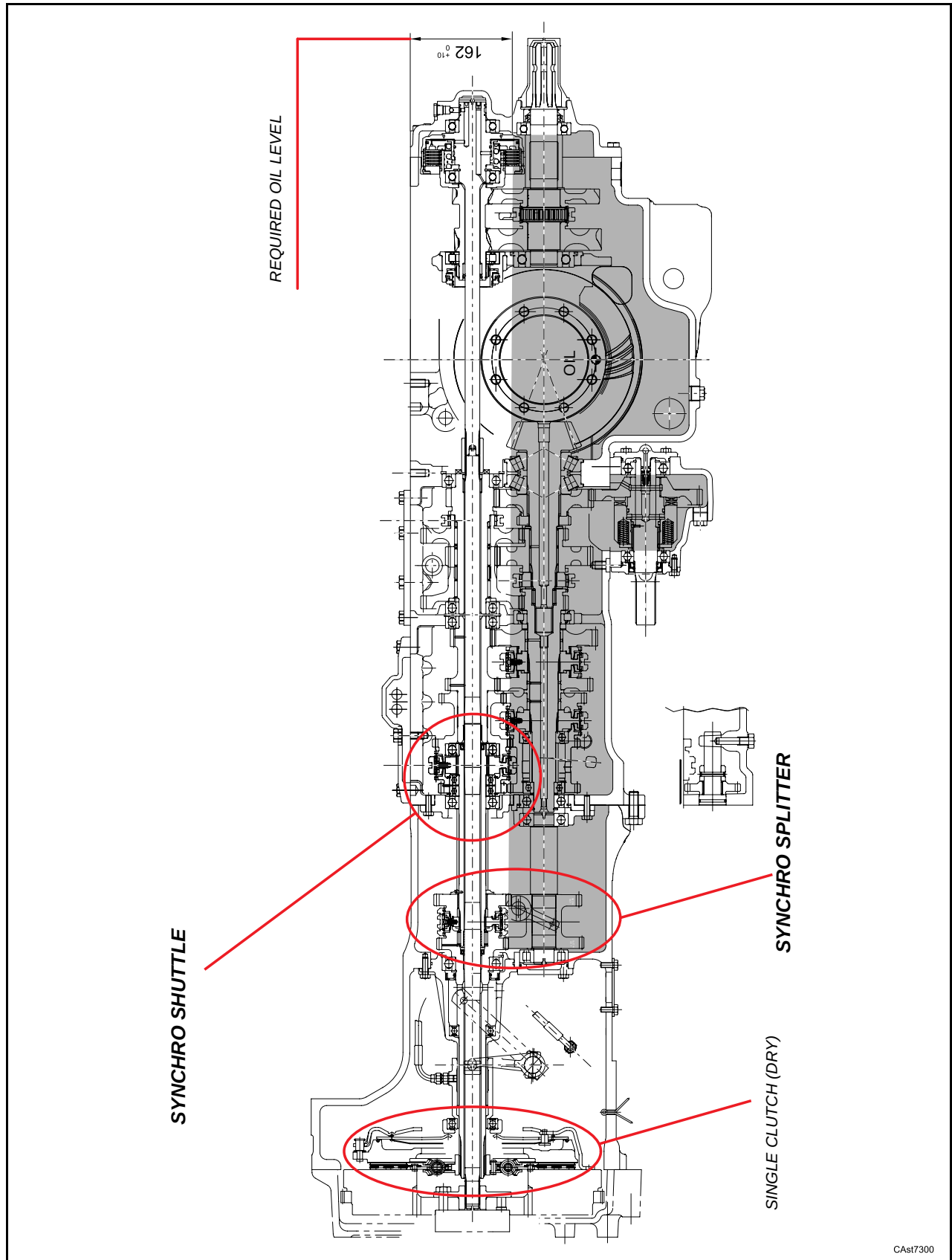
# General Specifications

12+12 synchro shuttle



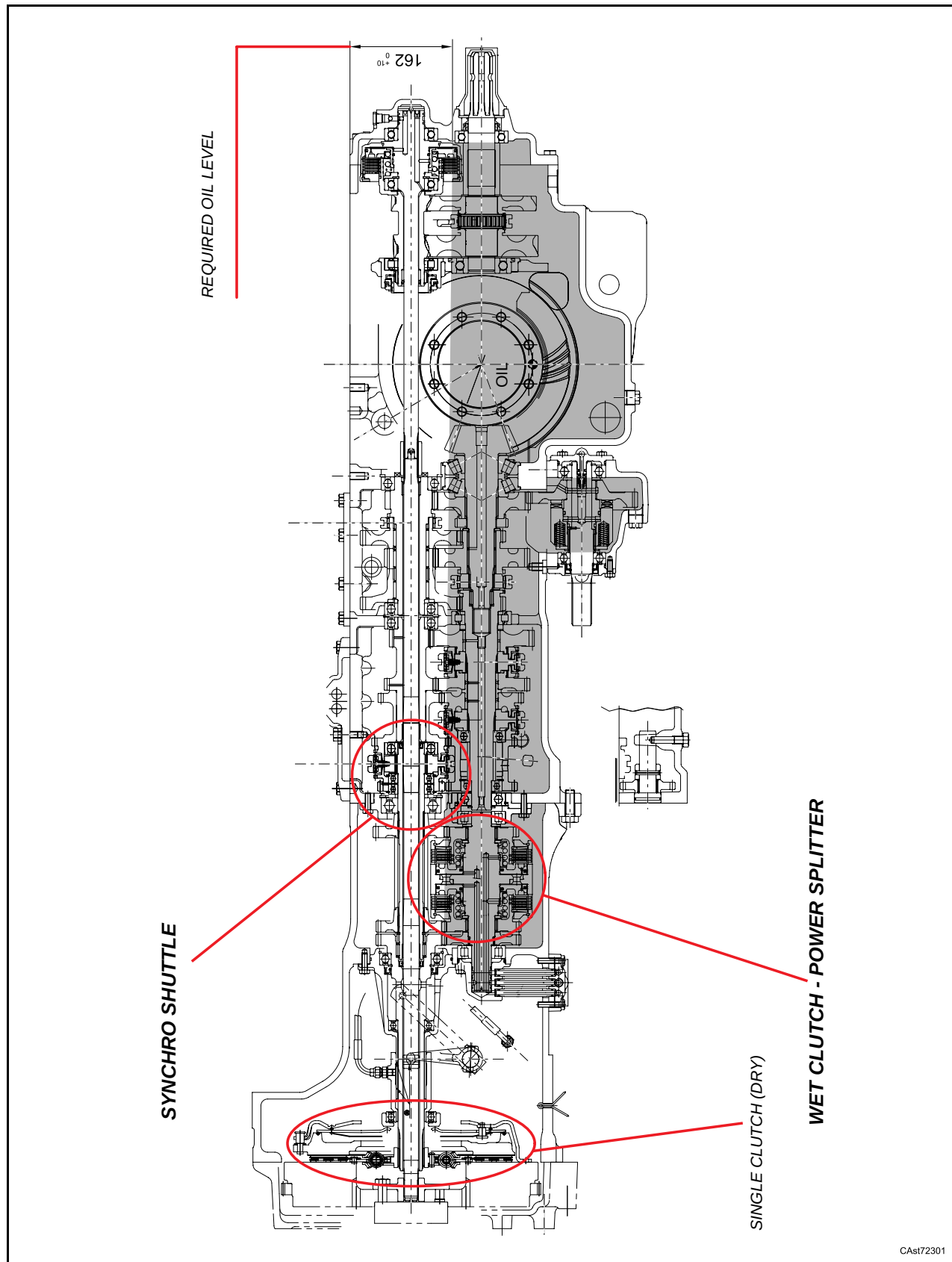
## General Specifications

### 24+24 synchro shuttle and synchro splitter



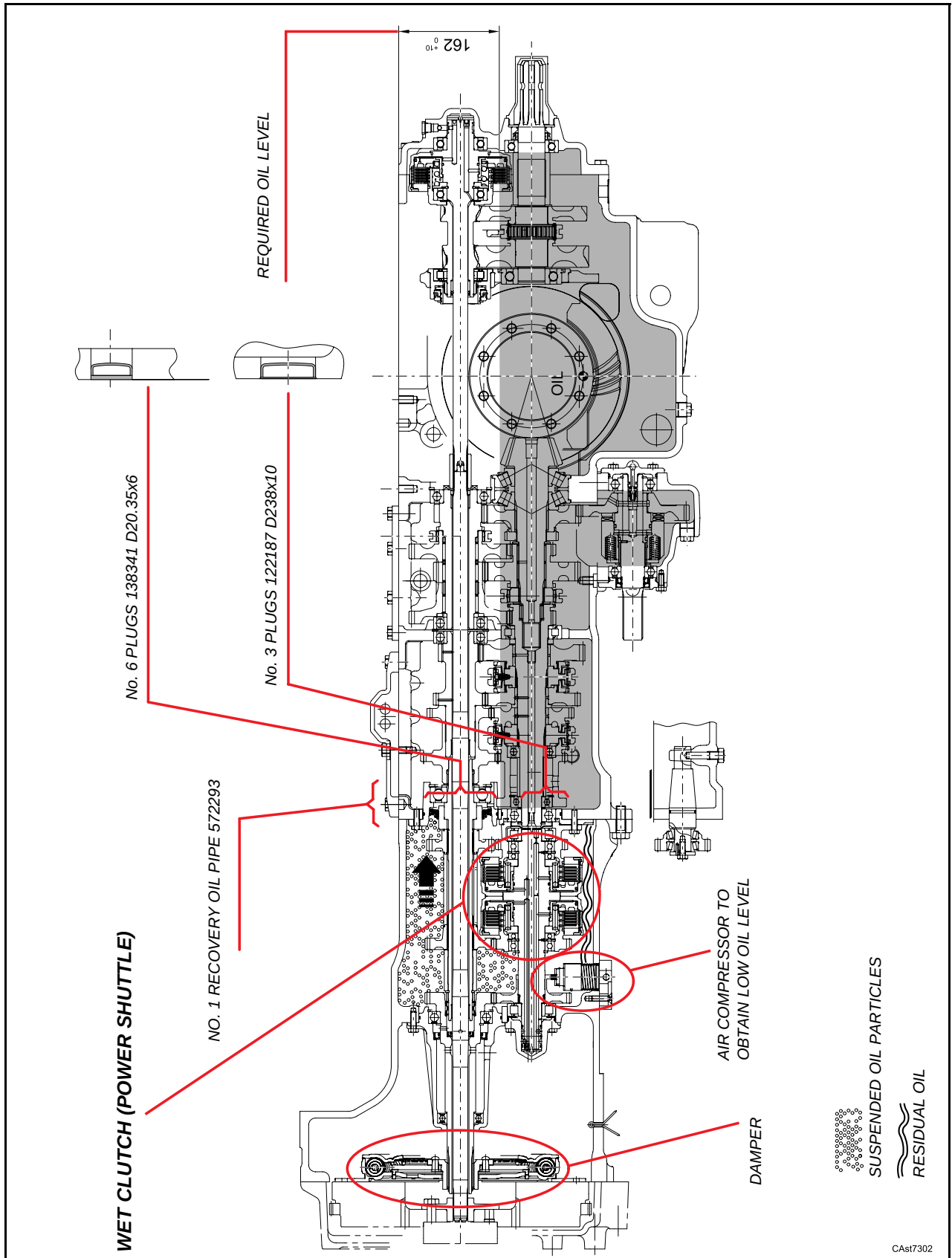
# General Specifications

## 24+24 synchro shuttle and power splitter



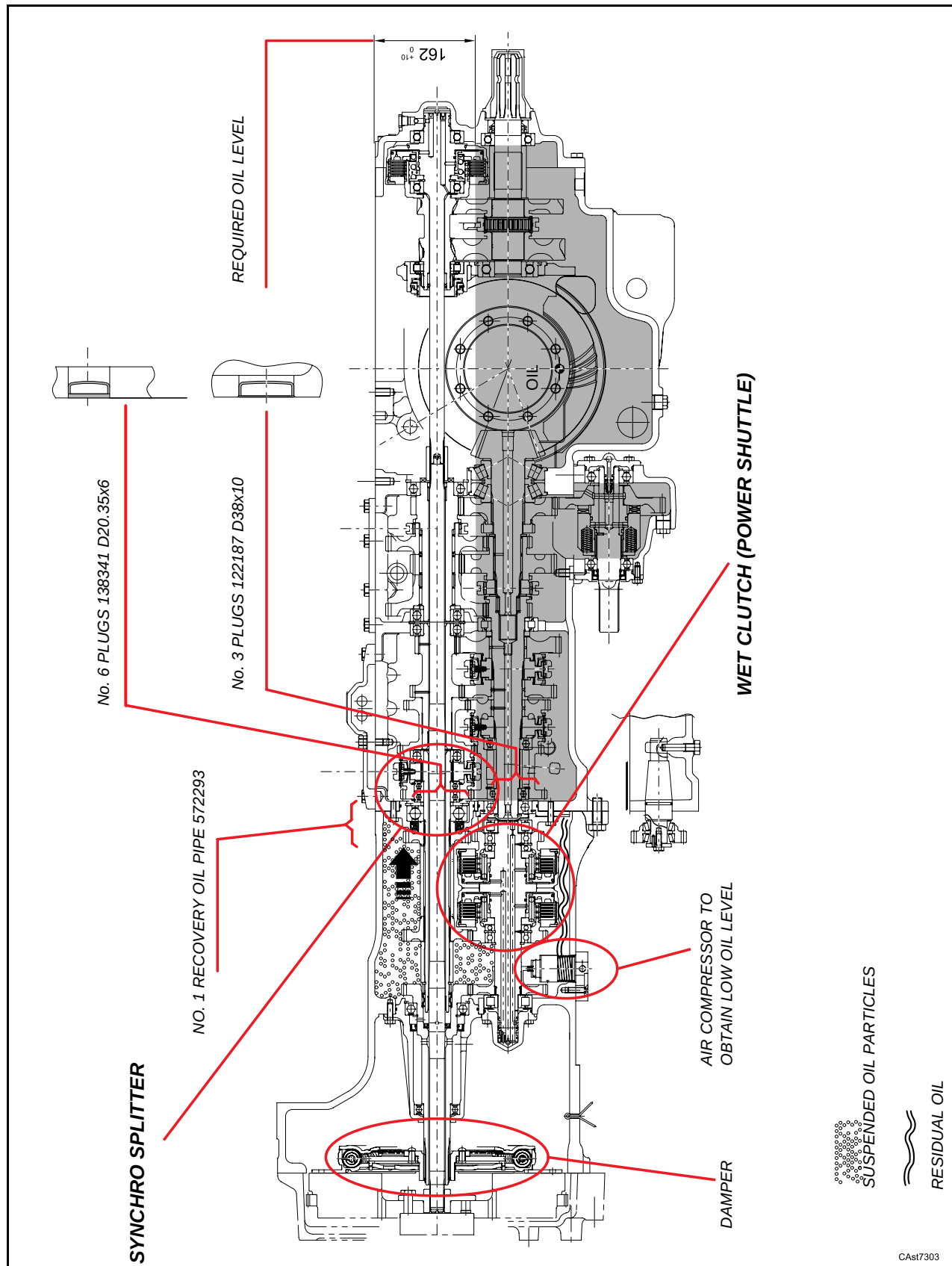
## General Specifications

12 + 12 power shuttle



# General Specifications

24 + 24 power shuttle and synchro splitter



# General Specifications

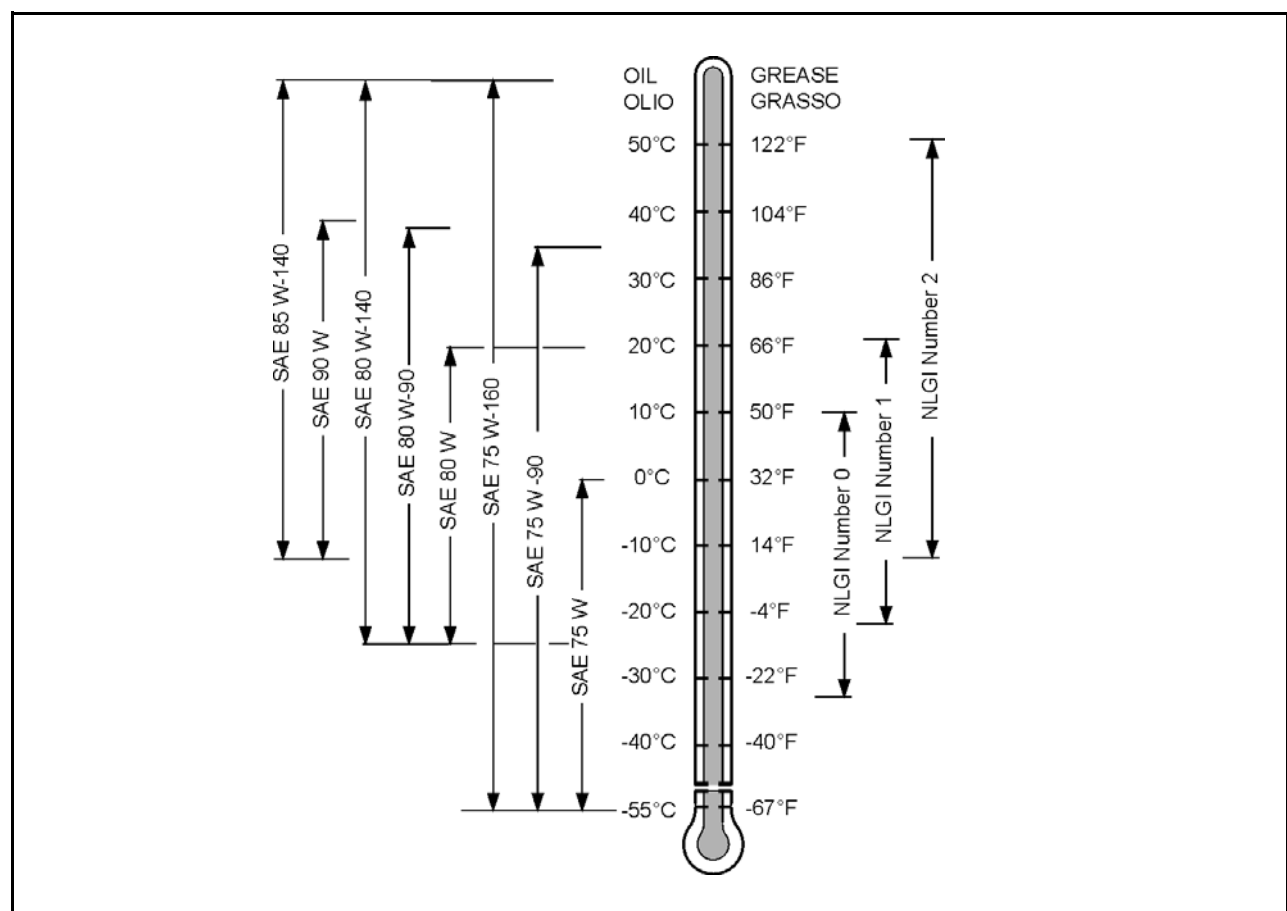
## SERVICE SCHEDULE

Specified maintenance intervals are for standard-duty use.

Severe operating conditions may require more short intervals.

| Operation                                           | Recommended intervals |       |       |        |
|-----------------------------------------------------|-----------------------|-------|-------|--------|
|                                                     | 50 h                  | 400 h | 800 h | 1200 h |
| Change the transmission/hydraulic oil               |                       |       |       |        |
| Change the oil suction strainer                     |                       |       |       |        |
| Change high pressure filter element                 |                       |       |       |        |
| Grease trumpet bearings                             |                       |       |       |        |
| Check automatic pick-up hitch for correct operation |                       |       |       |        |

Lubricants application range



# General Specifications

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# Disassembly and Assembly Operations

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## Disassembly and Assembly Operations

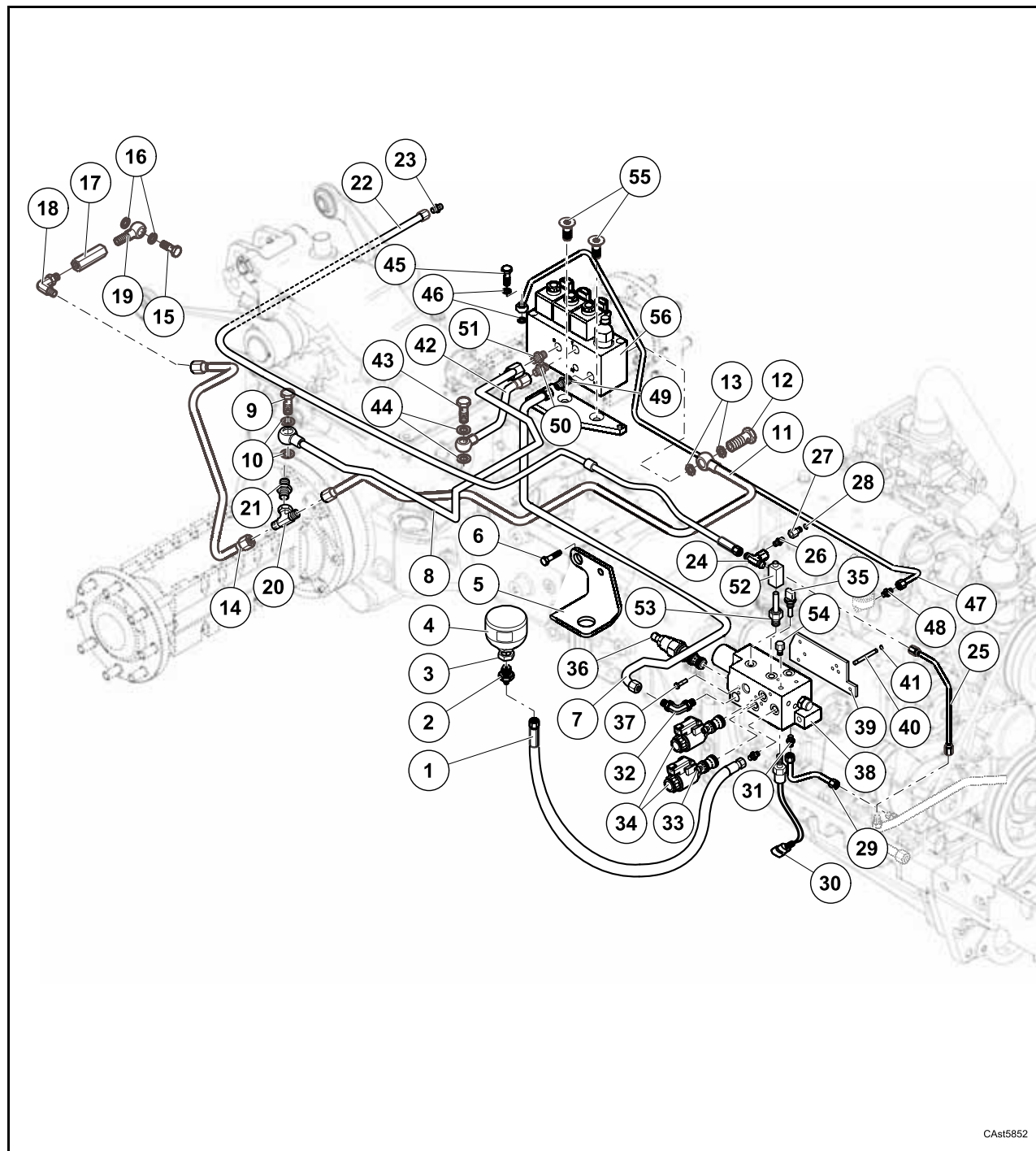
### Section 4A

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# Disassembly and Assembly Operations

## HYDRAULIC SYSTEM ASSY



CAst5852

**8+8  
synchro  
shuttle**

**12+12  
synchro  
shuttle**

**24+24  
synchro shuttle  
and synchro  
splitter**

**24+24  
synchro shuttle  
and power  
splitter**

**12+12  
power  
shuttle**

**24+24  
power shuttle  
and synchro  
splitter**

For models

-

-

-

-

|

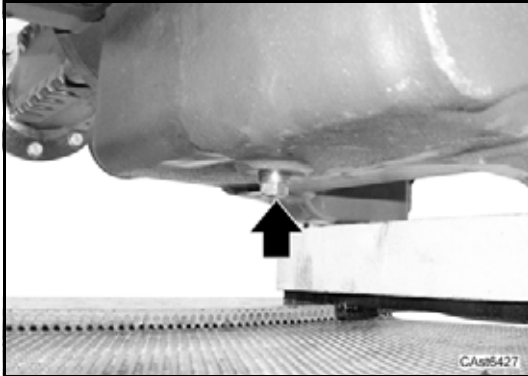
|

# Disassembly and Assembly Operations

## Disassembly

Some of the following pictures may not show exactly your transmission version, but the indicated operations are correct anyway.

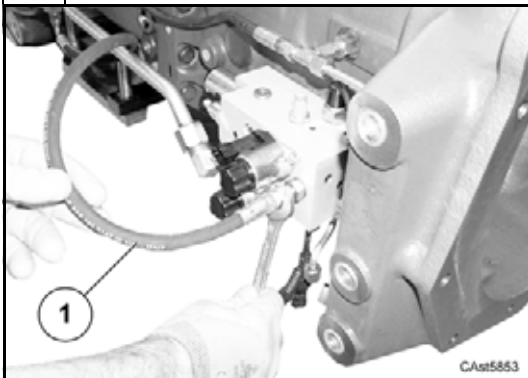
1.



Remove drain plug and drain oil from the transmission.

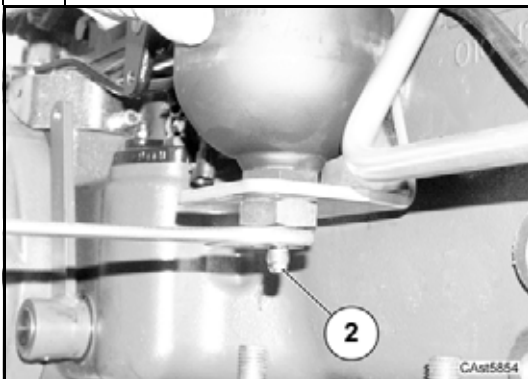
[Refer to: section C.7.](#)

2.



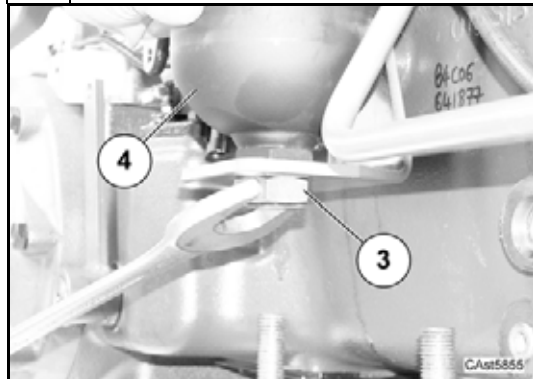
Disassemble accumulator hose (1) from control valve and accumulator.

3.



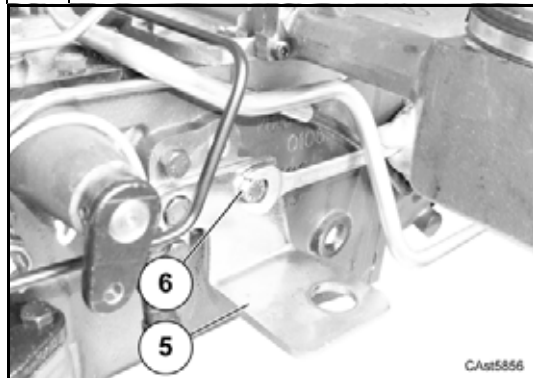
Remove connector (2).

4.



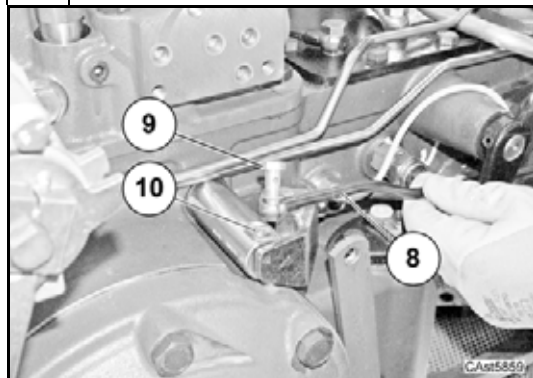
Remove accumulator (4) unscrewing nut (3).

5.



Remove bracket (5) supporting accumulator by unscrewing screw (6).

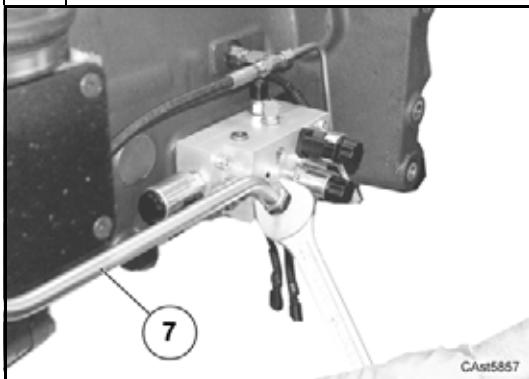
6.



Remove pipe (8) supplying differential oil connection, by loosening drilled screw (9) and relevant washers (10).

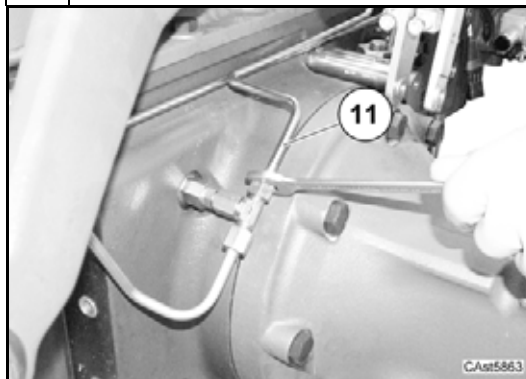
## Disassembly and Assembly Operations

7.



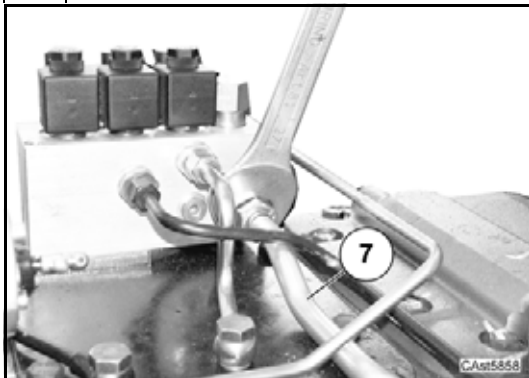
Remove pipe (7) from the reverser control valve.

10.



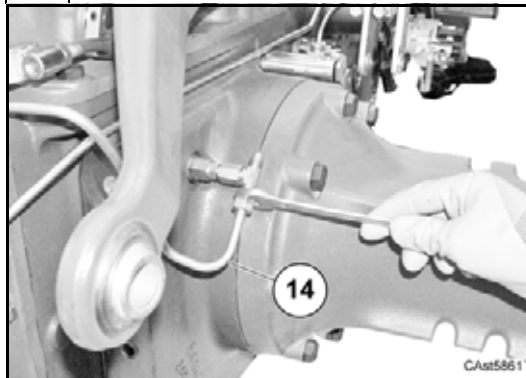
Remove pipe (11) from the T connector of PTO brake.

8.



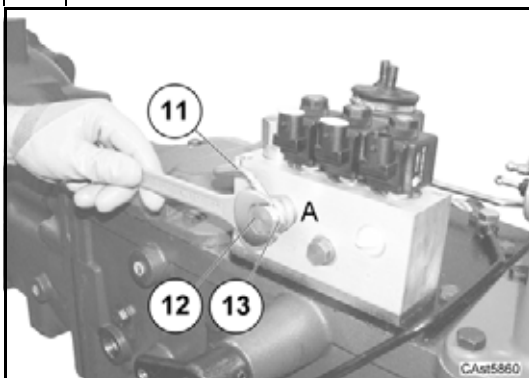
Remove pipe (7) from the control valve.

11.



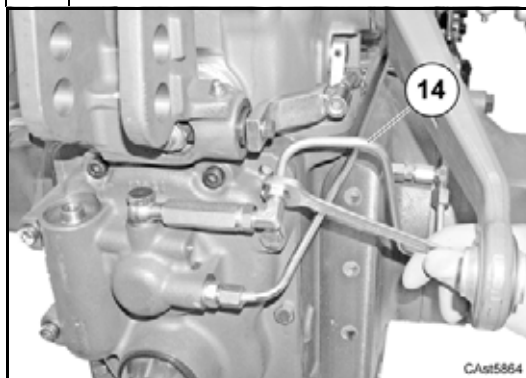
Remove pipe (14) from the T connector of PTO brake.

9.



Remove pipe (11) from port A of control valve, by loosening drilled screw (12) and relevant washers (13).

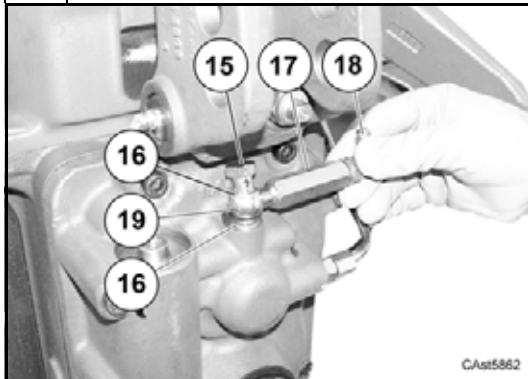
12.



Remove pipe (14) from the PTO oil supply.

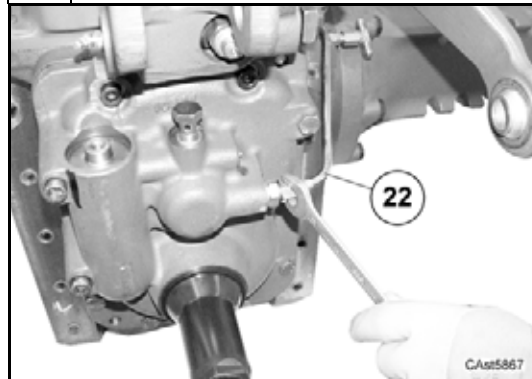
# Disassembly and Assembly Operations

13.



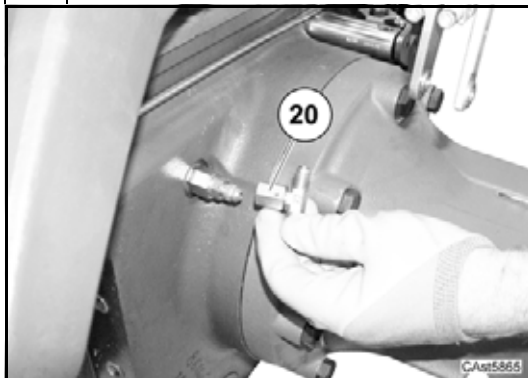
Remove drilled screw (15) and relevant washers (16), valve (17) and 90° connection (18). Remove connector (19) from the valve.

16.



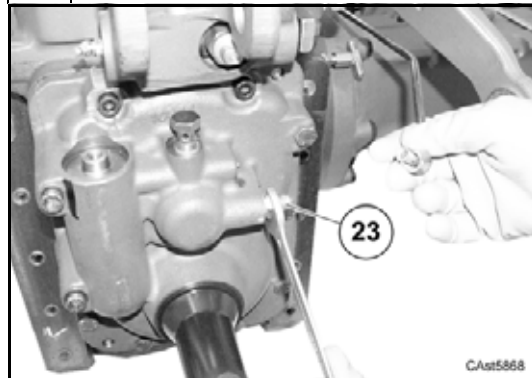
Disassemble pipe end for PTO lubrication (22).

14.



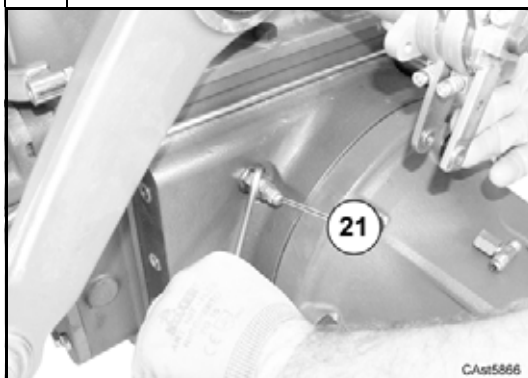
Disassemble T connector (20) of the PTO.

17.



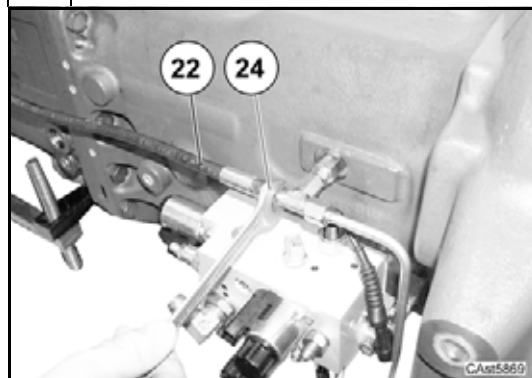
Remove connector (23).

15.



Disassemble connector (21) for brake input. Remove O-Ring and copper washer.

18.

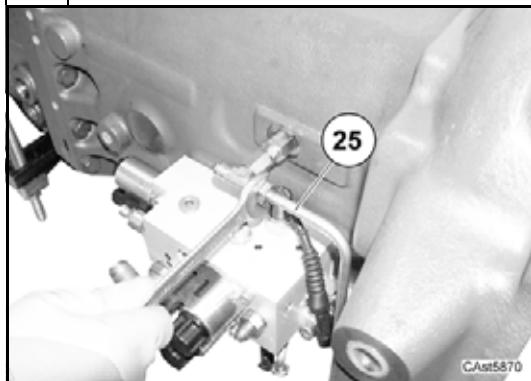


Disassemble hose end (22) from the T connector for input shaft (24) lubrication.



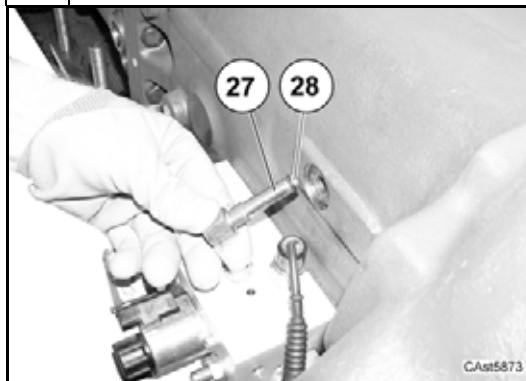
# Disassembly and Assembly Operations

19.



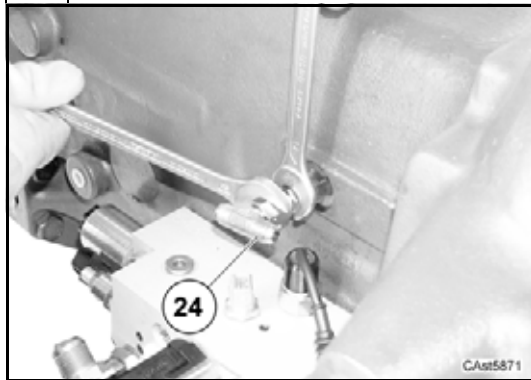
Assemble pipe (25) for input shaft lubrication.

22.



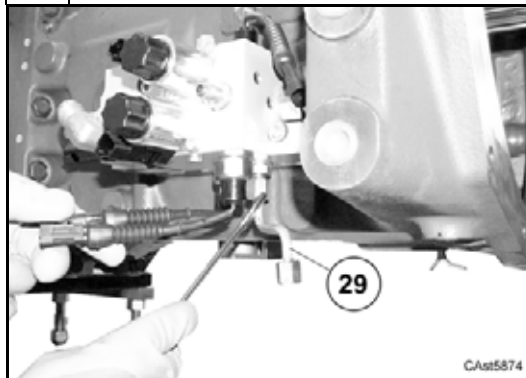
Remove connector (27) for input shaft lubrication and relevant O-Ring (28).

20.



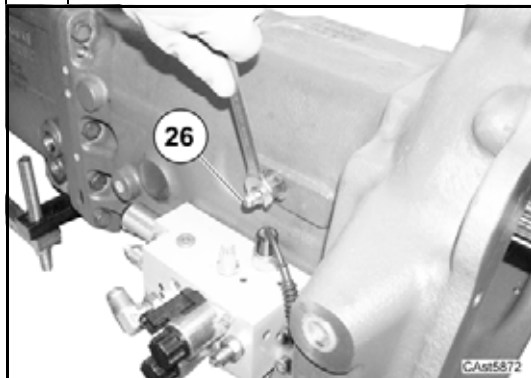
Remove T connector (24) with two wrenches.

23.



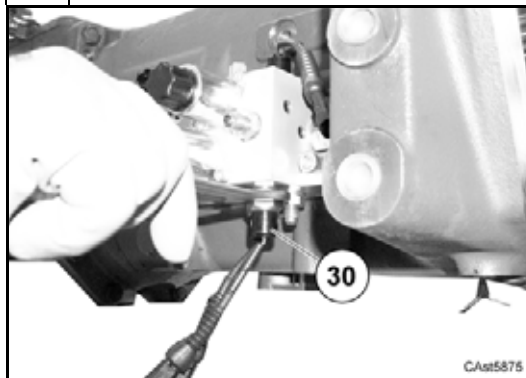
Remove pipe (29) for reverser input from control valve.

21.



Remove straight connector (26) with relevant washer and O-Ring.

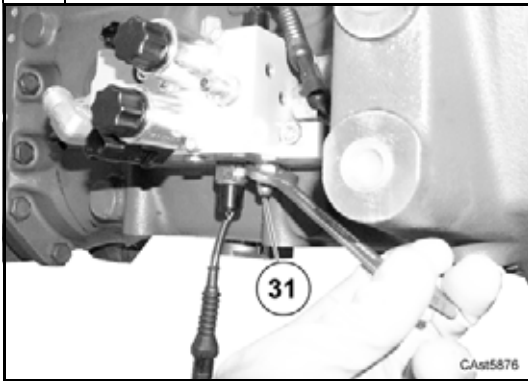
24.



Remove pressure sensor (30).

# Disassembly and Assembly Operations

25.



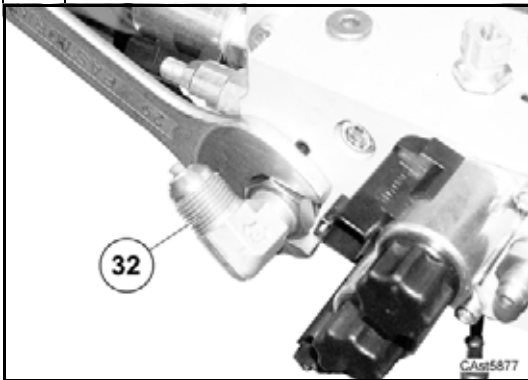
Remove connector (31) for input oil.

28.



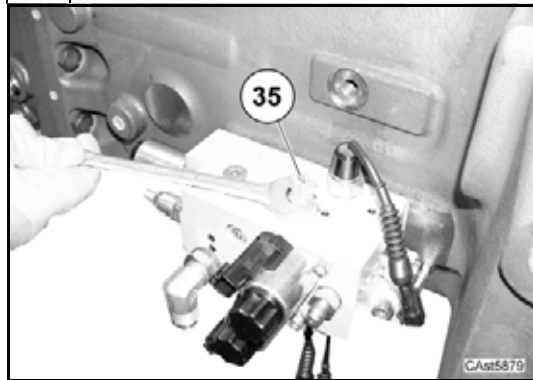
Disassemble solenoid valves by means of a screwdriver.

26.



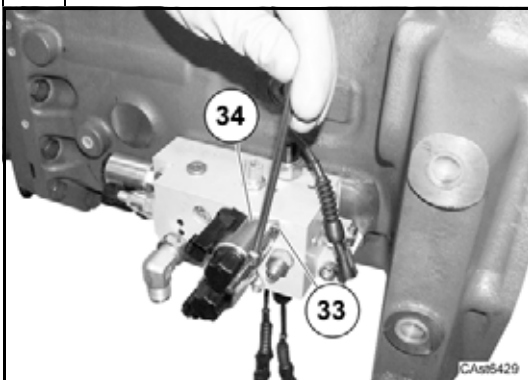
Remove 90° connector (32) for output oil pipe.

29.



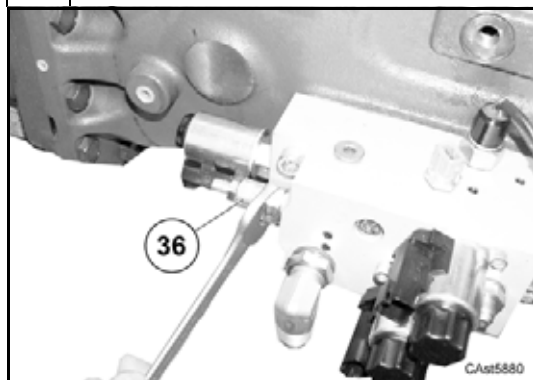
Remove temperature sensor (35).

27.



Remove two screws (33) of the solenoid valve (34) forward gear and relevant three O-Rings. Repeat same operation also for solenoid of idle gear.

30.

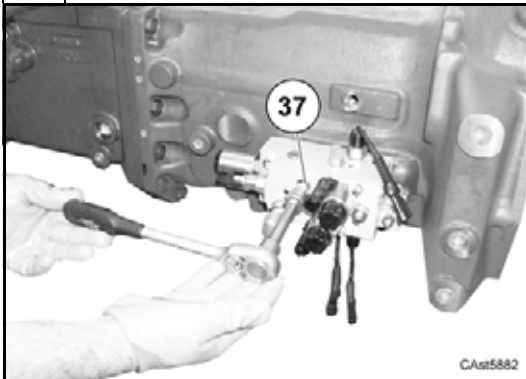


Remove delivery valve (36) adjusted at 6 litres/min and relevant O-Ring.



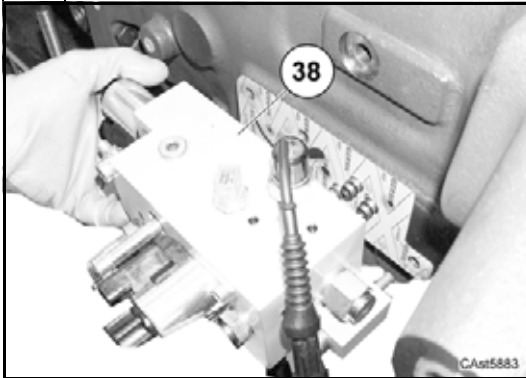
# Disassembly and Assembly Operations

31.



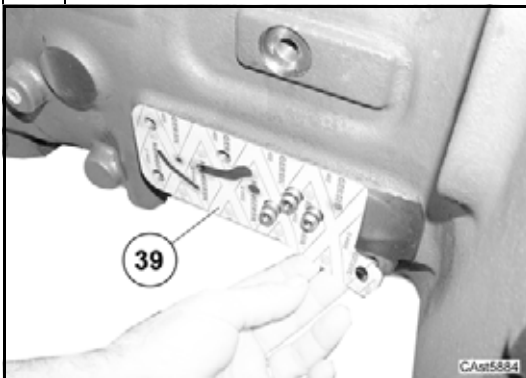
Remove four screws (37) fastening control valve.

32.



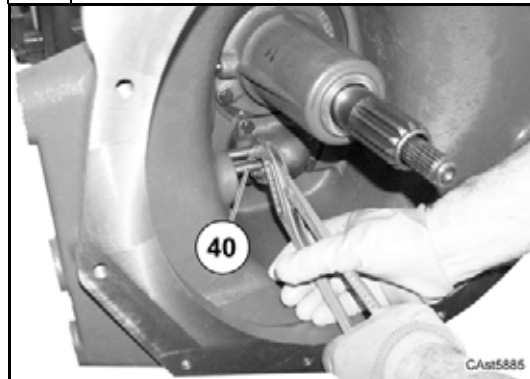
Remove control valve (38).

33.



Remove gasket (39).

34.



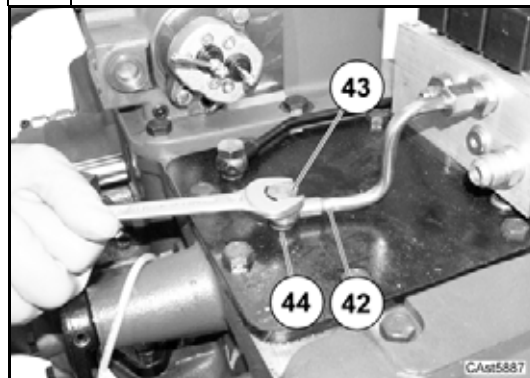
Remove three pipes (40) with relevant O-Rings (41) with pliers.

35.



Loosen pipe draining solenoid valves (42) from the control valve.

36.

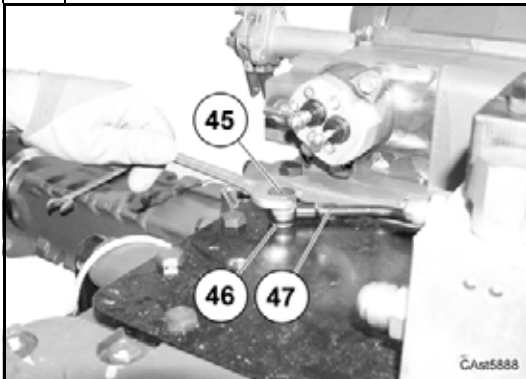


Remove drilled screw (43) and relevant washers (44) from the gear box cover.

Remove pipe (42).

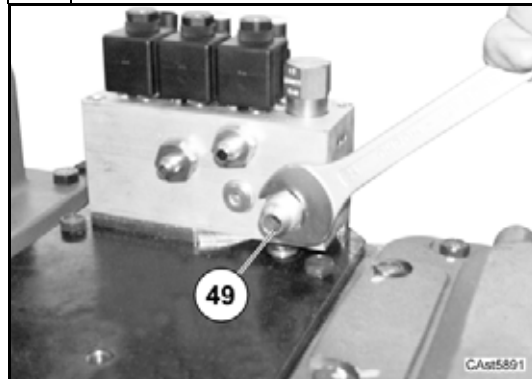
# Disassembly and Assembly Operations

37.



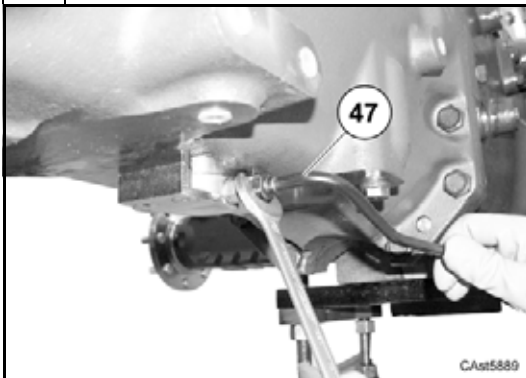
Remove drilled screw (45) and relevant washers (46) from air inlet pipe of compressor (47).

40.



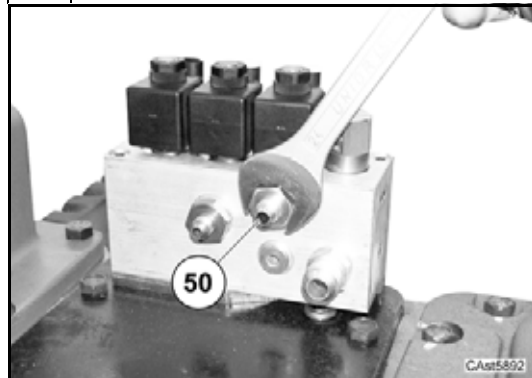
Remove connector (49) for control valve.

38.



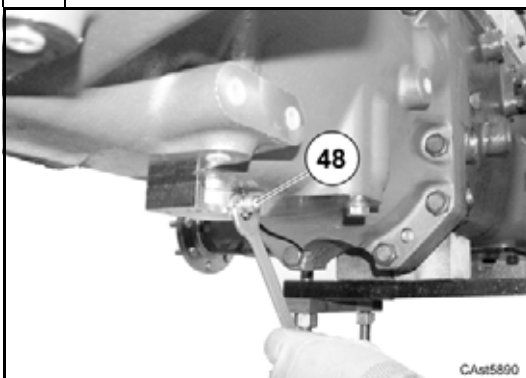
Remove pipe (47) from lower side of box (left machine seat side).

41.



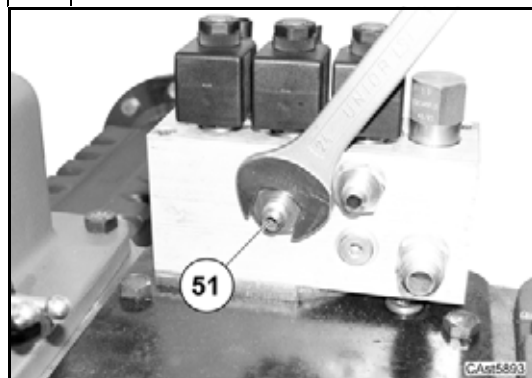
Remove connector (50) for solenoid valve drain.

39.



Remove connector (48).

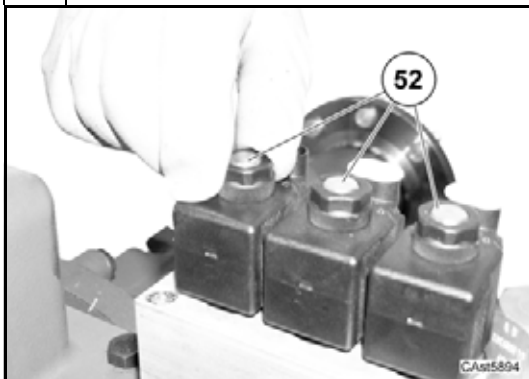
42.



Remove connector (51) of differential lock piping.

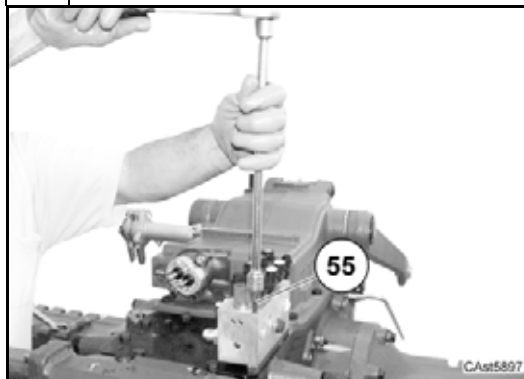
## Disassembly and Assembly Operations

43.



Remove manually three coils (52) (PTO, differential lock, 4WD).

46.



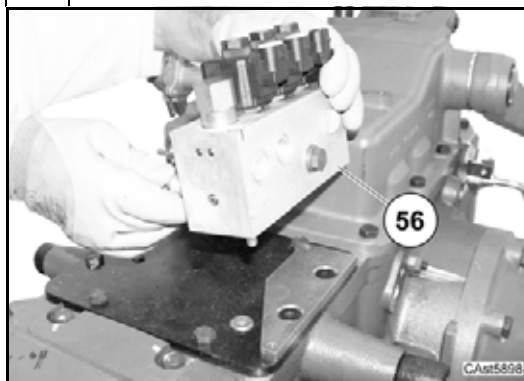
Remove two screws (55) fastening control valve.

44.



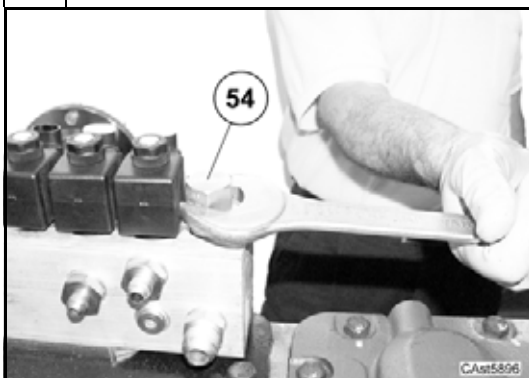
Remove three valves (53) with relevant O-Rings.

47.



Remove control valve (56).

45.



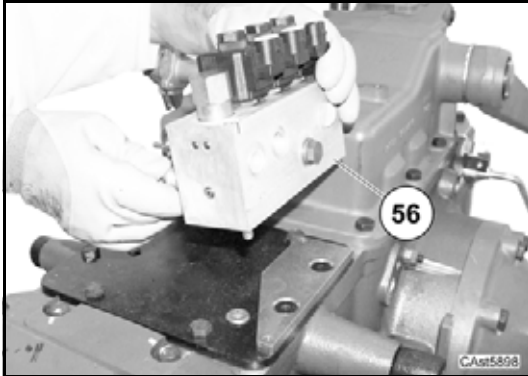
Remove main relief valve (54) with relevant O-Rings.

# Disassembly and Assembly Operations

## Assembly

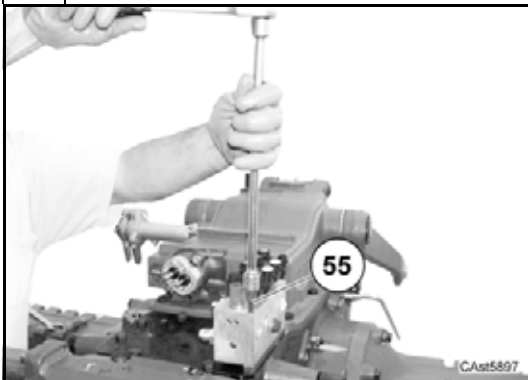
Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

1.



Position control valve (56) on transmission.

2.



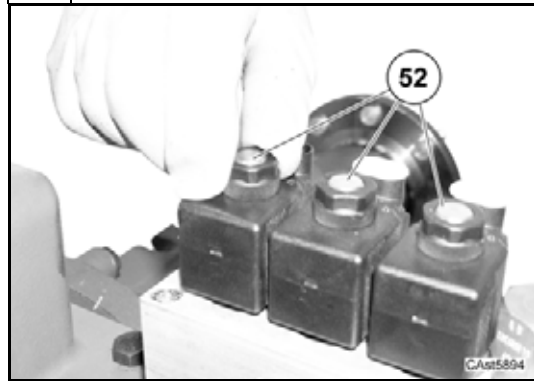
Screw in screws (55) fastening control valve (56).

3.



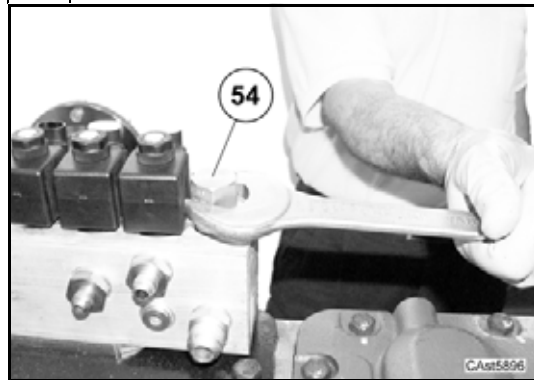
Assemble valves (53) with relevant O-Rings.

4.



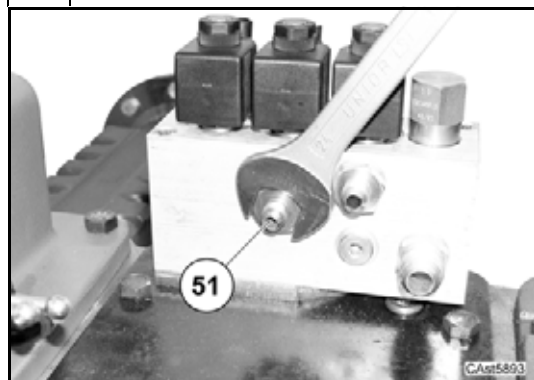
Assemble manually three coils (52).

5.



Assemble main relief valve (54) with relevant O-Rings.

6.

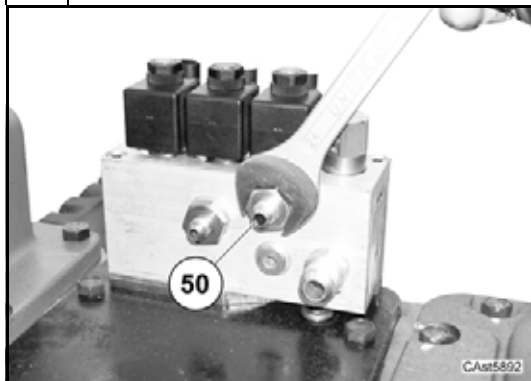


Tighten differential lock connector (51).



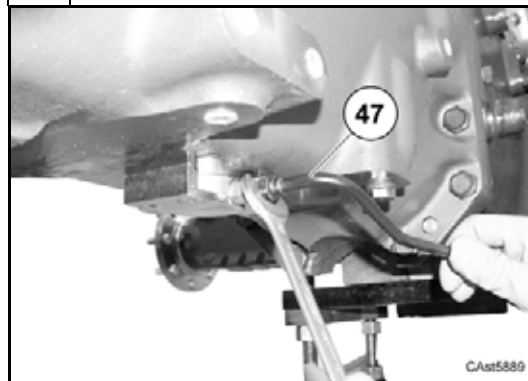
## Disassembly and Assembly Operations

7.



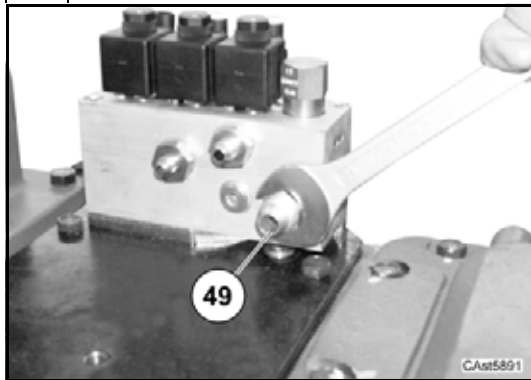
Tighten solenoid valves drain connector (50).

10.



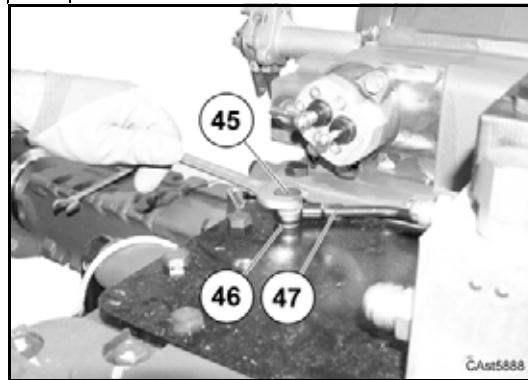
Assemble pipe (47) in the lower side of the box.

8.



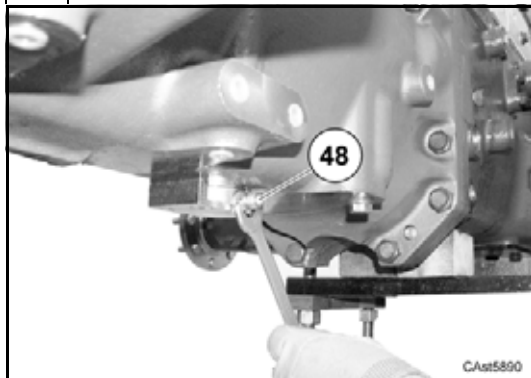
Screw in the connector for users control valve (49).

11.



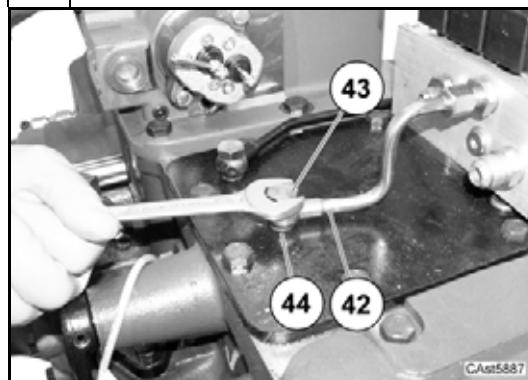
Assemble pipe (47), tighten drilled screw (45) and copper washers (46).

9.



Assemble connector (48).

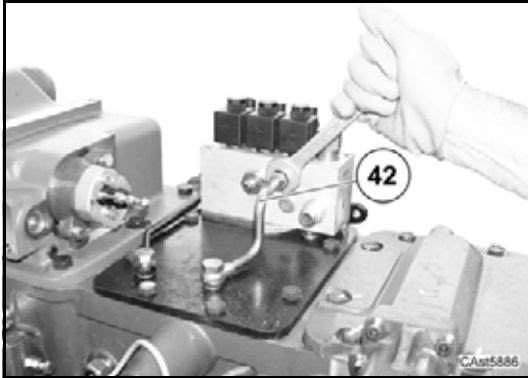
12.



Assemble pipe (42) draining solenoid valves and tighten drilled screw (43) with copper washers (44).

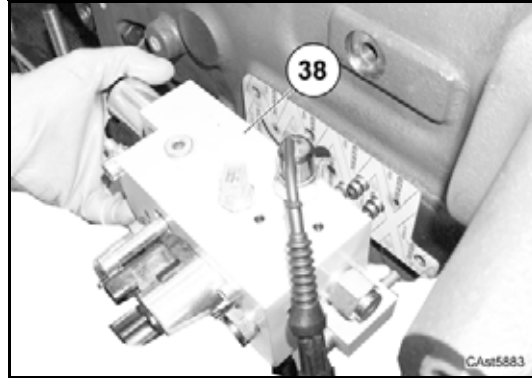
# Disassembly and Assembly Operations

13.



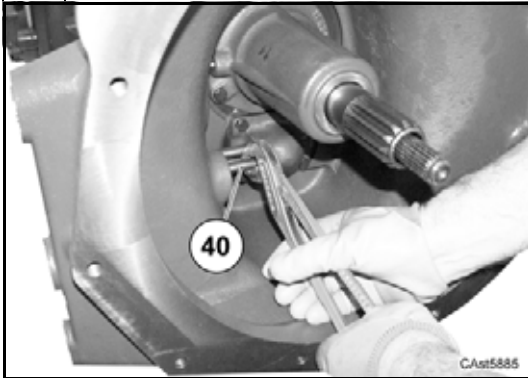
Tighten pipe (42) on the control valve.

16.



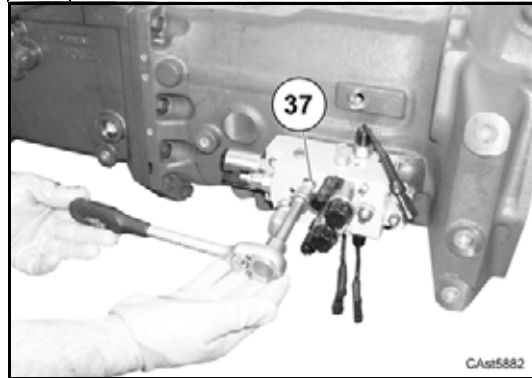
Assemble control valve (38).

14.



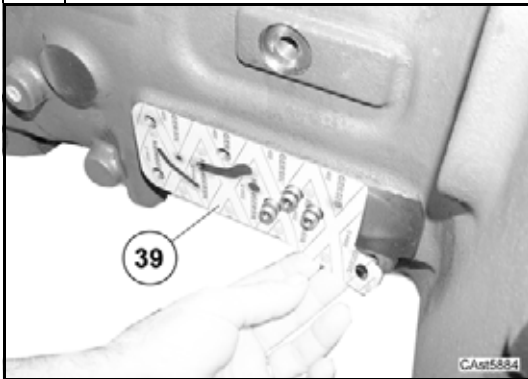
Assemble three pipes (40) with relevant O-Rings (41) with pliers.

17.



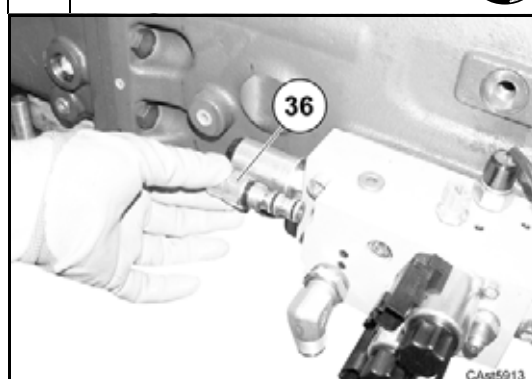
Tighten four screws (37) to the prescribed torque.  
[Refer to: section C.4.](#)

15.



Lubricate and apply gasket (39) after condition check.

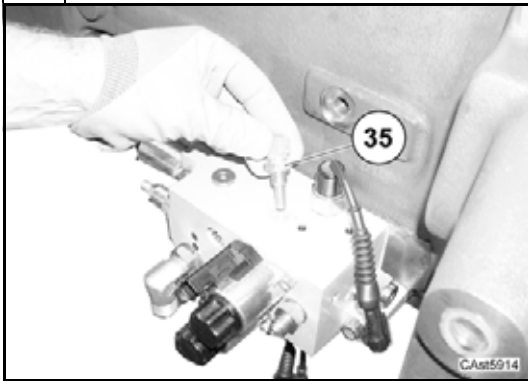
18.



Insert valve for delivery adjustment (36) set at 6 litres/min and relevant O-Rings on the control valve.

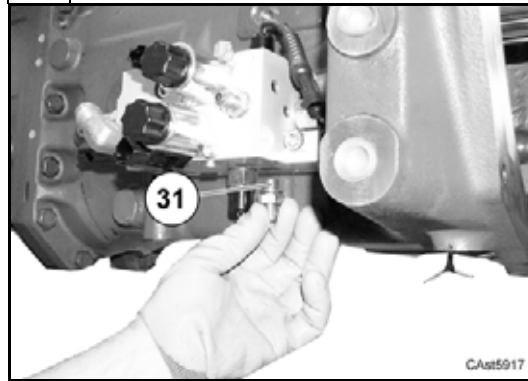
# Disassembly and Assembly Operations

19.



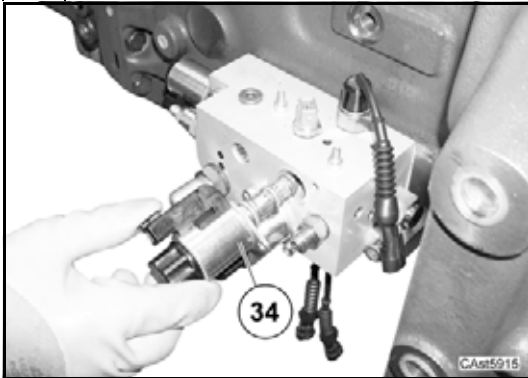
Insert temperature sensor (35).

22.



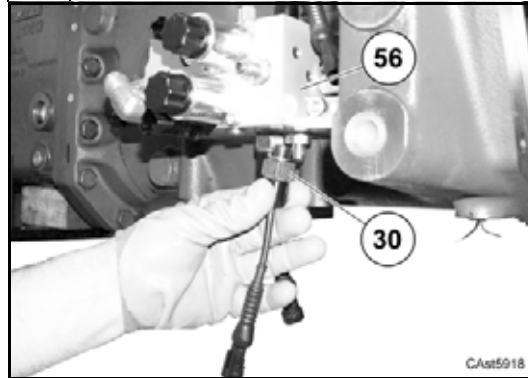
Assemble connector (31) for reverser input.

20.



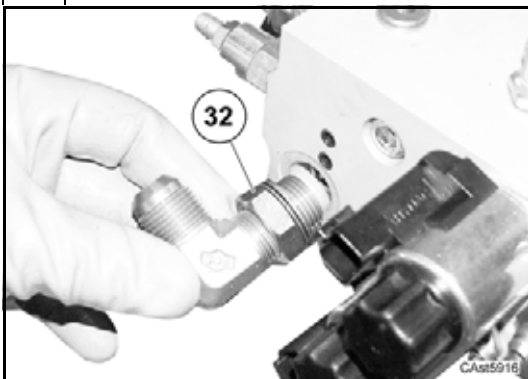
Assemble three O-Rings on the solenoid valve (34) for forward gear control and insert it in the control valve. Tighten screws (33). Repeat same operation also for solenoid of idle gear (the lower one).

23.



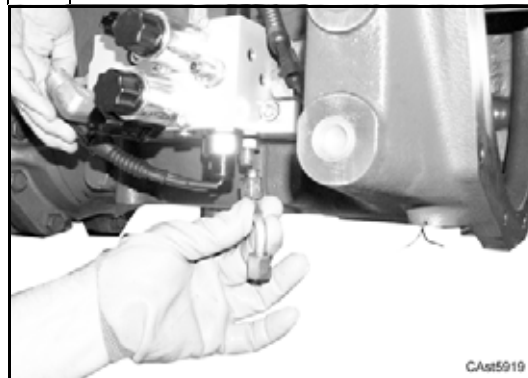
Insert pressure sensor (30) under control valve (56).

21.



Assemble 90° connector (32) of the users supply pipe.

24.

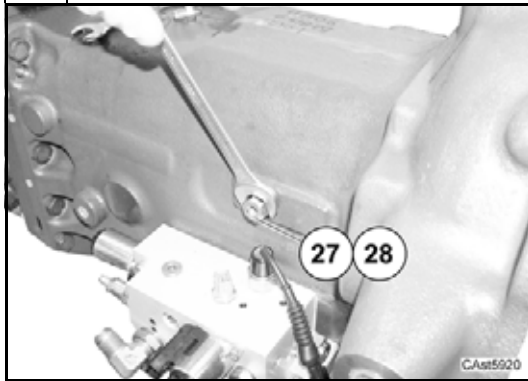


Assemble pipe (29) for reverser input from control valve.



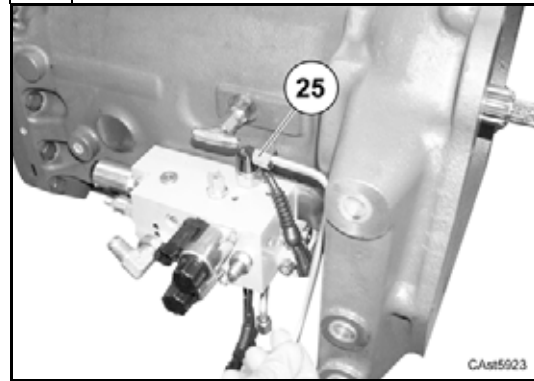
# Disassembly and Assembly Operations

25.



Assemble connector (27) on the body for input shaft and relevant O-Ring (28) lubrication.

28.



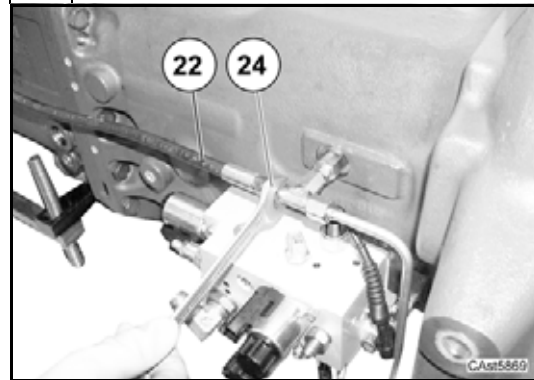
Assemble pipe (25) for input shaft lubrication.

26.



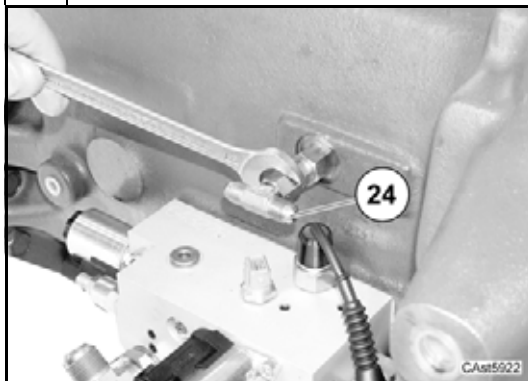
Assemble straight connector (26) with relevant washer and O-Ring.

29.



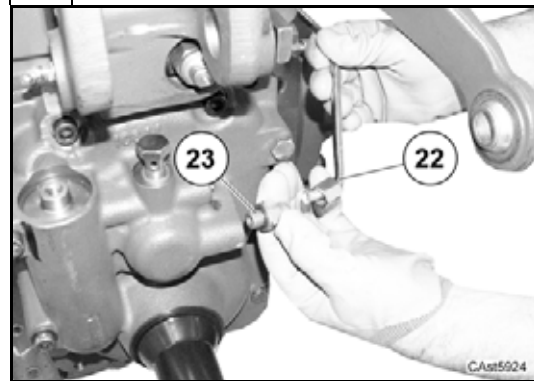
Assemble hose end (22) on the T connector (24) for input shaft lubrication.

27.



Insert T connector (24).

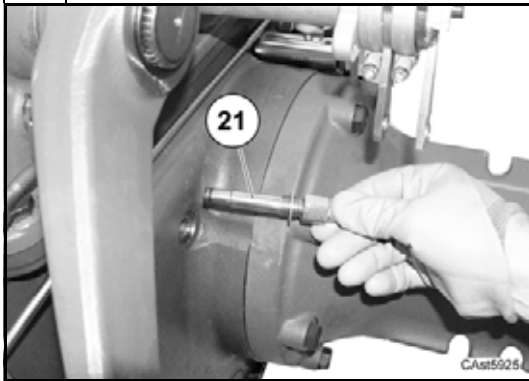
30.



Assemble connector (23) and pipe end (22) for PTO lubrication.

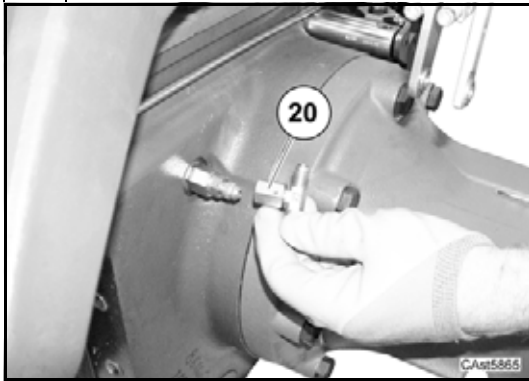
# Disassembly and Assembly Operations

31.



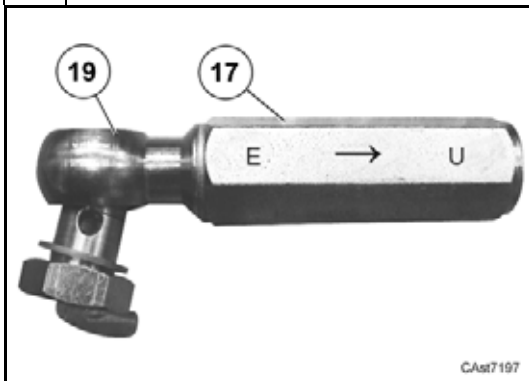
Insert O-Ring and copper washer on the input connector (21) of the brake. Assemble connector (21) as shown in the figure.

32.



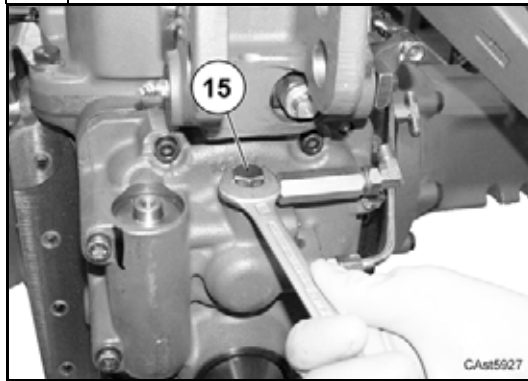
Assemble T connector (20) of the PTO.

33.



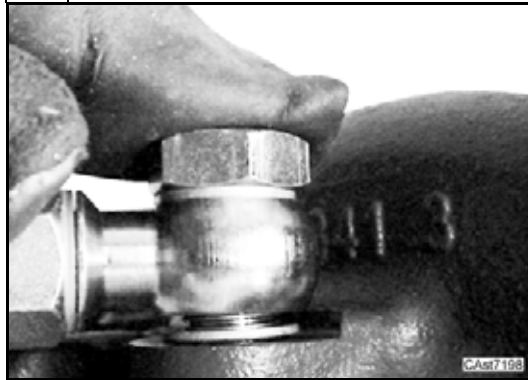
Assemble connector (19) on valve (17). Insert O-Ring and 90° connector (18) from opposite side.

34.



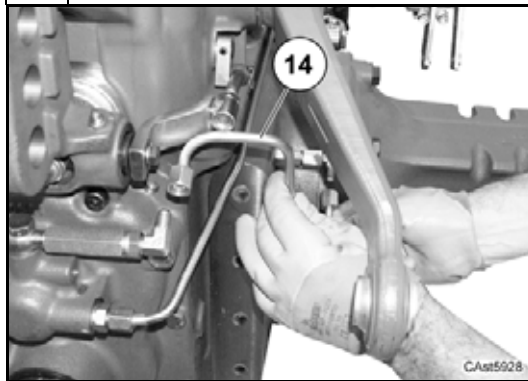
Assemble valve (17) and fasten it with drilled screw (15) and relevant washers.

35.



**NOTE:** Correct assembly of valve (17).

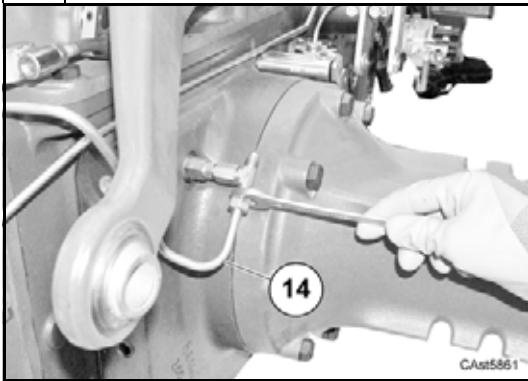
36.



Assemble pipe (14) of PTO oil supply.

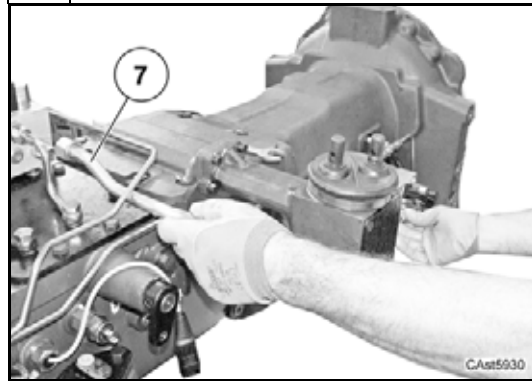
# Disassembly and Assembly Operations

37.



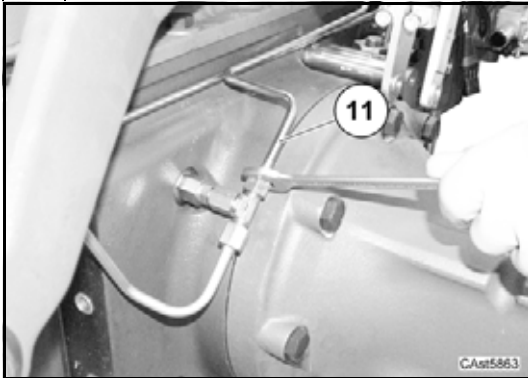
Assemble pipe (14) on T connector of the PTO brake.

40.



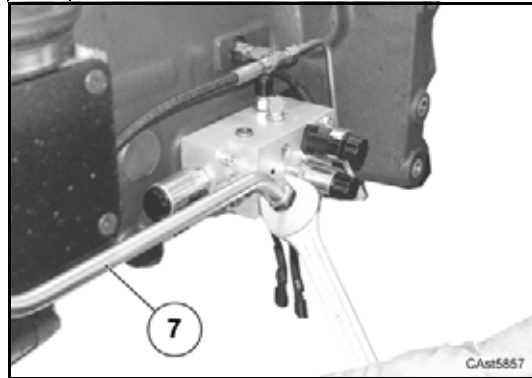
Assemble pipe (7) on the control valve.

38.



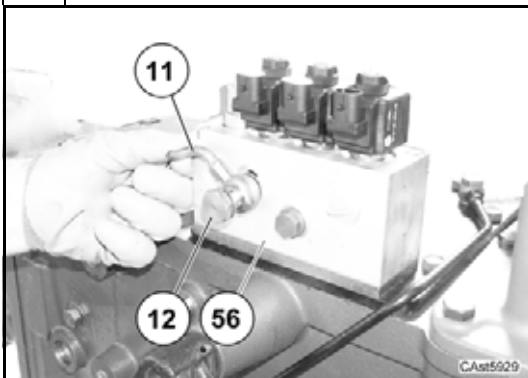
Assemble second pipe (11) on T connector of the PTO brake.

41.



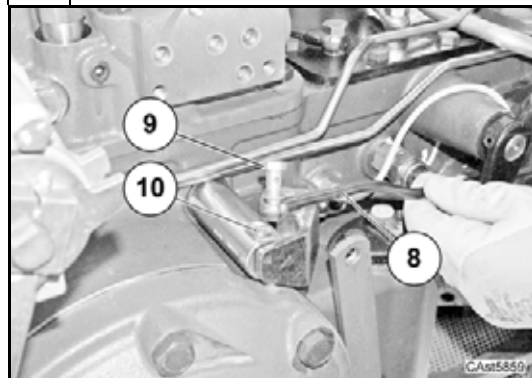
Assemble pipe (7) on the reverser control valve, as shown in the figure.

39.



Assemble pipe (11) at control valve (56) (A) port.  
Screw in the drilled screw (12) and relevant washers.

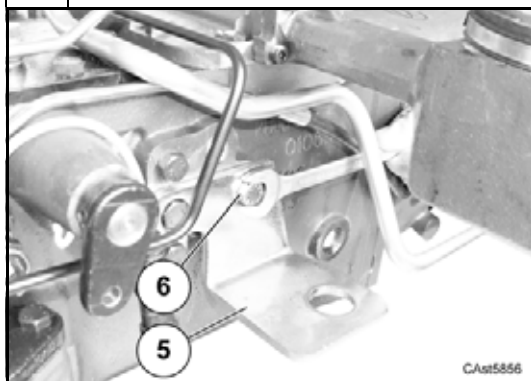
42.



Assemble pipe (8) for differential oil connection.  
Screw in the drilled screw (9) with relevant washers (10).

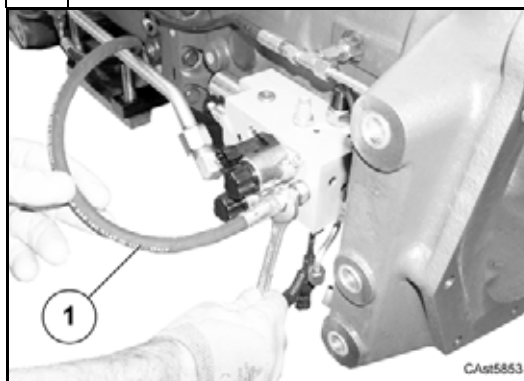
## Disassembly and Assembly Operations

43.



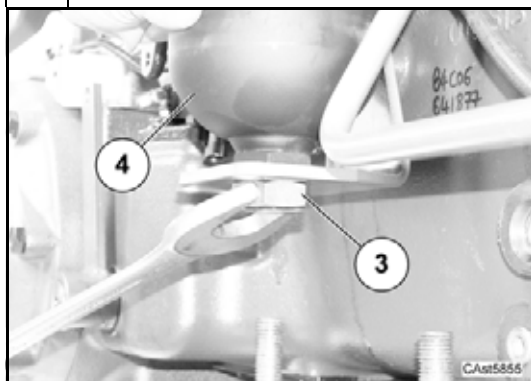
Assemble bracket (5) supporting accumulator and tighten screw (6).

46.



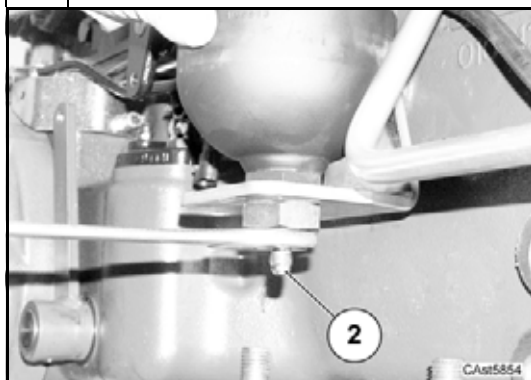
Assemble hose (1) on the accumulator and control valve.

44.



Assemble accumulator (4) on the bracket (5) and screw in the nut (3).

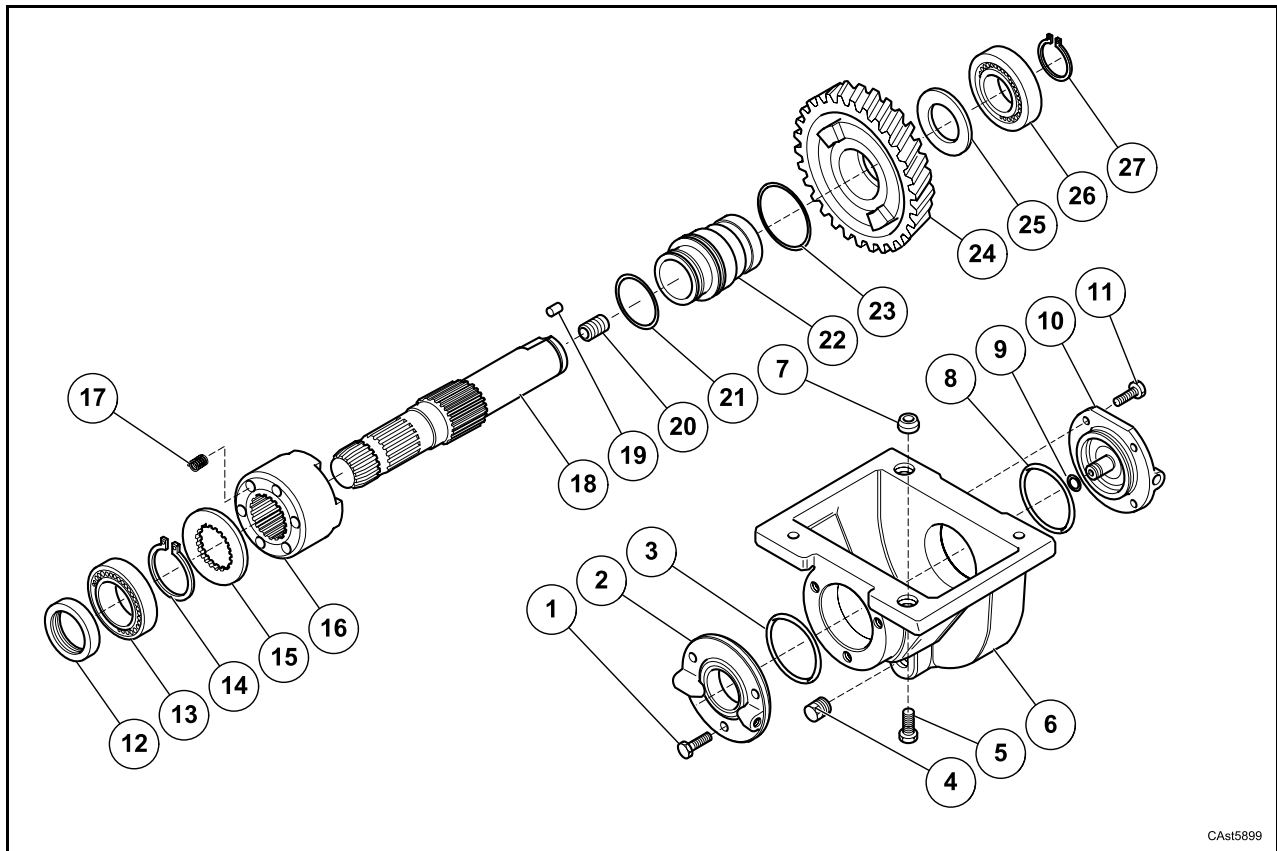
45.



Insert connector (2).

# Disassembly and Assembly Operations

## DROP BOX



CAst5899

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models |                           |                             |                                                     |                                                   |                           |                                                   |

### Disassembly

1. Remove drain plug (4) and drain transmission oil completely.

Refer to: [section C.8.](#)

2. Remove fastening screws (5).
3. Disassemble drop box from the gear box.
4. Remove bushes (7) from the box (6) if necessary.
5. Remove screws (11).
6. Disassemble cover (10) from the box (6).
7. Remove O-Ring (8) from the cover (10).

**NOTE:** Destructive operation for the O-Ring.

8. Disassemble seal ring (9) from the cover (10).

**NOTE:** Destructive operation for the seal ring.

9. Extract valve (20) from the shaft (18).
10. Remove snap ring (27).
11. Remove bearing (26).

12. Collect spacer (25).

13. Collect roller (19).

14. Remove screws (1).

15. Disassemble cover (2) from the box (6).

16. Remove O-Ring (3) from the cover (2).

**NOTE:** Destructive operation for the O-Ring.

17. Remove seal ring (12) from the cover (2).

**NOTE:** Destructive operation for the seal ring.

18. Remove bearing (13) from the box (6).

19. Extract shaft (18) from the box (6) and from the bush (22).

20. Remove snap ring (14) from the shaft (18).

21. Extract at the same time from the box (6): bush (22), sleeve (16) and gear (24), keeping springs (17) together with the thrust washer (15).

22. Separate thrust washer (15) from the springs (17).

**NOTE:** Keep springs.



# Disassembly and Assembly Operations

---

23. Remove springs from the sleeve (16).
24. Remove sleeve (16) from the gear (24).
25. Remove bush (22) from the sleeve (16).
26. Remove O-Rings (21) and (23) from the bush (22).

**NOTE:** Destructive operation for O-Rings.

## Assembly

1. Assemble drain plug (4).

Lubricate and assembly O-Rings (21) and (23) on the bush (22).

[Refer to: section C.4.](#)

2. Assemble group (A) as follow:
  - assemble bush (22) on the sleeve (16);
  - assemble sleeve (16) on the gear (24);
  - insert springs (17) into the sleeve (16).

Position box (6) in an appropriate vice with rear side downward.

3. Insert group (A) into the box (6).
4. Insert thrust washer (15) into the box (6) on the springs (17).
5. Insert snap ring (14) in the shaft (18).
6. Insert shaft (18) into the box (6) and into the bush (22).
7. Assemble bearing (13) to the box (6) using prescribed special tool CA715843 and a hammer.

[Refer to: section E.1 \(drop box\).](#)

8. Insert seal (12) on the cover (2) using prescribed driver "CA715804" on page 311 and a hammer.

9. Lubricate O-Ring (3).

[Refer to: section C.4.](#)

10. Assemble O-Ring (3) on the cover (2).

11. Lubricate seal ring (12).

[Refer to: section C.4.](#)

12. Assemble cover (2) to the box (6).

13. Tighten screws (1) to the requested torque

[Refer to: section C.4.](#)

14. Turn box (6) upside down.

15. Settle shaft (18) downward.

16. Align key-way on the shaft (18).

17. Insert needle (19).

18. Assemble washer (25).

19. Assemble bearing (26) using prescribed driver "CA715843" on page 311 and a hammer.

[Refer to: section E.1 \(drop box\).](#)

20. Assemble snap ring (27).

21. Lubricate hole in the shaft (18).

22. Insert valve (20) into the shaft (18).

23. Lubricate valve (20).

24. Assemble shaft (9) on the cover (10) using tool "CA715845" on page 311.

[Refer to: section E.1 \(drop box\).](#)

25. Clench shaft (9) using special tool "calibrator".

26. Lubricate O-Ring (8).

[Refer to: section C.4.](#)

27. Assemble O-Ring (8) on the cover (10).

28. Assemble cover (10) on the box (6).

29. Tighten screws (11) to the requested torque.

[Refer to: section C.4.](#)

30. Check right working insufflating air into the box through the hole on the cover (10).

31. Apply prescribed sealing on the bushes (7).

[Refer to: section C.4.](#)

32. Assemble bushes (7) on the box (6).

33. Apply prescribed sealing on the contact surface of 4WD box (6) with gear box.

[Refer to: section C.4.](#)

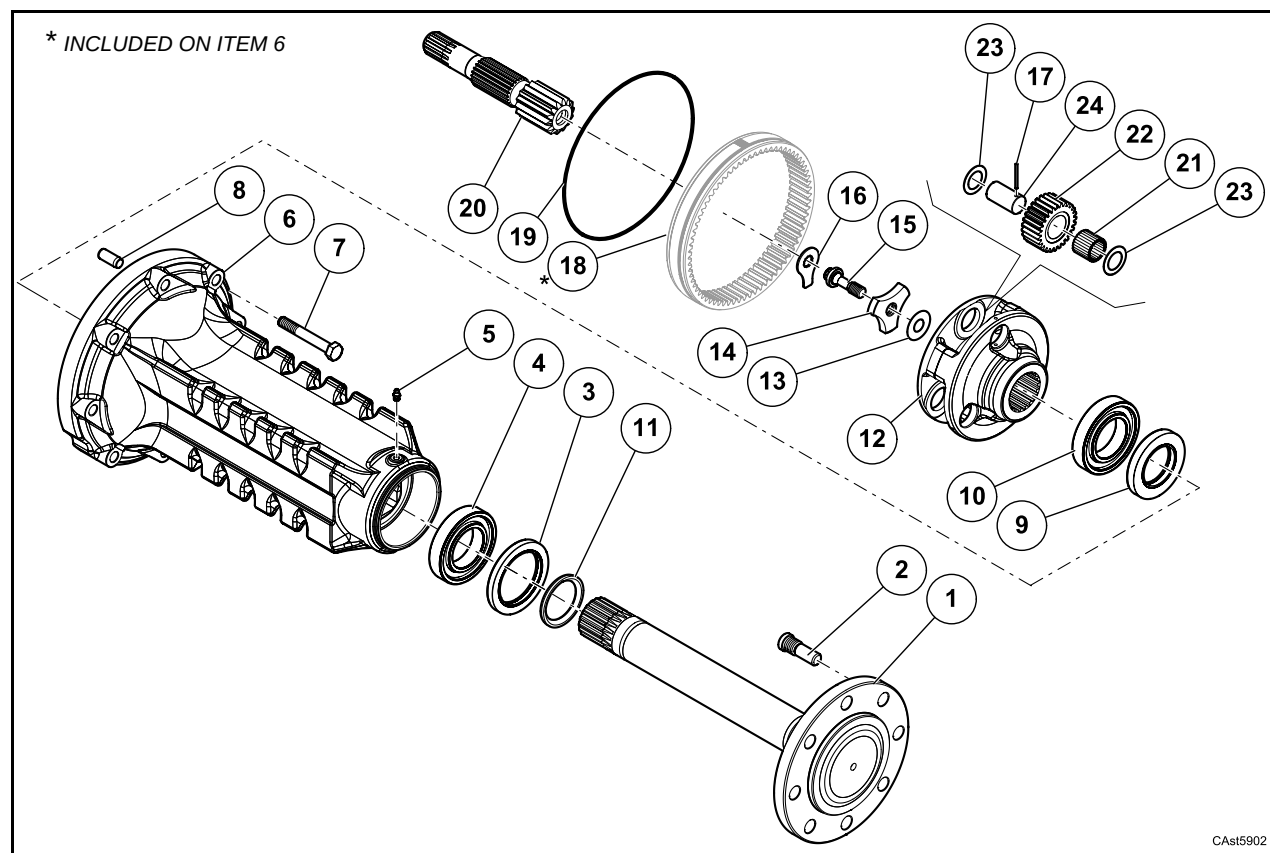
34. Assemble 4WD box (6) to the gear box.

35. Tighten screws (5) to the requested torque.

[Refer to: section C.4.](#)

# Disassembly and Assembly Operations

## FINAL DRIVE - FROM 55 TO 75 HP



|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models |                           |                             |                                                     |                                                   |                           |                                                   |

### Disassembly

1. Unscrew locking screws (7) of trumpet (6).
2. Remove trumpet (6) from the gear box.
3. Remove shaft (20) from the transmission.
4. Remove washer (16) locking screw (15).
5. Unscrew screw (15).
6. Remove retaining washer (14) and shims (13).
7. Extract planetary carrier (12).
8. Disassemble planetary gears carrier by removing pins (17).
9. Remove pins (24) and pull out planetary gears carrier (12), washers (23), gears (22) and rollers (21).
10. Remove pins (8) from the trumpet (6).
11. Remove O-Ring (19) on the ring gear (18).

**NOTE:** Destructive operation for O-Ring.

12. Remove washer (11).
13. Collect bearing (10).

14. Turn assy upside down.

15. Extract wheel shaft (1) from the trumpet (6).
16. If necessary remove studs (2) from the wheel axle (1).
17. Remove seal ring (3) from the trumpet (6).

**NOTE:** Destructive operation for seal ring.

18. Remove bearing (4) from the trumpet (6).
19. Turn trumpet (6) upside down.
20. Extract seal ring (9) from the trumpet (6).

**NOTE:** Destructive operation for seal ring.

21. If necessary remove grease points (5) from the trumpet (6).



# Disassembly and Assembly Operations

## Assembly

1. With vertical trumpet:  
Assemble bearing (4) on trumpet (6) using tool "CA715825" on page 329.

**NOTE:** Correct bearing position with screen directed as shown in the figure.

Refer to: section E.1 (" " on page 328) and figure 1.

2. Assemble seal (3) with tool "CA119034" on page 329.

Refer to: section E.1 (" " on page 328) and figure 2.

3. Grease area as shown in the figure.

Refer to: section C.4 and figure 2.

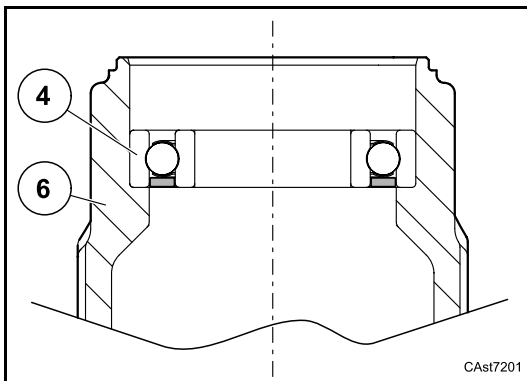


Figure 1

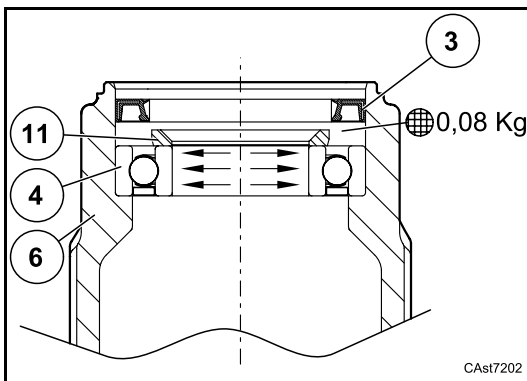


Figure 2

4. Assemble shim (11).
5. Assemble studs (2) on wheel axle (1).
6. Warm shown area to 120 °C for 4/5 minutes to allow introduction of the wheel axle (1).

Refer to: figure 2.

7. Assemble wheel axle (1).
8. Turn trumpet (6). Assemble seal (9) with tool CA715824.

Refer to: section E.1 (" " on page 328).

9. Assemble bearing (10) with tool CA715825.

Refer to: section E.1 (" " on page 328).

10. Assemble a new O-Ring (19) on ring gear (18).

11. Assemble pins (8) on trumpet (6).

12. Assemble planetary gear assy on trumpet.

**NOTE:** correct assembly of planetary gear assy and correct assembly of pins (17).

Refer to: figure 3, 4 and 5.

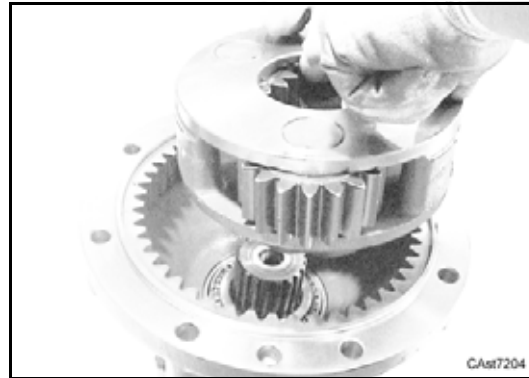


Figure 3

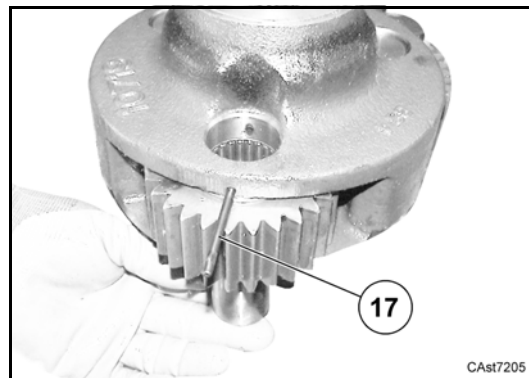


Figure 4

# Disassembly and Assembly Operations

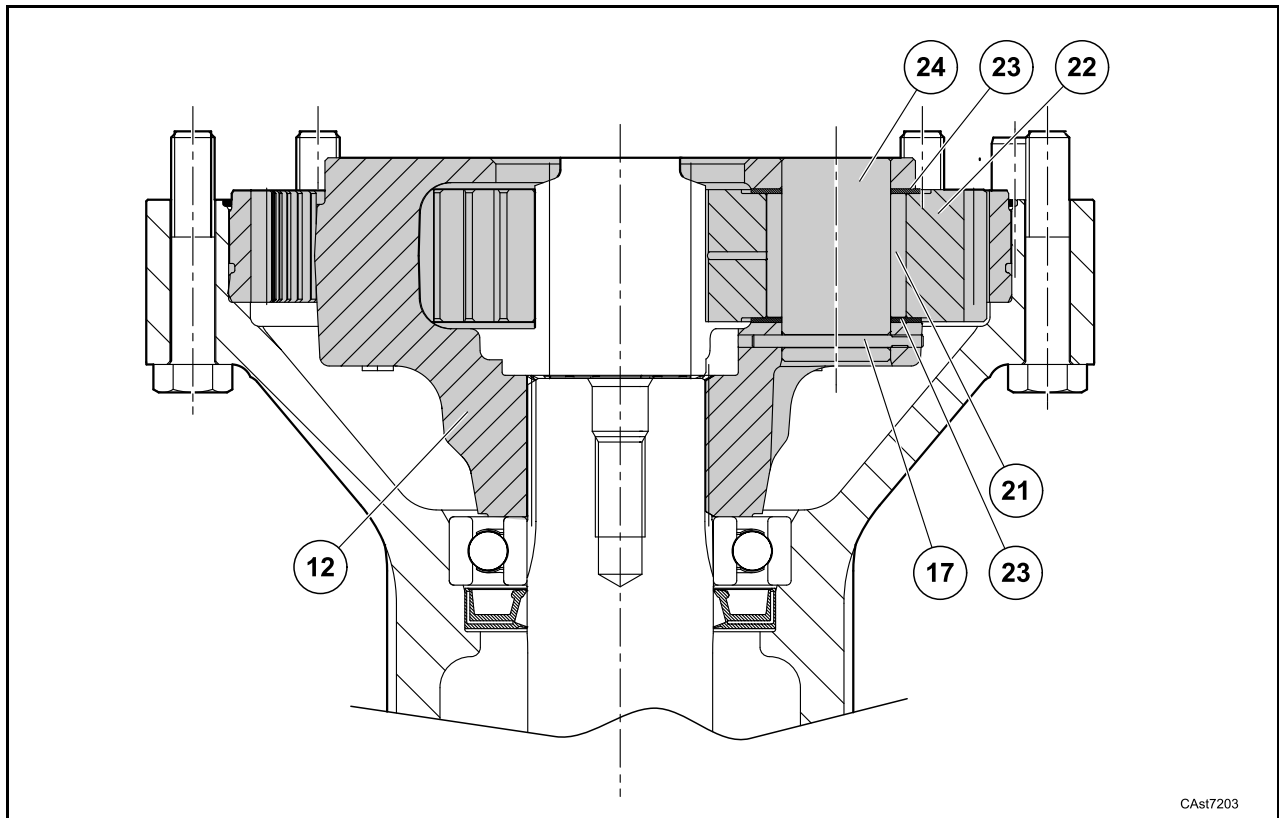


Figure 5

13. Check that wheel axle (1) is assembled up to stroke end.

## End float

1. Measure with depth gauge dimension A.

[Refer to: figure 6 and 8.](#)

2. Measure with depth gauge dimension B.

[Refer to: figure 7 and 8.](#)



Figure 6

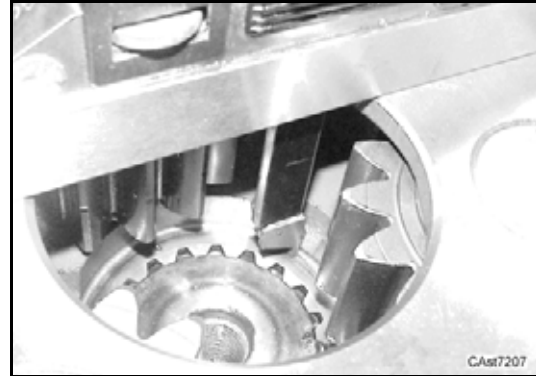


Figure 7

3. The value (C) (without shims) must be within  $0.4 \div 0.2$  mm.

$$C = A - B = (0.4 \div 1.2) \text{ mm}$$

[Refer to: figure 8.](#)

# Disassembly and Assembly Operations

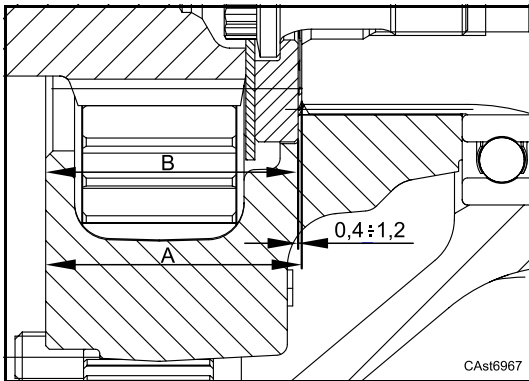


Figure 8

## SHIMS RANGE

|                |      |      |      |      |
|----------------|------|------|------|------|
| Thickness - mm | 0.05 | 0.10 | 0.30 | 0.50 |
| Quantity       | ---  | ---  | ---  | ---  |

Figure 9

4. Choose shims (13) among range available to ensure a end float of 0.1-0.5 mm on the bearings.

[Refer to: figure 9 and item \[12\].](#)

5. Assemble shims (13).

[Refer to: figure 10.](#)

6. Assemble lock washer (14).

[Refer to: figure 11.](#)

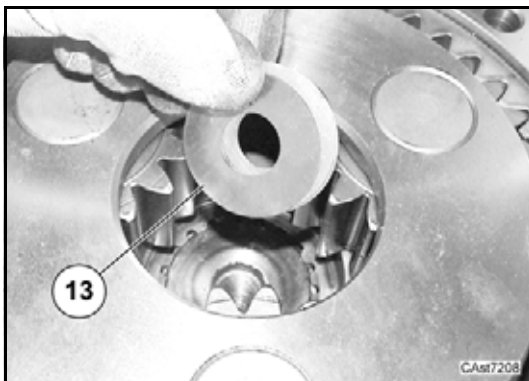


Figure 10

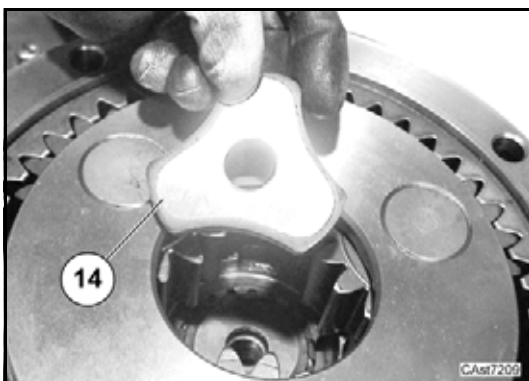


Figure 11

7. Settle whole using a plastic hammer.

[Refer to: figure 12.](#)

8. Tighten screw (15) to the requested torque, locking rotation of a gear by means of a pin.

[Refer to: section C.4 and figure 13.](#)

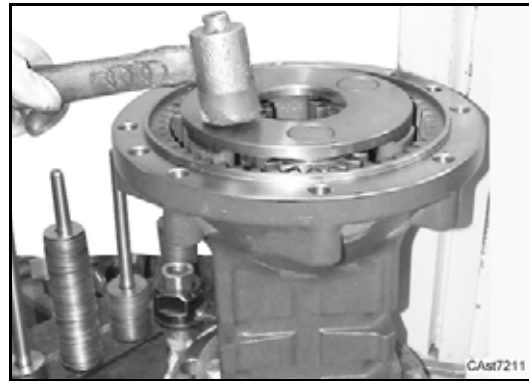


Figure 12

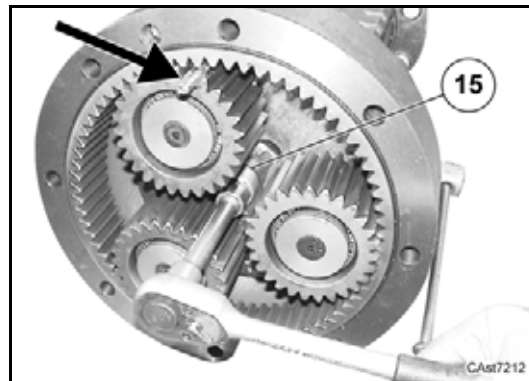


Figure 13

9. Settle again using a plastic hammer.

10. Check there is not end float turning the planetary carrier (12).

[Refer to: figure 14.](#)

11. Grease lock washer (16).

[Refer to: figure 15.](#)

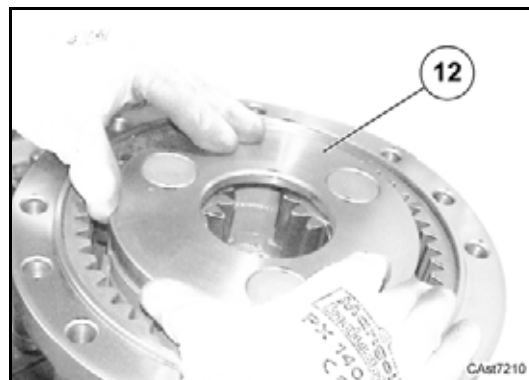


Figure 14

# Disassembly and Assembly Operations

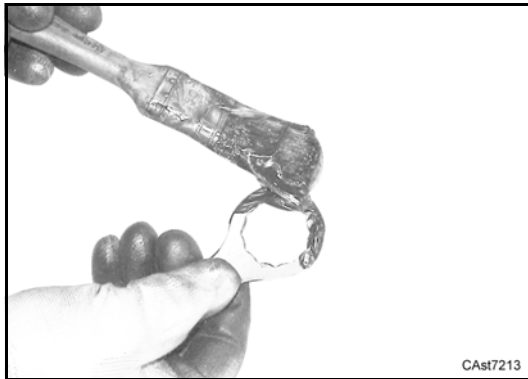


Figure 15

12. Assemble lock washer (16) with a magnet.

[Refer to: figure 16.](#)

**NOTE:** Tighten screw (15) as much as necessary to insert washer (16).

13. Insert shaft (20) into the transmission.

[Refer to: figure 17.](#)

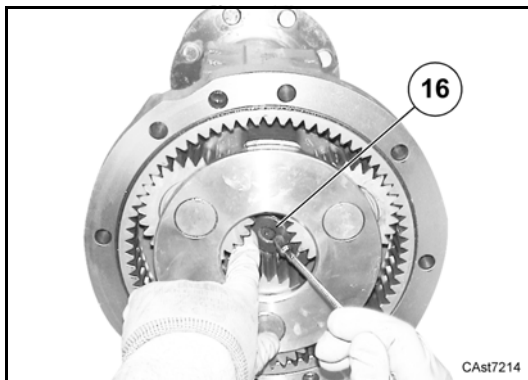


Figure 16

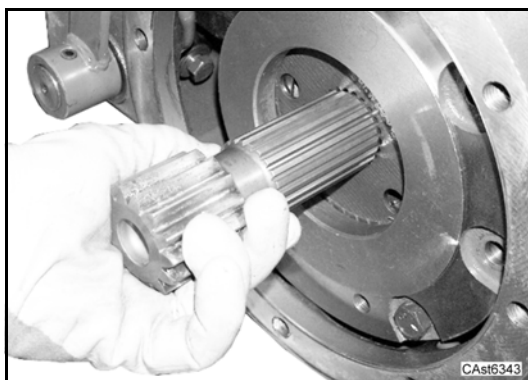


Figure 17

14. Assemble trumpet (6) to gear box.

[Refer to: figure 18.](#)

15. Assemble locking screw (7) to requested torque.

[Refer to: section C.4.](#)

16. Assemble grease points (5).

[Refer to: figure 19.](#)

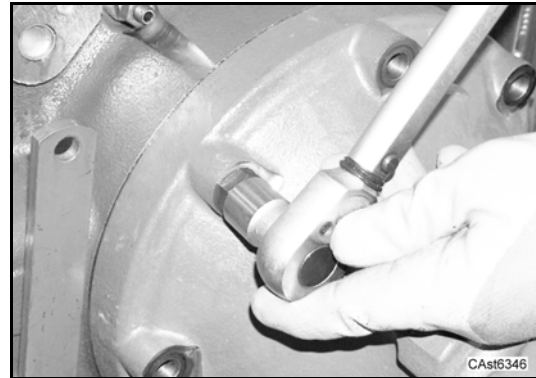


Figure 18

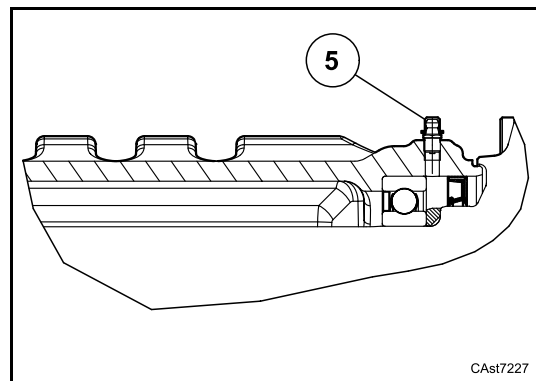
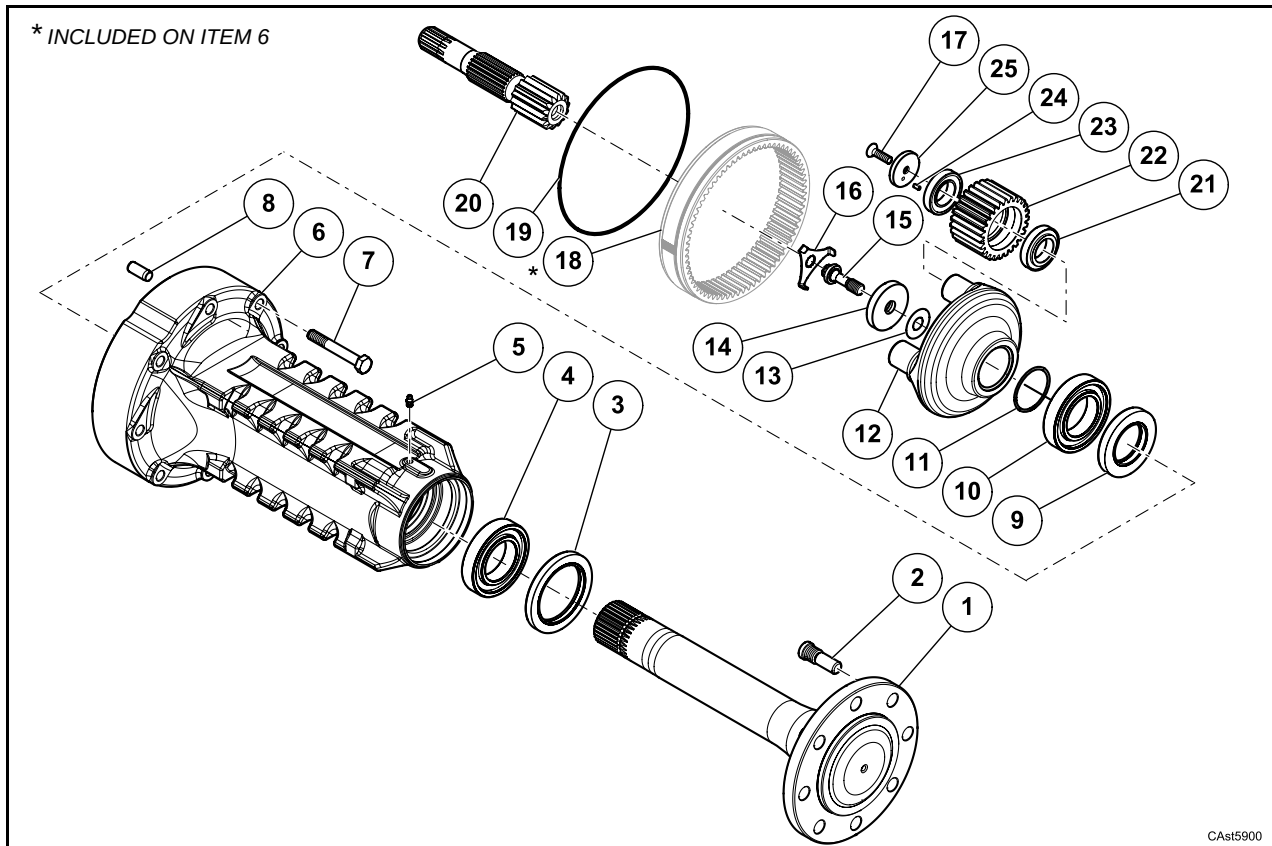


Figure 19

# Disassembly and Assembly Operations

## FINAL DRIVE - 85 HP



**8+8  
synchro  
shuttle**

**12+12  
synchro  
shuttle**

**24+24  
synchro shuttle  
and synchro  
splitter**

**24+24  
synchro shuttle  
and power  
splitter**

**12+12  
power  
shuttle**

**24+24  
power shuttle  
and synchro  
splitter**

For models

|

|

|

|

|

|

### Disassembly

1. Unscrew locking screws (7) of trumpet (6).
2. Remove trumpet (6) from gear box.
3. Remove shaft (20) from the transmission.
4. Remove tab washer (16).
5. Unscrew screw (15).
6. Remove thrust washer (14) and shims (13).
7. Extract planetary carrier (12).
8. Remove locking screws (17) and disassemble planetary carrier.
9. Remove from each shaft: thrust washer (25), bearing (23), gear (22) and bearing (21).
10. Remove pins (8) from trumpet (6).
11. Remove O-Ring (19) on ring gear (18).

**NOTE:** Destructive operation for O-Ring.

12. Remove snap ring (11).
13. Collect bearing cone (10).

14. Turn the group upside down.
15. Extract the wheel shaft (1) from trumpet (6).
16. If necessary remove studs (2) from wheel axle (1).
17. Remove seal ring (3) from trumpet (6).
- NOTE:** Destructive operation for seal ring.
18. Remove bearing cone (4).
19. Extract bearing cup (4) from trumpet (6).
20. Turn trumpet (6) upside down.
21. Remove bearing cup (9) from trumpet (6).
22. Extract seal ring (9) from trumpet (6).
- NOTE:** Destructive operation for seal ring.
23. If necessary remove grease points (5) from trumpet (6).

# Disassembly and Assembly Operations

## Assembly

1. With vertical trumpet:  
Fill with grease as shown in the figure using tool "CA715844" on page 331. Assemble bearing cup (4).

Refer to: figure 1, section C.4 and section E.1 (" " on page 330).

2. Assemble bearing cone (4). Fill with grease again.

Refer to: figure 1.

3. Assemble seal ring (3) with tool "CA715836" on page 331.

Refer to: figure 1 and section E.1 (" " on page 330).

4. Assemble studs (2) on wheel axle (1).

5. Warm the outlined area at 120 °C for 4/5 minutes to allow introduction of the wheel axle (1).

Refer to: figure 1.

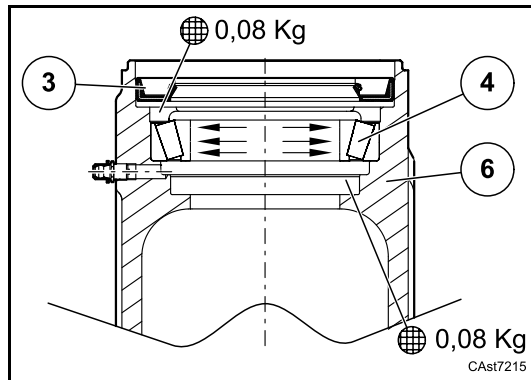


Figure 1

6. Assemble wheel axle (1).
7. Turn while holding axle beam.
8. Assemble seal ring (9) with tool "CA715826" on page 331.

Refer to: section E.1 (" " on page 330).

9. Assemble bearing cup (10) with tool "CA715827" on page 331.

Refer to: sec E.1 (" " on page 330).

10. Assemble bearing cone (10).
11. Assemble snap ring (11).
12. Assemble a new O-Ring (19) on ring gear (18).
13. Assemble pins (8) on trumpet (6).

14. Assemble planetary gear assy.

- Assemble on gear (22) bearing cups (21) and (23) using tool "CA715827" on page 331.
- Assemble bearing cone (21) on planetary gears carrier (12) pin. Assemble gear (22) to gear carrier (12).
- Assemble bearing cone (23).
- Assemble pin (24).
- Assemble washer (25).
- Apply sealant to screw (17).

Refer to: section C.4.

- Tighten screw (17) to requested torque.

Refer to: section C.4.

- Assemble planetary gear assy on trumpet.

Refer to: figure 2 and section E.1 (" " on page 330).



# Disassembly and Assembly Operations

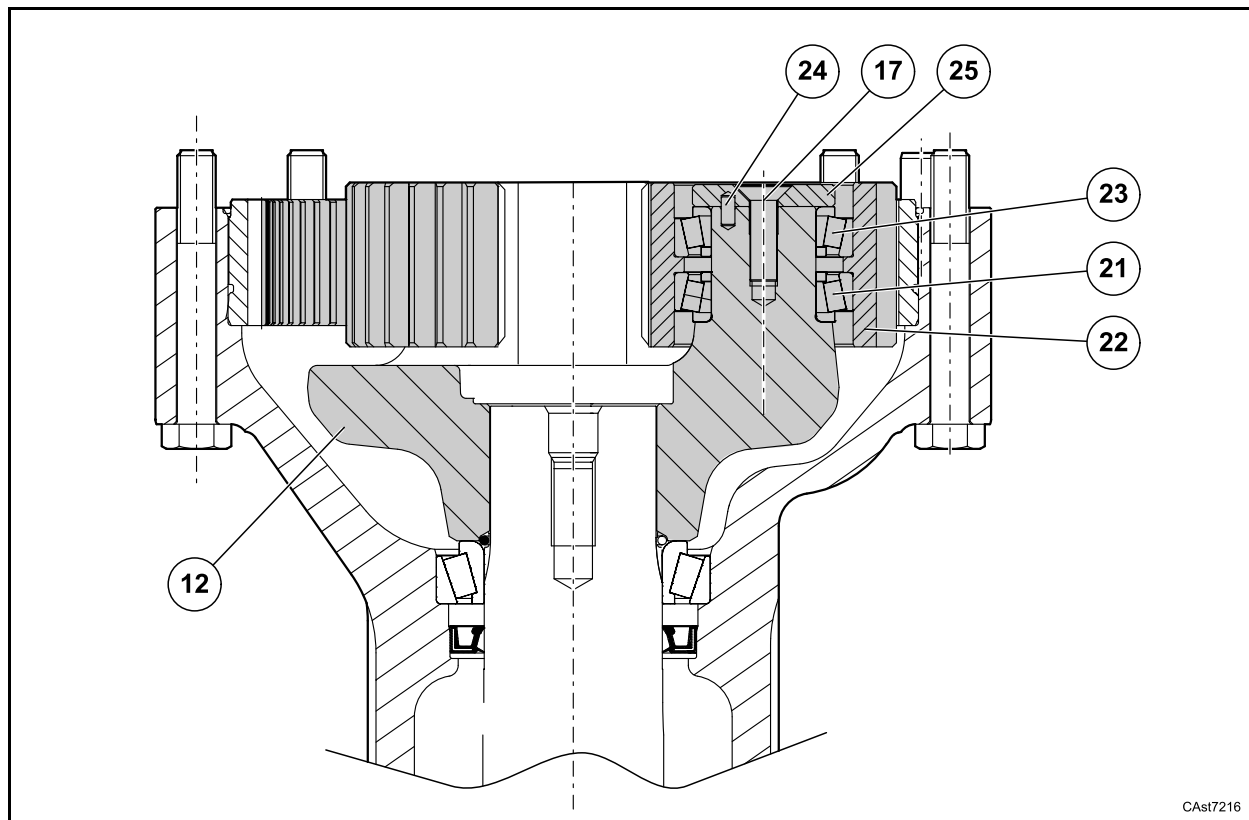


Figure 2

## Taper roller bearings preloading

1. If parts as trumpet or wheel axle are not replaced, use shims collected during disassembly. Check correct preloading.
2. If trumpet or wheel axle are to be replaced, proceed as follows:
  - start with a packet of shim (13) 1 mm each;
  - assemble washer (14) and screw (15);
  - tighten screw (15) to prescribed torque.

Refer to: figure 3 and section C.4.

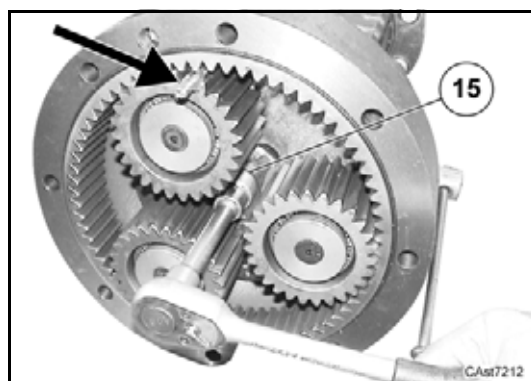


Figure 3

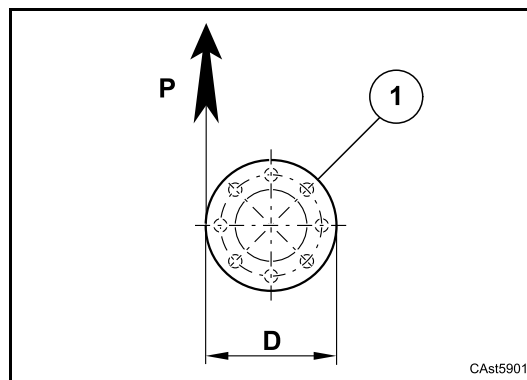


Figure 4

3. Measure preloading P of the taper roller bearings with a dynamometer whose cord is wound on the wheel axle (1).  
The real preloading P is measured on D= 245 mm and it must be within following range:

$$P = 13 \div 20 \text{ N}$$

If  $P < (13 \div 20) \text{ N}$ , remove shims.

If  $P > (13 \div 20) \text{ N}$ , add shims, choose them from the range available, so as to observe prescribed preloading.

Refer to: figure 4, 5 and 6.



# Disassembly and Assembly Operations

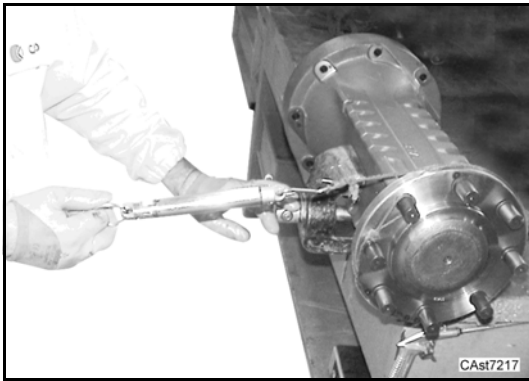


Figure 5

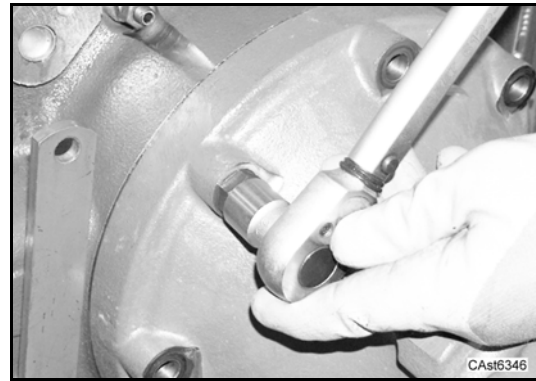


Figure 9

## SHIMS RANGE

|                |      |      |      |      |
|----------------|------|------|------|------|
| Thickness - mm | 0.05 | 0.10 | 0.30 | 0.50 |
| Quantity       | ---  | ---  | ---  | ---  |

Figure 6

4. Assemble tab washer (16).
5. Insert shaft (20) into the transmission.

[Refer to: figure 8.](#)

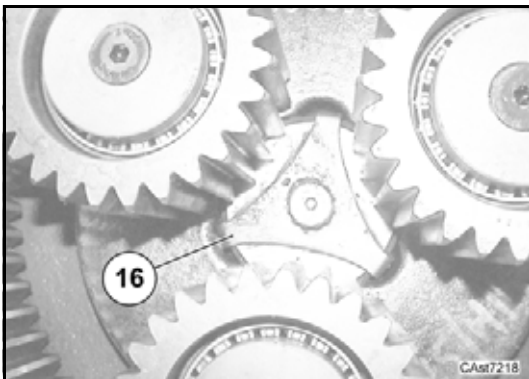


Figure 7

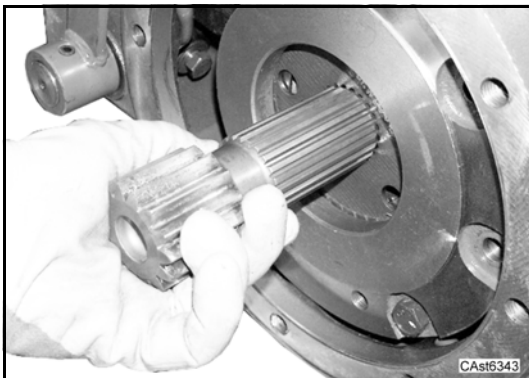


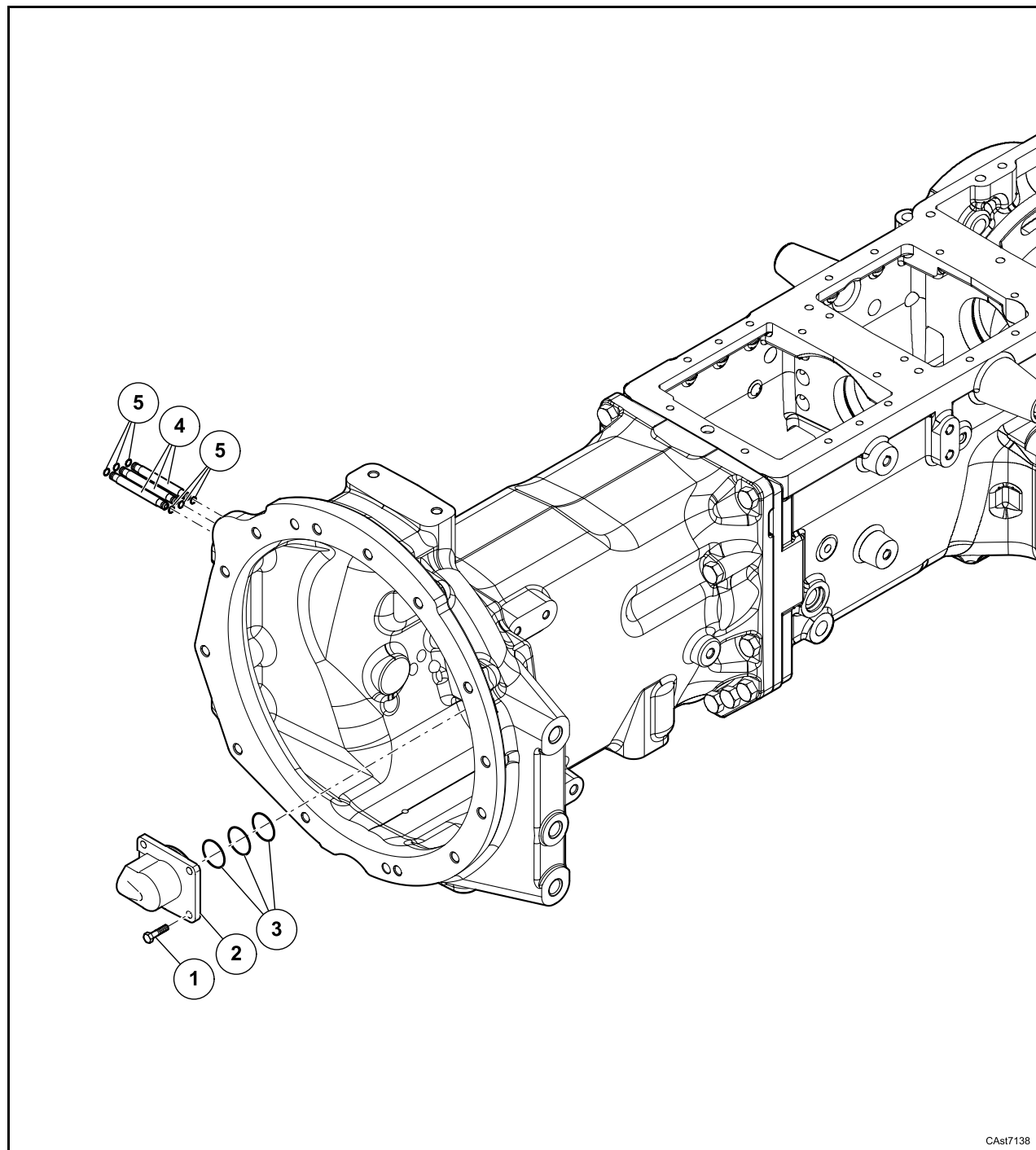
Figure 8

6. Assemble trumpet (6) to gear box.

[Refer to: figure 9.](#)

# Disassembly and Assembly Operations

## TEFLON SEALS REPLACEMENT (CLUTCH SHAFT)



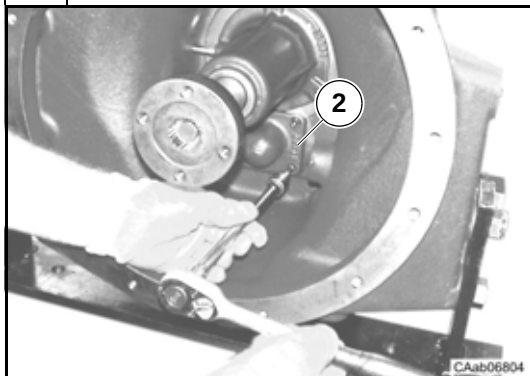
CAst7138

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models | -                         | -                           | -                                                   |                                                   |                           |                                                   |

# Disassembly and Assembly Operations

## Replacement

1.

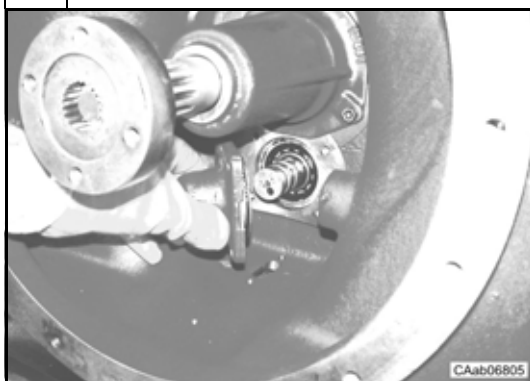


### Warning

**Before operating on the assy, drain oil.**

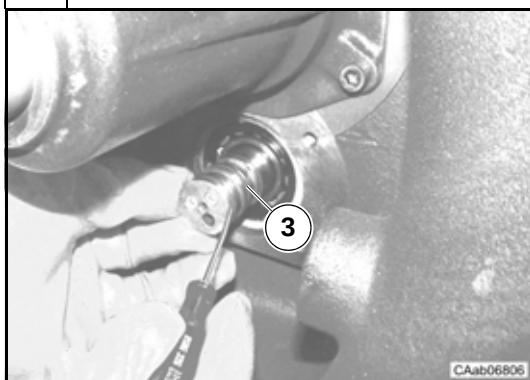
Remove cover (2) locking screws (1).

2.



Remove cover (2) and relevant oil pipes (4) from the transmission housing.

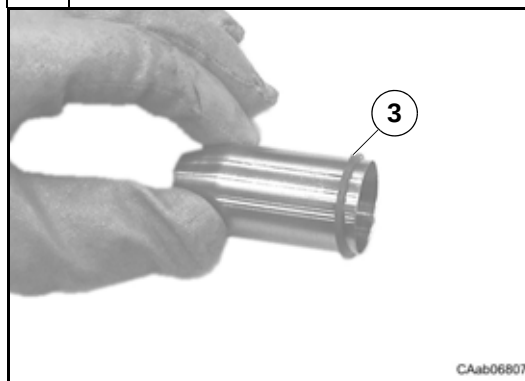
3.



Remove old seal rings (3) with a lever or a screwdriver.

**NOTE:** This is a destructive operation for the seal rings.

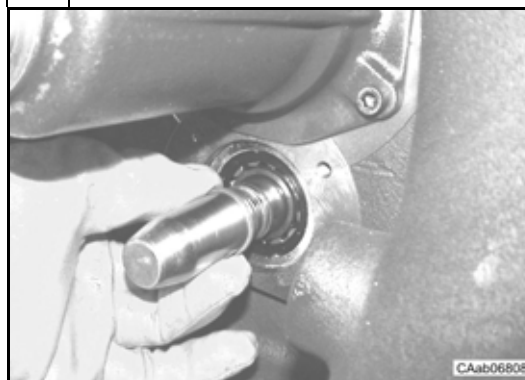
4.



Warm a new seal ring CA149839 (3) in water at 80 °C for 3 minutes.

Insert seal ring (3) on the special tool "CA715888" on page 323 as shown in figure.

5.



Insert special tool "CA715888" on page 323 with seal ring (3) on the shaft.

Push seal ring (3) on the shaft and fit it in the relevant seat.

Repeat same operations to assembly every seal ring.

[Refer to: section E.1 \(" " on page 322\).](#)

6.

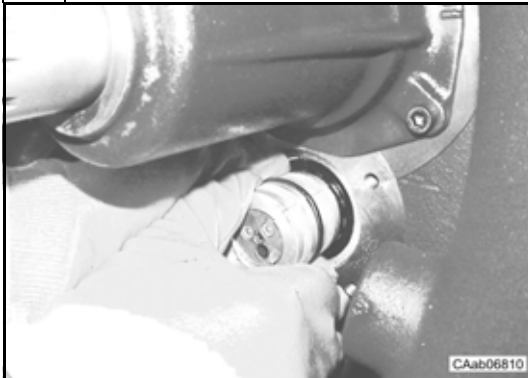


Insert special tool "CA715887" on page 323 with relevant O-Ring on the shaft and seals (3).

# Disassembly and Assembly Operations

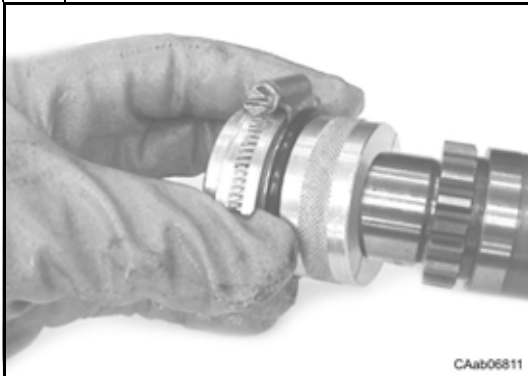
Refer to: section E.1 (" " on page 322).

7.



Close completely special tool on the seals (3).

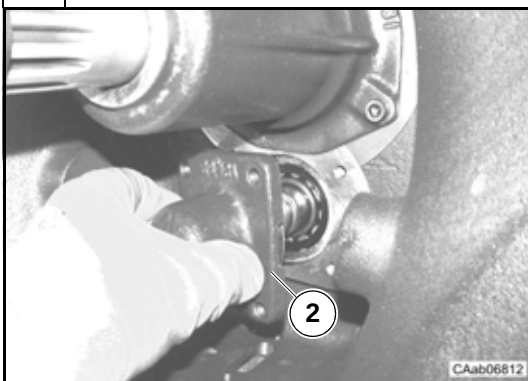
8.



Assemble and tighten clamp on the special tool as shown in figure.

Leave special tool "CA715887" on page 323 on the seals (3) for 5 minutes.

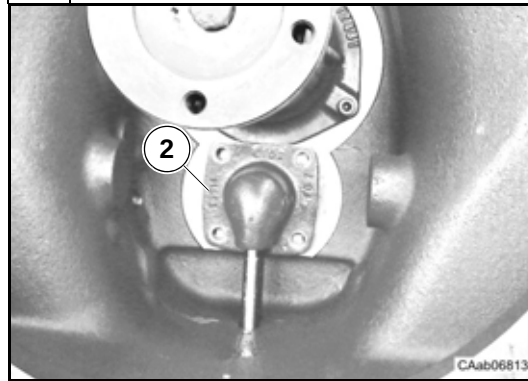
9.



Remove clamp and special tool.

Assemble cover (2).

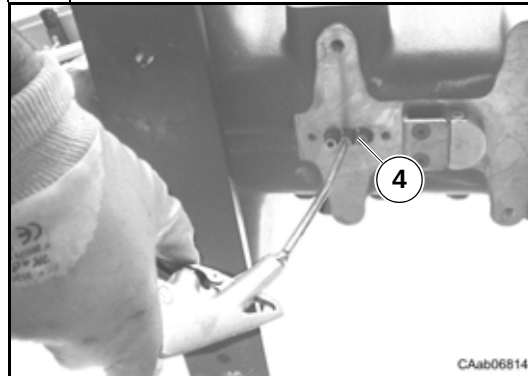
10.



Assemble oil pipes to cover (1).

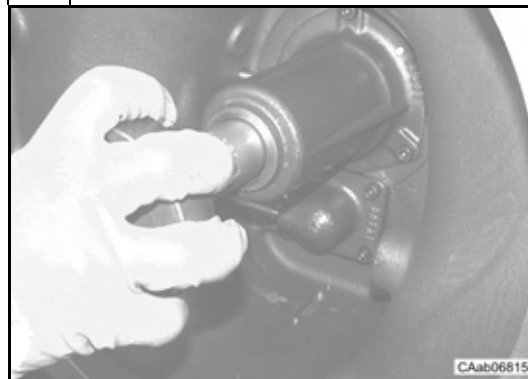
Assemble cover (2) locking screws (1).

11.



Test the clutch control with compressed air (5 bar of pressure) in the oil pipes (4).

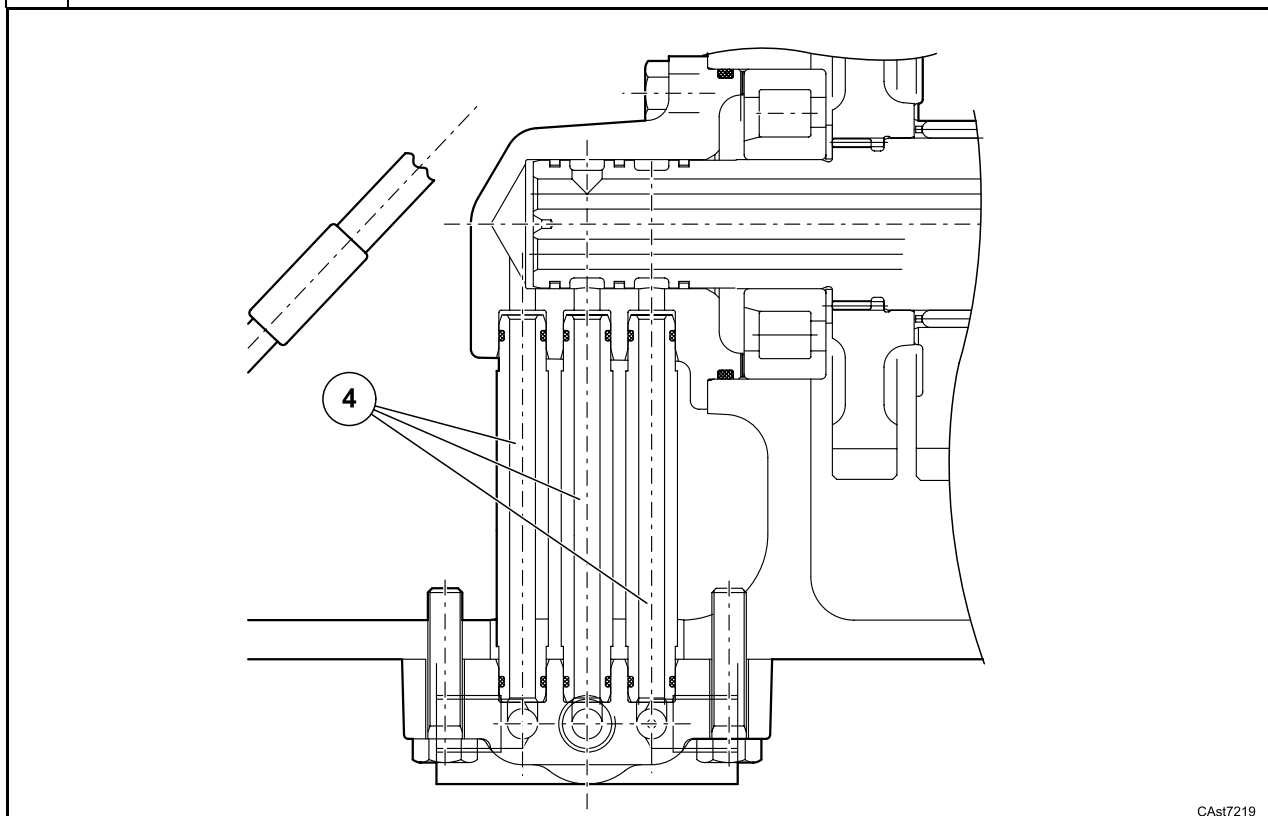
12.



If the gear is connected properly primary shaft is locked.

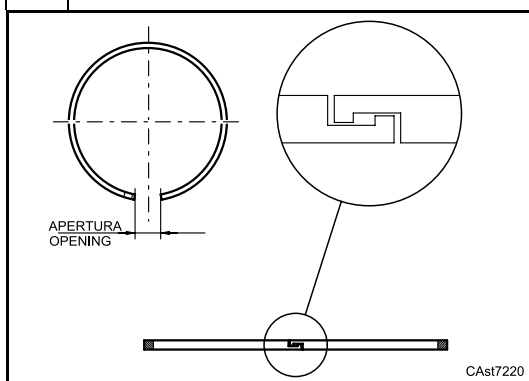
# Disassembly and Assembly Operations

13.



**NOTE:** With 24+24 synchro shuttle-power splitter transmission, hoses (4) are placed below clutch housing and not at the side.

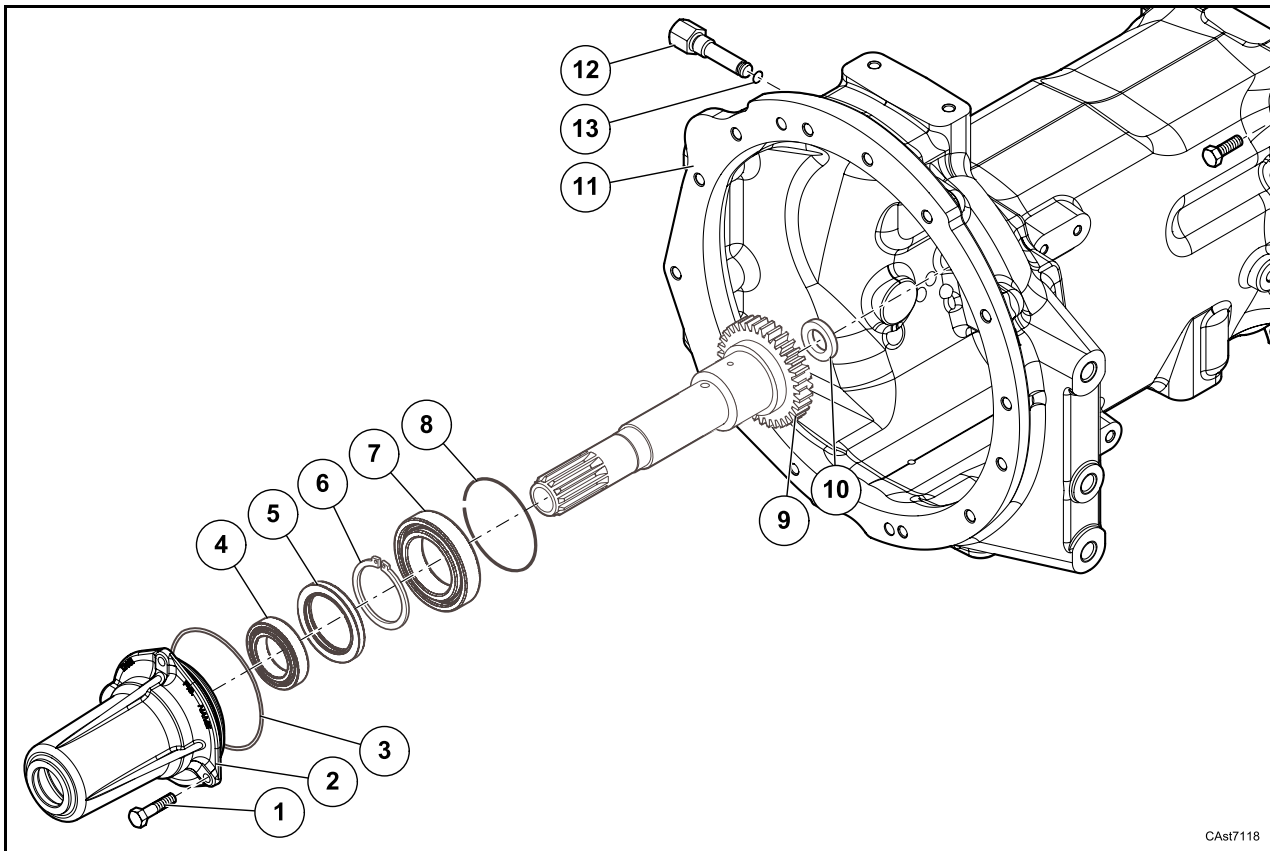
14.



**NOTE:** For CA138784 seals assembled as per 24+24 synchro shuttle-power splitter version no special tools are needed, in consideration of their particular shape.

## Disassembly and Assembly Operations

## INPUT SHAFT AND SUPPORT



**8+8  
synchro  
shuttle**

**12+12**  
**synchro**  
**shuttle**

**24+24  
synchro shuttle  
and synchro  
splitter**

**24+24  
synchro shuttle  
and power  
splitter**

**12+12  
power  
shuttle**

**24+24  
power shuttle  
and synchro  
splitter**

For models

—

—

—

—

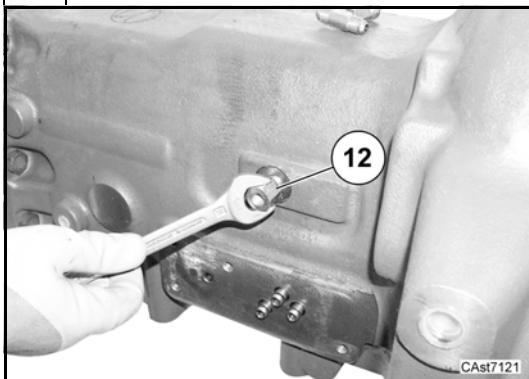
1

1

## Disassembly

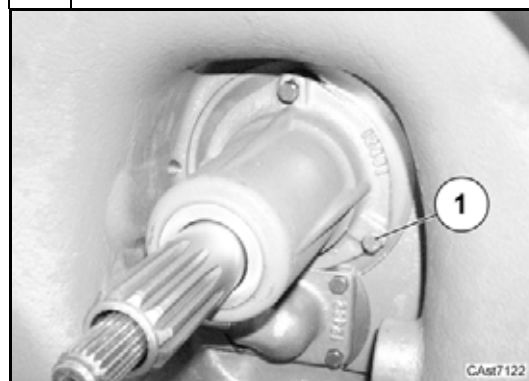
Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

1.



Remove lubrication pipe (12). Remove O-Ring (13).

2.

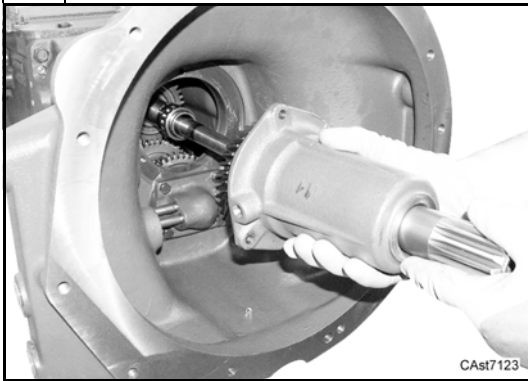


Remove screws (1).



# Disassembly and Assembly Operations

3.



Remove assy.

4.



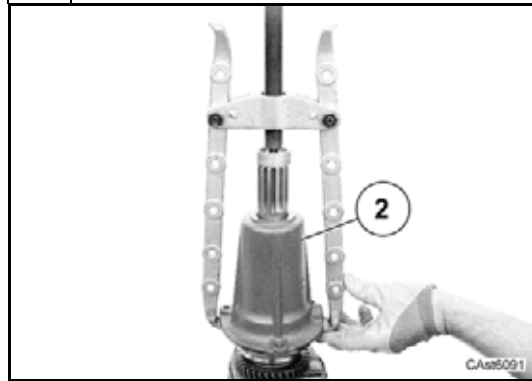
Assemble assy on the vice.

5.



Remove snap ring (8) using hole on the support.

6.



Turn over assy and remove support (2) by means of a puller.

**NOTE:** So as not to damage shaft use a pad.

7.



Remove seal ring (5) from the support (2).

**NOTE:** Destructive operation for seal ring.

8.

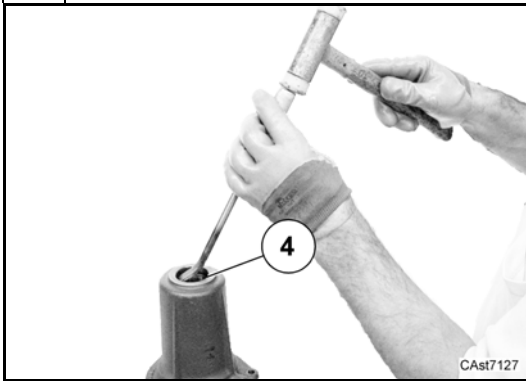


Remove O-Ring (3) from support (2).



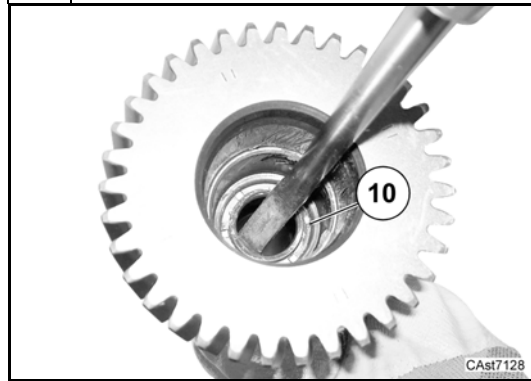
## Disassembly and Assembly Operations

9.



Remove bearing (4).

12.



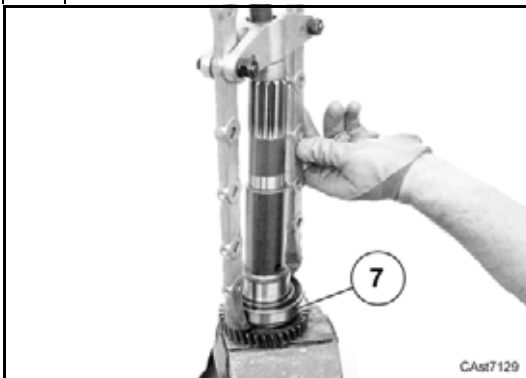
Remove seal ring (10) inside of the shaft.

10.



Remove snap ring (6) from input shaft (9).

11.

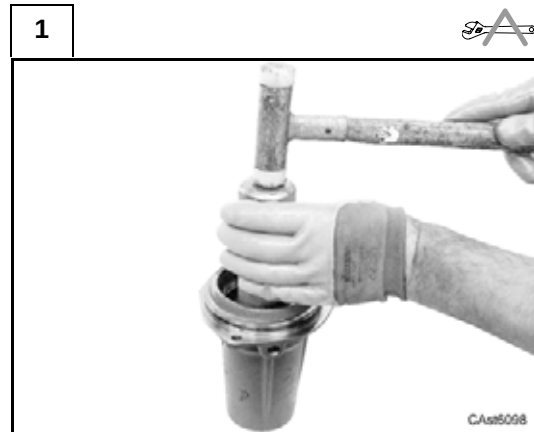


Assemble puller on a support base (pad) to remove bearing (7).

# Disassembly and Assembly Operations

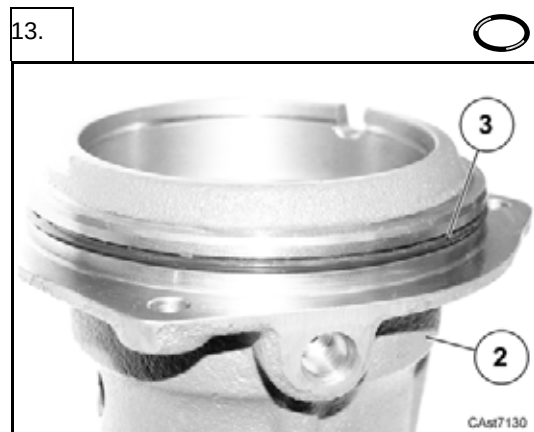
## Assembly

Some of the following pictures may not show exactly your gear box, but the described operations are correct anyway.

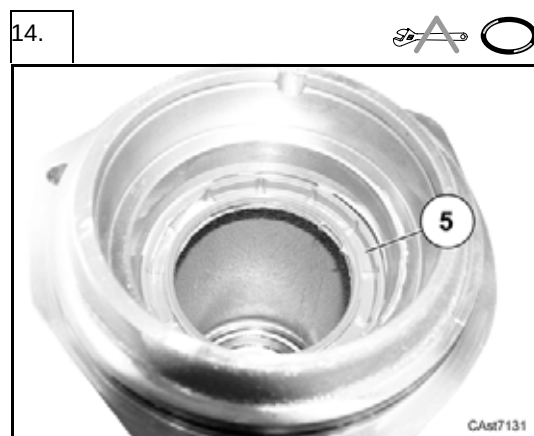


Assemble bearing (4) using special tool "CA716139" on page 321.

Refer to: E.1 ("Clutch housing (12+12 Power shuttle)" on page 319 and ") on page 332).

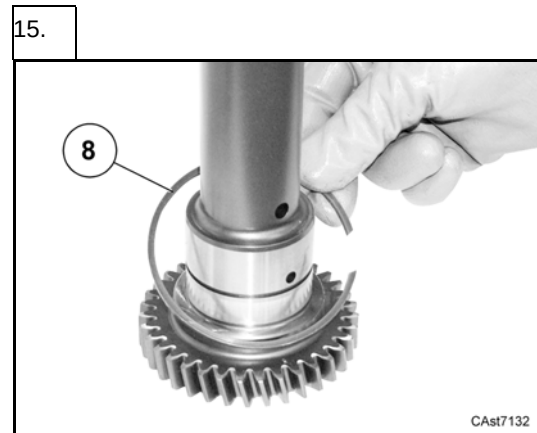


Assemble O-Ring (3) on the support.

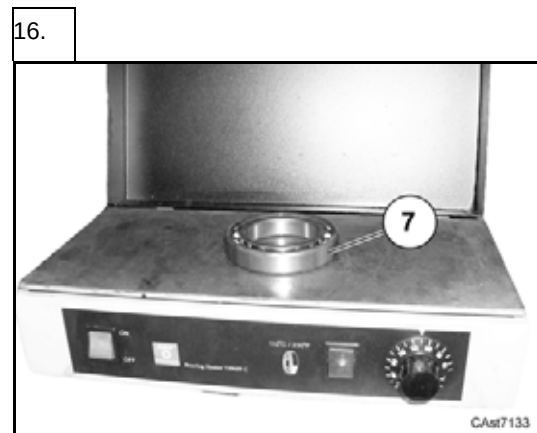


Assemble seal ring (5) using special tool "CA716133" on page 320.

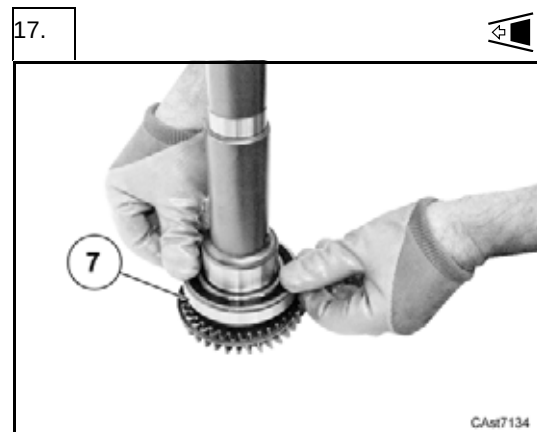
Refer to: E.1 ("Clutch housing (12+12 Power shuttle)" on page 319 and ") on page 332).



Insert snap ring (8).



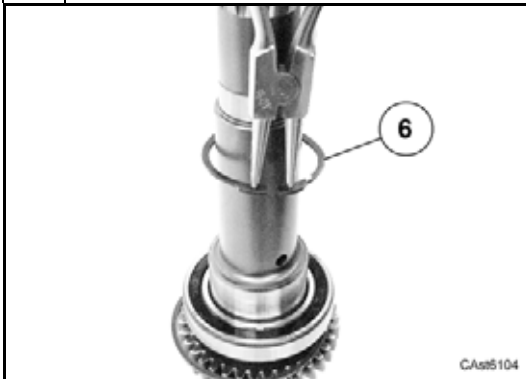
Warm bearing (7) to 80÷100 °C.



Assemble bearing (7) with the shield upwards as shown in the figure.

# Disassembly and Assembly Operations

18.



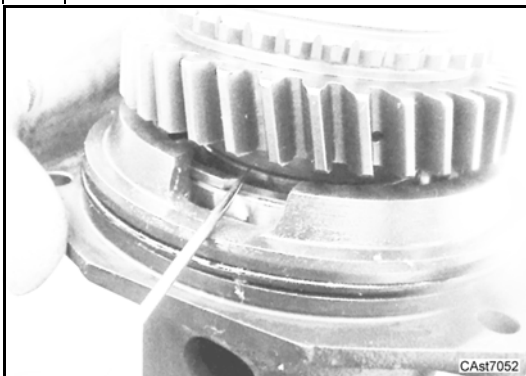
Insert snap ring (6).

19.



Assemble shaft into the support.

20.



Assemble ring (8) in its seat.

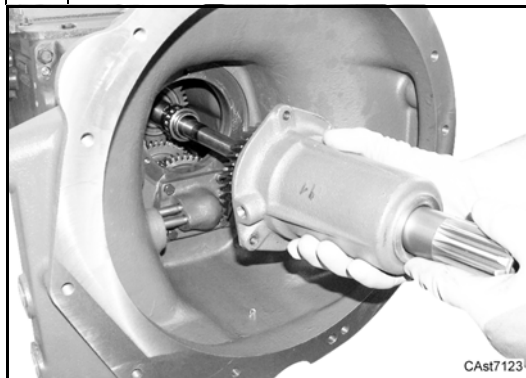
21.



Assemble seal ring (10) using special tool "CA716152" on page 321.

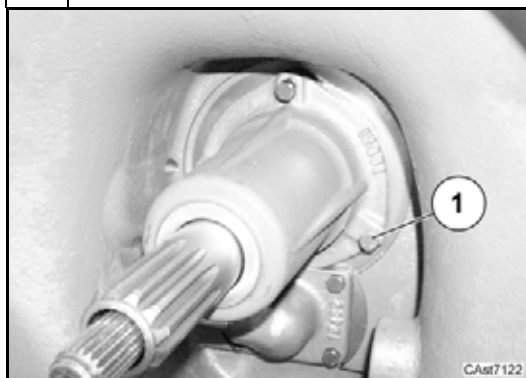
Refer to: section E.1 ("Clutch housing (12+12 Power shuttle)" on page 319 and " ) on page 332).

22.



Insert assy.

23.

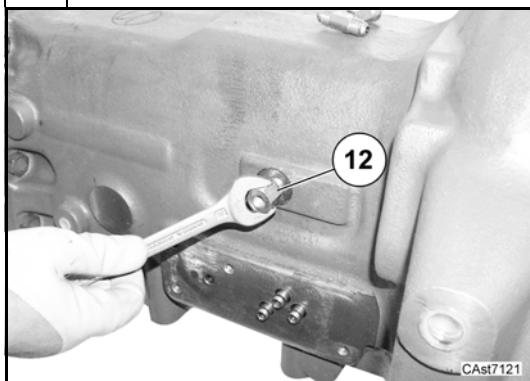


Tighten screws (1) to the prescribed torque.

Refer to: section C.4.

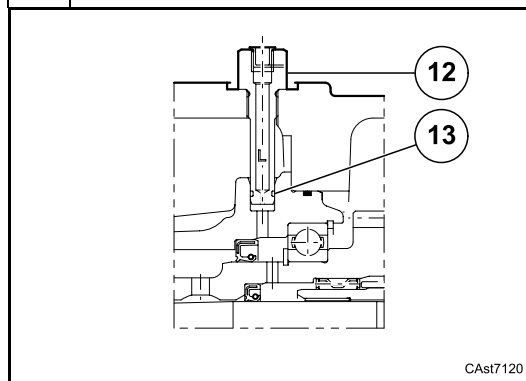
## Disassembly and Assembly Operations

24.



Assemble lubrication pipe (12) and O-Ring (13).

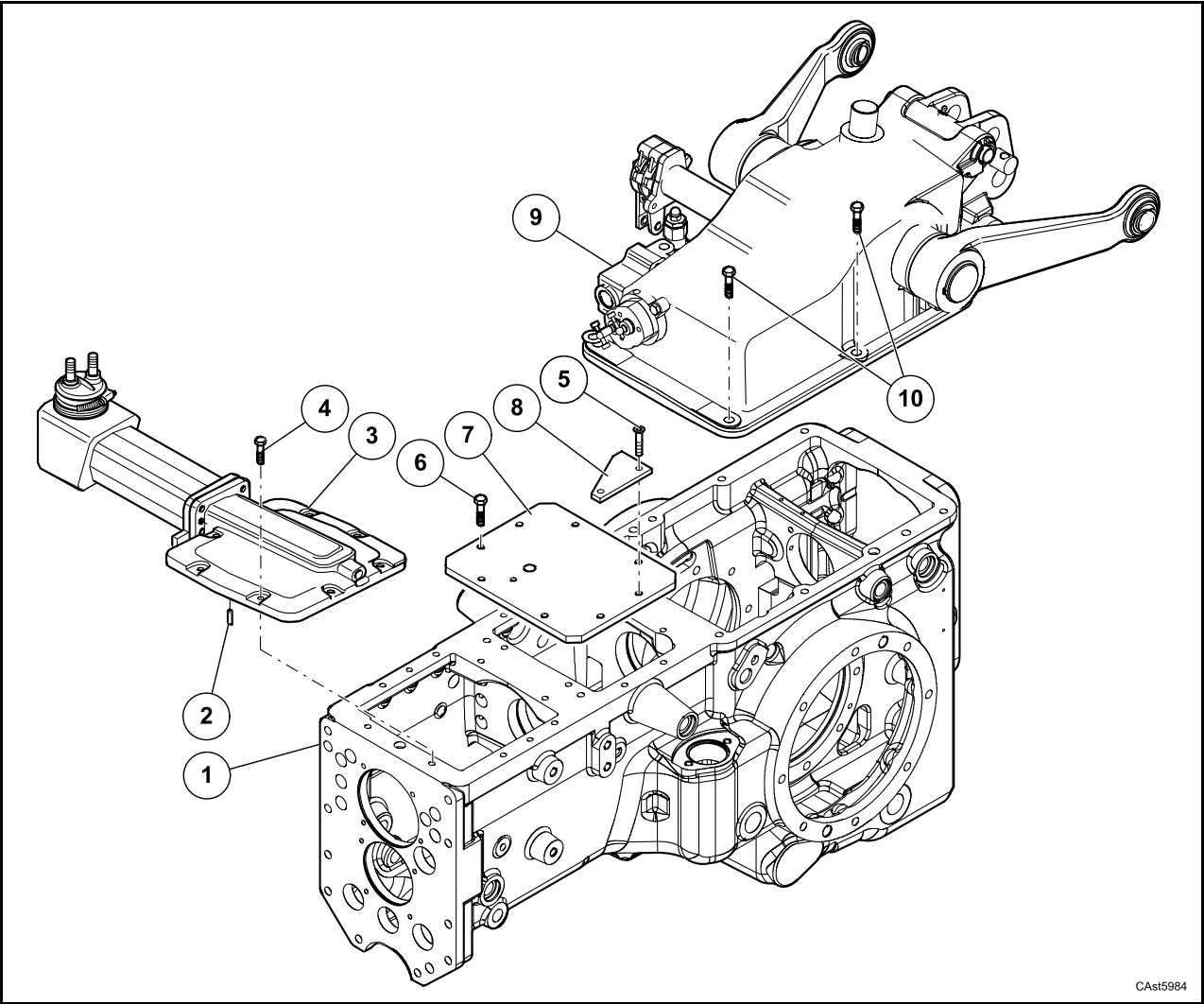
25.



**NOTE:** Assemble lubrication pipe as shown in the figure.

# Disassembly and Assembly Operations

## UPPER COVERS AND ROCKSHAFT



CAst5984

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models |                           |                             |                                                     |                                                   |                           |                                                   |

### Disassembly

1. Remove oil dipstick.  
Hook rockshaft to a suitable lifting device.  
Remove rockshaft case (9) after unscrewing screws (10).



### Warning

Approximate weight of rockshaft case assembly is 82 Kg.

Refer to: figure 1.



### Warning

During disassembly procedure do not damage the shield.

**NOTE:** For rockshaft disassembly see tractor manual.

Refer to: figure 2.

# Disassembly and Assembly Operations

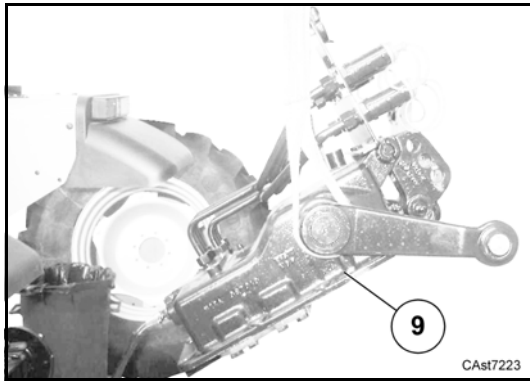


Figure 1

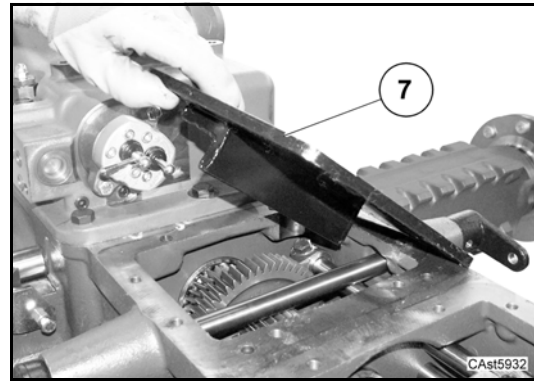


Figure 4

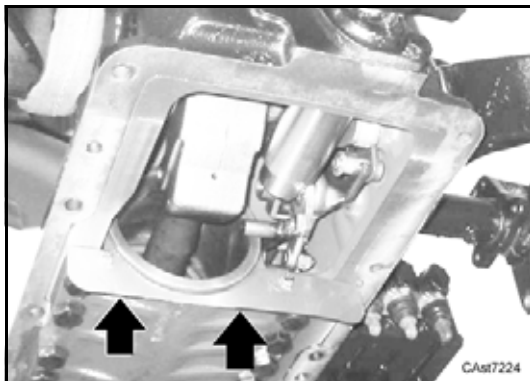


Figure 2

2. Unscrew fastening screws (4).
3. Remove gear box lever assy (3).
4. Unscrew fastening screws (5).

[Refer to: figure 3.](#)

5. Remove bracket (8).
6. Unscrew fastening screws (6).
7. Remove cover (7).

[Refer to: figure 4.](#)

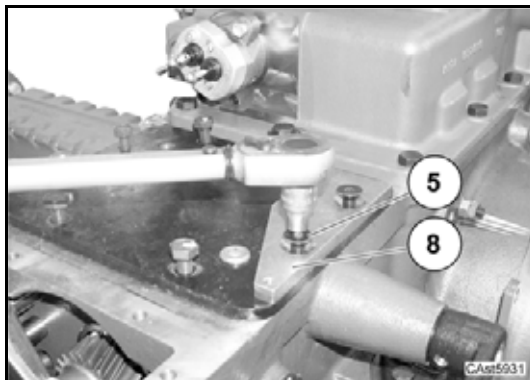


Figure 3

## Assembly

1. Clean all contact surfaces of cover (7) with care.
2. Apply prescribed sealing.

[Refer to: section C.4.](#)

3. Assemble cover (7) to the gear box (1).

[Refer to: figure 4.](#)

**NOTE:** Cover (7) correct assembly.

[Refer to: figure 5.](#)

# Disassembly and Assembly Operations

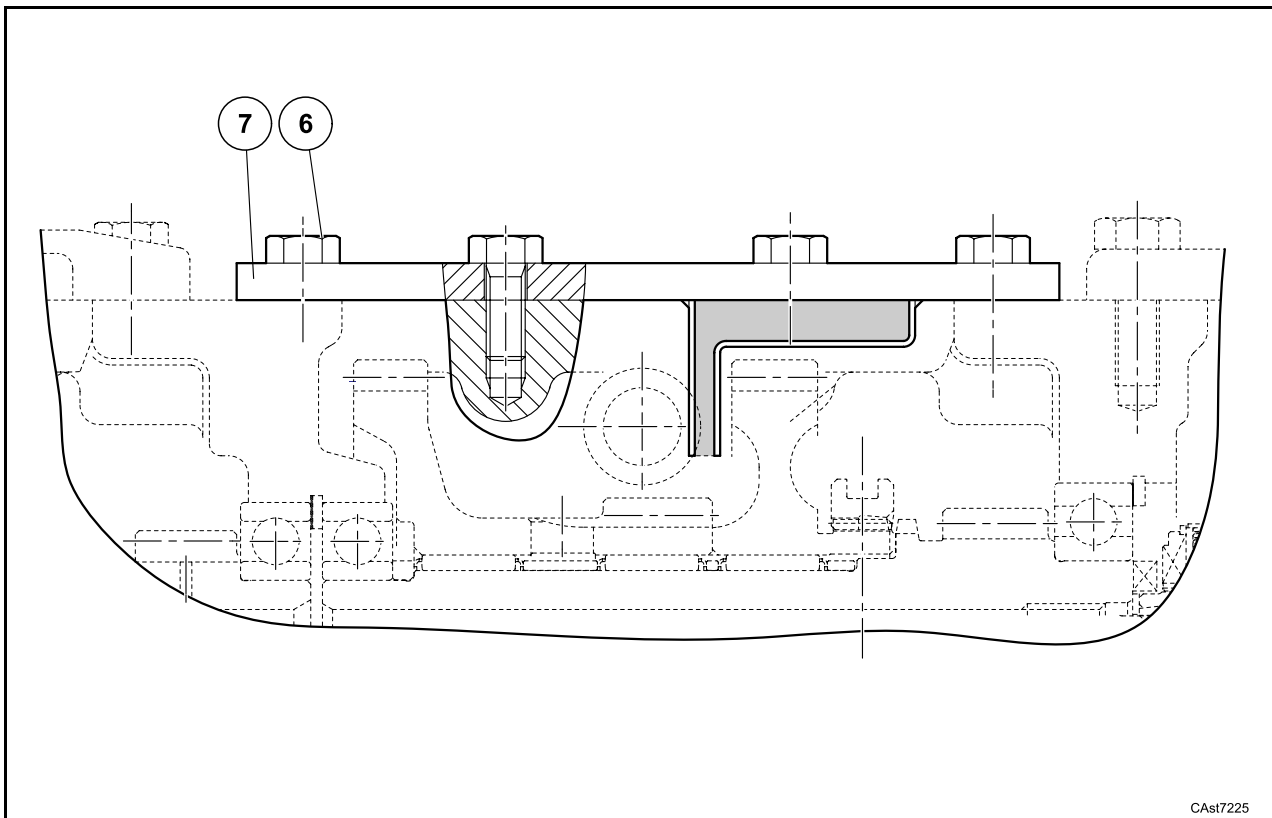


Figure 5

4. Assemble bracket (8) on cover (7).
  5. Tighten screws (5) to the prescribed torque.  
[Refer to: figure 3 and section C.4.](#)
  6. Assemble screws (6) to the prescribed torque.  
[Refer to: section C.4.](#)
  7. Clean all contact surfaces of the lever assy (3) with care.
  8. Apply prescribed sealing.  
[Refer to: section C.4.](#)
  9. Assemble lever assy (3) on gear box (1).
- NOTE:** Check the correct assembly of centring pins (2) and gear lever detent.
10. Assemble screws (4) to the requested torque.  
[Refer to: section C.4.](#)

11. Clean mating surfaces of rockshaft case and differential housing. Apply a coat of Loctite® 574 to mating surfaces.

[Refer to: figure 6.](#)

12. Install rockshaft case (9) using a suitable lifting device. Screw up the nine bolts (10). Torque wrench setting: 120 Nm (90 lb.ft).



## Warning

**During the assembly procedure do not damage the shield.**

[Refer to: figure 7.](#)



## Disassembly and Assembly Operations

---

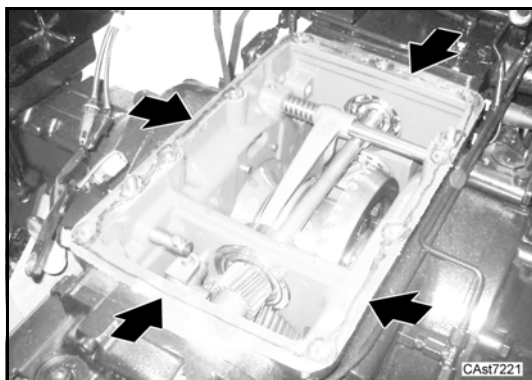


Figure 6

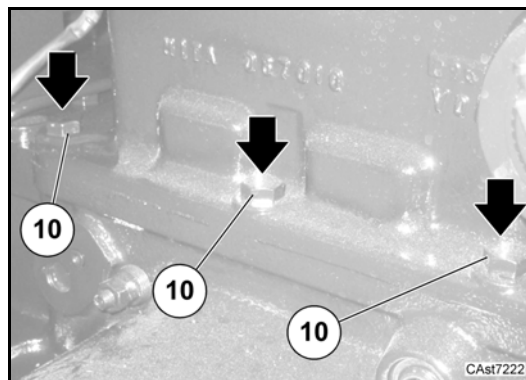
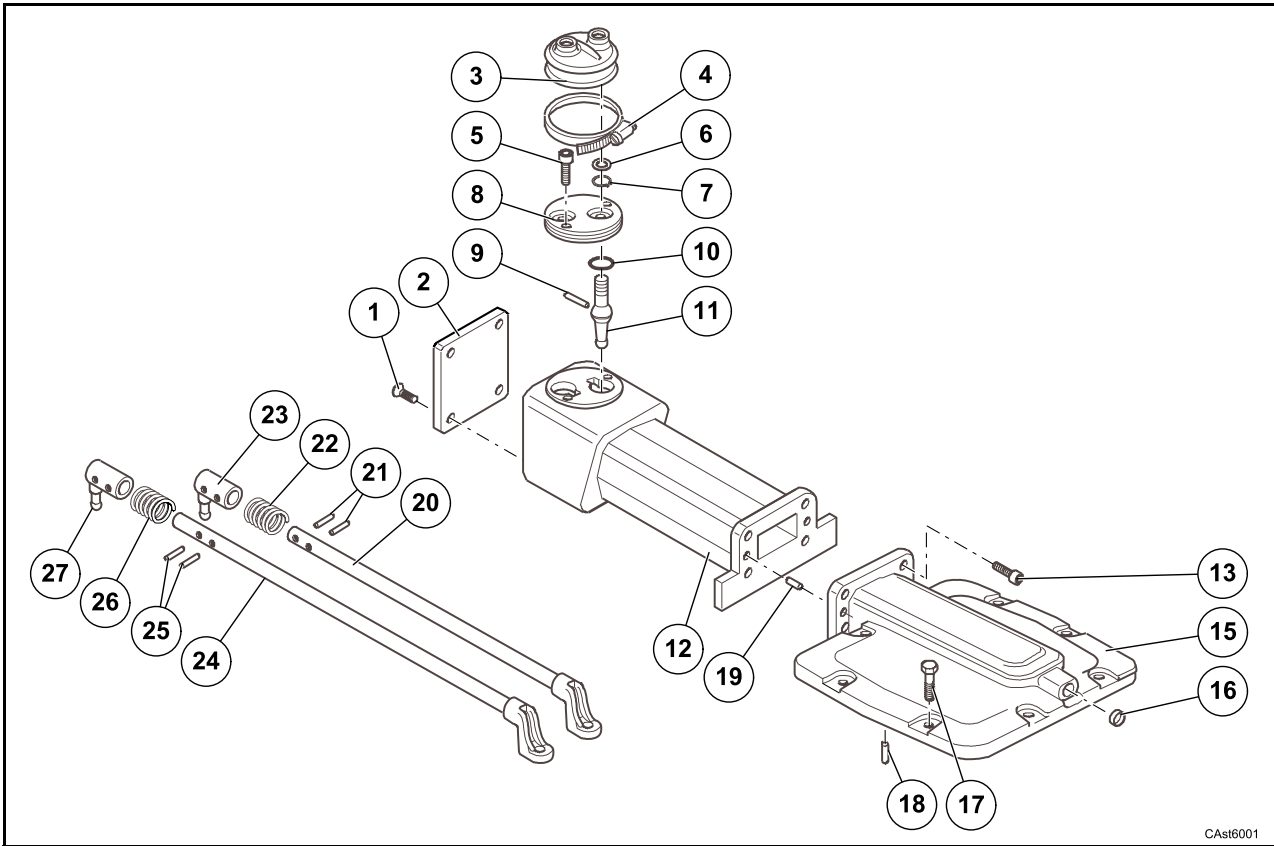


Figure 7

# Disassembly and Assembly Operations

## SPEED AND RANGES LEVERS



|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models |                           |                             |                                                     |                                                   |                           |                                                   |

### Disassembly

1. Unscrew fastening screws (1).
2. Remove cover (2).
3. Loose rubber hose clamp (4) and remove rubber booth (3).
4. Remove washers (6) and snap rings (7) from the levers (11).
5. Remove locking screws (5).
6. Disassemble plate (8) from the lever support (12).
7. Remove O-Rings (10).
8. Remove lever (11).
9. If necessary extract pins (9) from the levers (11).
10. Turn cover upside down (15).
11. Remove pins (25).
12. Remove lever (27), spring (26), long lever (24) from the lever support (12).
13. Remove pins (21).
14. Remove lever (23), spring (22) and short lever (20) from the lever support (12).
15. Remove screws (13).
16. Remove lever support (12) from the cover (15).

# Disassembly and Assembly Operations

## Assembly

1. Clean all processed surfaces with care.
2. Insert pins (19) into the lever support (12).
3. Apply prescribed sealing on the contact surfaces.

[Refer to: section C.4.](#)

4. Assemble lever support (12) to the cover (15).
5. Assemble locking screws (13) to the requested torque.

[Refer to: section C.4.](#)

6. Lubricate rods housings.

[Refer to: section C.4.](#)

7. Assemble short rod (20) into the lever support (12).

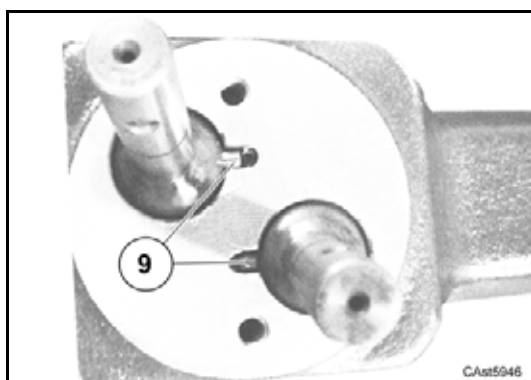


Figure 1

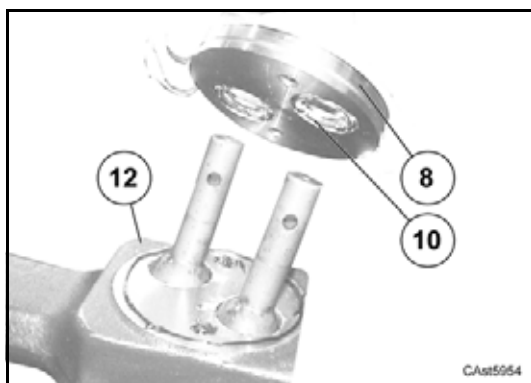


Figure 2

8. Assemble spring (22).
9. Assemble lever (23) at the cover side (15).
10. Assemble two pins (21).
11. Assemble long lever (24) into the lever support (12).
12. Assemble spring (26).
13. Assemble lever (27) at the over side (15).
14. Assemble the pins (25).
15. Turn cover (15) upside down.
16. Lubricate levers housings (11) on the lever support (12).

[Refer to: section C.4.](#)

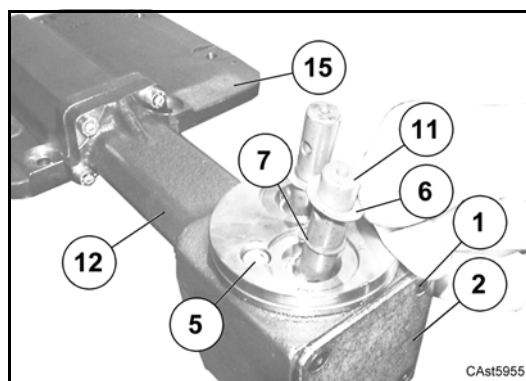


Figure 3

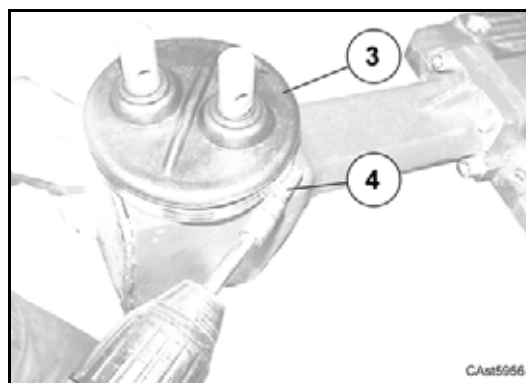


Figure 4

17. Insert pins (9) on the respective levers (11).
18. Assemble levers (11) with clutch ball to the rods (20) and (24).
19. Check pins (9) be inserted in the respective housings on the lever support (12).
20. Lubricate two new O-Rings (10).
21. Assemble two O-Rings (10) in the circular plate (8).
22. Apply prescribed sealing on the contact surfaces of plate (8) and of lever support (12).
- [Refer to: section C.4.](#)
23. Assemble plate (8) to the lever support (12).

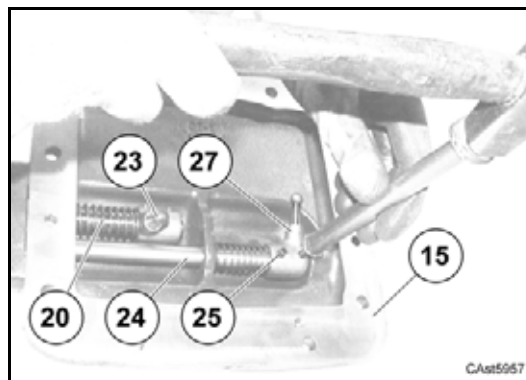


Figure 5

# Disassembly and Assembly Operations

---

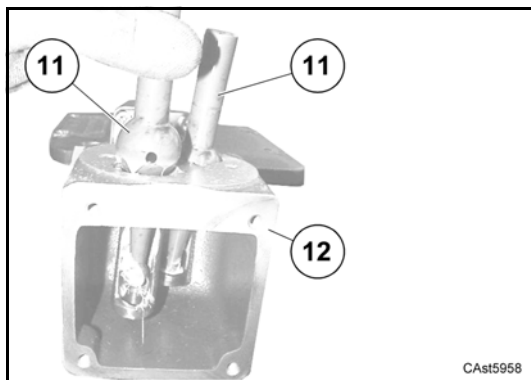


Figure 6

24. Assemble locking screws (5) to the requested torque.

[Refer to: section C.4.](#)

25. Assemble snap rings (7) to the levers (11).

26. Apply prescribed sealing on the cover support surface (2).

[Refer to: section C.4.](#)

27. Assemble cover (2).

28. Assemble locking screws (1) to the requested torque.

[Refer to: section C.4.](#)

29. Insert washers (6) on the lever (11) above snap rings (7).

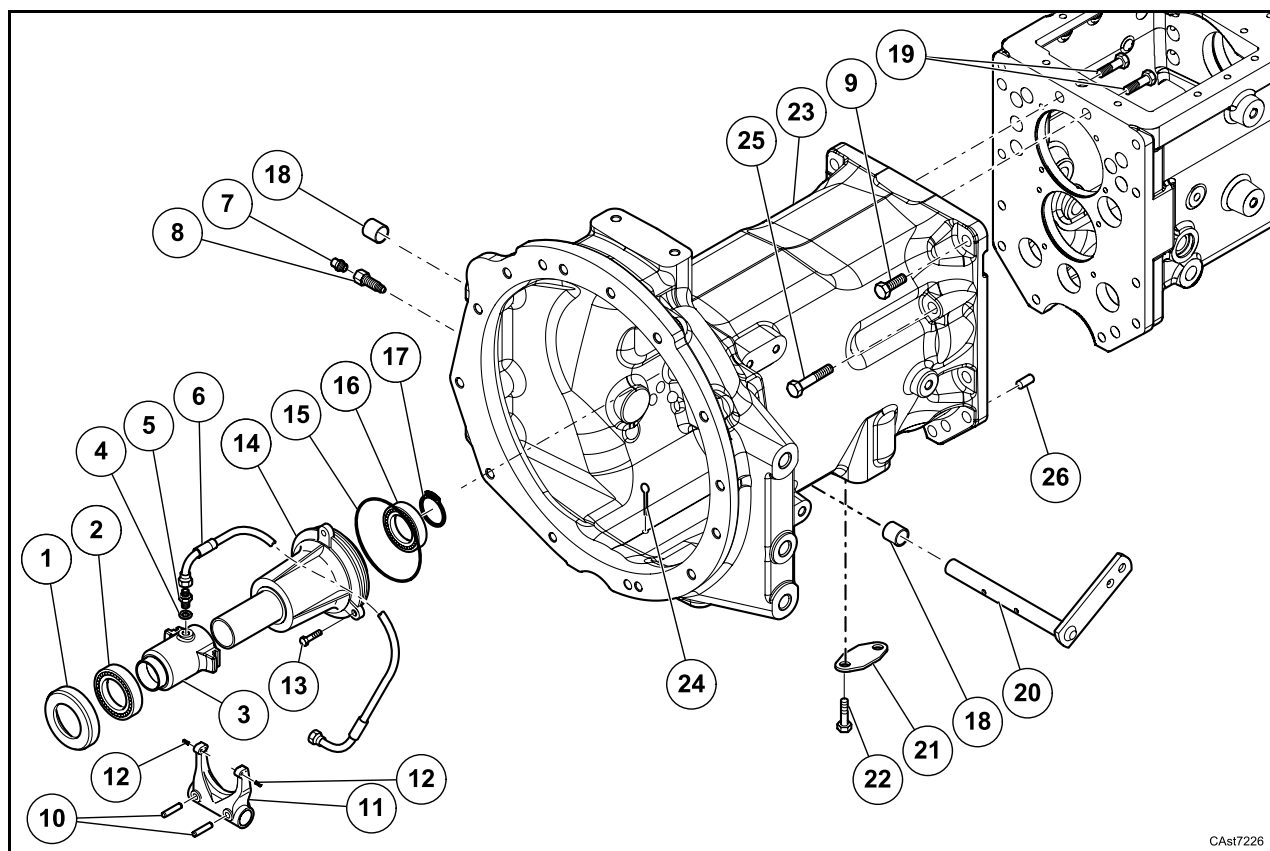
30. Assemble rubber booth (3) with hose clamp (4).

31. Apply prescribed sealing to the plug (16).

32. Assemble plug (16) using driver CA715846 and a hammer.

# Disassembly and Assembly Operations

## CLUTCH HOUSING - SYNCHRO SHUTTLE



CAst7226

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models | I                         | I                           | -                                                   | -                                                 | -                         | -                                                 |

### Disassembly

1. Remove pins (10).
2. Remove lever (20). Detach hose (6).
3. Remove and disassemble following components: fork (11) with split pins (12), disc pusher ring (1), bearing (2) and sleeve (3).
4. If necessary remove bushes (18) from clutch housing (23).
5. Remove screws (13) and assembled group.
6. Disassemble following components: sleeve support (14), O-Ring (15) and bearing (16).
7. Remove screws (25), (9) and (19).



### Danger

**Lock clutch housing (23) using an appropriate lifting apparatus.**

8. Remove clutch housing (23) from gear box.

### Assembly

1. Assemble to sleeve support (14) bearing (16) using prescribed tools.
2. Assemble O-Ring (15) on sleeve support (14).
3. Assemble sleeve support (14) to clutch housing (23) tightening screws (13) to prescribed torque.
4. Apply on clutch housing (23) the prescribed sealant.
5. Assemble clutch housing (23) to gear box.
6. Assemble screws (25), (9) and (19) and tighten them to prescribed torque.
7. Assemble bushes (18) to clutch housing (23) using prescribed tools. Grease bushes.

[Refer to: section E.1\("\) on page 332\).](#)

[Refer to: section C.4.](#)

[Refer to: section C.4 and figure 1.](#)

[Refer to: section C.4.](#)

[Refer to: section E.1 \(clutch housing mechanical\).](#)

# Disassembly and Assembly Operations

8. Assemble bearing (2) on disc pusher ring (1) with prescribed tool.

Refer to: [section E.1 \(clutch housing mechanical\)](#).

9. Assemble sleeve (3) on disc pusher ring (1) with prescribed tool.

Refer to: [section E.1 \(clutch housing mechanical\)](#) and figure 2.

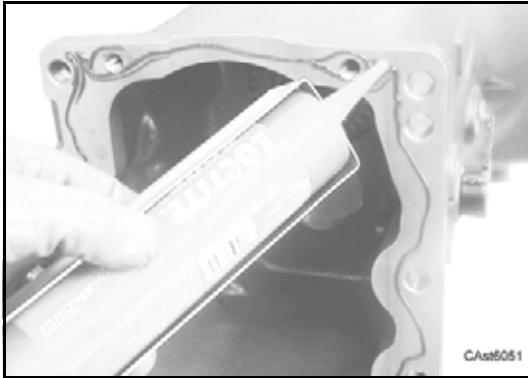


Figure 1



Figure 2

10. Assemble and lubricate sleeve (3).  
11. Assemble assy (1), (2) and (3) on sleeve support (14).  
12. Assemble pins (12).

Refer to: [figure 3](#).

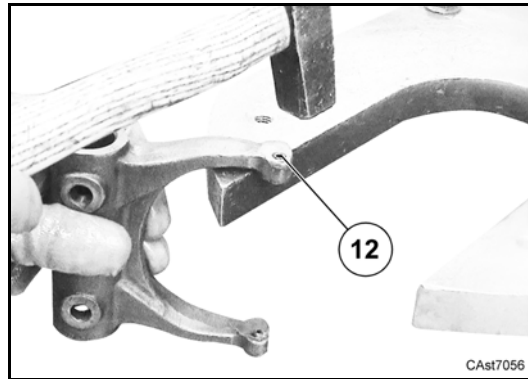


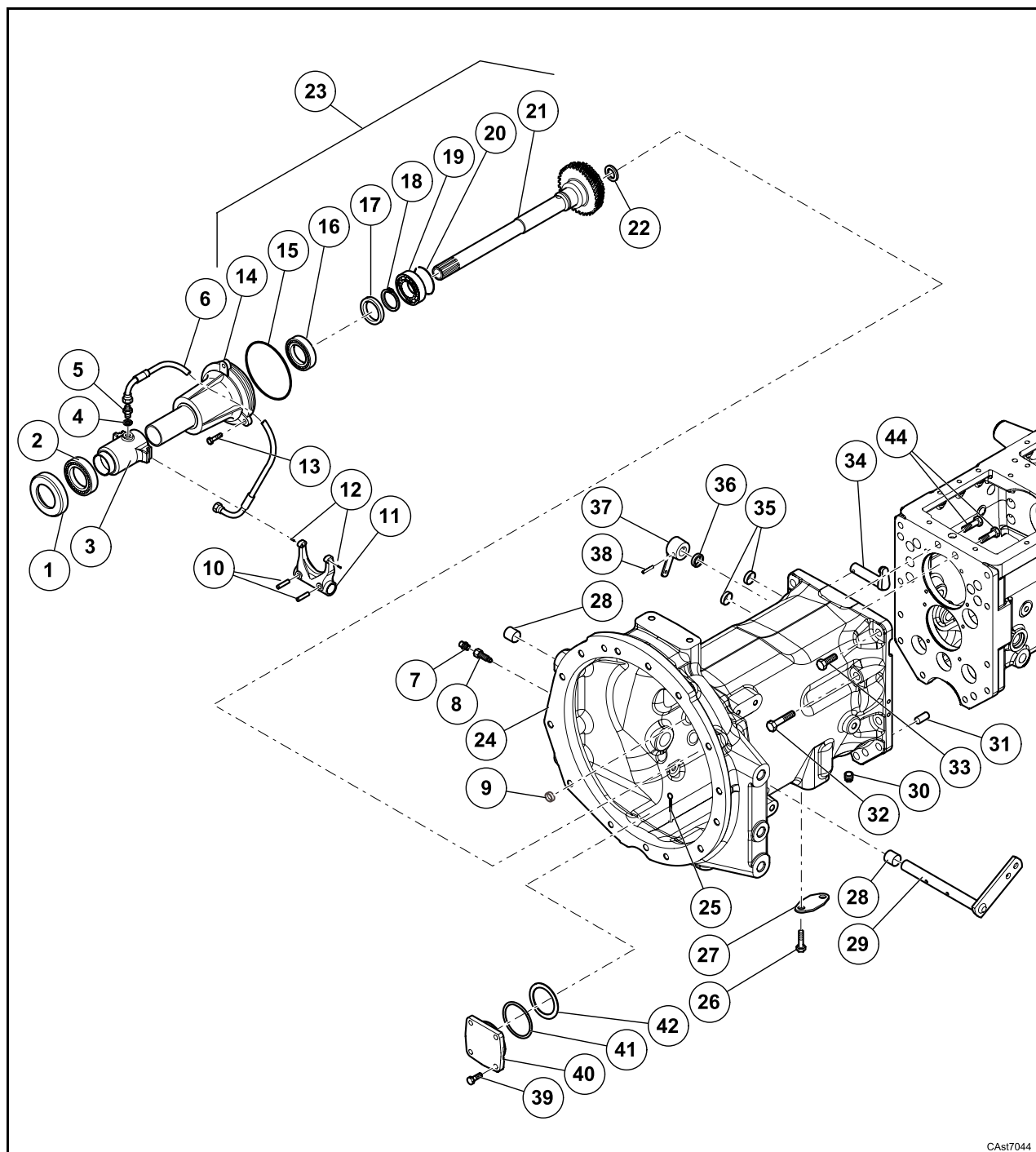
Figure 3

13. Assemble fork (11) on assy.  
14. Assemble lever (20).  
15. Assemble pins (10).  
16. Assemble hose (6). Fasten fittings to prescribed torques.

Refer to: [section C.4](#).

# Disassembly and Assembly Operations

## CLUTCH HOUSING - SYNCHRO SPLITTER



CAst7044

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models | -                         | -                           | I                                                   | -                                                 | -                         | -                                                 |



# Disassembly and Assembly Operations

## Disassembly

1. Remove pins (10).
2. Remove lever (29). Detach hose (6).
3. Remove and disassemble following components: fork (11) with split pins (12), disc pusher ring (1), bearing (2) and sleeve (3).
4. If necessary remove bushes (28) from clutch housing (24).
5. Remove screws (13) and assy.
6. Disassemble following components: sleeve support (14), O-Ring (15), seal ring (17), snap ring (18), bearing (19), snap ring (20), input shaft (21) and seal ring (22).

**NOTE:** Destructive operation for seal rings.

7. Remove screws (39).
8. Remove cover (40) and shims (42).
9. Remove O-ring (41) from cover (40).
10. Remove screws (33), (32) and (44).



## Danger

**Lock clutch housing (24) using an appropriate lifting apparatus.**

11. Remove clutch housing (24) from gear box.
12. Remove pin (38).
13. Remove outer lever (37).
14. Collect control lever (34) from inside of clutch housing (24).
15. Remove seal ring (36).

**NOTE:** Destructive operation for seal ring.

## Assembly

**NOTE:** For special tools see section E.1 ("") on page 332).

1. Assemble seal (22) on shaft (21) with prescribed tool.
2. Assemble to sleeve support (14) bearing (16) and seal (17) using prescribed tools.
3. Assemble to sleeve support (14) O-ring (15).
4. Grease seal (17).
5. Assemble to input shaft (21): bearing (19) using prescribed tool and snap ring (18).
6. Assemble shaft (21) to sleeve support (14) using prescribed tool.



Figure 1



Figure 2

7. Assemble snap ring (20) on sleeve support (14).

[Refer to: figure 3.](#)

8. Assemble plug (9). Use prescribed tool. Assemble group (23) as shown in figure and tighten screws (13) to the requested torque.

# Disassembly and Assembly Operations

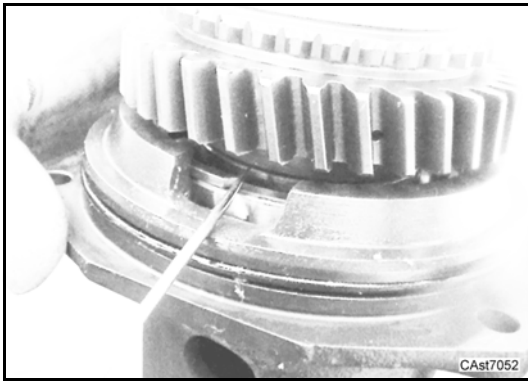


Figure 3

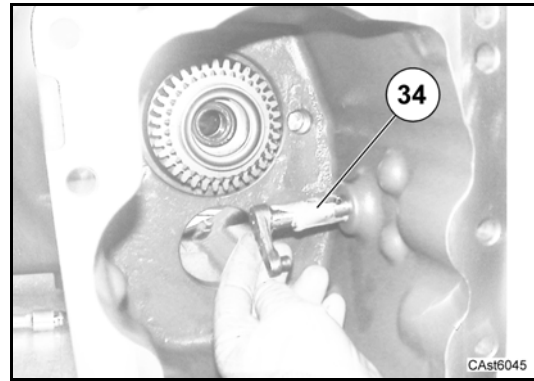


Figure 6

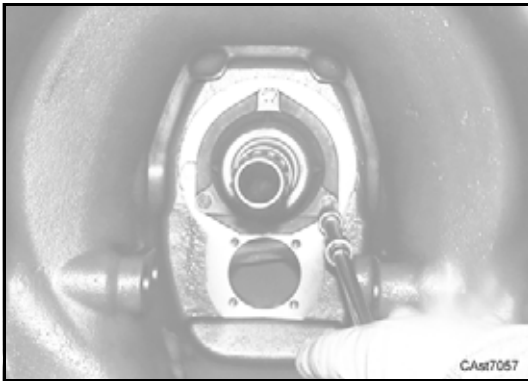


Figure 4

9. Assemble and lubricate seal ring (36) using prescribed tool.

[Refer to: figure 5.](#)

10. Assemble control lever (34) from inside of clutch housing (24).

[Refer to: figure 6.](#)

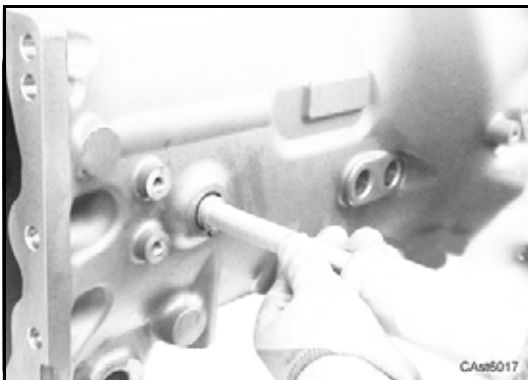


Figure 5

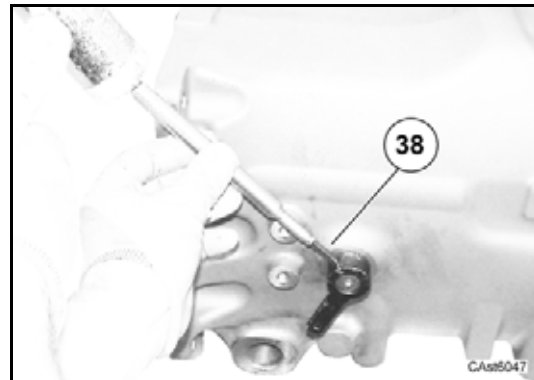


Figure 7

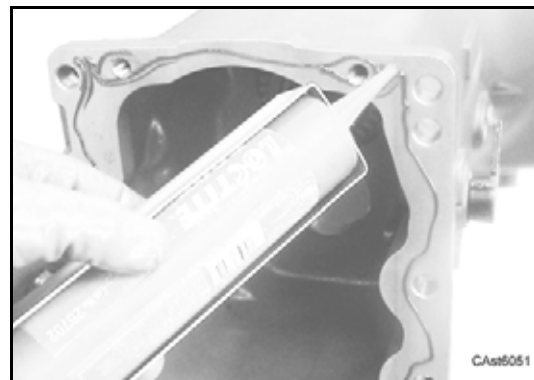


Figure 8

14. Assemble clutch housing (24) to gear box.

15. Assemble screws (32), (33) and (44) and tighten to requested torque.

[Refer to: section C.4 and figure 9.](#)

16. Lubricate and assemble O-ring (41) to cover (40).

17. Push bearing with screwdriver to stroke end.

[Refer to: figure 10.](#)

# Disassembly and Assembly Operations

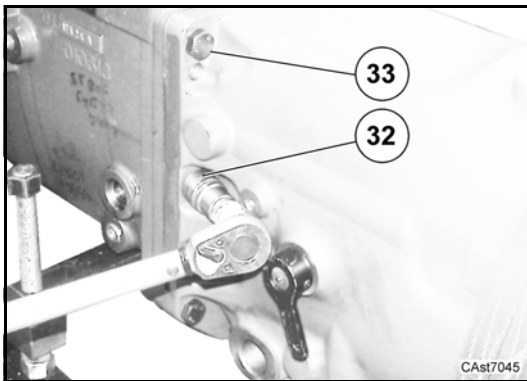


Figure 9

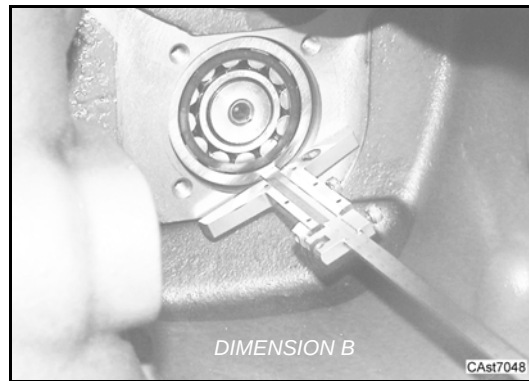


Figure 12

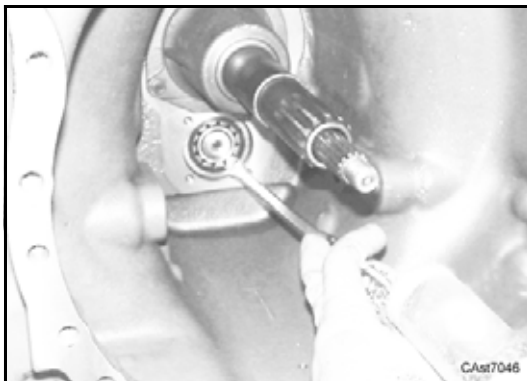


Figure 10

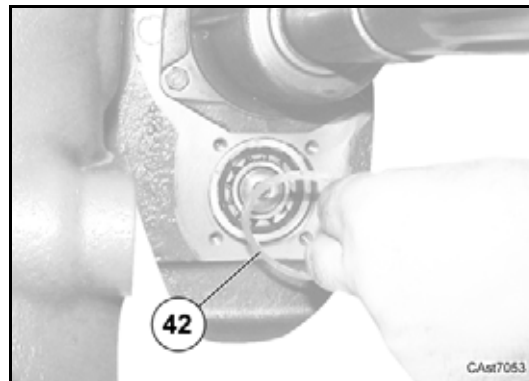


Figure 13

18. Measure dimension (A). Measure dimension (B).  
Obtain the thickness (C) using shims (42) of the available range, according to the following formula:

$$C = [B - A - (0.1 \div 0.2)] \text{ mm}$$

Assemble shims (42).

Refer to: section C.6 [7] and figure 11,12 and 13.

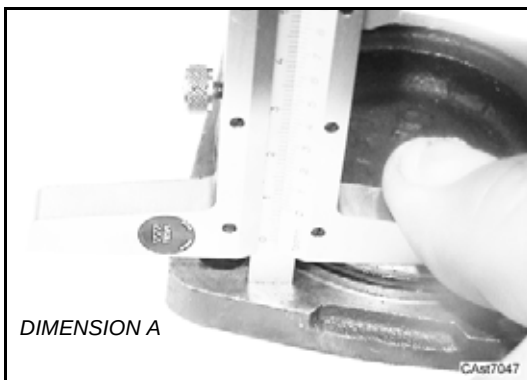


Figure 11

19. Assemble cover (40).

20. Assemble and tighten screws (39) to the requested torque.

Refer to: section C.4 and figure 14.

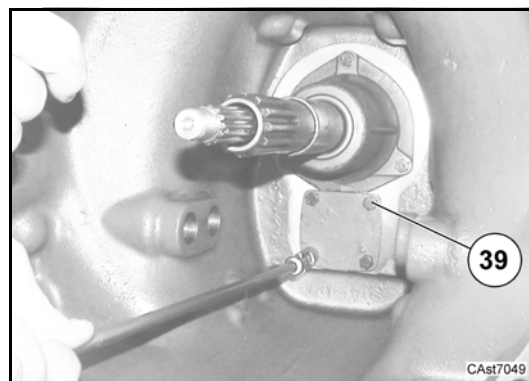


Figure 14

21. Assemble bushes (28) in clutch housing (24) using prescribed tools. Grease bushes.

Refer to: section E.1 (clutch housing mechanical).

22. Assemble bearing (2) on disc pusher ring (1) using prescribed tool.

23. Assemble sleeve (3) on disc pusher ring (1) using prescribed tool.

Refer to: figure 15.

24. Grease and assemble sleeve (3).

# Disassembly and Assembly Operations

25. Assemble assy (1,2 and 3) on sleeve support (14).

[Refer to: figure 18.](#)

26. Assemble pins (12).

[Refer to: figure 16.](#)



Figure 15

27. Assemble fork (11) in assembled group.

28. Assemble lever (29).

[Refer to: figure 17.](#)

29. Assemble pins (10).

[Refer to: figure 18.](#)

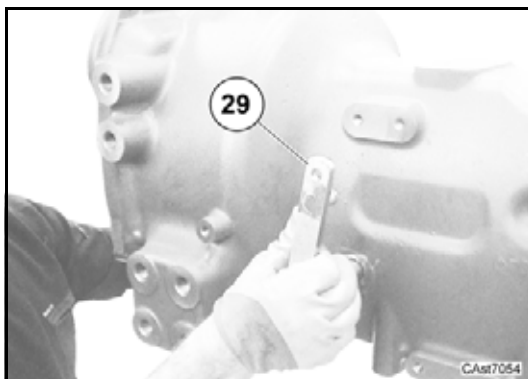


Figure 16

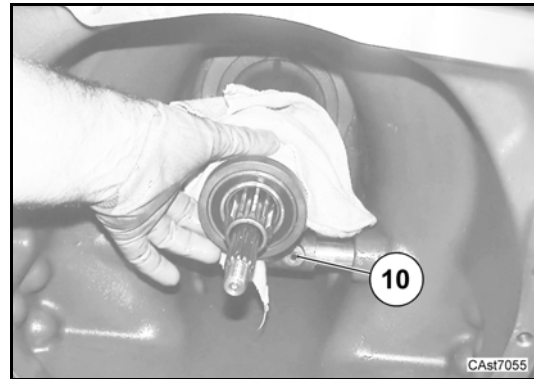


Figure 17

30. Assemble pipe (6). Fasten fittings.

[Refer to: section C.4 and figure 19.](#)

**NOTE:** *Correct assembly.*

[Refer to: figure 20.](#)

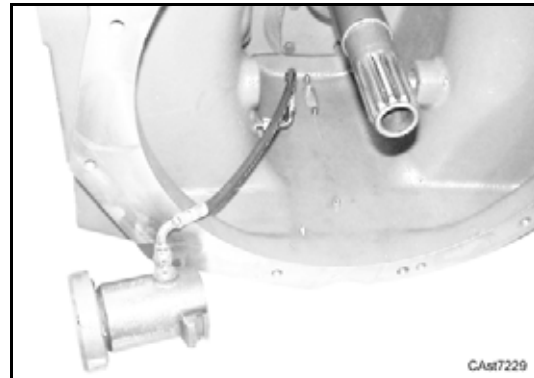


Figure 18

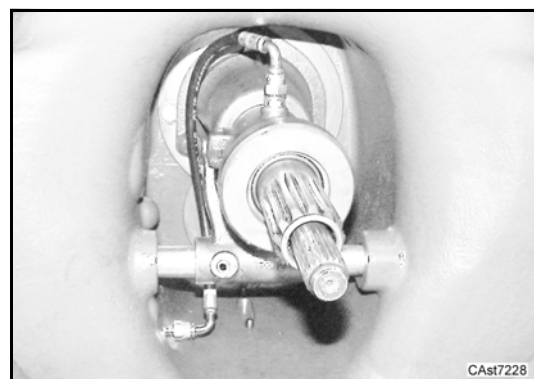
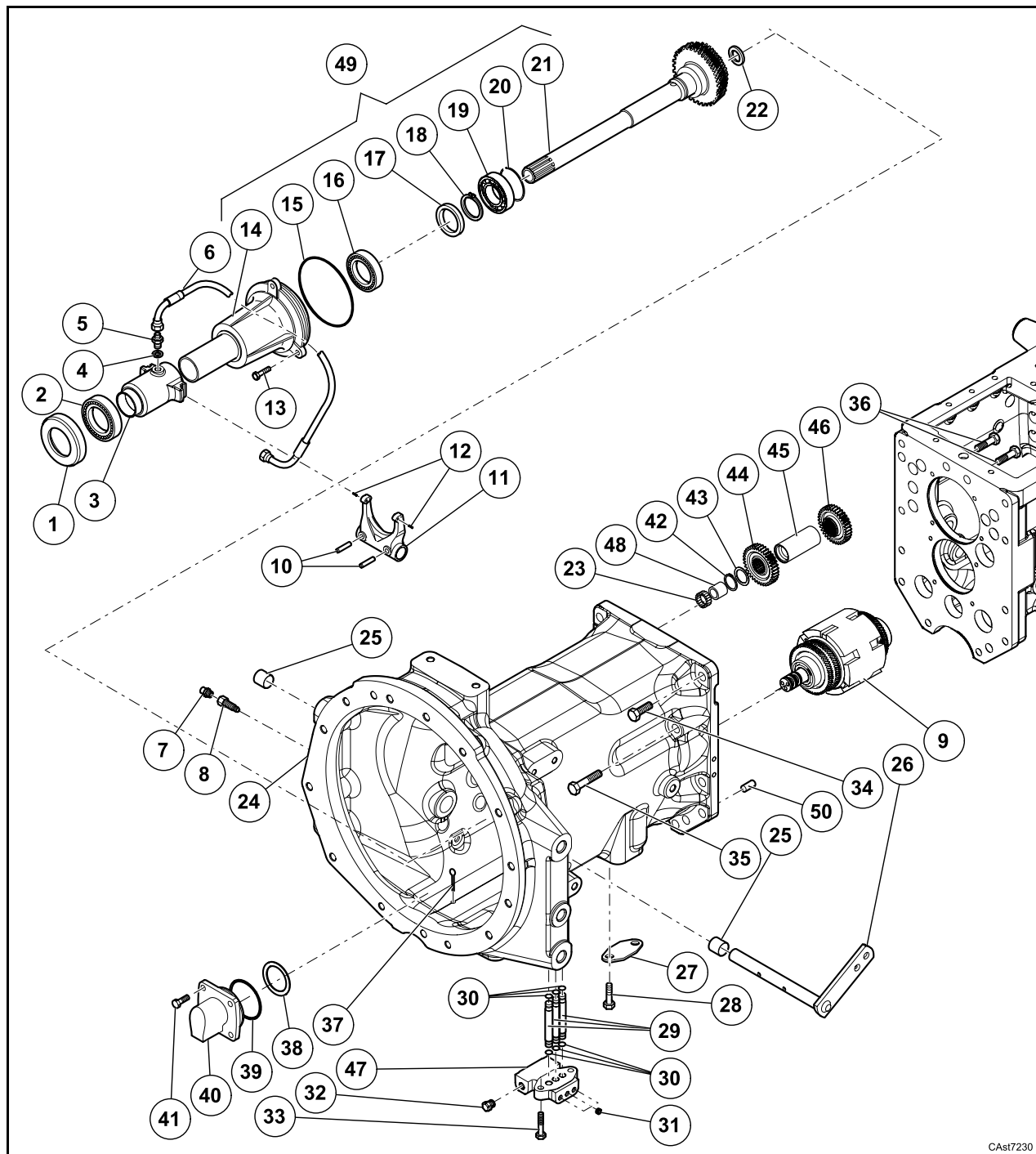


Figure 19

# Disassembly and Assembly Operations

## SYNCHRO SHUTTLE AND POWER SPLITTER



CAst7230

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models | -                         | -                           | -                                                   | I                                                 | -                         | -                                                 |



# Disassembly and Assembly Operations

## Disassembly

1. Remove pins (10).
2. Remove lever (26). Detach hose (6).
3. Remove and disassemble following components: fork (11) with split pins (12), disc pusher ring (1), bearing (2) and sleeve (3).
4. If necessary remove bushes (25) from clutch housing (24).
5. Remove screws (13) and assy.
6. Disassemble following components: sleeve support (14), O-Ring (15), bearing (16), seal ring (17), snap ring (18), bearing (19), snap ring (20), input shaft (21) and seal ring (22).

**NOTE:** Destructive operation for seal rings.

7. Remove screws (33) and (41).
8. Remove block (47) and three lubricating pipes (29) with relevant O-Rings (30).
9. Remove cover (40) and O-Ring (39).
10. Collect shims (38).
11. Remove screws (34), (35) and (36).



## Danger

**Lock clutch housing (24) using an appropriate lifting apparatus.**

12. Remove clutch housing (24) from gear box.
13. Remove needle bearing (23) and spacer (48).
14. Remove snap ring (42) and shims (43).
15. Remove gear (44).
16. Remove spacer (45).
17. Remove clutch assy (9).
18. Remove gear (46).

## Assembly

**NOTE:** For special tools see section E.1 ("") on page 332).

1. Assemble gear (46).
2. Assemble clutch assy (9).
3. Assemble spacer (45).
4. Assemble gear (44).
5. Assemble shims collected on disassembly (43).

**NOTE:** Determination of end float 6a.

Refer to: section C.6.

Assemble snap ring (42). With thickness gauge determine the end float between ring (42) and gear (44). Insert shims (43) up to obtain an end float between 0÷0,1 mm.

Choose shims among the range available.

Refer to: figure 1.

### SHIMS RANGE

|                |      |      |      |
|----------------|------|------|------|
| Thickness - mm | 0.10 | 0.30 | 0.50 |
| Quantity       | ---  | ---  | ---  |

6. Assemble spacer (48) and needle bearing (23).
7. Check clutch assy is in its seat.
8. Clean with detergent the gear box surface.
9. Apply prescribed sealing to clutch housing (24).

Refer to: section C.4.

10. Assemble screws (34), (35) and (36) and tighten to prescribed torque.

Refer to: section C.4.

11. Lubricate and assemble O-Ring (39) to cover (40).
12. Push to stroke end front bearing of clutch assy (9).
13. Measure dimension (A). Measure dimension (B). Obtain the thickness (C) using shims (38) of the available range, according to the following formula:

$$C = [B - A - (0.1 \div 0.2)] \text{ mm}$$

Assemble shims (38).

Refer to: section C.6 [7a] and figure 2.

# Disassembly and Assembly Operations

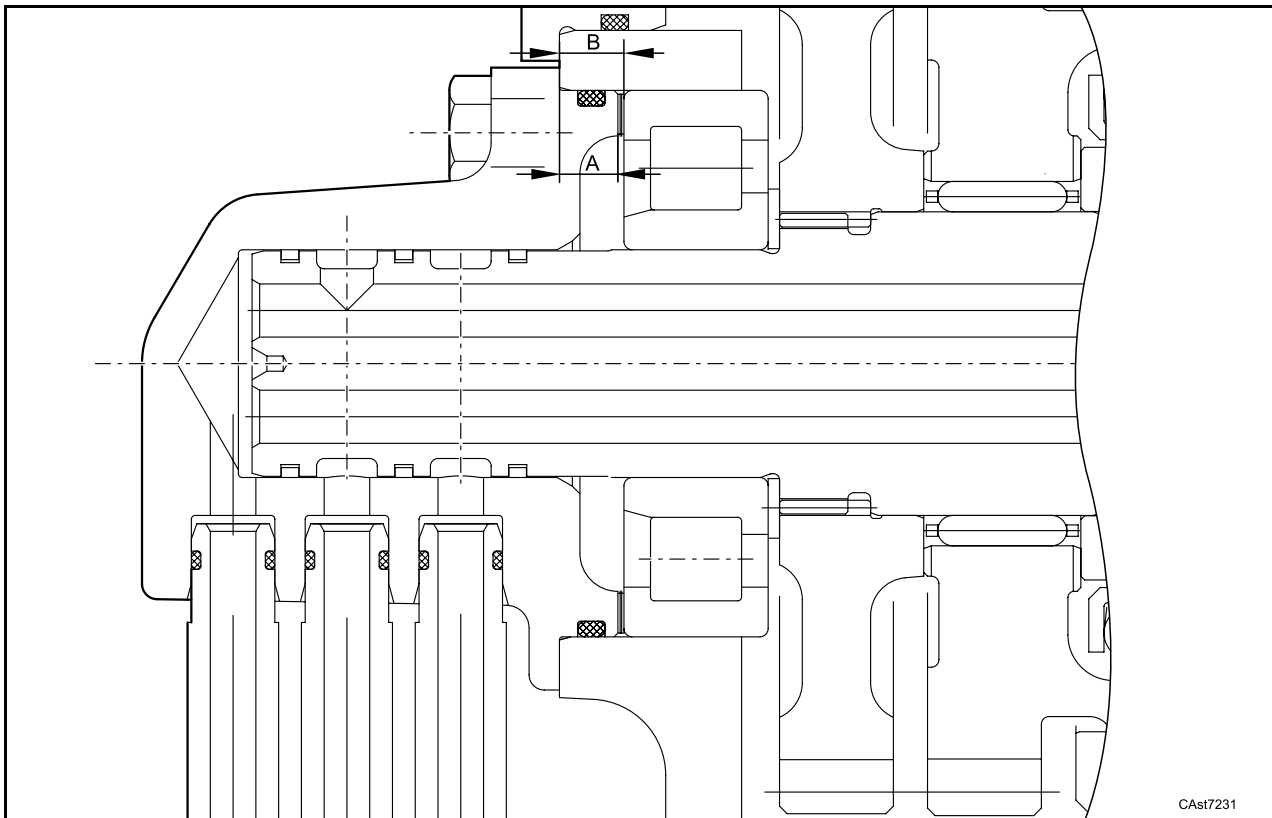


Figure 20

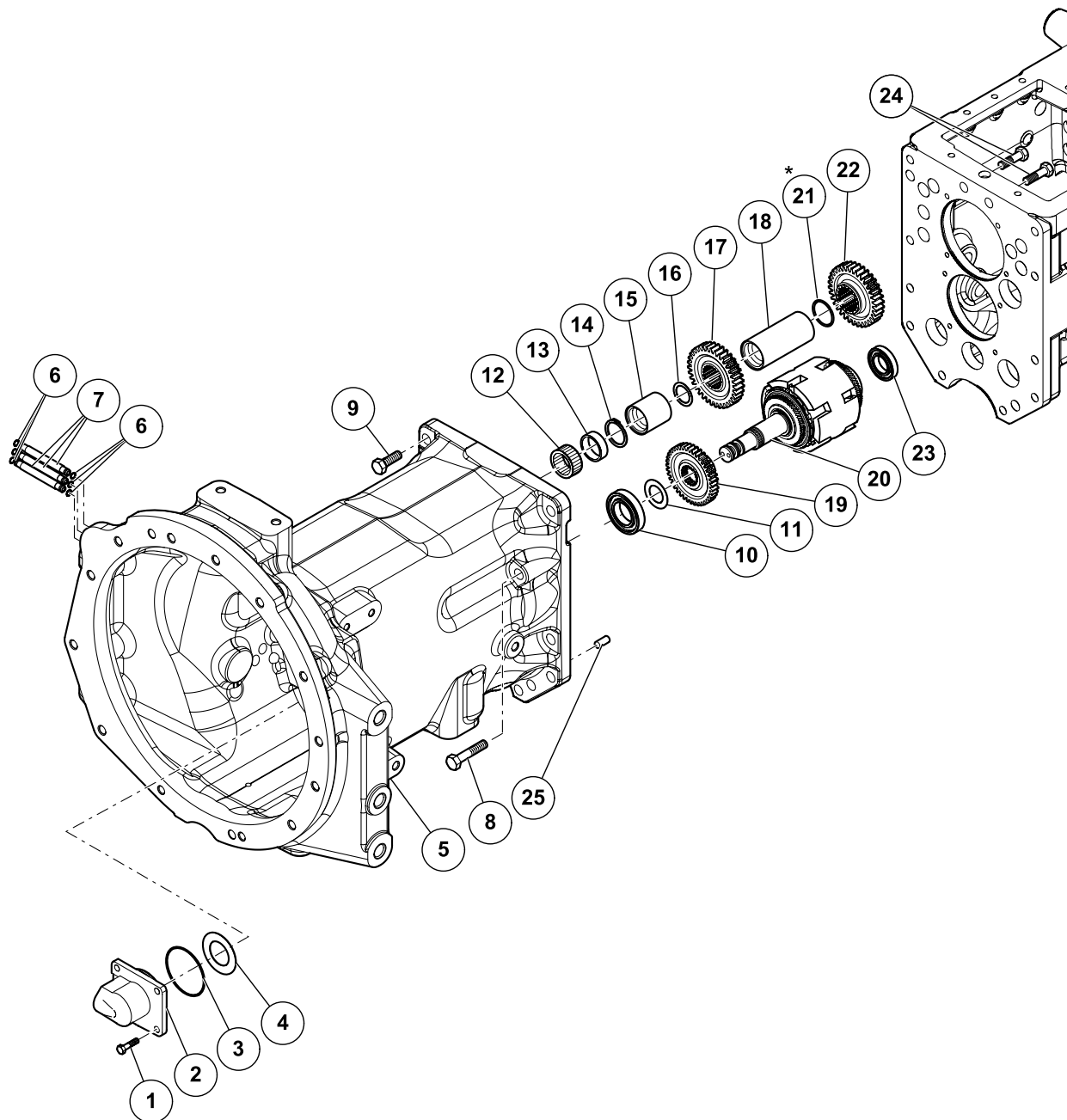
14. Assemble cover (40). Assemble screws (41) without tightening them.
15. Assemble O-Rings (30) on lubrication pipes (29). Grease O-Rings (30).
16. Assemble pipes (29).
17. Tighten screws (41) to the prescribed torque.  
[Refer to: section C.4.](#)
18. Assemble seal (22) on shaft (21) using the prescribed tool.
19. Assemble to sleeve support (14), bearing (16) and seal (17) with prescribed tools.  
[Refer to: section E.1 \(clutch housing mechanical\).](#)
20. Assemble O-Ring (15) to sleeve support (14).
21. Grease seal (17).
22. Assemble on shaft (21): bearing (19) with prescribed tool and snap ring (18).
23. Assemble shaft (21) to sleeve support (14).
24. Place snap ring into its seat (20) on sleeve support (14).
25. Assemble assy (49) and tighten screws (13) to prescribed torque.  
[Refer to: Section. C.4.](#)
26. Assemble bushes (25) into clutch housing (24) with prescribed tools. Grease bushes.
27. Assemble bearing (2) on disc pusher ring (1) with prescribed tools.  
[Refer to: section E.1 \(clutch housing mechanical\).](#)
28. Assemble sleeve (3) on disc pusher ring (1) with prescribed tool.
29. Assemble and lubricate sleeve (3).
30. Assemble assy (1), (2) and (3) on sleeve support (14).
31. Assemble pins (12).
32. Assemble fork (11) on assy.
33. Assemble lever (26).
34. Assemble pins (10).
35. Assemble pipe (6). Tighten fittings.  
[Refer to: section C.4.](#)



# Disassembly and Assembly Operations

## POWER SHUTTLE - POWER SHUTTLE AND SYNCHRO SPLITTER

\* 24+24 ONLY FOR POWER SHUTTLE AND SYNCHRO SPLITTER



CAst7119

**8+8  
synchro  
shuttle**

**12+12  
synchro  
shuttle**

**24+24  
synchro shuttle  
and synchro  
splitter**

**24+24  
synchro shuttle  
and power  
splitter**

**12+12  
power  
shuttle**

**24+24  
power shuttle  
and synchro  
splitter**

For models

-

-

-

-

|

|

# Disassembly and Assembly Operations

## Disassembly

1. Remove compressor and control valve.

Refer to: [section D.10 and D.1.](#)

2. Remove screws (1).

3. Remove three lubrication pipes (7) with relevant O-Rings (6).

Refer to: [figure 1.](#)

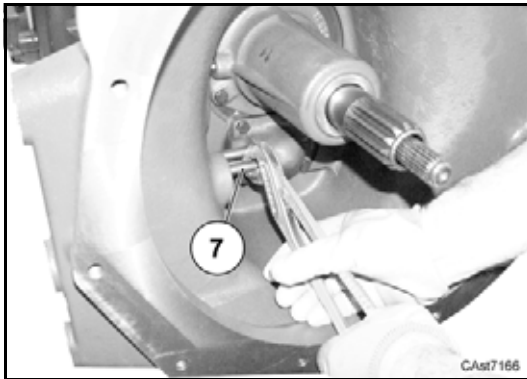


Figure 1

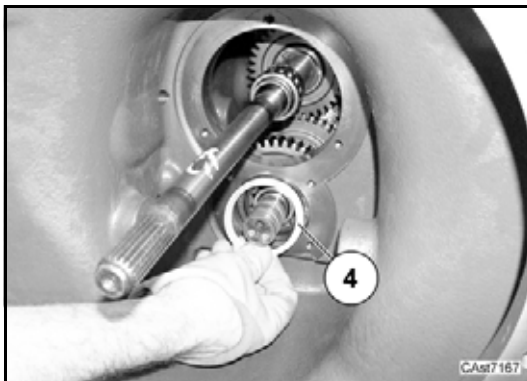


Figure 2

4. Remove cover (2) and O-Ring (3).

5. Collect shims (4).

Refer to: [figure 2.](#)

6. Remove screws (8) and (9).



## Danger

**Lock hydraulic housing using an appropriate lifting apparatus.**

7. Remove clutch housing (5) from gear box.

8. Remove outer race of bearing (10).

Refer to: [figure 3.](#)

9. Remove inner race of bearing (10) using puller.

Refer to: [figure 4.](#)



Figure 3



Figure 4

10. Remove thrust washer (11).

Refer to: [figure 5.](#)

11. Remove needle bearing (12) and spacer (13).

Refer to: [figure 6.](#)

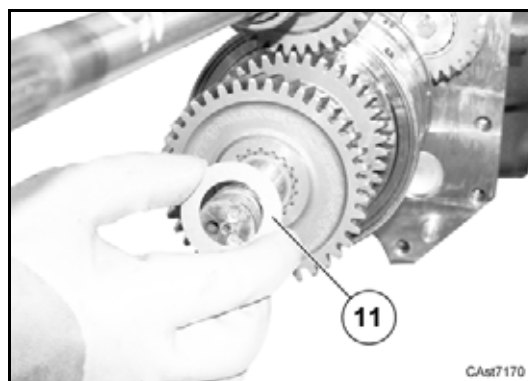


Figure 5

# Disassembly and Assembly Operations

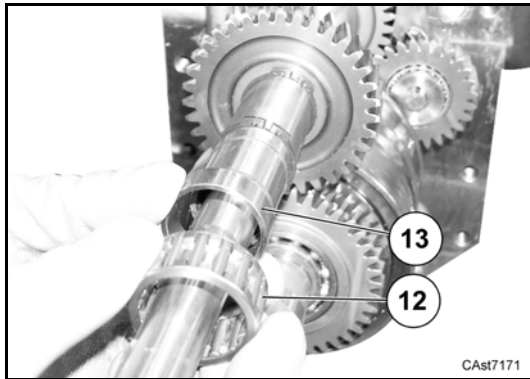


Figure 6

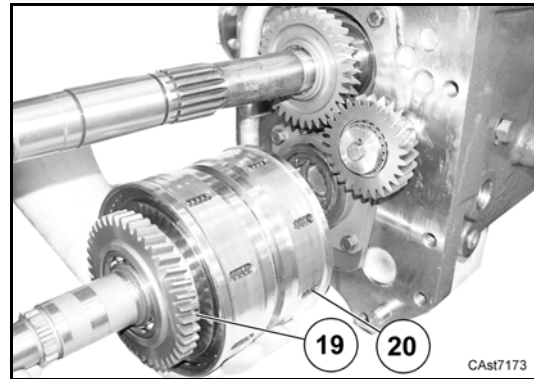


Figure 9

12. Remove snap ring (14), spacer (15) and shims (16).

[Refer to: figure 7.](#)

13. Remove gear (17).

[Refer to: figure 8.](#)

14. Remove spacer (18).

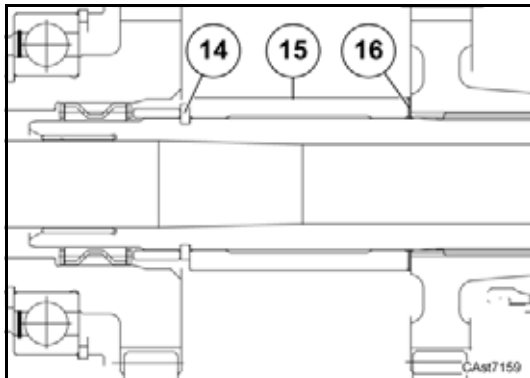


Figure 7

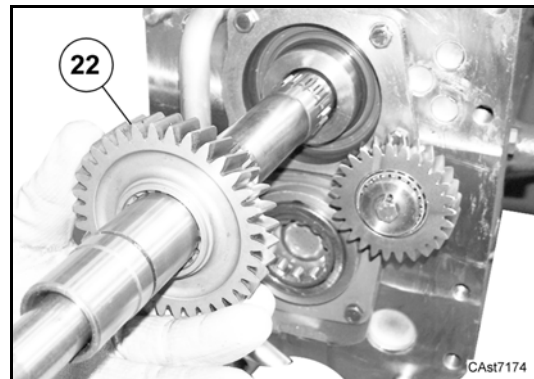


Figure 10

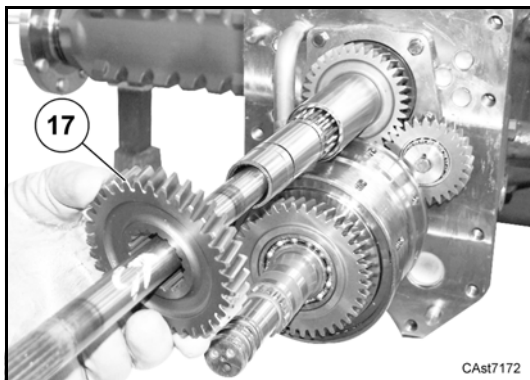


Figure 8

15. Remove clutch assy (19, 20).

[Refer to: figure 9.](#)

16. Remove O-Ring (21).

17. Remove gear (22).

[Refer to: figure 10.](#)

18. Remove outer race of bearing (23).

# Disassembly and Assembly Operations

## Assembly

1. Assemble outer race of bearing (23).
2. figure 11.
3. Assemble idle gear assy.

Refer to: section D.24b.

4. Assemble gear (22).

Refer to: figure 12.

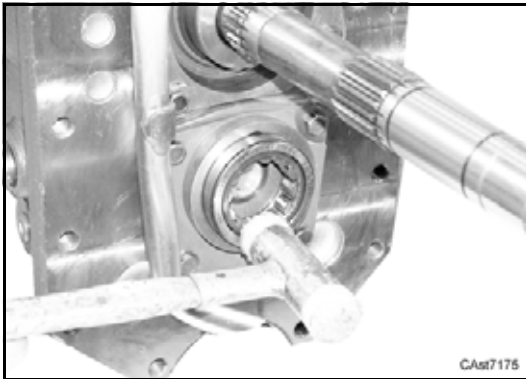


Figure 11

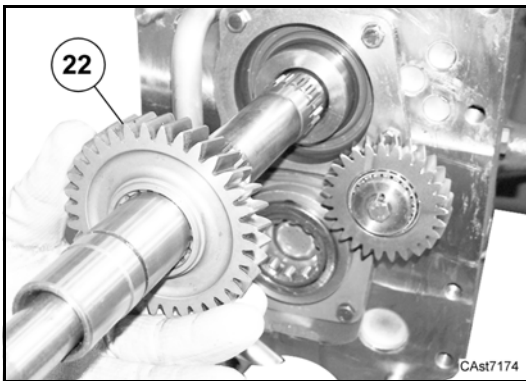


Figure 12

5. Assemble O-Ring (21) on gear (22).

**NOTE:** For version 24+24 power shuttle-synchro splitter only.

6. Assemble clutch assy (19, 20).
7. Assemble spacer (18).
8. Assemble gear (17).

Refer to: figure 13.

9. Assemble shims (16) collected on disassembly.

**NOTE:** Determination of end float 6b.

Refer to: section C.6.

Refer to: Assemble spacer (15) and snap ring (14).

With thickness gauge measure end float between spacer (15) and gear (17).

Insert shims (16) until you reach an end float value included between  $0 \div 0.1$  mm.

Choose shims among range available.

10. Assemble spacer (13) and needle bearing (12).

11. Verify clutch assy is in its seat.

Refer to: figure 14.

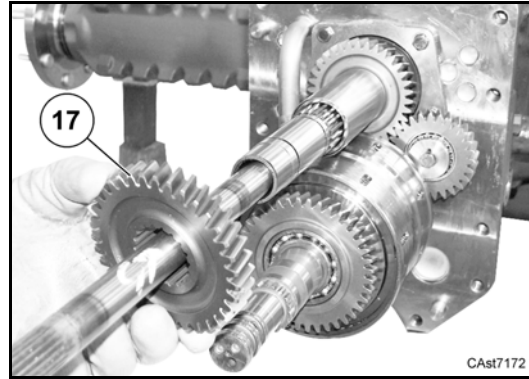


Figure 13

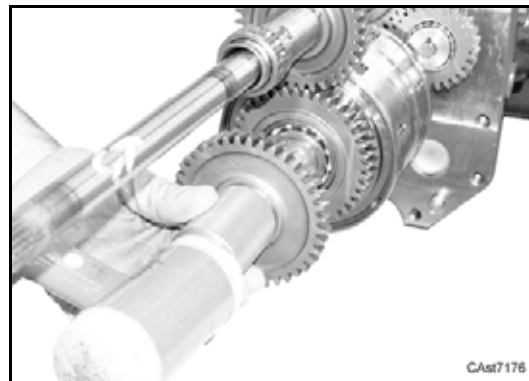


Figure 14

12. Assemble thrust washer (11).

Refer to: figure 15.

13. Assemble inner race of bearing (10) using special tool CA715954.

14. Assemble outer race of bearing.

Refer to: figure 16.

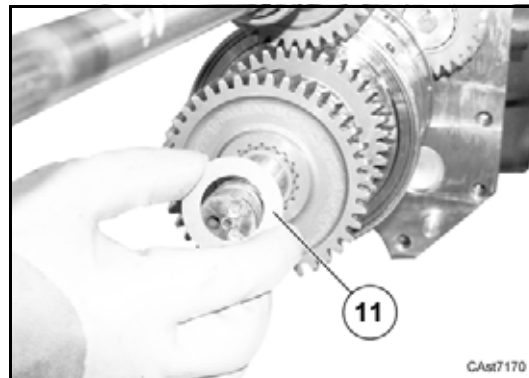


Figure 15



# Disassembly and Assembly Operations



Figure 16

15. Clean surface with detergents.

[Refer to: figure 17.](#)

16. Apply prescribed sealing to clutch housing (5).

[Refer to: section C.4 and figure 18.](#)

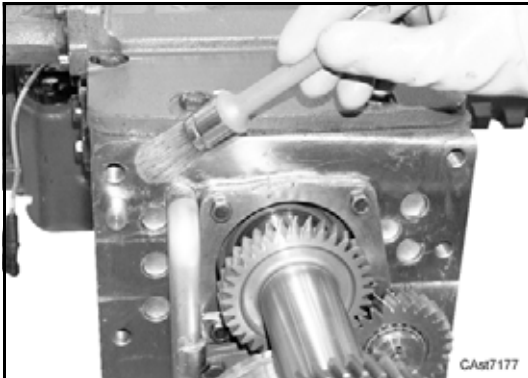


Figure 17

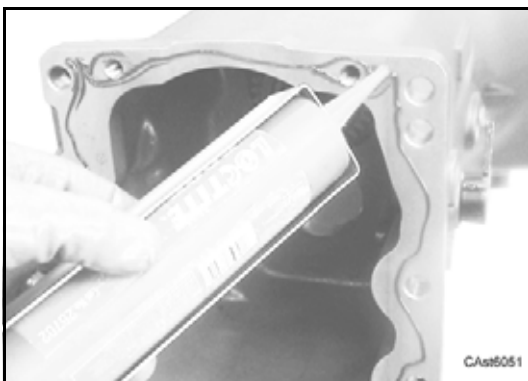


Figure 18

17. Assemble screws (8), (9) and (24) and tighten to prescribed torque.

[Refer to: section C.4 and figure 19.](#)

18. Lubricate and assemble O-Ring (3) to cover (2).

19. Push bearing with screwdriver to stroke end.

[Refer to: figure 20.](#)

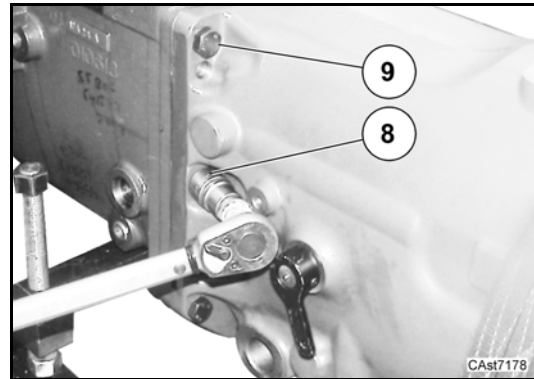


Figure 19

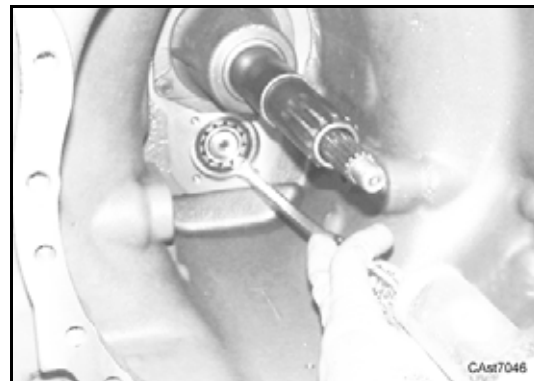


Figure 20

20. Measure dimension (A). Measure dimension (B). Obtain the thickness (C) using the shims (4) of the available range, according to the following formula:

$$C = [B - A - (0.1 \div 0.2)] \text{ mm}$$

Assemble shims (4).

[Refer to: section C.6 \[7a\] and figure 21, 22 and 23.](#)

21. Assemble cover (2). Assemble screws (1) without tightening them.

[Refer to: figure 24.](#)

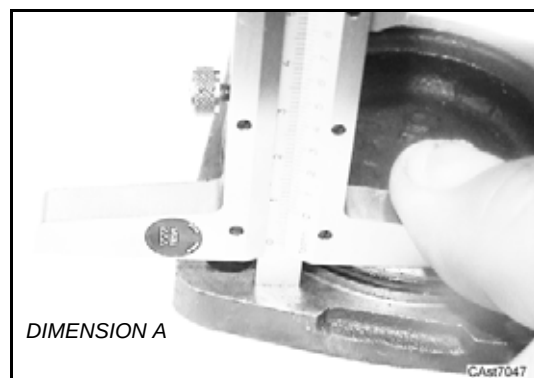


Figure 21

# Disassembly and Assembly Operations

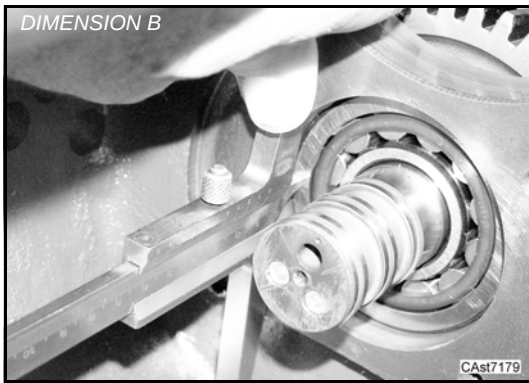


Figure 22



Figure 25

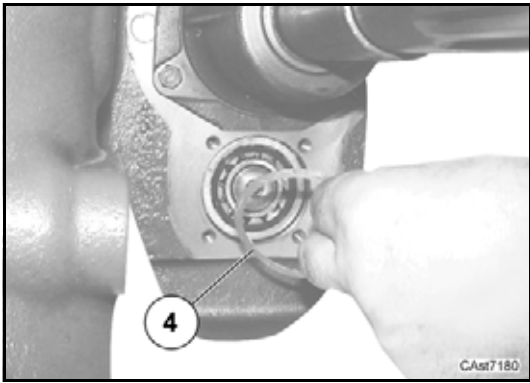


Figure 23

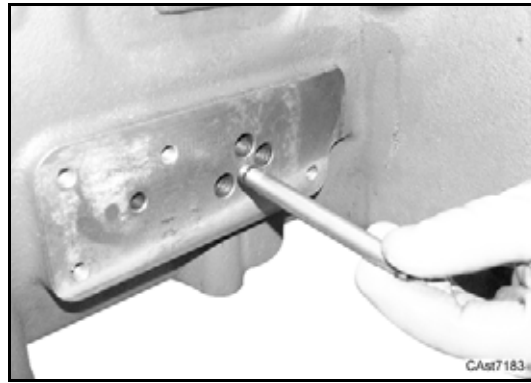


Figure 26

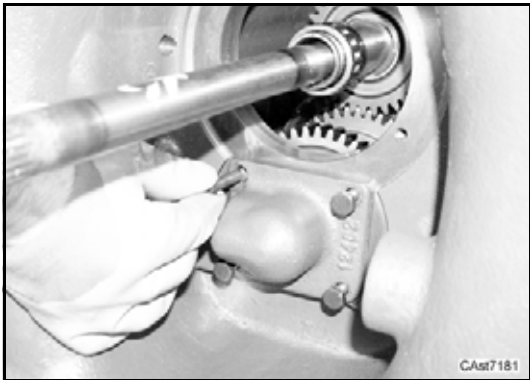


Figure 24

22. Assemble O-Rings (6) on lubrication pipes (7). Grease O-Rings.

[Refer to: figure 25.](#)

23. Assemble pipes (7).

[Refer to: figure 26.](#)

24. Tighten screws (1) to prescribed torque.

[Refer to: section C.4 and figure 27.](#)

25. Assemble input shaft and support assy.

[Refer to: section D.6.](#)

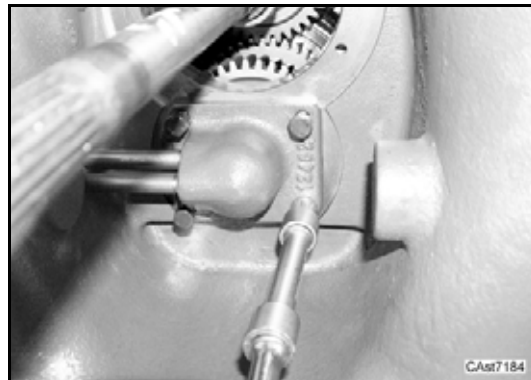
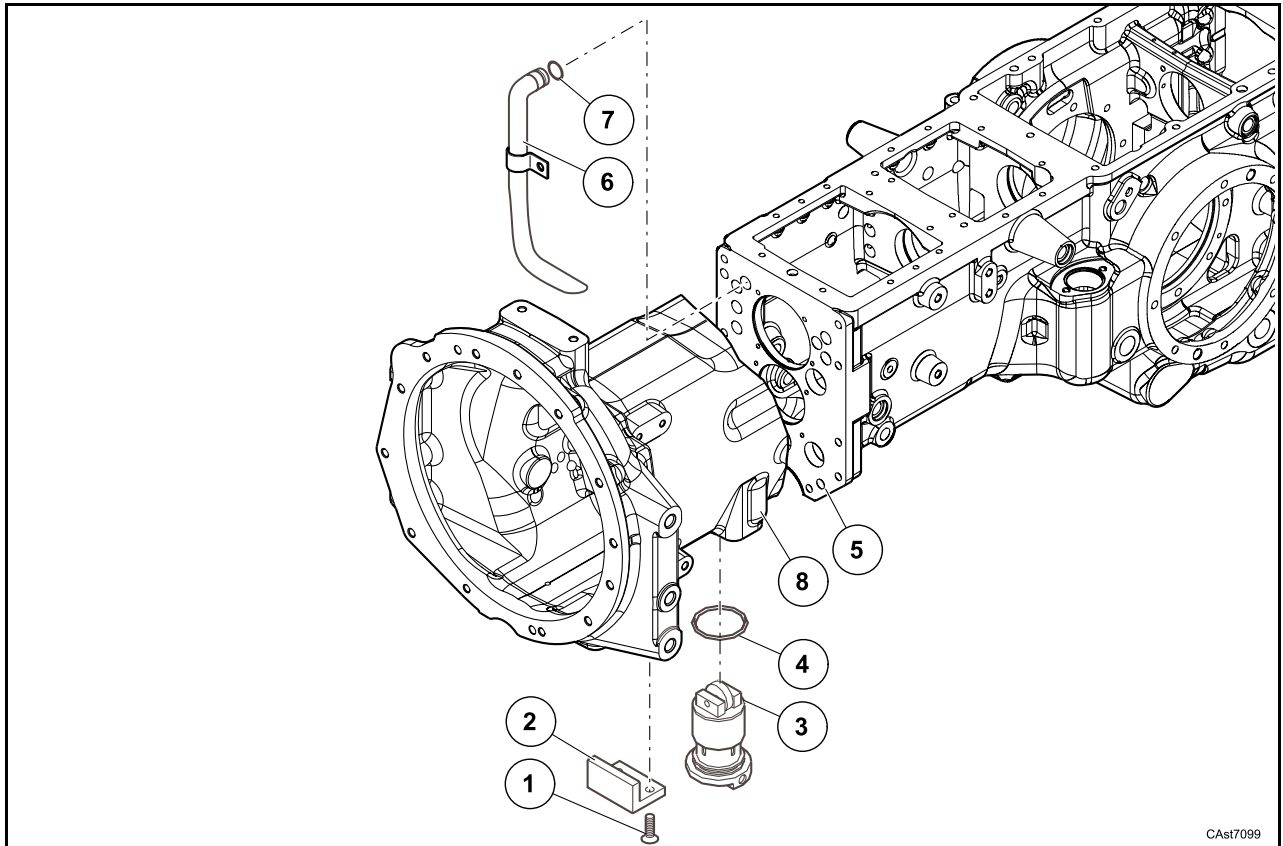


Figure 27

# Disassembly and Assembly Operations

## AIR COMPRESSOR



CAst7099

**8+8  
synchro  
shuttle**

**12+12  
synchro  
shuttle**

**24+24  
synchro shuttle  
and synchro  
splitter**

**24+24  
synchro shuttle  
and power  
splitter**

**12+12  
power  
shuttle**

**24+24  
power shuttle  
and synchro  
splitter**

For models

-

-

-

-

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|



# Disassembly and Assembly Operations

## Disassembly

**NOTE:** Compressor (3) function is to recover oil contained in the clutch housing (8) and to send it to gear box (5), through hose (6).

1. Remove pipe and connector.

Refer to: figure 1.

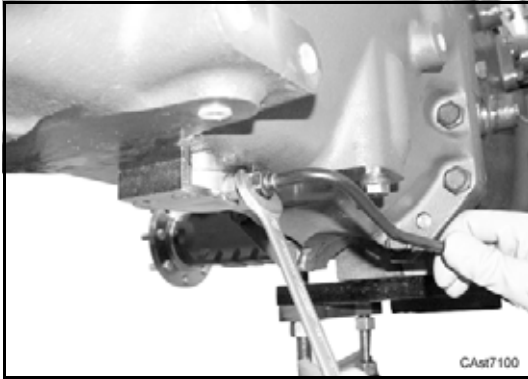


Figure 1

2. Remove screws (1), plate (2), compressor (3) and O-Ring (4).

## Assembly

1. Assemble O-Ring (4) on compressor (3).
2. Assemble compressor (3) on clutch body (8).
3. Assemble plate (2).
4. Assemble screws (1) to the requested torque.

Refer to: figure 2 and section C.4

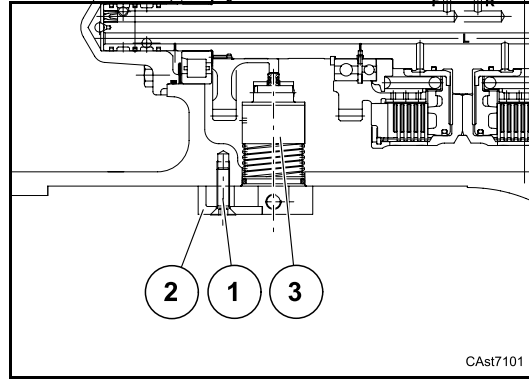


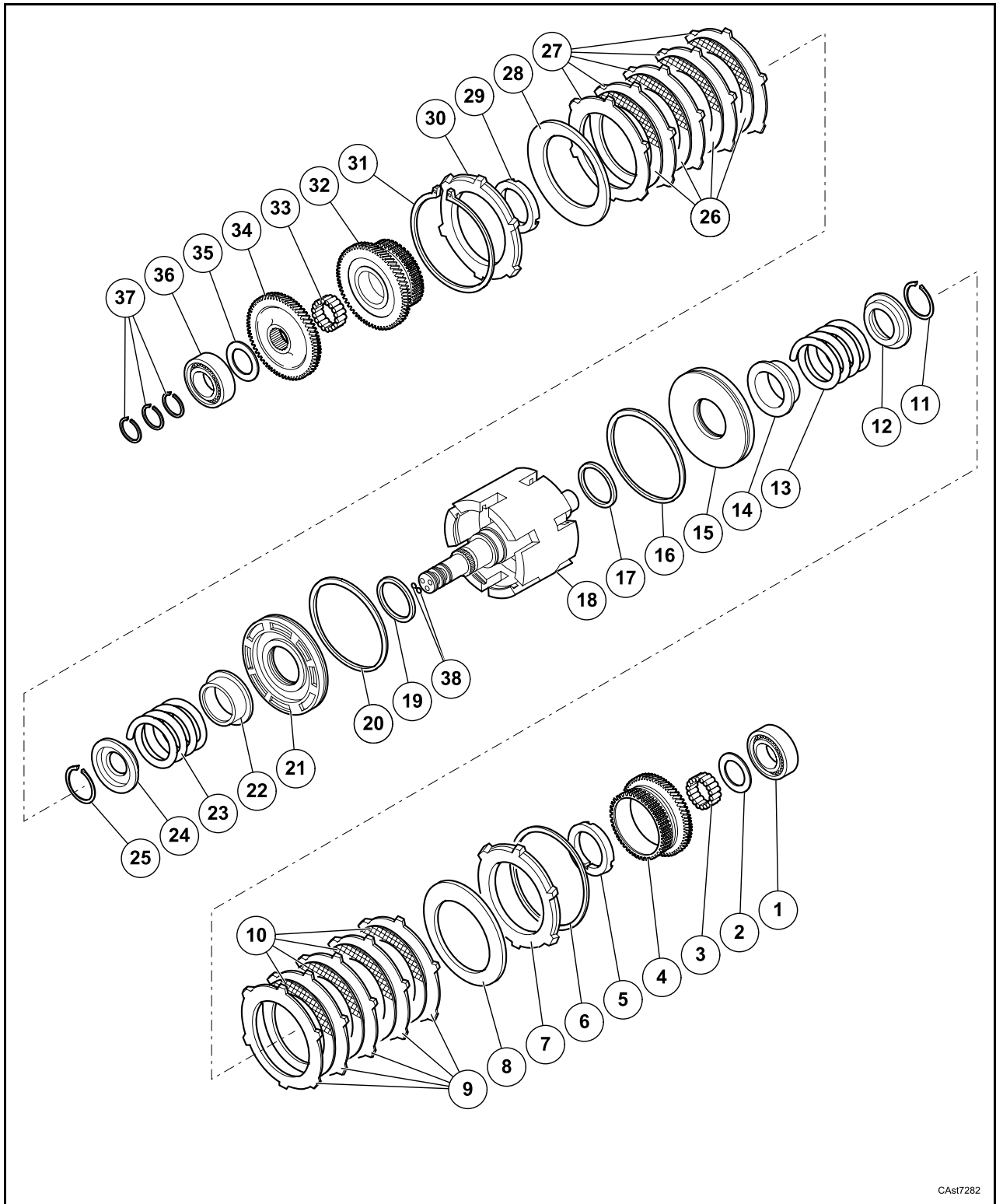
Figure 2

5. Restore connector and pipe.

Refer to: figure 2.

# Disassembly and Assembly Operations

## WET CLUTCH - POWER SPLITTER



CAst7282

**8+8  
synchro  
shuttle**

**12+12  
synchro  
shuttle**

**24+24  
synchro shuttle  
and synchro  
splitter**

**24+24  
synchro shuttle  
and power  
splitter**

**12+12  
power  
shuttle**

**24+24  
power shuttle  
and synchro  
splitter**

For models

-

-

-

|

-

-

# Disassembly and Assembly Operations

## Disassembly

1. Remove clutch from clutch housing.

[Refer to: section D.9c](#)

2. Lock tool "CA715358" on page 327 with a vice.

[Refer to: section E.1 \(" " on page 325\).](#)

3. Assemble clutch on the tool.

4. Remove gear (4), bearing (1) and disc (2).

[Refer to: figure 1.](#)

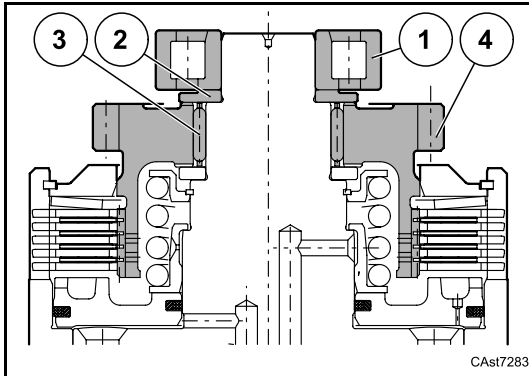


Figure 1

5. Remove needle bearing (3).

[Refer to: figure 1.](#)

6. Remove disc (5).

[Refer to: figure 2.](#)

7. Remove snap ring (6).

[Refer to: figure 2.](#)

8. Remove clutch counterdisc (7).

[Refer to: figure 2.](#)

9. Turn clutch. Remove belleville washer (8), clutch plates (10) and clutch drive plates (9).

[Refer to: figure 2.](#)

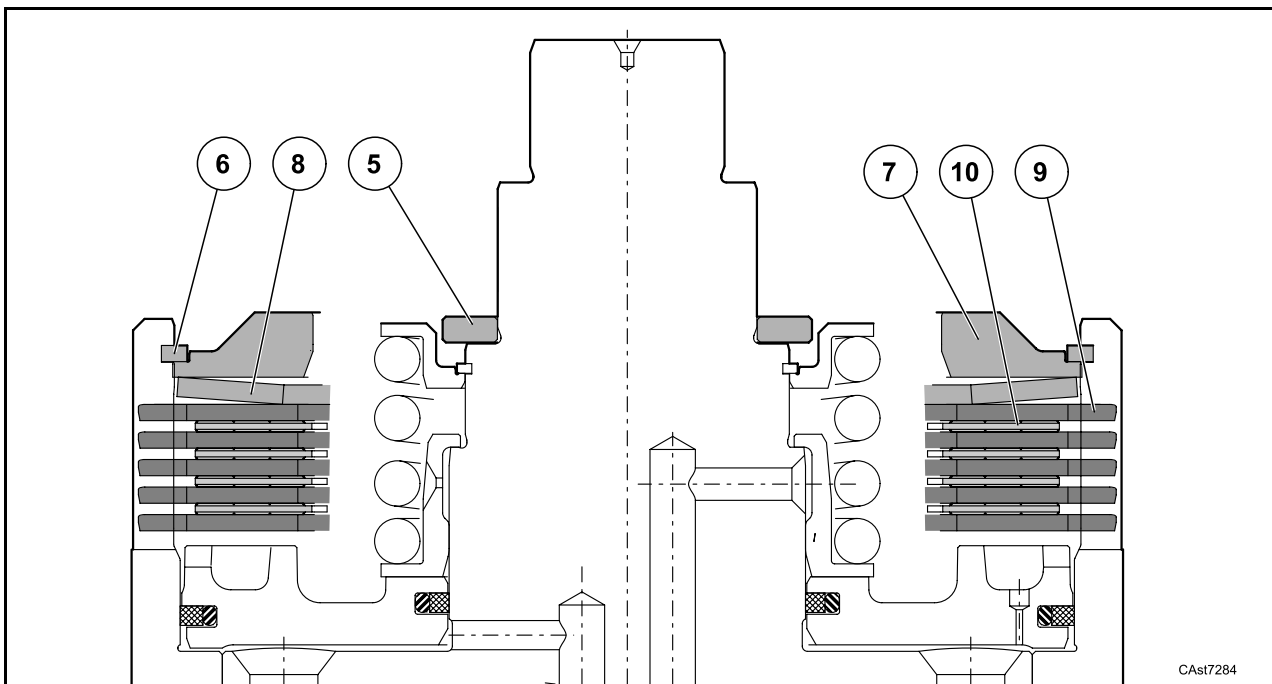


Figure 2

10. Assemble bush "CA716105" on page 327 and upper cover of tool "CA715358" on page 327.

[Refer to: figure 3. and section E.1 \(" " on page 325\).](#)

11. Turn handles. Remove snap ring (11).

[Refer to: figure 3.](#)

12. Release gradually spring pressure.

13. Remove spring retaining cover (12).

[Refer to: figure 3.](#)

14. Remove spring (13).

[Refer to: figure 3.](#)

15. Remove cover (14).

[Refer to: figure 3.](#)

# Disassembly and Assembly Operations

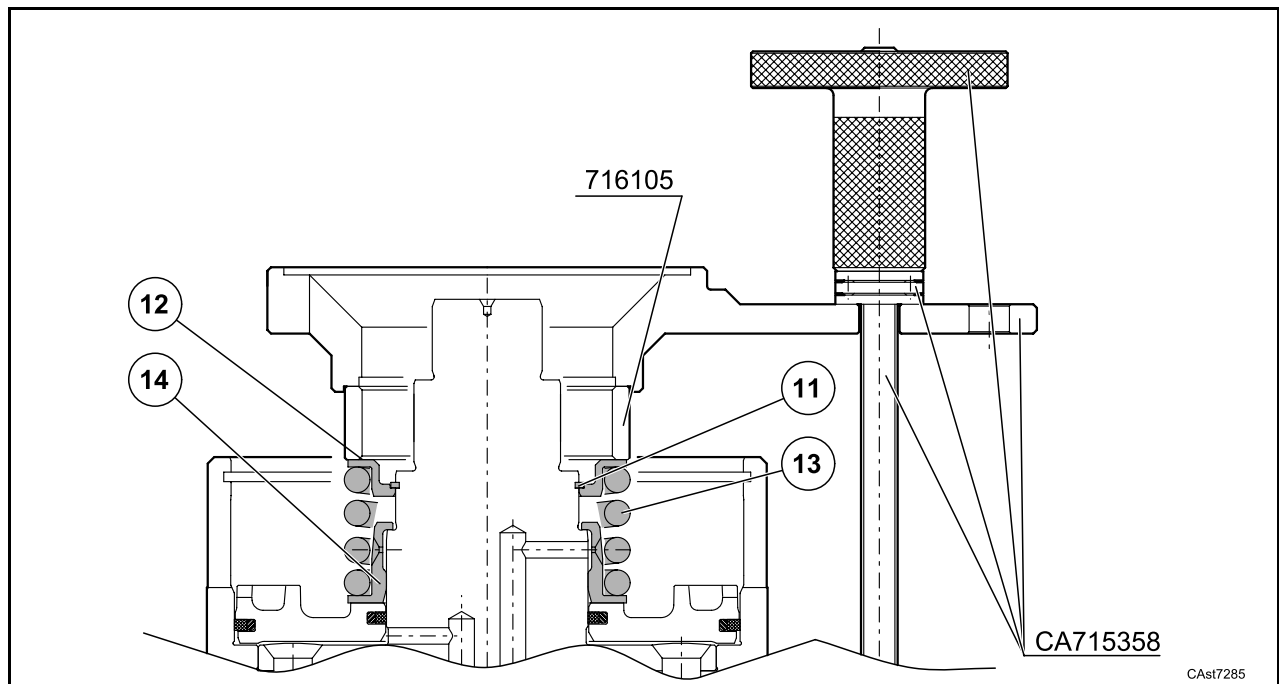


Figure 3

16. Release piston (15) using compressed air gun at 6 bar.

17. Remove piston (15). Remove seals (16) and (17) from piston.

[Refer to: figure 4.](#)

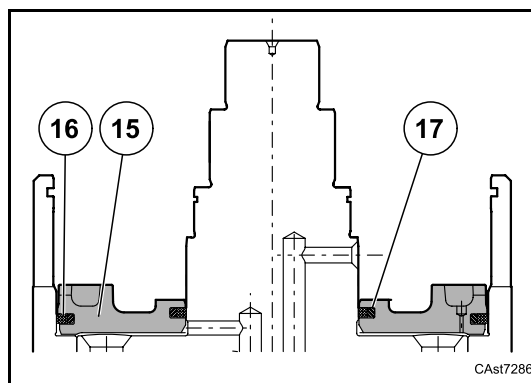


Figure 4

18. Turn clutch and remove seals (38) and teflon seal rings (37) if damaged.

19. Remove bearing (36) and gears (34) and (32) with a puller.

Collect shim (35).

Remove needle bearing (33).

For disassembly of the other parts, repeat operations from step 7 to step 17.

[Refer to: figure 5 and section D.11a.1.](#)

# Disassembly and Assembly Operations

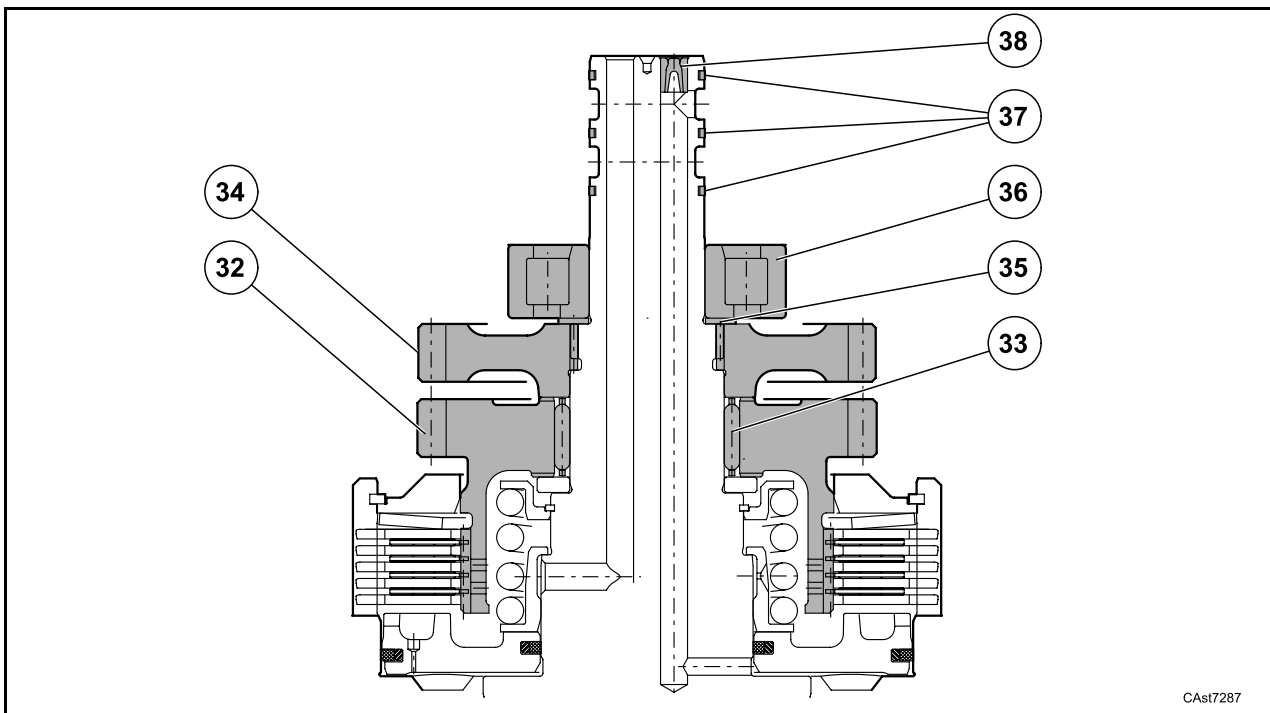


Figure 5

## Assembly

1. Lock tool "CA715358" on page 327 with a vice. Assemble clutch (18) on the tool. Oil shaft faces.
2. Assemble new seals (16) and (17) on piston (15). Assemble piston (15).

Refer to: figure 6

3. Assemble piston (15) in its seat.
4. Assemble cover (14). Assemble spring (13). Assemble spring-retaining cover (12).

Refer to: figure 7.

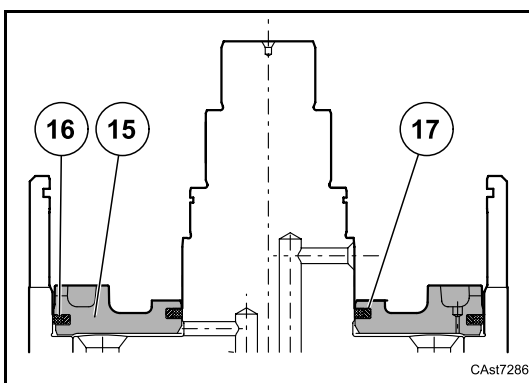


Figure 6

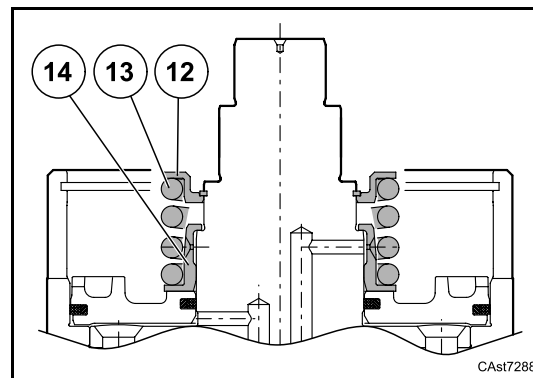


Figure 7

5. Assemble bush "CA716105" on page 327 and upper cover of tool "CA715358" on page 327. Turn handles. Insert snap ring (11). Remove tool.

Refer to: figure 8 and section E.1 (" " on page 325).

# Disassembly and Assembly Operations

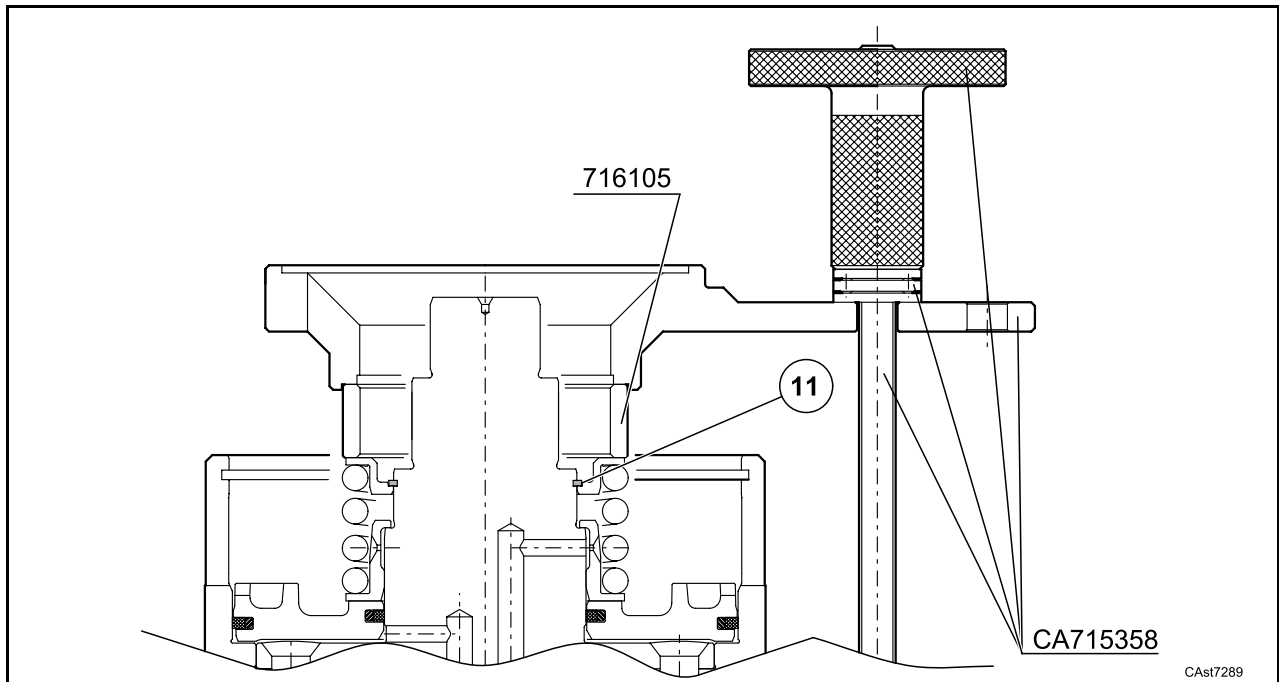


fig. 8

6. Assemble first counterdisc (9). Assemble first disc (10). Assemble all counterdiscs (total quantity=5) and all discs (total quantity=4).

Refer to: figure 9.

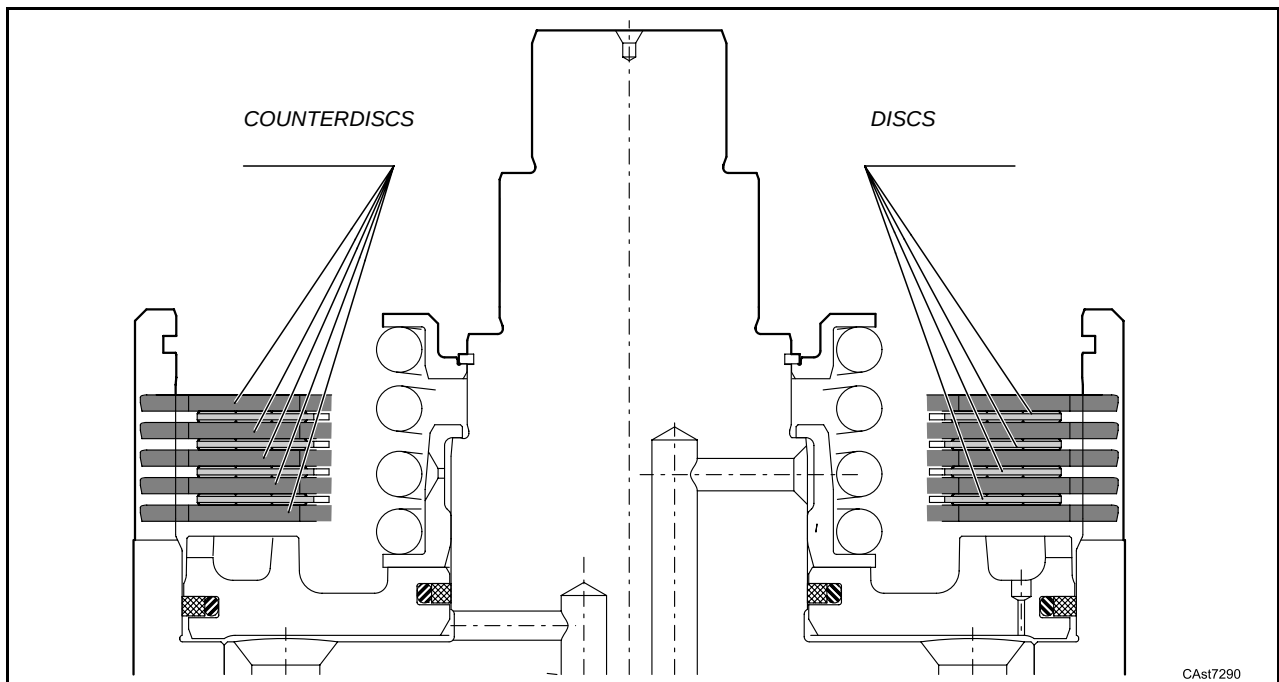


Figure 9

7. Assemble belleville washer (8).

**NOTE:** Correct assembly of belleville washer (8).

Refer to: figure 10.

## Disassembly and Assembly Operations

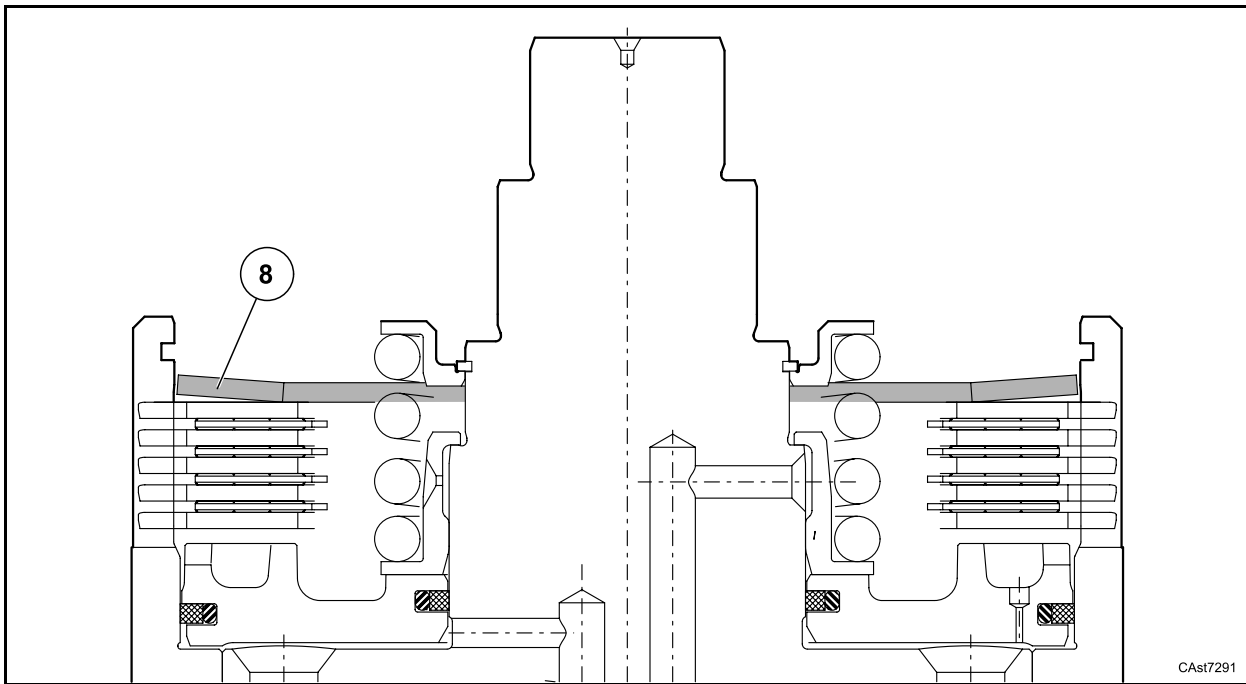


Figure 10

8. Assemble clutch counterdisc (7). Assemble snap ring (6). Assemble disc (5).

[Refer to: figure 11.](#)

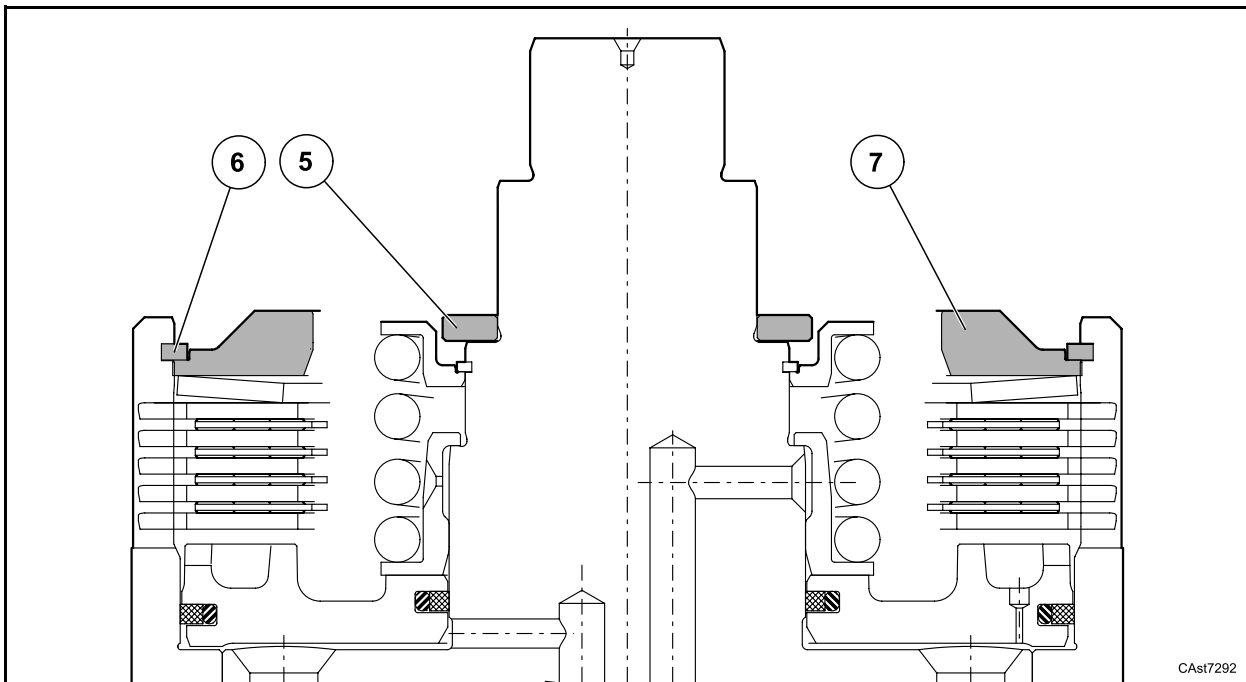


Figure 11

9. Insert needle bearing (3). Insert gear (4) up to stroke end.

[Refer to: figure 12.](#)



# Disassembly and Assembly Operations

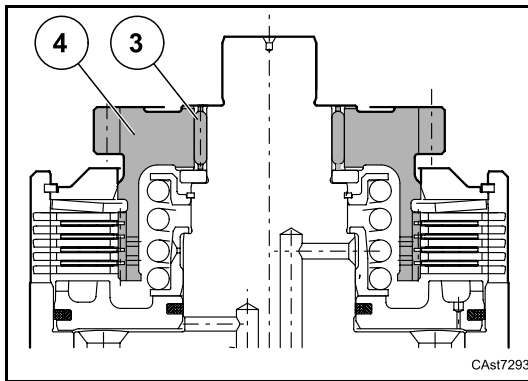


Figure 12

10. Check with compressed air at 6 bar pressure the correct assembly of the clutch assy.

**NOTE:** If the gear does not lift up, this means that one or more discs have not engaged.



## Warning

**Do not blow compressed air prior to assembly of clutch counterdisc (7).**

11. Assemble disc (2). Assemble inner ring of bearing (1) with tool "CA716156" on page 326.

Refer to: [figure 13 and section E.1 \(clutch-synchro shuttle\)](#).

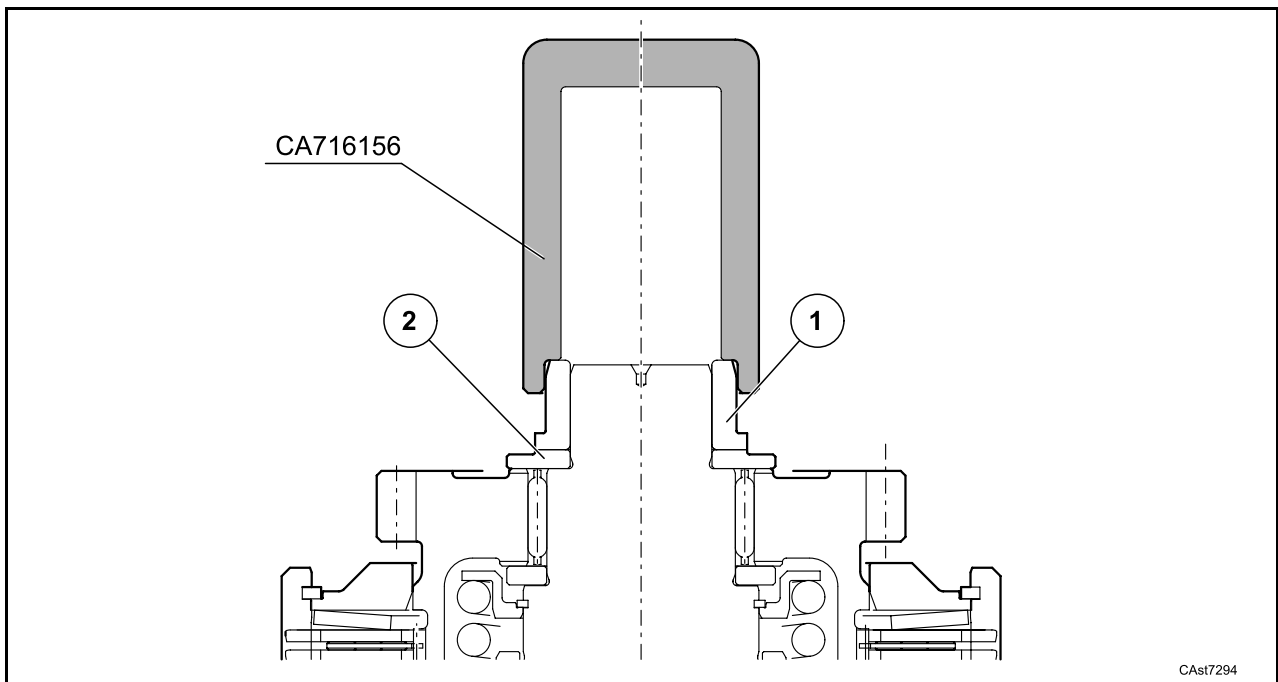


Figure 13

12. Turn clutch assy. For assembly of other parts repeat operations from step 2 to step 10.

Refer to: [section D.11a.2](#).

13. Insert gear (34). Insert shim (35). Assemble inner ring of bearing (36) using tool "CA716156" on page 326.

Refer to: [figure 14 and section E.1 \(" " on page 325\)](#).

# Disassembly and Assembly Operations

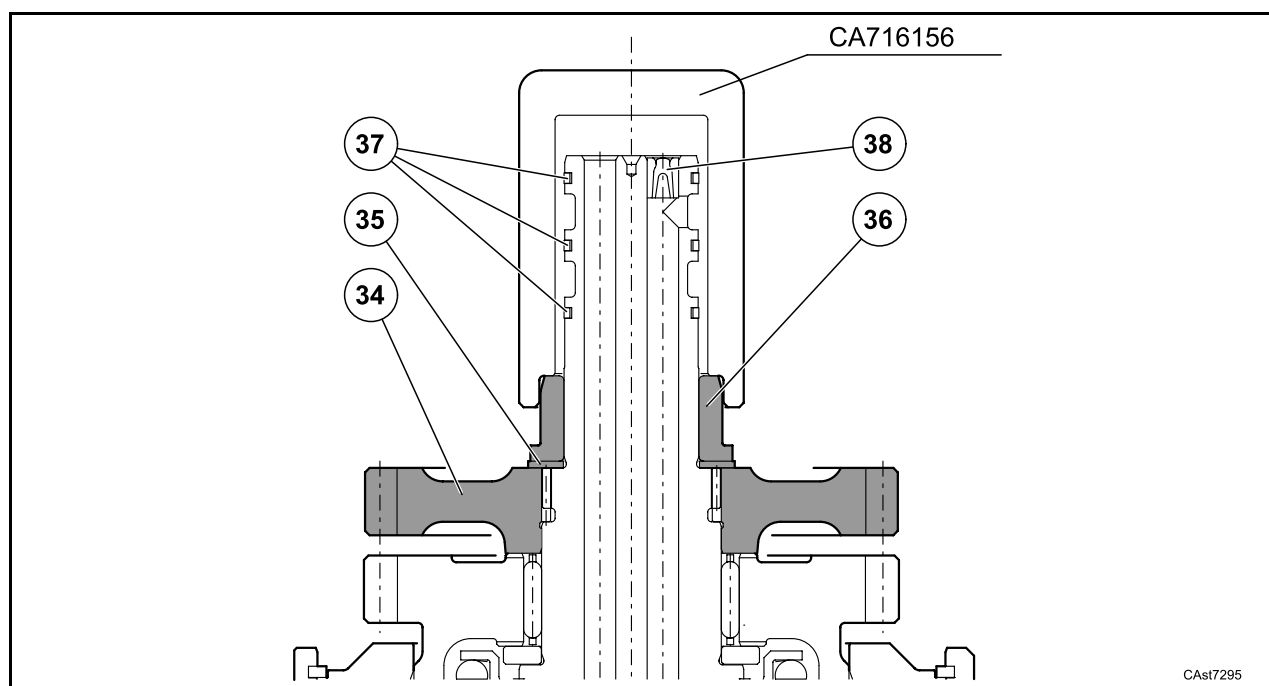


Figure 14

14. Assemble seals (38) and teflon seal rings (37).

**NOTE:** For CA138784 seals no special tools are needed, in consideration of their particular shape.

Refer to: figure 15.

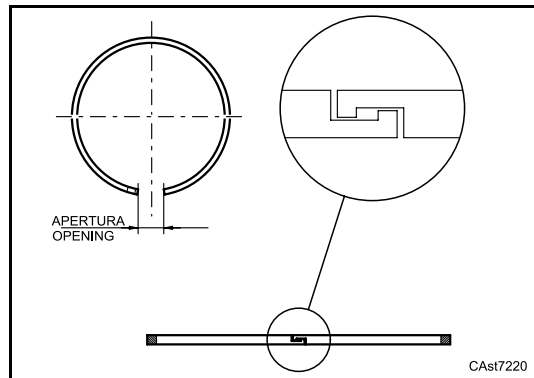


Figure 15

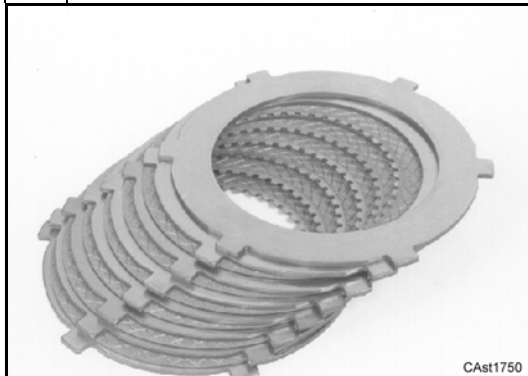
15. Assemble clutch inside clutch housing.

Refer to: section D.9c.

# Disassembly and Assembly Operations

## Clutch pack wear

16.



In any case lubricate contact surfaces of clutch drive plates with clean transmission oil before assembly.

|                                          |                    |
|------------------------------------------|--------------------|
| Number of clutch plate (each side)       | 4                  |
| Number clutch steel plate (each side)    | 5                  |
| Nominal clutch drive plate thickness     | $2.5 \pm 0.05$ mm  |
| Nominal clutch plate thickness           | $1.75 \pm 0.05$ mm |
| Maximum clutch plate wearing (each side) | 0.15 mm            |

If clutch discs are to be used again, keep clutch packs in the same previous assembly order separate and record which clutch pack goes with each clutch.

17.



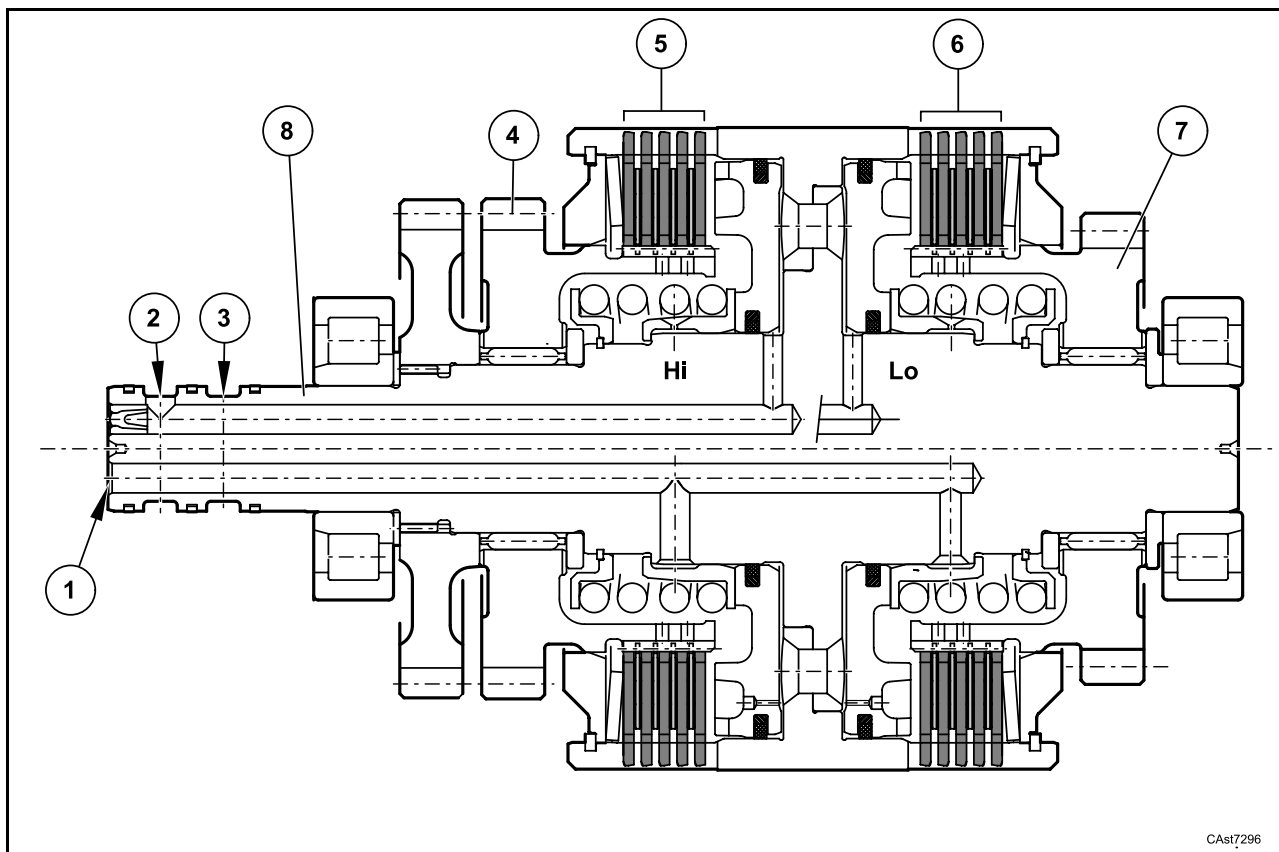
At each disassembly, verify with a gauger that thicknesses of the clutch plates and clutch drive plates are within wear limit (see table on page bottom). If not, replace them with new ones.

Verify that all clutch plates do not appear burned or that the friction material it is not damaged and that splines are well traced.

Verify also that all clutch drive plates are perfectly plane and inspect for pitting or scoring.

If using new clutch plates soak them in clean transmission oil for at least an hour before assembly.

# Disassembly and Assembly Operations



1. Lubrication oil passage
2. High clutch oil passage
3. Low clutch oil passage
4. High gear
5. High clutch pack
6. Low clutch pack
7. Low gear
8. Clutch shaft

Refer to: [See illustration above.](#)

Apply compressed air of approximately 6 bar to the high clutch oil passage. Verify that high piston is moving to lock high clutch pack.

Try to move the high gear. The high gear must not turn on the clutch shaft. Try to move low gear. The low gear must turn freely on the clutch shaft.

If the clutches do not work correctly, disassemble clutches to find the problem.

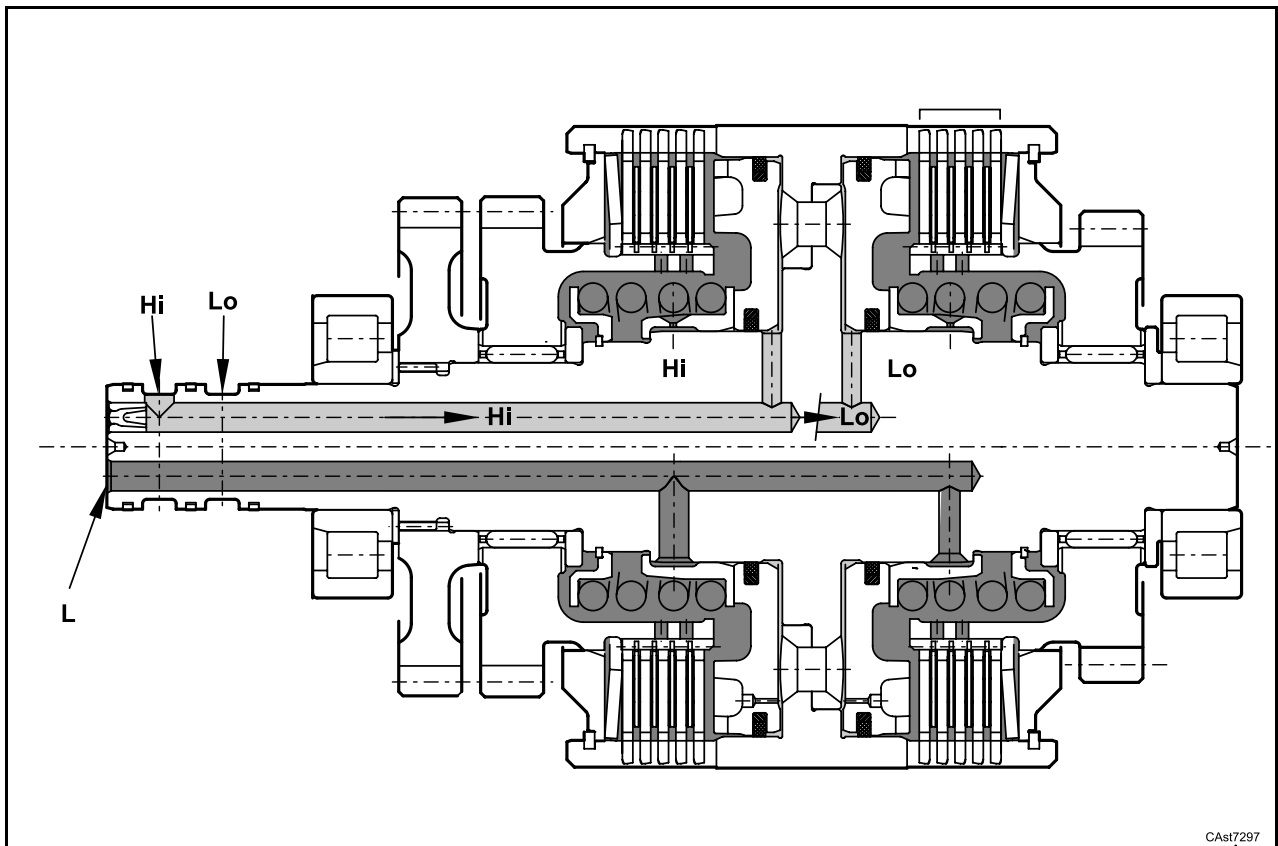
Refer to: [See illustration above.](#)

Apply compressed air of approximately 6 bar to the low clutch passage. Verify that low piston is moving to lock low clutch pack. Try to move low gear. The low gear must not turn on the clutch shaft. Try to move high gear.

The high gear must turn freely on the clutch shaft.

If clutches do not work correctly, disassemble clutches to find problem.

## Disassembly and Assembly Operations

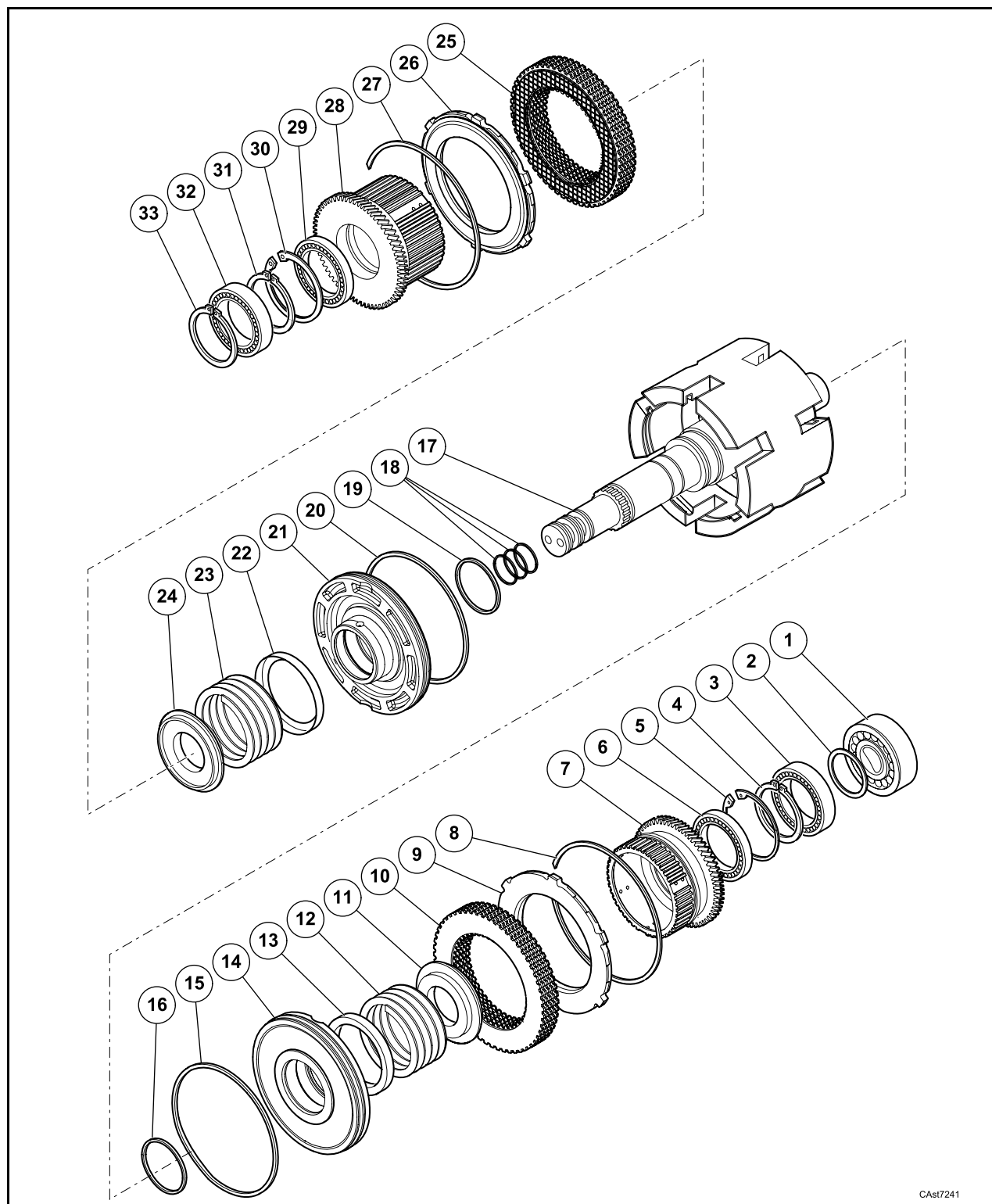


L= lubricating oil passage

Hi/LO= high/low gear oil passage

# Disassembly and Assembly Operations

## WET CLUTCH - POWER SHUTTLE



CAst7241

**8+8  
synchro  
shuttle**

**12+12  
synchro  
shuttle**

**24+24  
synchro shuttle  
and synchro  
splitter**

**24+24  
synchro shuttle  
and power  
splitter**

**12+12  
power  
shuttle**

**24+24  
power shuttle  
and synchro  
splitter**

For models

-

-

-

-

|

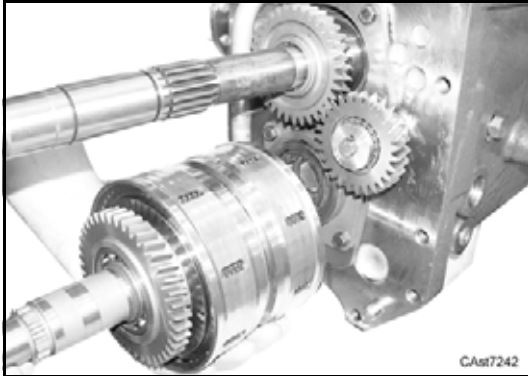
|

# Disassembly and Assembly Operations

## Disassembly

Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

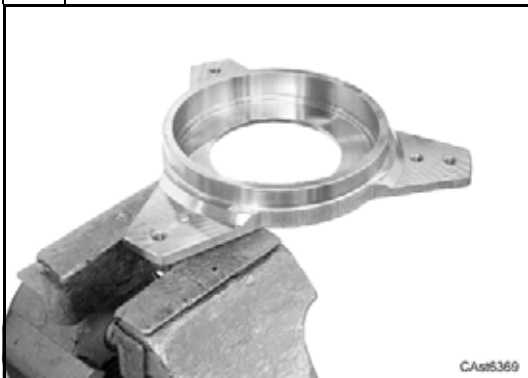
1.



Remove clutch from housing.

Refer to: [section D.9d](#).

2.



Lock tool "CA715358" on page 324 with a vice.

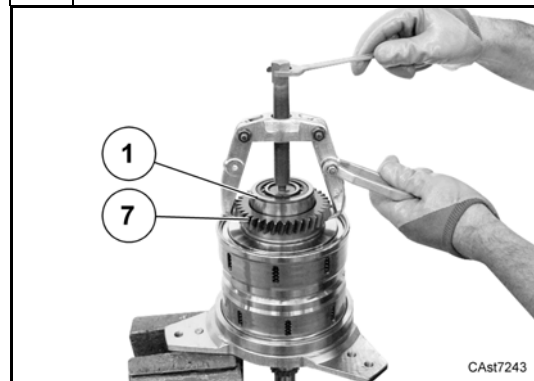
Refer to: [section E.1](#) (" " on page 322).

3.



Assemble clutch on the tool.

4.



Remove gear (7) and bearing (1) with puller.

Collect shim (2), bearing (3) and snap ring (5).

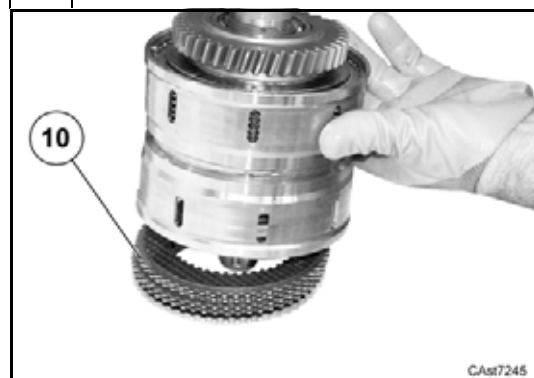
5.



Remove snap ring (8).

Remove clutch counterdisc (9).

6.



Turn clutch. Remove clutch disc assy (10).



# Disassembly and Assembly Operations

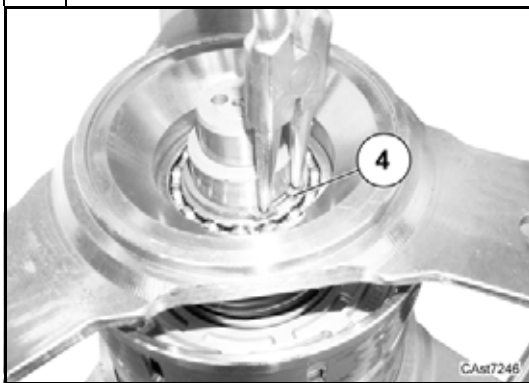
7.



Assemble bush "CA715791" on page 324 and upper cover of tool "CA715358" on page 324.

[Refer to: section E.1 \(" " on page 322\).](#)

8.



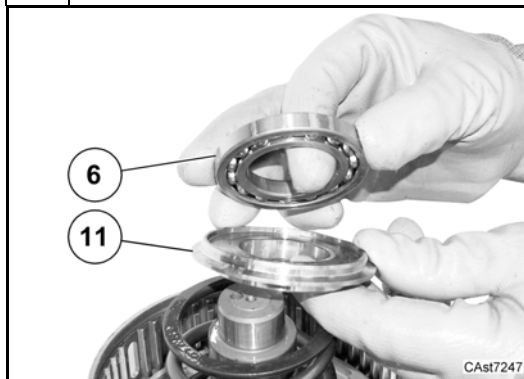
Turn handles. Remove snap ring (4).

9.



Release gradually spring pressure.

10.



Remove bearing (6) and cover (11).

11.



Remove spring (12).

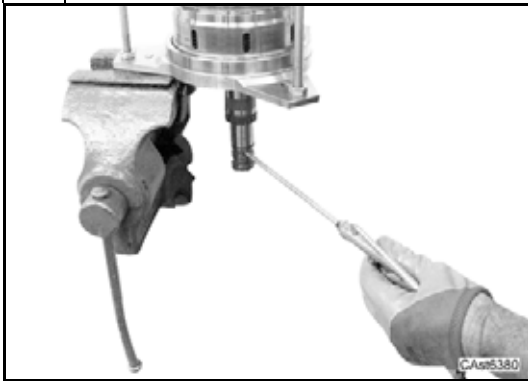
12.



Remove cover (13).

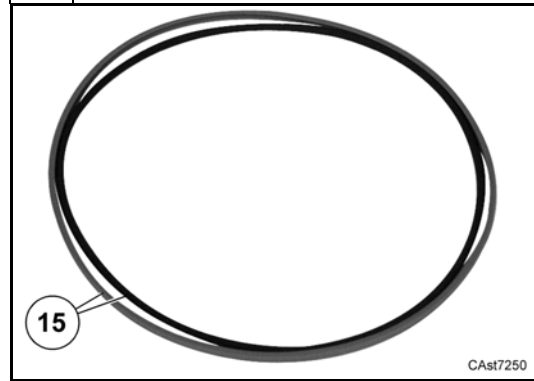
# Disassembly and Assembly Operations

13.



Release piston using compressed air gun at 6 bar.

16.



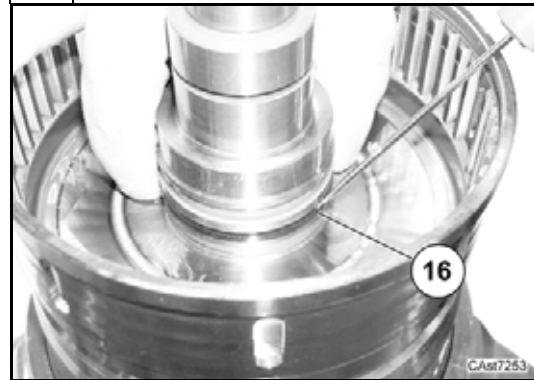
**NOTE:** Gaskets shape (15).

14.



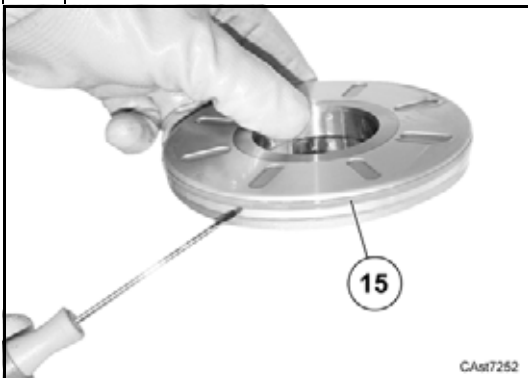
Remove piston (14).

17.



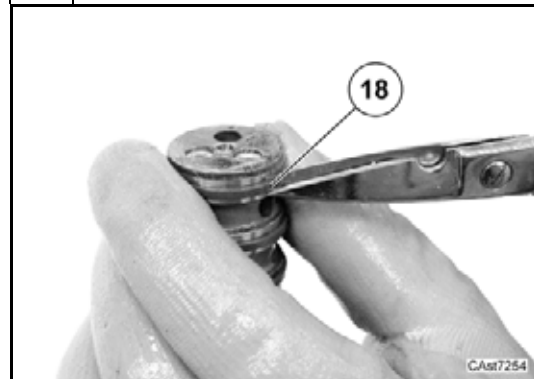
Remove seal ring (16).

15.



Remove seals (15) from piston.

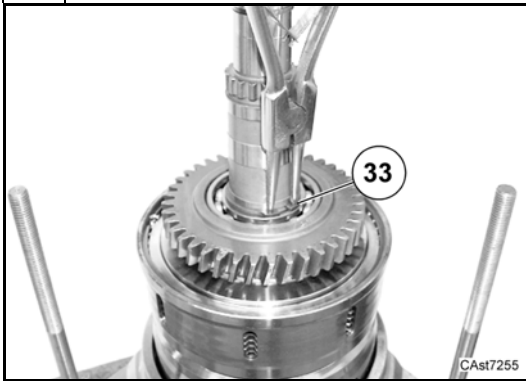
18.



Turn clutch and remove teflon seal rings (18) if damaged.

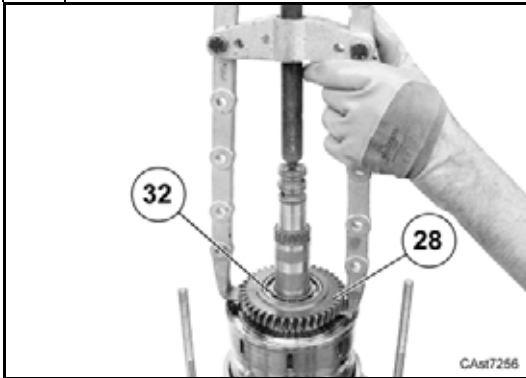
# Disassembly and Assembly Operations

19.



Remove snap ring (33).

20.



Remove gear (28) and bearing (32) with a puller.

21.



Remove snap ring (27). For disassembly of the parts, repeat operations from step 6 to step 17.

Refer to: [section D.11b.1.](#)

## Assembly

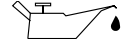
Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

1.



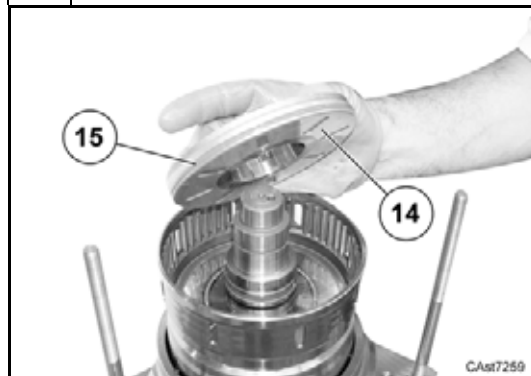
Assemble seal (16).

2.



Lubricate shaft faces.

3.



Assemble new seals (15) on piston (14).  
Assemble piston (14).

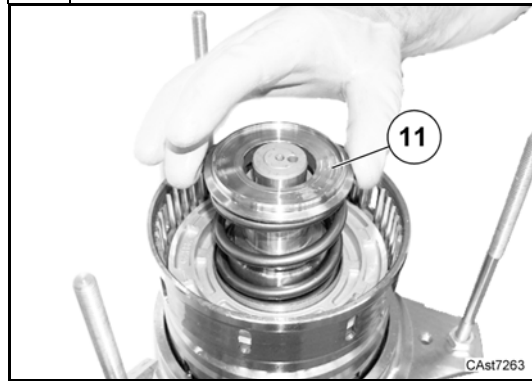
# Disassembly and Assembly Operations

4.



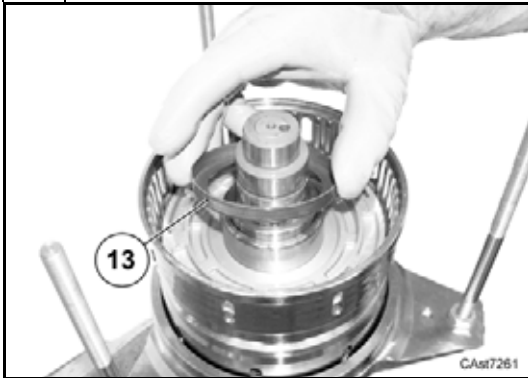
Assemble piston (14) in its seat.

7.



Assemble cover (11).

5.



Assemble cover (13).

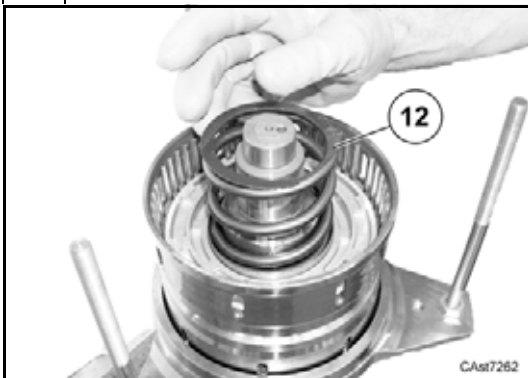
8.



Assemble bush "CA715791" on page 324 and upper cover of tool "CA715358" on page 324.

[Refer to: section E.1 \(" " on page 322\).](#)

6.



Insert spring (12).

9.



Assemble bearing (6).

# Disassembly and Assembly Operations

10.



Assemble bearing (6) in its seat with a buffer.

[Refer to: section E.1 \(" " on page 322\).](#)

11.



Turn handles. Insert snap ring (4).

12.



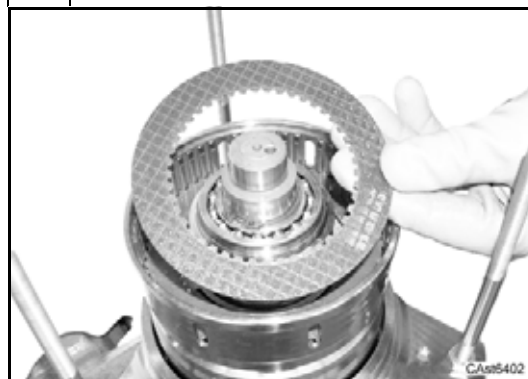
Remove tool.

13.



Assemble first counterdisc.

14.



Assemble first disc. Assemble complete clutch discs  
assy (10).

15.



Assemble clutch counterdisc (9).



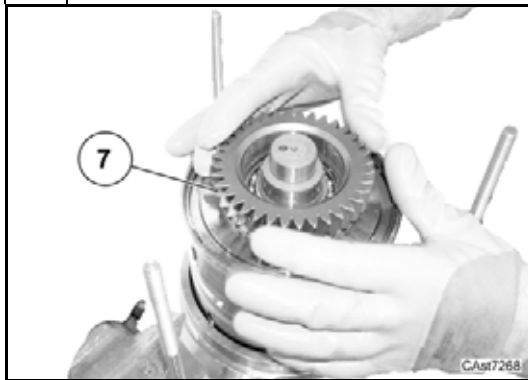
# Disassembly and Assembly Operations

16.



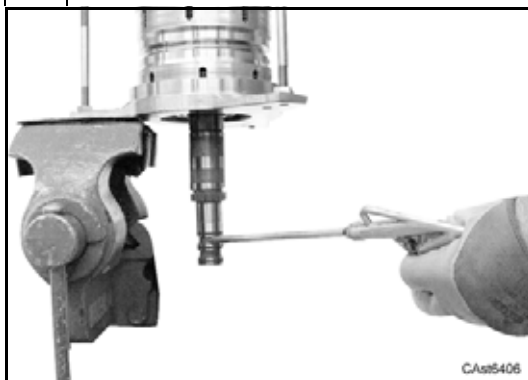
Assemble snap ring (8).

17.



Insert gear (7) and snap ring (5) up to stroke end.

18.



Check with compressed air at 6 bar pressure correct assembly of the clutch assy.

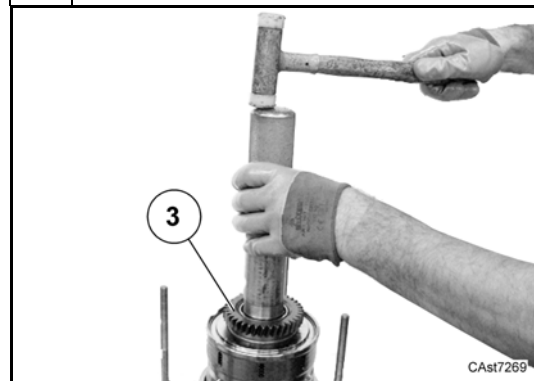
**NOTE:** If gear lifts up, this means that one or more discs have not engaged.



## Warning

**Do not blow compressed air prior to assembly of clutch detent disc.**

19.



Assemble bearing (3) using tool "CA716157" on page 323.

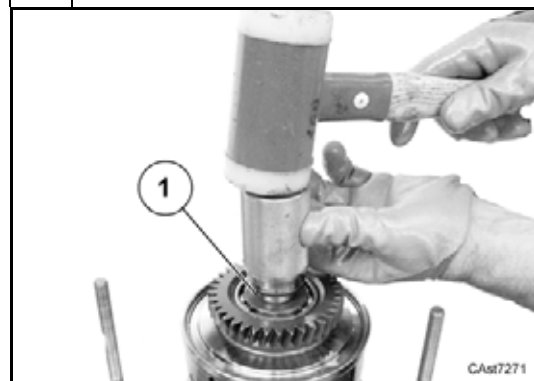
Refer to: section E.1 (" " on page 322).

20.



Assemble shim (2).

21.



Assemble inner ring of bearing (1) with tool "CA716156" on page 323.

Refer to: section E.1 (" " on page 322).

# Disassembly and Assembly Operations

22.

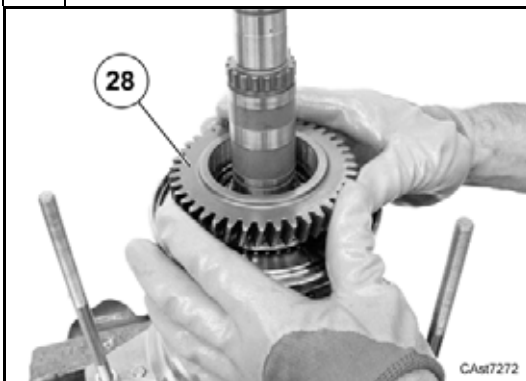


Turn clutch.

For assembly of the parts, repeat operations from step 3 to step 16.

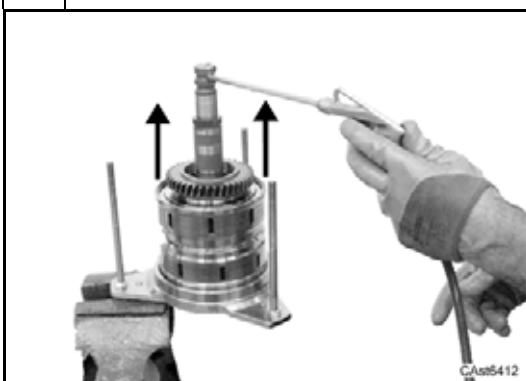
[Refer to: section D.11b.2.](#)

23.



Insert gear (28).

24.



Check with compressed air at 6 bar pressure correct assembly of the clutch assy.

**NOTE:** If gear lifts up, this means that one or more discs have not engaged.



## Warning

**Do not blow compressed air prior to assembly of clutch detent disc.**

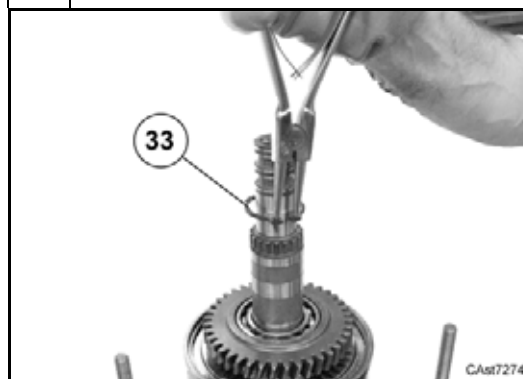
25.



Assemble bearing (32) using tool "CA716157" on page 323.

[Refer to: section E.1 \(" " on page 322\).](#)

26.



Assemble snap ring (33).

27.



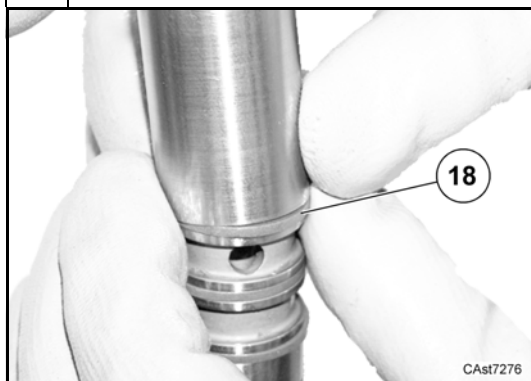
Warm a new seal ring CA149839 (18) in water at 80 °C for 3 minutes. Insert seal ring on the special tool "CA715888" on page 323.

[Refer to: section E.1 \(" " on page 322\).](#)



# Disassembly and Assembly Operations

28.



Insert tool "CA715888" on page 323 with seal ring on the shaft. Push the seal ring on the shaft and fit it in the relevant seat. Repeat the same operations to assembly every seal ring.

Refer to: section E.1 (" " on page 322).

29.



Insert special tool "CA715887" on page 323 with relevant O-Ring on the shaft and seals. Close completely the tool on the seals.

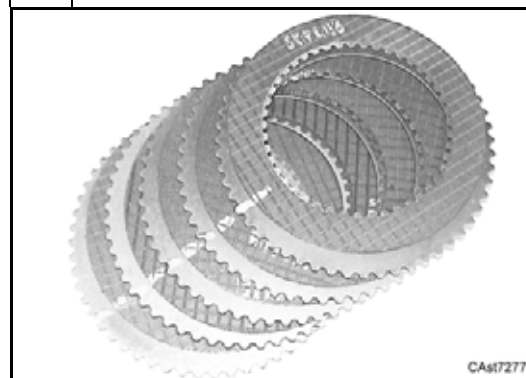
Assemble and tighten clamp on the tool.

Leave the tool "CA715887" on page 323 on the seals for 5 minutes.

Remove the clamp and the tool.

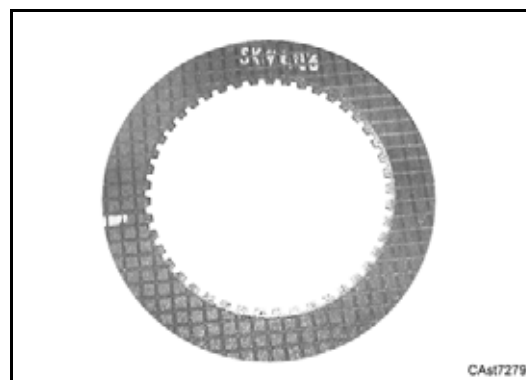
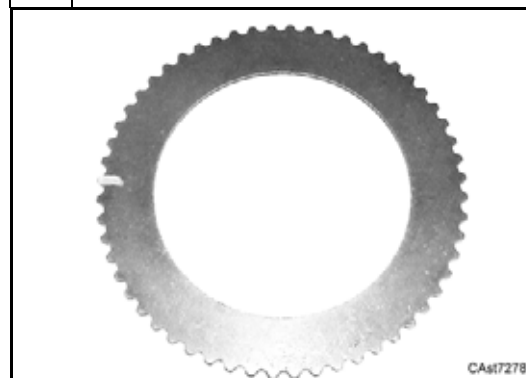
## Clutch pack wear

30.



If clutch discs are to be used again, keep clutch packs in the same previous assembly order separate and record which clutch pack goes with each clutch.

31.



At each disassembly, verify with a gauger that total thickness of the clutch kit is within wear limit (see "Clutch kit" table). If not, replace clutch kit with a new one.

Verify that all clutch plates do not appear burned or that friction material it is not damaged and that splines are well traced.

Verify also that all clutch drive plates are perfectly plane and inspect for pitting or scoring.

In the case that at least one of the above problems occurs, replace complete clutch kit with a new one.

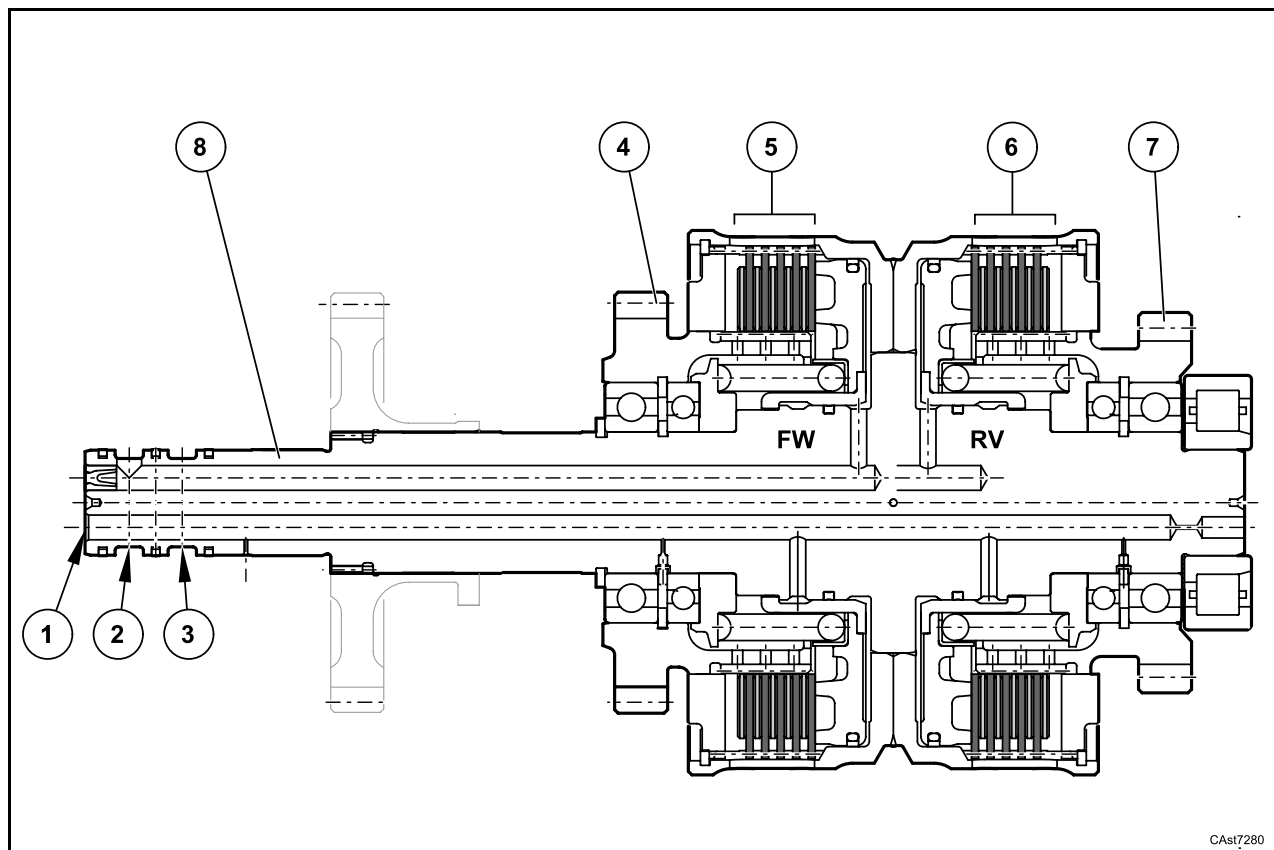
# Disassembly and Assembly Operations

If using a new clutch kit soak clutch plates in clean transmission oil for at least an hour before assembly.  
In any case lubricate contact surfaces of clutch drive plates with clean transmission oil before assembly.

## CLUTCH KIT

|                                       |                 |
|---------------------------------------|-----------------|
| Number of clutch plate (each side)    | 5               |
| Number clutch steel plate (each side) | 5               |
| Nominal clutch plate thickness        | 2.40±0.05 mm    |
| Nominal clutch kit thickness          | * 2180÷22.00 mm |
| Maximum clutch plate wear (each side) | 0.25 mm         |
| Maximum clutch kit wear               | 2.5 mm          |

\* Under load of 163 kg



1. Lubrication oil passage
2. Forward clutch oil passage
3. Reverse clutch oil passage
4. Forward gear
5. Forward clutch pack
6. Reverse clutch pack
7. Reverse gear
8. Clutch shaft

Refer to: [See illustration above.](#)

Apply compressed air of approximately 6 bar to the forward clutch passage. Listen to hear the forward piston moving to lock the forward clutch pack.

Try to move the forward gear. The forward gear must not turn on the input shaft. Try to move idle gear. The idle gear must turn freely on the input shaft.

# Disassembly and Assembly Operations

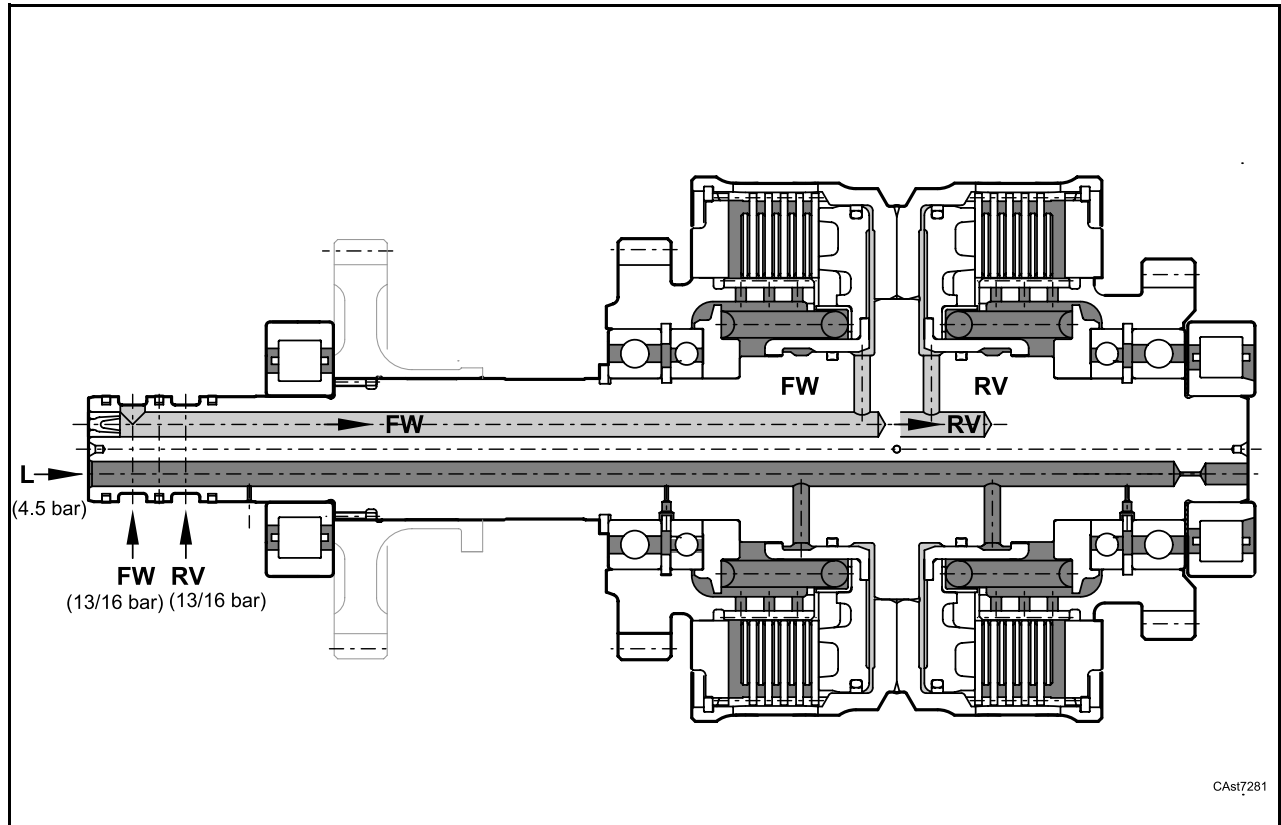
If the clutches do not work correctly, disassemble clutches to find the problem.

Refer to: [See the illustration above.](#)

Apply compressed air of approximately 6 bar to the reverse clutch passage. Listen to hear reverse piston moving to lock reverse clutch pack. Try to move idle gear. The idle gear must not turn on the input shaft. Try to move the forward gear.

The forward gear must turn freely on the input shaft.

If clutches do not work correctly, disassemble clutches to find problem.

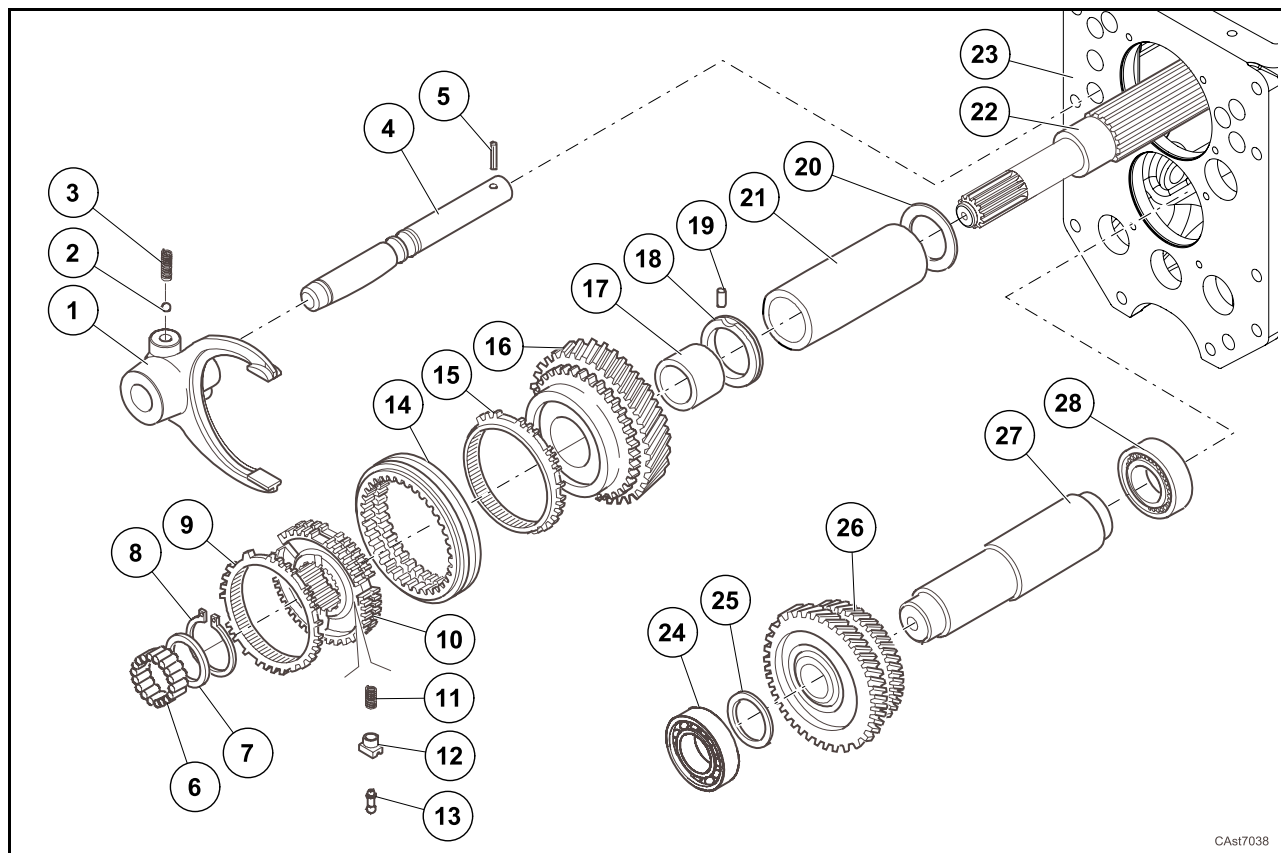


L= lubricating oil passage

FW/RV= forward/idle gear oil passage

# Disassembly and Assembly Operations

## HI-LO SYNCHRONIZER (SYNCHRO SPLITTER)



CAst7038

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models | -                         | -                           | I                                                   | -                                                 | -                         | -                                                 |

### Disassembly

1. Remove pin (5).
2. Remove Hi-LO pin (4) with fork from the cover.
3. Remove Hi-LO pin (4) from the fork (1).
4. Collect spring (3) and ball (2) from the fork (1).
5. Remove Hi-LO shaft group from the secondary cover.
6. Remove bearing (24) and washer (25) from the Hi-LO shaft (27).
7. Remove bearing (28) from the Hi-LO shaft (27).
8. Remove the shaft (27) from the gear (26).
9. Remove needle bearing (6).
10. Remove spacer (7).
11. Remove snap ring (8).
12. Collect synchro ring (9).

13. Remove Hi-LO synchronizer kit in the following order:  
hub (10) with the springs kit (11, 12 and 13), sleeve (14) and synchro ring (15).

14. Remove gear (16).
15. If necessary remove bush (17) from the gear (16).
16. Remove thrust washer (18).
17. Remove pin (19).

**NOTE:** This is a destructive operation for the pin.

18. Remove spacer (21) from the input shaft (22).
19. Remove spacer (20).

# Disassembly and Assembly Operations

## Assembly

1. Assemble spacer (21) on input shaft (22).

Refer to: [figure 1](#).

2. Assemble thrust washer (18).

Refer to: [figure 2](#).

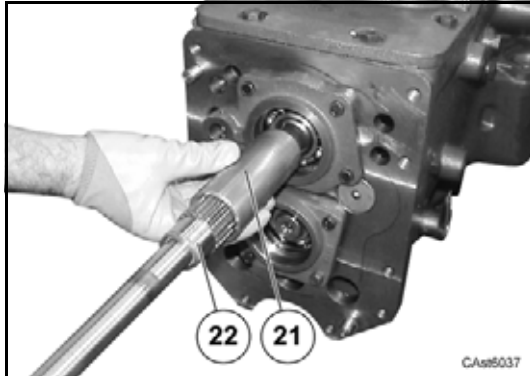


Figure 1

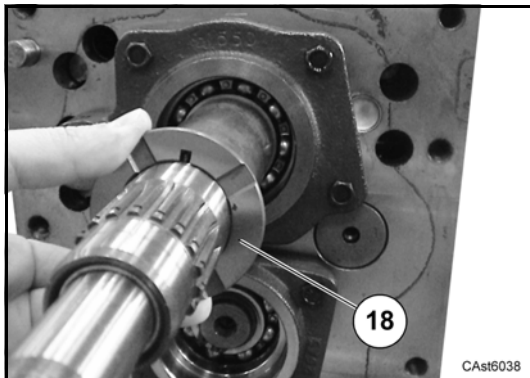


Figure 2

1. Assemble bush (17) to the gear (16) using prescribed tool.

Refer to: [section E.1 \(""\)](#) on page 332).

2. Assemble gear (16).

Refer to: [figure 3](#).

3. Check distance [6] (157.4÷157.5 mm).

Refer to: [figure 4](#) and [section C.6](#).

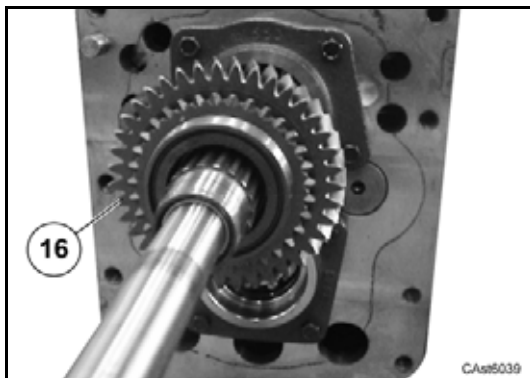


Figure 3

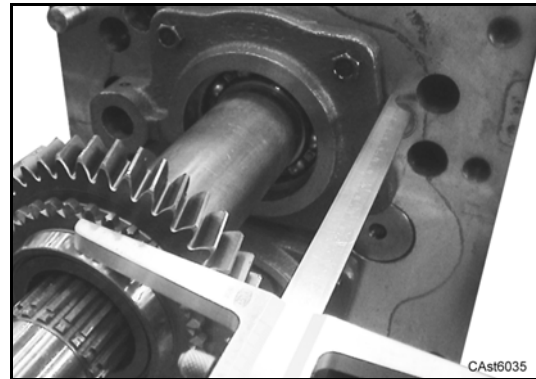


Figure 4

4. Remove gear (16), thrust washer (18) and spacer (21).
5. Assemble spacer (20) to get wanted measure. Reassemble spacer (21).
6. Assemble lock pin (19).
7. Assemble thrust washer (18) with pin in own housing.

**NOTE:** *Observe direction*

Refer to: [figure 5](#).

8. Assemble gear (16) with its bush (17).
9. Assemble the synchronizer kit in the following order: synchro ring (15), sleeve (14) and hub (10) with the springs kit (11, 12 and 13).
10. Assemble the snap ring (8).

Refer to: [figure 6](#).

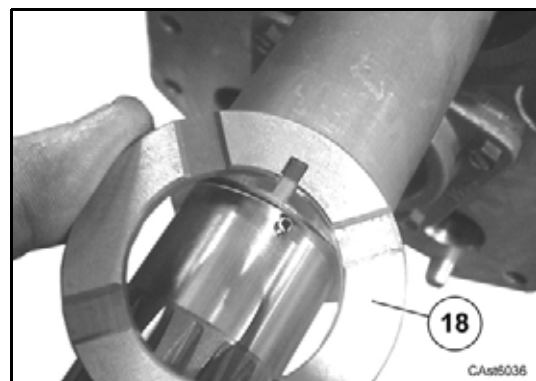


Figure 5

# Disassembly and Assembly Operations

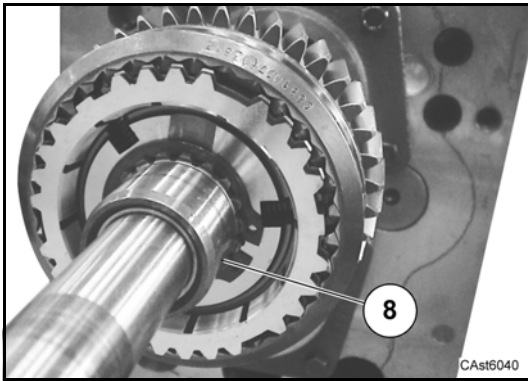


Figure 6

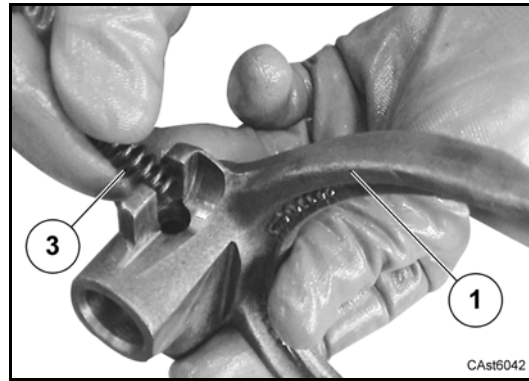


Figure 8

11. Grease and assemble synchro ring (9).
12. Assemble Hi-LO shaft (27) to the gear (26) using a press.
13. Assemble bearing (28) to Hi-LO shaft with the prescribed special tool.

[Refer to: section E.1 \(Hi-LO synchronizer\).](#)

14. Assemble washer (25) and inner race of bearing (24) to the Hi-LO shaft with the prescribed special tool.

[Refer to: section E.1 \(Hi-LO synchronizer\).](#)

15. Assemble outer race bearing (24).
16. Insert group on the cover of the secondary shaft.

[Refer to: figure 7.](#)

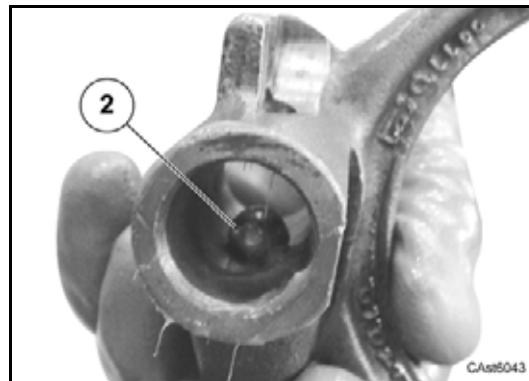


Figure 9

18. Fit Hi-LO pin (4) into the vice. Position ball (2) into its seat by means of a screwdriver to lock fork (1) on the Hi-LO pin (4).

[Refer to: figure 10 and 11.](#)

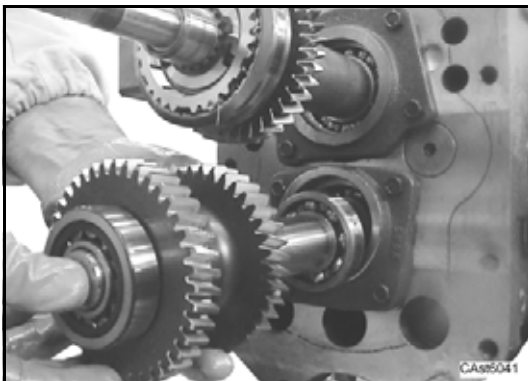


Figure 7

17. Assemble spring (3) and ball (2) to the fork (1).

[Refer to: figure 8 and 9.](#)

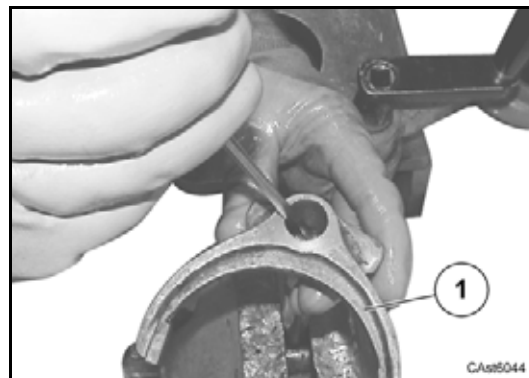


Figure 10



# Disassembly and Assembly Operations

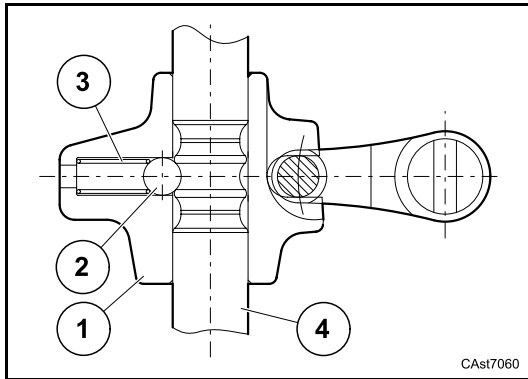


Figure 11

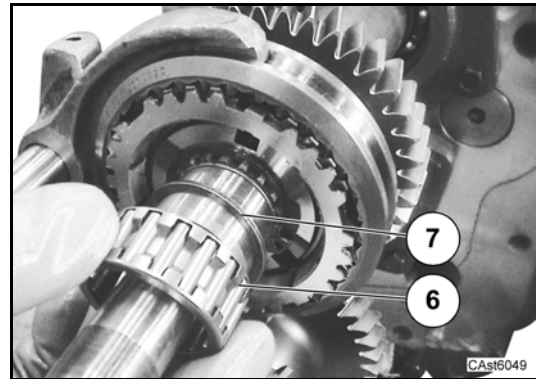


Figure 14

19. Assemble Hi-LO pin (4) with fork to the cover.

[Refer to: figure 12.](#)

20. Assemble pin (5) with prescribed special tool.

[Refer to: figure 13 and section E.1 \(""\) on page 332\).](#)

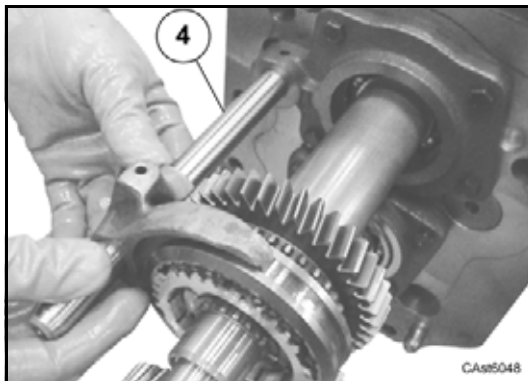


Figure 12

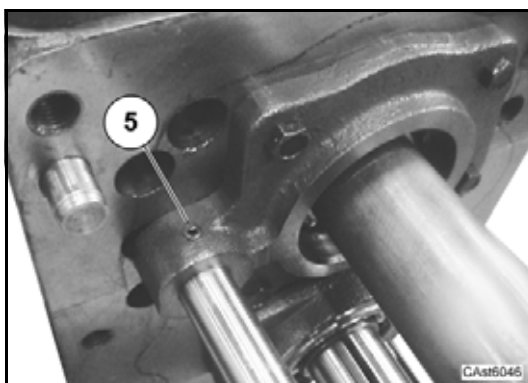


Figure 13

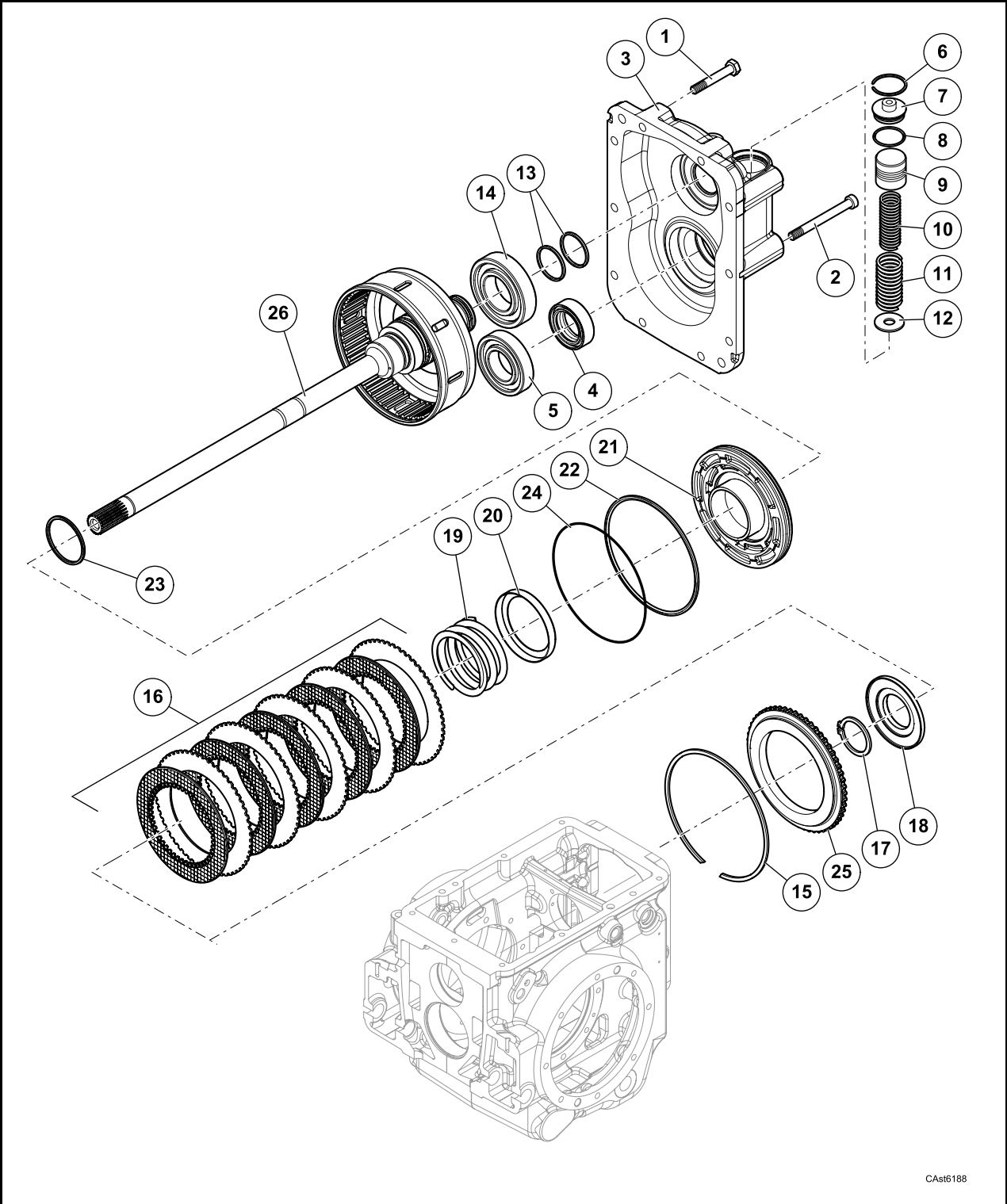
21. Assemble shim (7). Assemble needle bearing (6).

[Refer to: figure 14.](#)



# Disassembly and Assembly Operations

## COVER AND PTO WET CLUTCH



|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models |                           |                             |                                                     |                                                   |                           |                                                   |

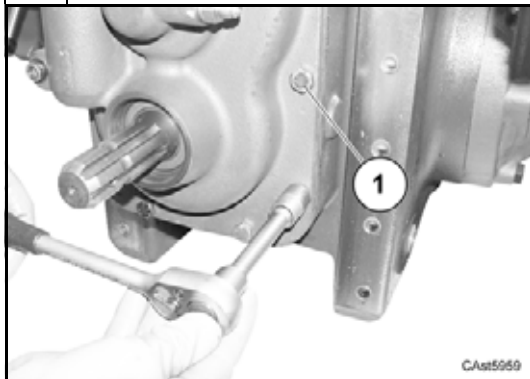
# Disassembly and Assembly Operations

## Disassembly

Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

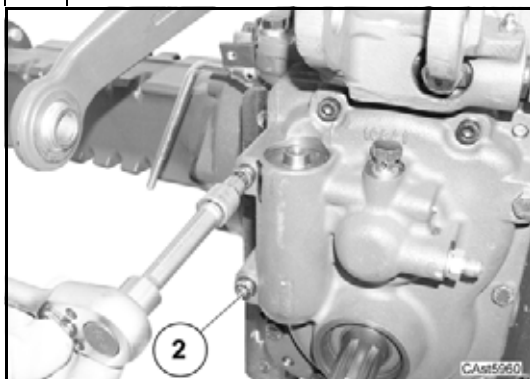
**NOTE:** All PTO maintenance operations (included the PTO brake) can be performed with the disassembly of the rear cover. Any other kind of disassembly is not necessary (this is not the case with GD PTO).

1.



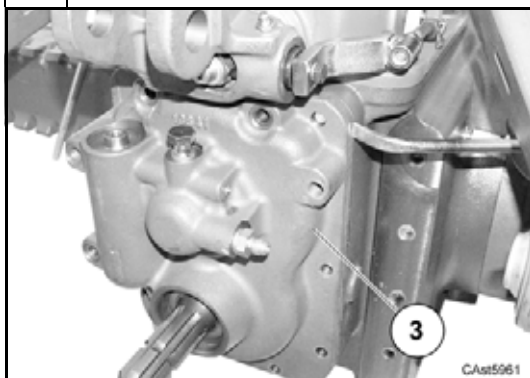
Unscrew TE (1) screws.

2.



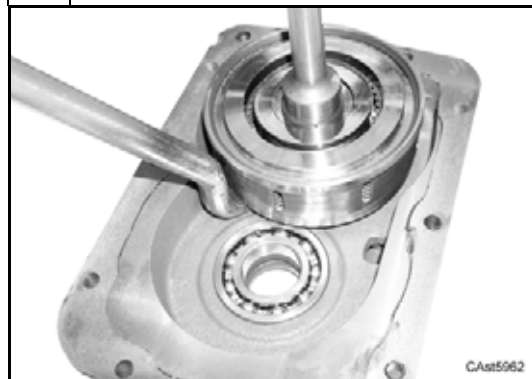
Unscrew TCEI (2) screws.

3.



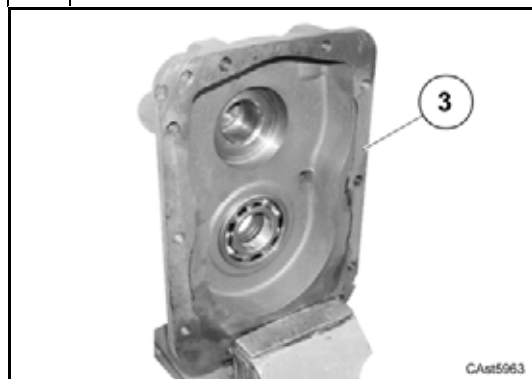
Remove cover (3) and PTO clutch prying them off.

4.



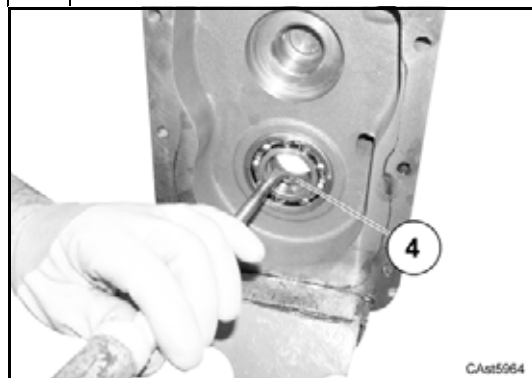
Disassemble PTO clutch from the cover prying off.

5.



Assemble cover (3) on the vice.

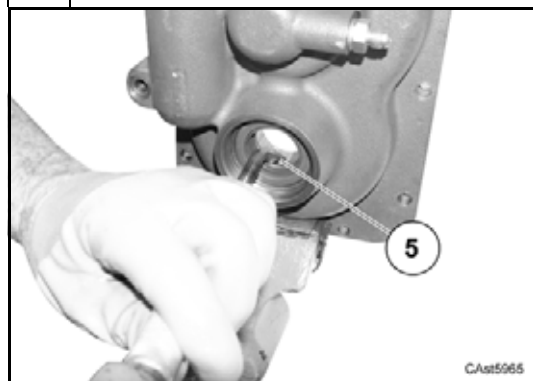
6.



Remove seal ring (4).

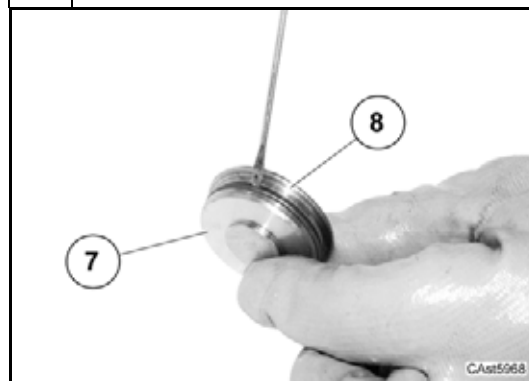
# Disassembly and Assembly Operations

7.



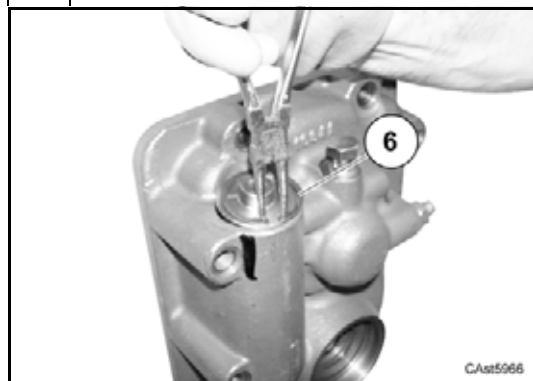
Turn cover and remove bearing (5).

10.



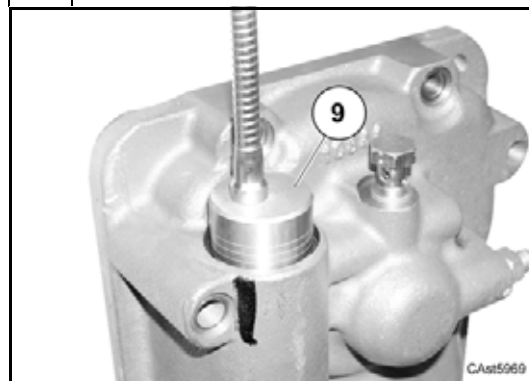
Remove O-Ring (8) from cover (7).

8.



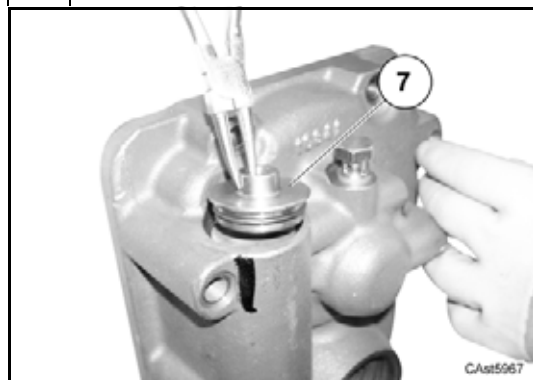
Remove snap ring (6).

11.



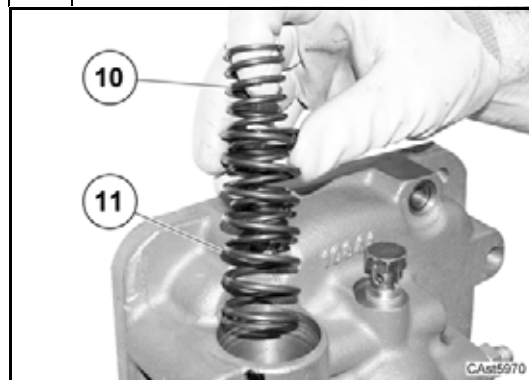
Pull out piston (9) by means of a magnet.

9.



Remove cover (7).

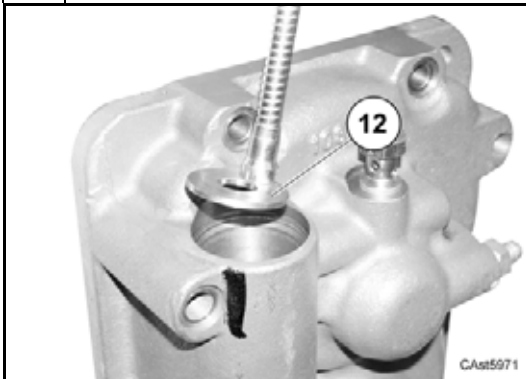
12.



Remove two springs (10) and (11).

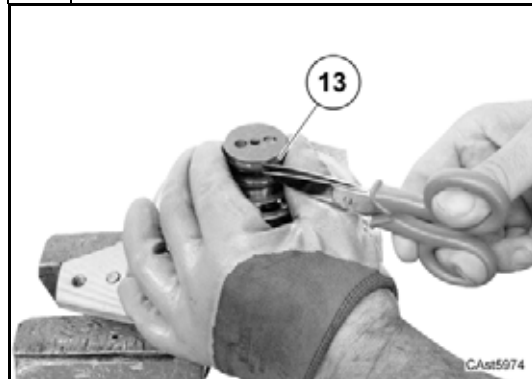
# Disassembly and Assembly Operations

13.



Remove shim (12).

16.



Cut gaskets (13) if necessary.

14.



Assemble tool "CA715358" on page 336 on vice.  
Refer to: section E.1 (" " on page 335).

17.



Remove bearing (14) by means of two levers.

15.



Assemble PTO clutch on the tool.

18.



Turn PTO clutch.

# Disassembly and Assembly Operations

19.



Remove snap ring (15).

20.



Extract discs pack (16) and clutch's counterdisc (25).

21.



Reposition PTO clutch on the tool.

22.



Insert spacer "CA716105" on page 336.

[Refer to: section E.1 \(" " on page 335\).](#)

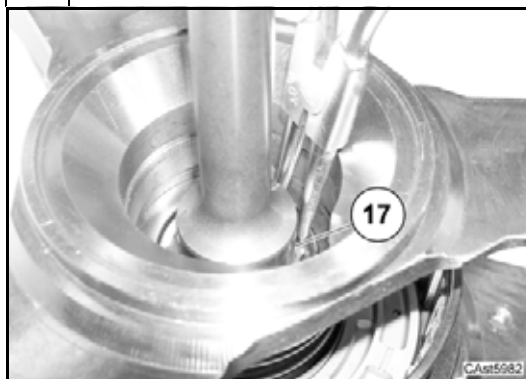
23.



Assemble cover of "CA715358" on page 336 tool.

[Refer to: section E.1 \(" " on page 335\).](#)

24.



Remove snap ring (17).



# Disassembly and Assembly Operations

25.



Remove tool "CA715358" on page 336 cover.

Refer to: section E.1 (" " on page 335).

28.



Remove spring (19).

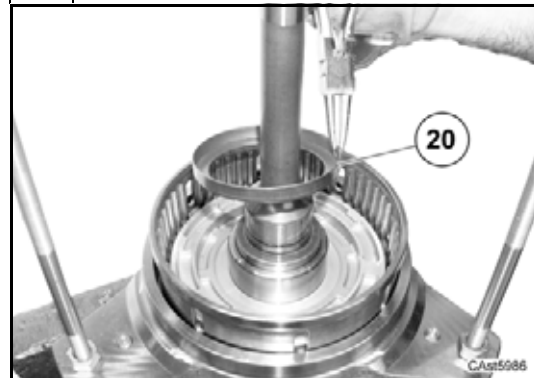
26.



Remove spacer "CA716105" on page 336.

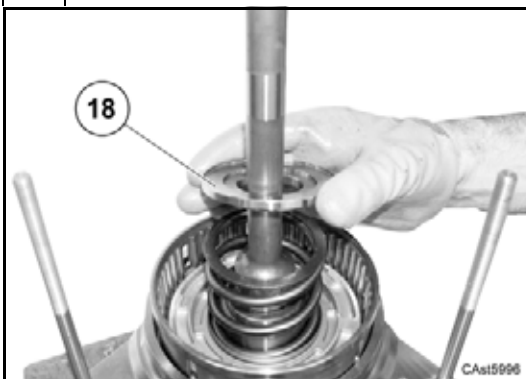
Refer to: section E.1 (" " on page 335).

29.



Remove spring guiding cover(20).

27.



Remove spring retaining cover (18).

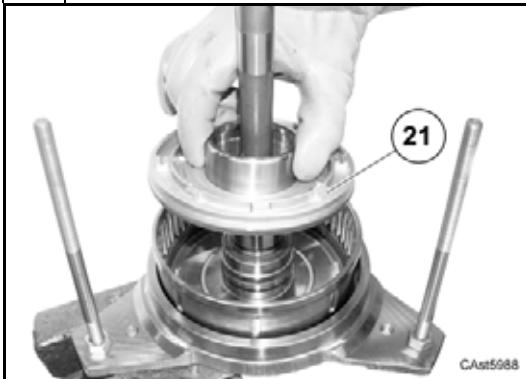
30.



Blow compressed air at 6 bar to remove the piston.

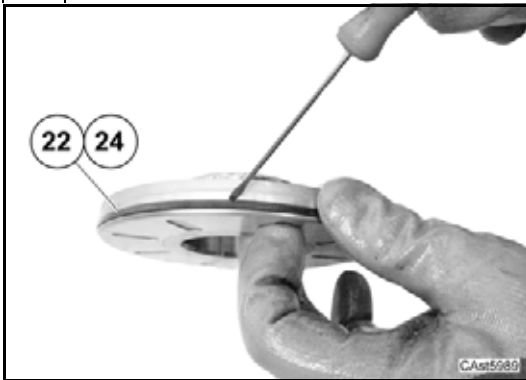
# Disassembly and Assembly Operations

31.



Remove piston (21).

32.



Remove gasket (22) and O-Ring (24) from piston.

33.

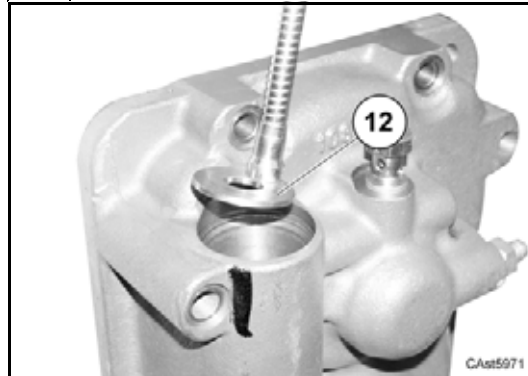


Remove O-Ring (23).

## Assembly

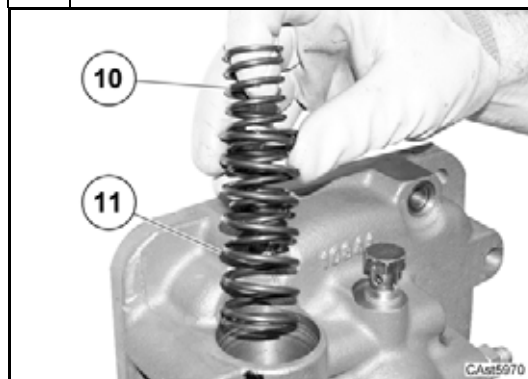
Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

1



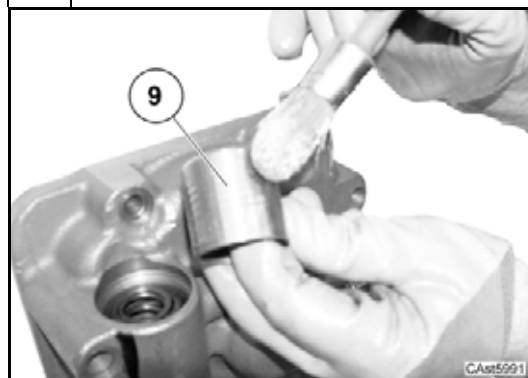
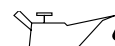
Insert shim (12).

34.



Insert two springs (10) and (11).

35.

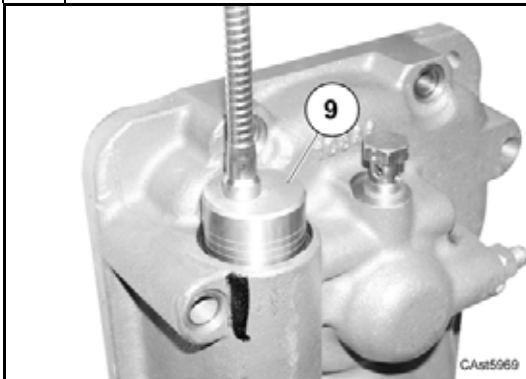


Lubricate piston (9).



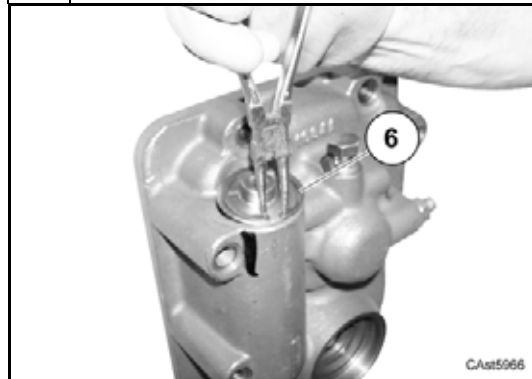
# Disassembly and Assembly Operations

36.



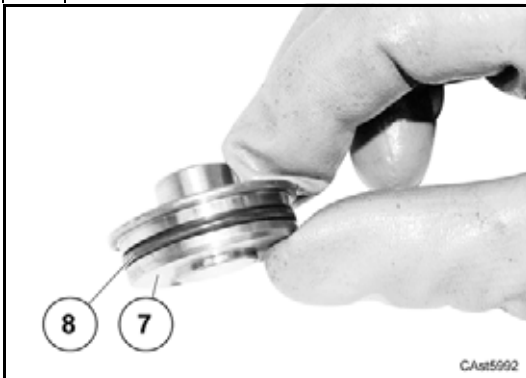
Insert piston (9).

39.



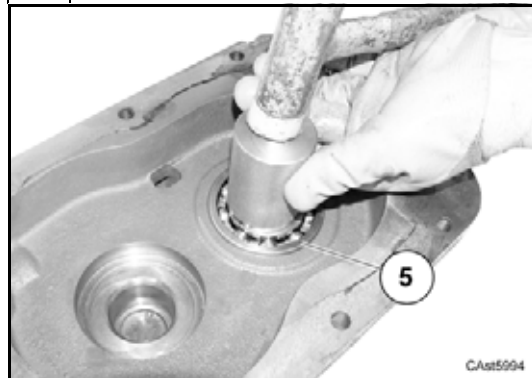
Assemble snap ring (6).

37.



Assemble O-Ring (8) on cover (7).

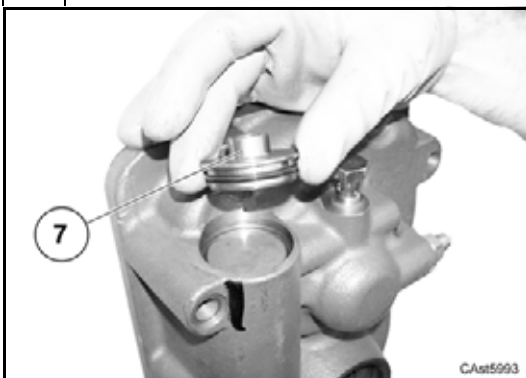
40.



Assemble bearing (5) using tool "CA715149" on page 338.

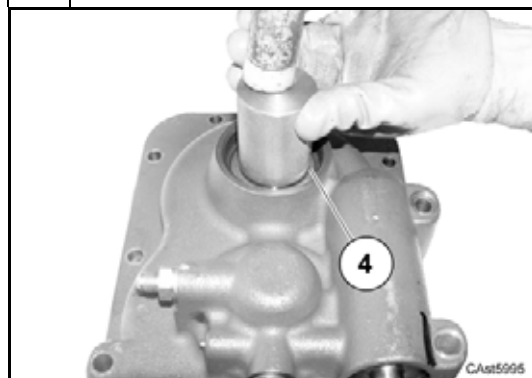
[Refer to: section E.1 \(" " on page 335\).](#)

38.



Assemble cover (7).

41.



Turn the cover.

Assemble seal ring (4) using tool "CA715842" on page 338.

[Refer to: section E.1 \(" " on page 335\).](#)

# Disassembly and Assembly Operations

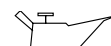
42.



Assemble tool CA715358 on vice.

Refer to: section E.1 (" " on page 335).

45.



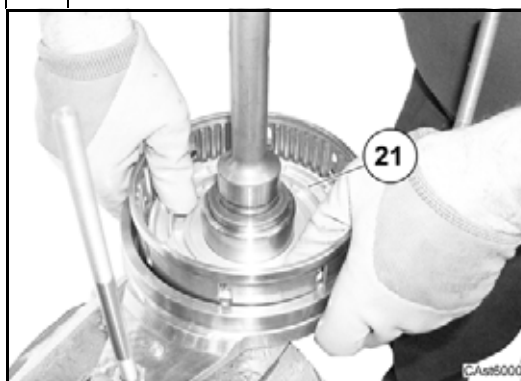
Lubricate piston seat.

43.



Assemble O-Ring (23) on PTO shaft (26).

46.



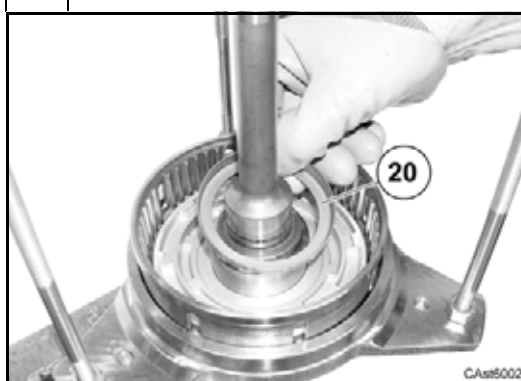
Insert and press piston (21).

44.



Assemble gasket (22) and O-Ring (24) on piston.

47.



Insert spring guiding cover (20).

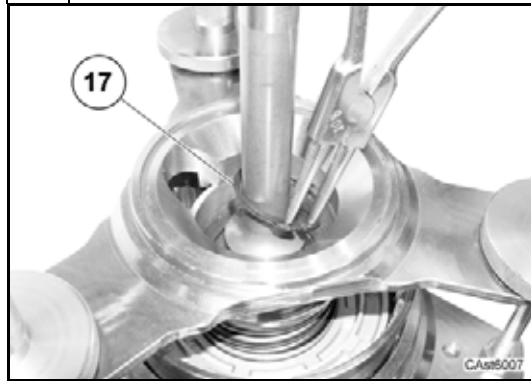
# Disassembly and Assembly Operations

48.



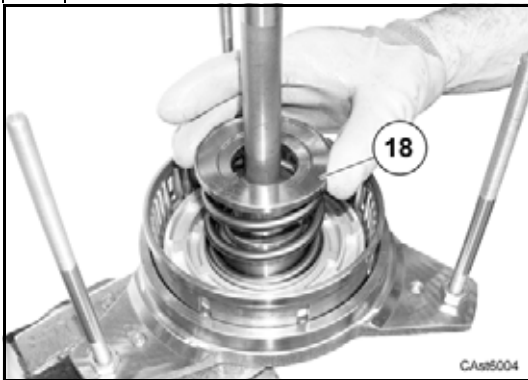
Insert spring (19).

51.



Assemble snap ring (17).

49.



Insert spring retaining cover (18).

52.



Remove cover of CA715358 tool.

[Refer to: section E.1 \(" " on page 335\).](#)

50.



Insert spacer CA716105 with a tool CA715358.

[Refer to: section E.1 \(" " on page 335\).](#)

53.



Remove spacer CA716105.

[Refer to: section E.1 \(" " on page 335\).](#)

# Disassembly and Assembly Operations

54.



Insert first counterdisc.

57.



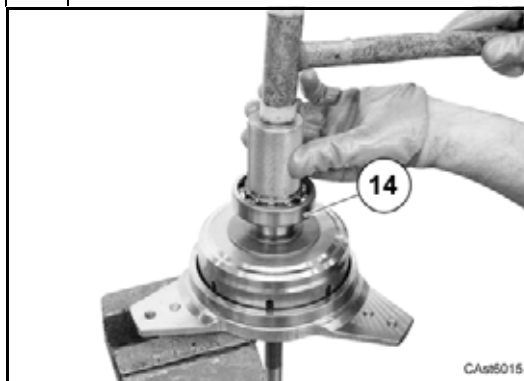
Insert snap ring (15).

55.



Insert first disc. Insert complete pack of discs (16).

58.



Turn assy. and insert bearing (14) by means of buffer CA715149.

[Refer to: section E.1 \(" " on page 335\).](#)

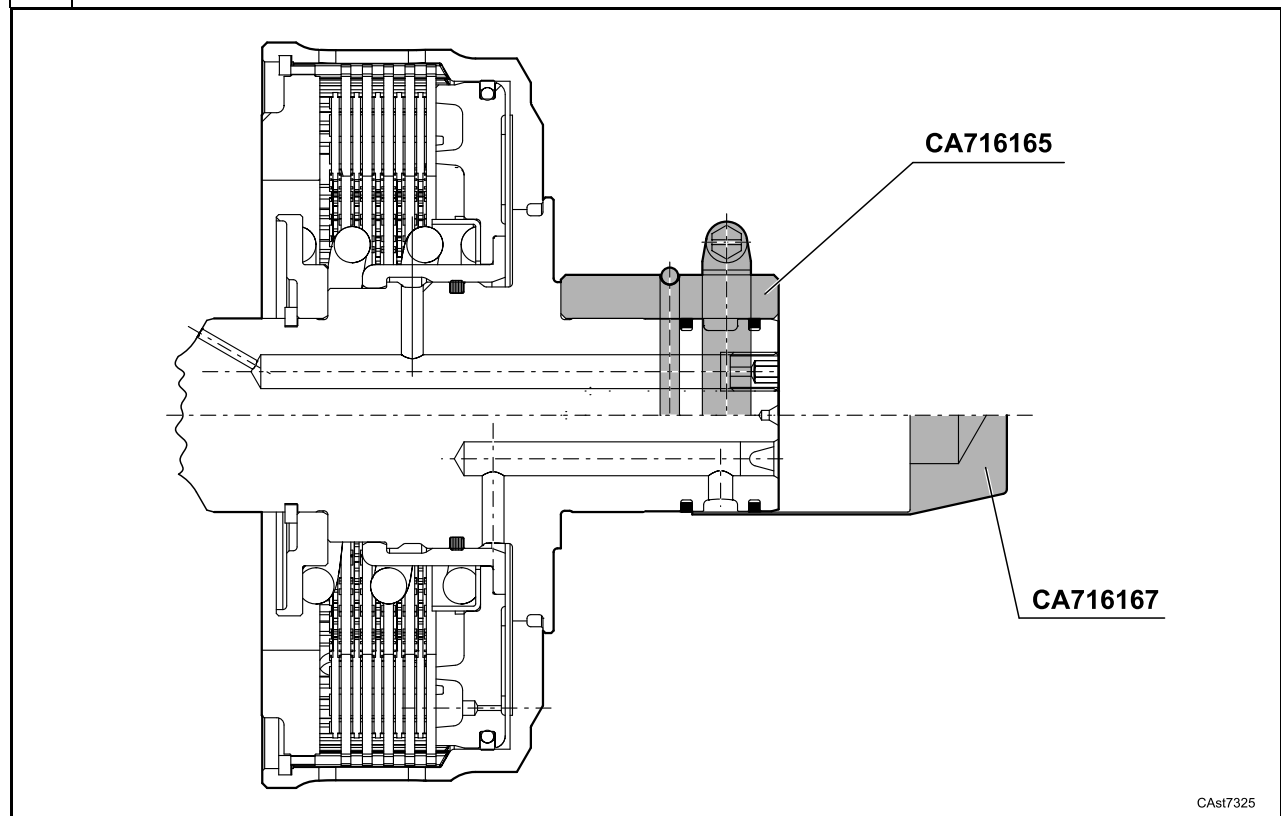
56.



Insert clutch's counterdisc (25).

# Disassembly and Assembly Operations

59.



Warm a new seal ring CA148565 (13) in water at 80 °C for 3 minutes.

Insert seal ring (13) on the special tool CA716167 as shown in figure.

Insert special tool CA716167 with seal ring (13) on the shaft.

Push seal ring (13) on the shaft and fit it in the relevant seat.

Repeat same operations to assembly every seal ring.

[Refer to: section E.1 \(" " on page 335\).](#)

Insert special tool CA716165 with relevant O-Ring on the shaft and seals (13).

[Refer to: section E.1 \(" " on page 335\).](#)

Close completely special tool on the seals (13).

Assemble and tighten clamp on the special tool.

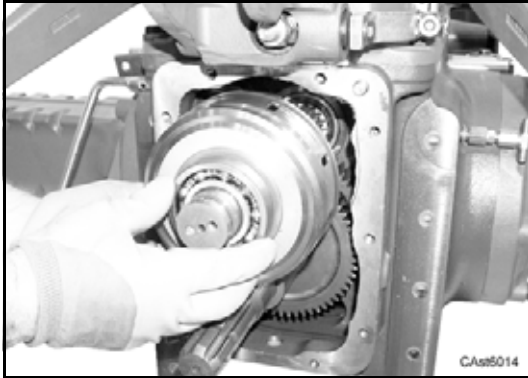
Leave special tool CA716165 on the seals (13) for 5 minutes.

Remove clamp and special tool.



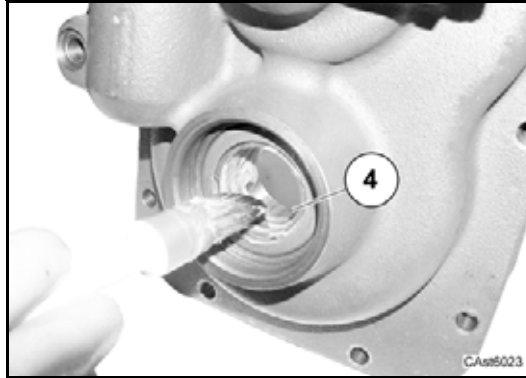
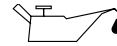
# Disassembly and Assembly Operations

60.



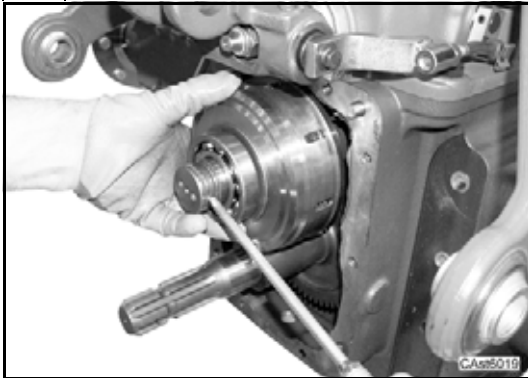
Insert PTO clutch assy. on transmission.

63.



Lubricate seal ring (4).

61.



Blow compressed air at 6 bar to check correct assembly.

**NOTE:** Pay attention that all discs are assembled correctly on the sleeve.

64.



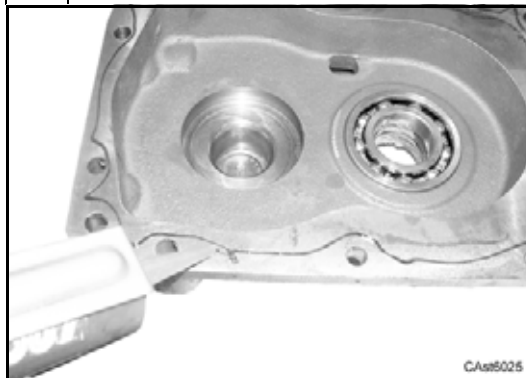
Lubricate seat of the PTO clutch shaft.

62.



**NOTE:** Correct assembly of discs/counterdiscs on sleeve.

65.

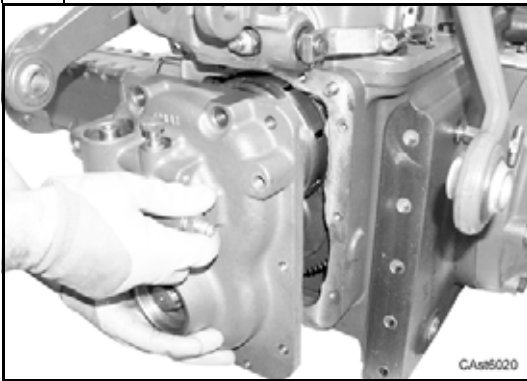


Apply sealant to the cover.

[Refer to: section C.4.](#)

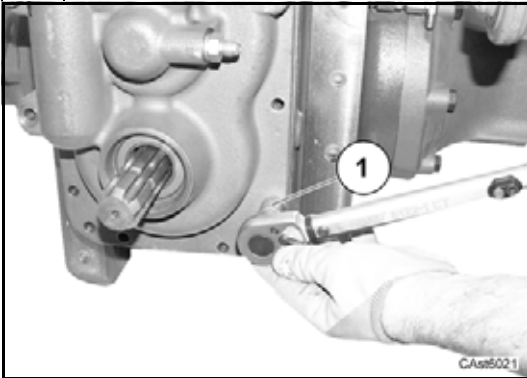
# Disassembly and Assembly Operations

66.



Assemble cover (3).

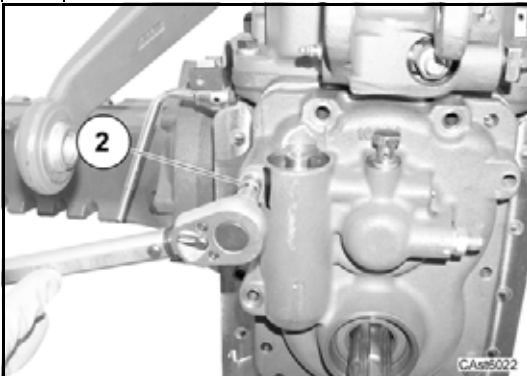
67.



Tighten TE (1) screws.

[Refer to: section C.4.](#)

68.

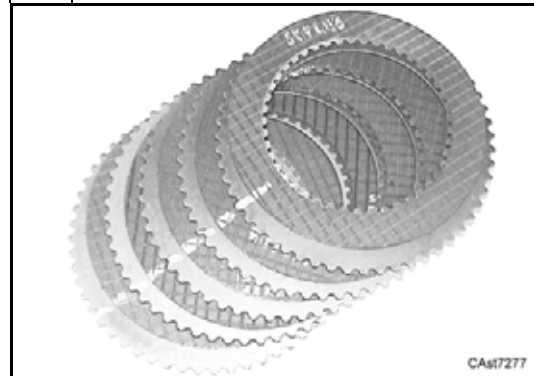


Tighten TCEI (2) screws.

[Refer to: section C.4.](#)

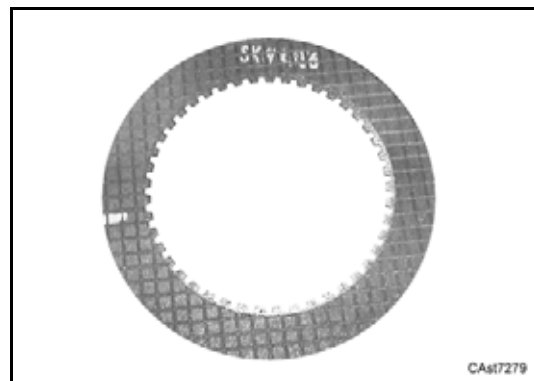
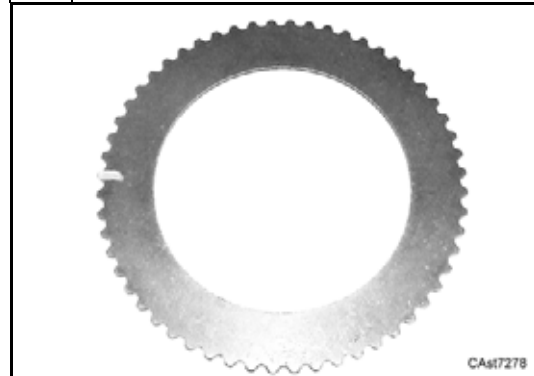
## Clutch pack wear

69.



If clutch discs are to be used again, keep clutch packs in the same previous assembly order separate and record which clutch pack goes with each clutch.

70.



At each disassembly, verify with a gauger that total thickness of the clutch kit is within wear limit (see "Clutch kit" table). If not, replace clutch kit with a new one.

Verify that all clutch plates do not appear burned or that friction material it is not damaged and that splines are well traced.

Verify also that all clutch drive plates are perfectly plane and inspect for pitting or scoring.

In case that at least one of the above problems occurs, replace complete clutch kit with a new one.



# Disassembly and Assembly Operations

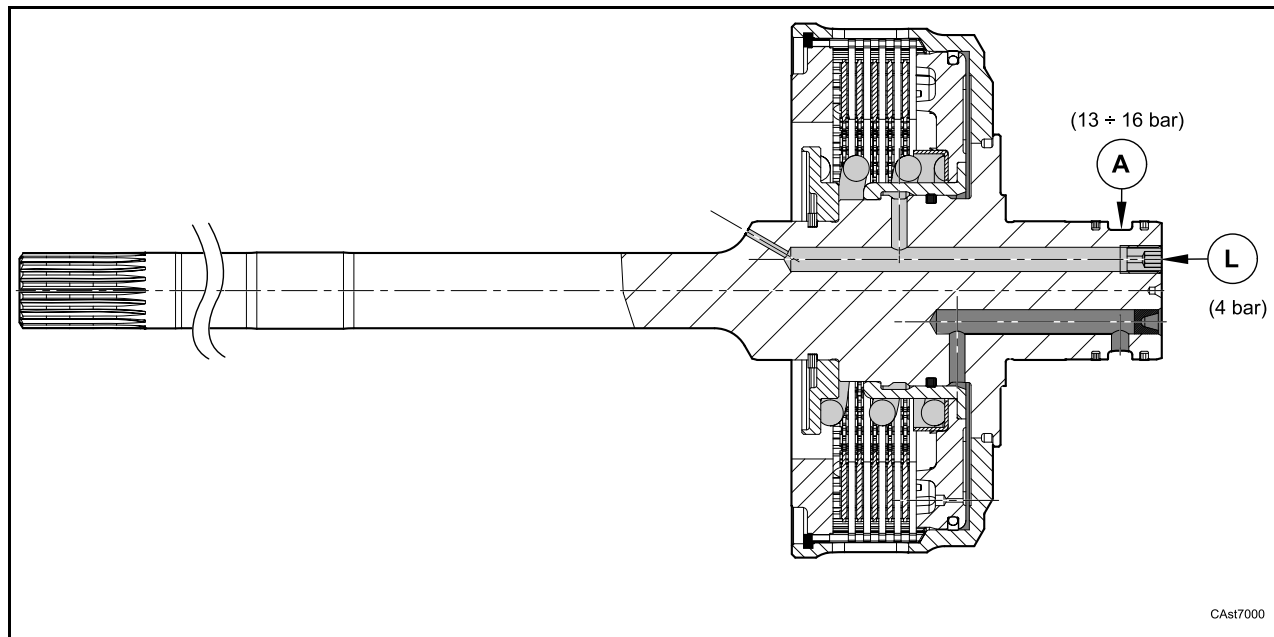
If using a new clutch kit soak clutch plates in clean transmission oil for at least an hour before assembly.

In any case lubricate contact surfaces of clutch drive plates with clean transmission oil before assembly.

## CLUTCH KIT

|                                        |                 |
|----------------------------------------|-----------------|
| Number of clutch discs (each side)     | 5               |
| Number clutch counterdiscs (each side) | 5               |
| Nominal clutch disc thickness          | 2.40±0.05 mm    |
| Nominal clutch pack thickness          | * 2180÷22.00 mm |
| Maximum clutch disc wear (each side)   | 0.25 mm         |
| Maximum clutch pack wear               | 2.5 mm          |

\* Under load of 163 kg

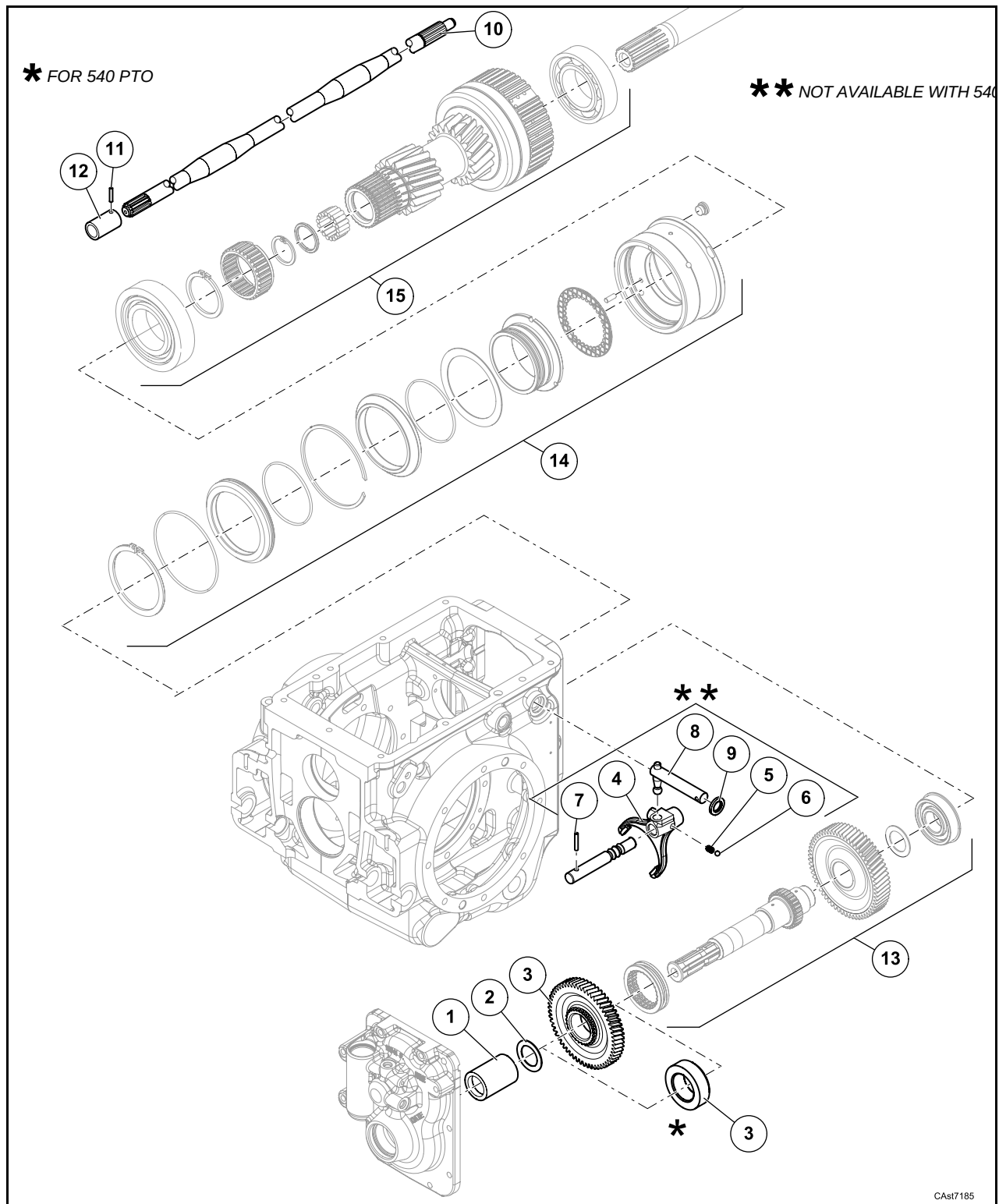


A= PTO clutch supply oil passage

L= PTO clutch lubricating oil passage

# Disassembly and Assembly Operations

## PTO - POWER TAKE OFF



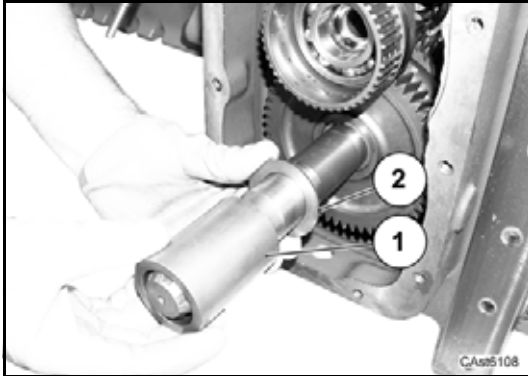
|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models |                           |                             |                                                     |                                                   |                           |                                                   |

# Disassembly and Assembly Operations

## Disassembly

Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

1.

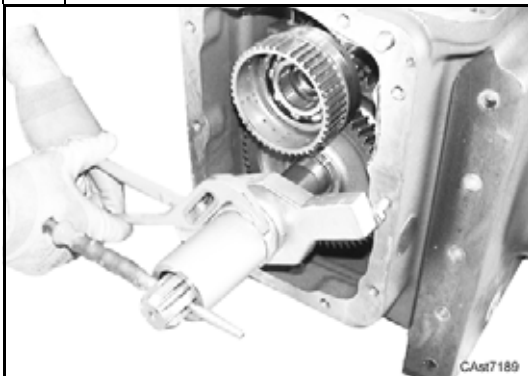


Remove cover and PTO wet clutch assy.

[Refer to: section D.13.](#)

Take out bush (1) and washer (2).

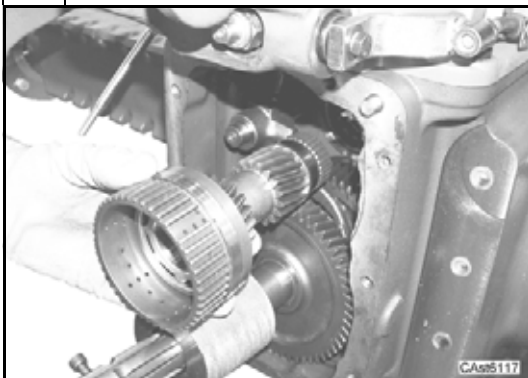
2.



Assemble tool CA716155 to remove PTO output shaft assy (13).

[Refer to: section E.1 \(PTO - Power take off\).](#)

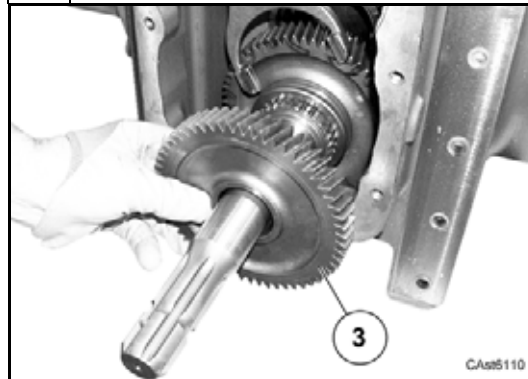
3.



Pull out PTO input shaft assy (15).

[Refer to: section D.15.](#)

4.



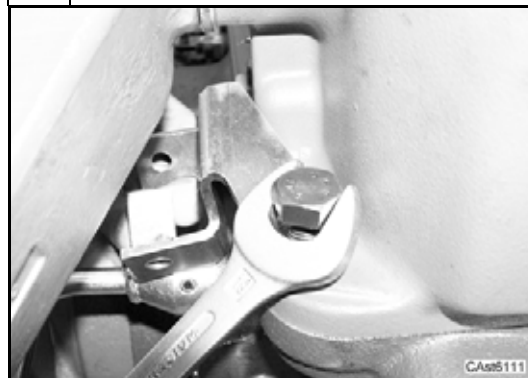
Remove gear (3).



## Warning

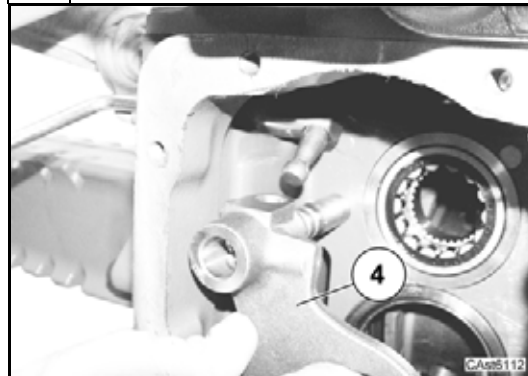
**For 540 PTO instead of gear is installed a spacer.**

5.



Remove bracket of PTO clutch sensor with relevant screws.

6.



Remove fork (4), spring (5) and ball (6) after raising the PTO control speed lever.

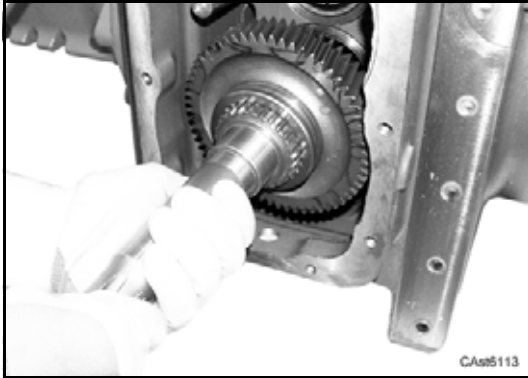


## Warning

**Not present for 540 PTO.**

# Disassembly and Assembly Operations

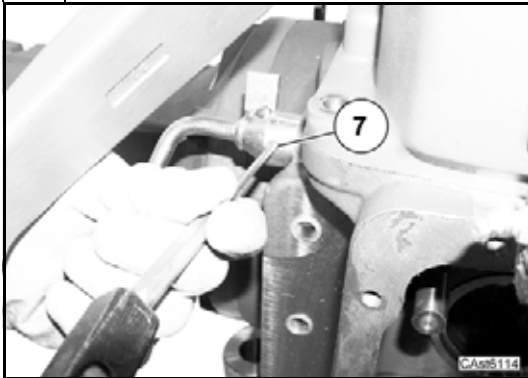
7.



Remove PTO output shaft assy (13).

[Refer to: section D.16.](#)

8.



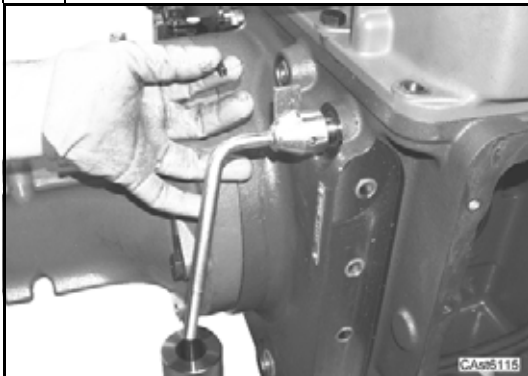
Remove spring pin (7).



**Warning**

**Not present for 540 PTO.**

9.



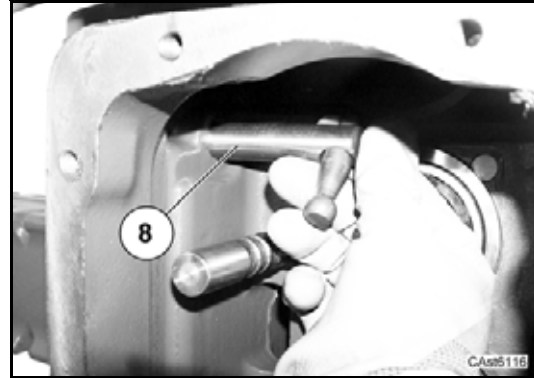
Remove lever.



**Warning**

**Not present for 540 PTO.**

10.



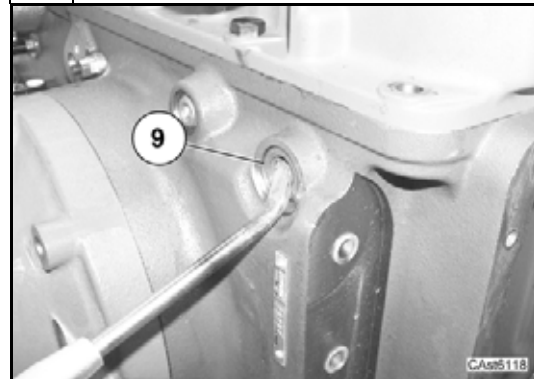
Take out pin (8).



**Warning**

**Not present for 540 PTO.**

11.



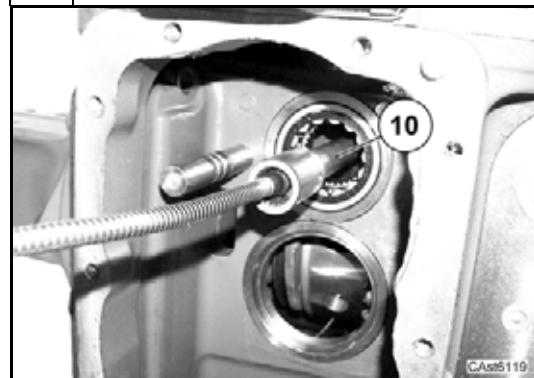
Remove seal ring (9).



**Warning**

**Not present for 540 PTO.**

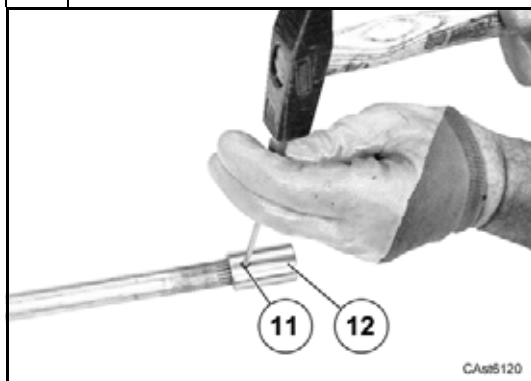
12.



Pull out PTO shaft (10) by means of a magnet.

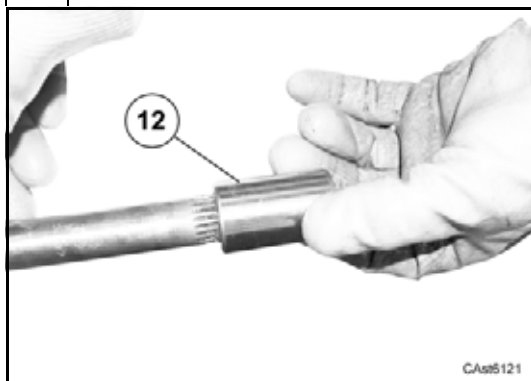
# Disassembly and Assembly Operations

13.



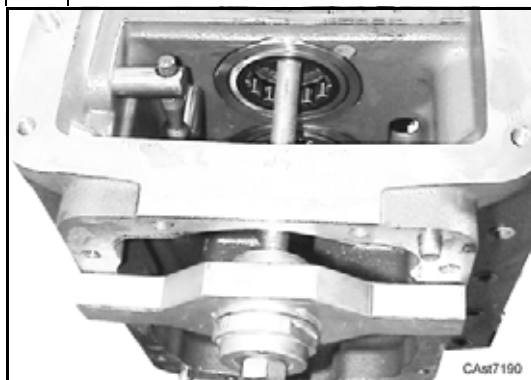
Remove spring pin (11).

14.



Remove shaft coupling (12).

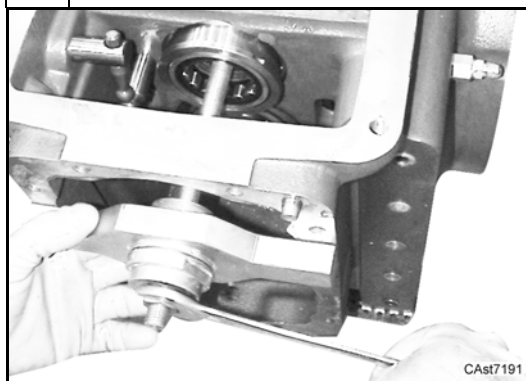
15.



Assemble tool CA716155.

Refer to: [section E.1 \(PTO - Power take off\)](#).

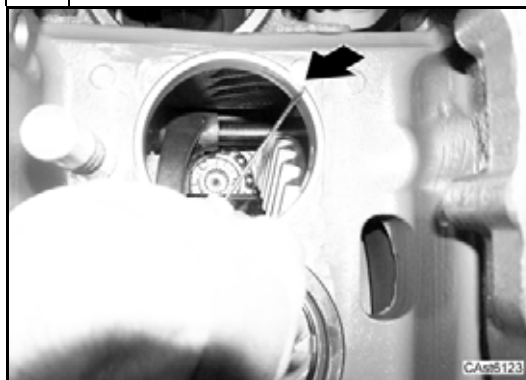
16.



Remove PTO brake.

Refer to: [section D.17](#).

17.



## Warning

Do not remove pin of position of the PTO brake.

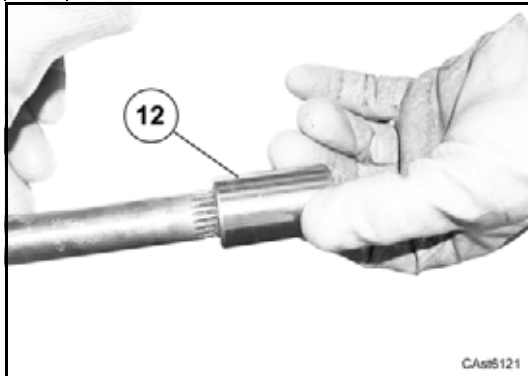


# Disassembly and Assembly Operations

## Assembly

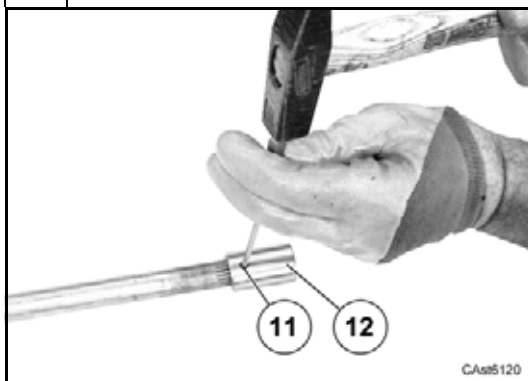
Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

1



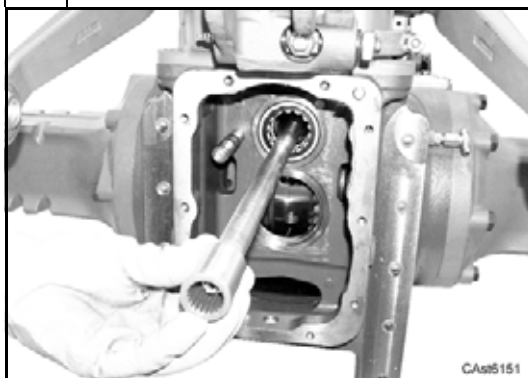
Assemble shaft coupling (12) on the PTO shaft.

18.



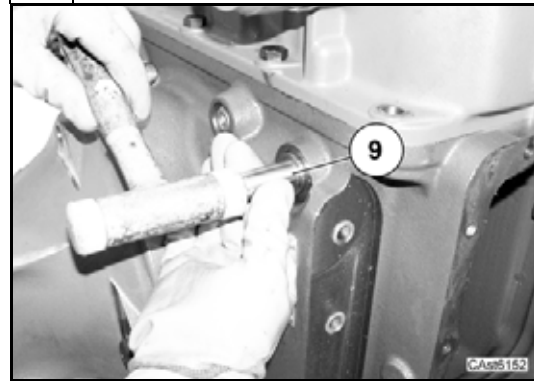
Assemble pin (11) on the shaft coupling (12).

19.



Insert PTO shaft.

20.



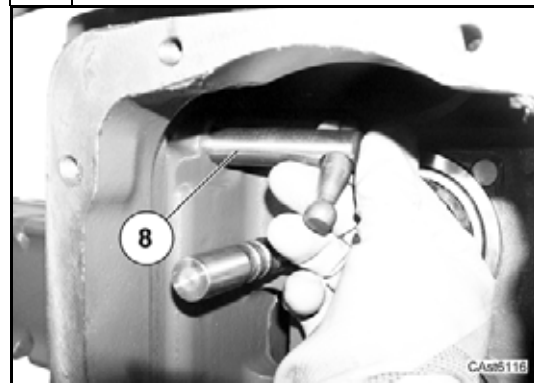
Assemble seal ring (9) using the tool CA715809.



**Warning**

**Not present for 540 PTO.**

21.



22.



Insert lever.

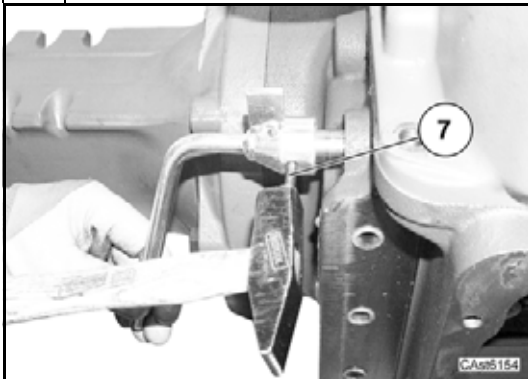


**Warning**

**Not present for 540 PTO.**

# Disassembly and Assembly Operations

23.



Insert pin (7).



**Warning**

**Not present for 540 PTO.**

24.



Assemble bracket for PTO clutch sensor with relevant screws.



**Warning**

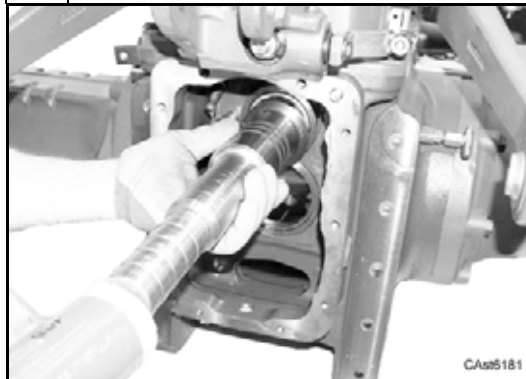
**Not present for 540 PTO.**

25.



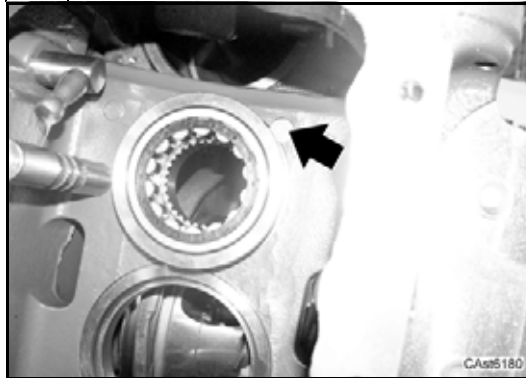
Verify that retaining pin of brake is in its seat.

26.



Assemble brake assy (14) with tool CA716112.

27.



Pre-assemble brake assy (14) matching pin with groove of the brake support.

28.

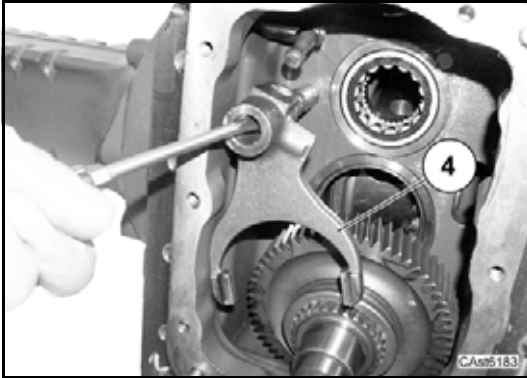


Lay PTO output shaft assy (13) on the gear box.



# Disassembly and Assembly Operations

29.



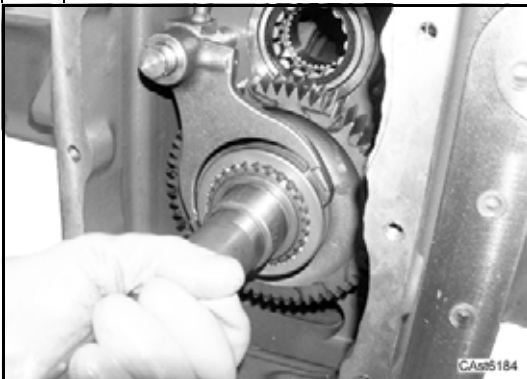
Insert spring (5) and ball (6) inside of the fork (4) and fit fork on the spindle.



## Warning

**Not present for 540 PTO.**

30.



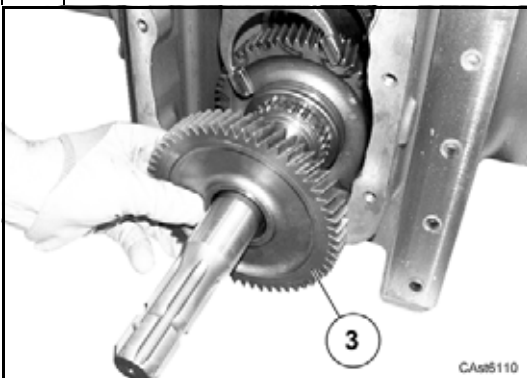
Align fork (4) with sleeve PTO.



## Warning

**Not present for 540 PTO.**

31.



Assemble gear (3).



## Warning

**Not present for 540 PTO.**

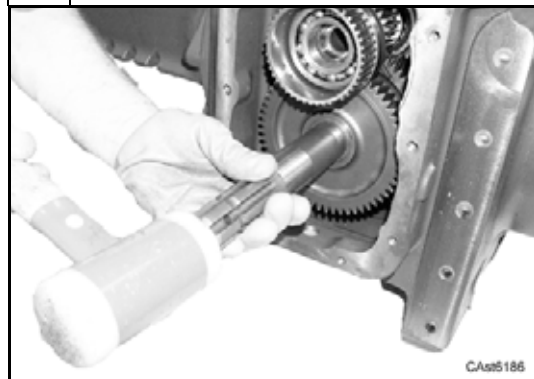
There is a spacer for 540 PTO.

32.



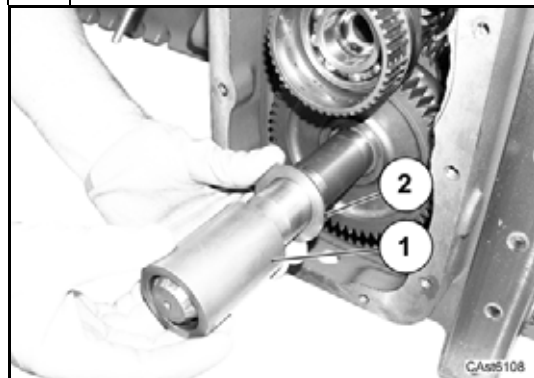
Insert PTO input shaft assy (15).

33.



Tap with a soft hammer PTO output shaft assy (13).

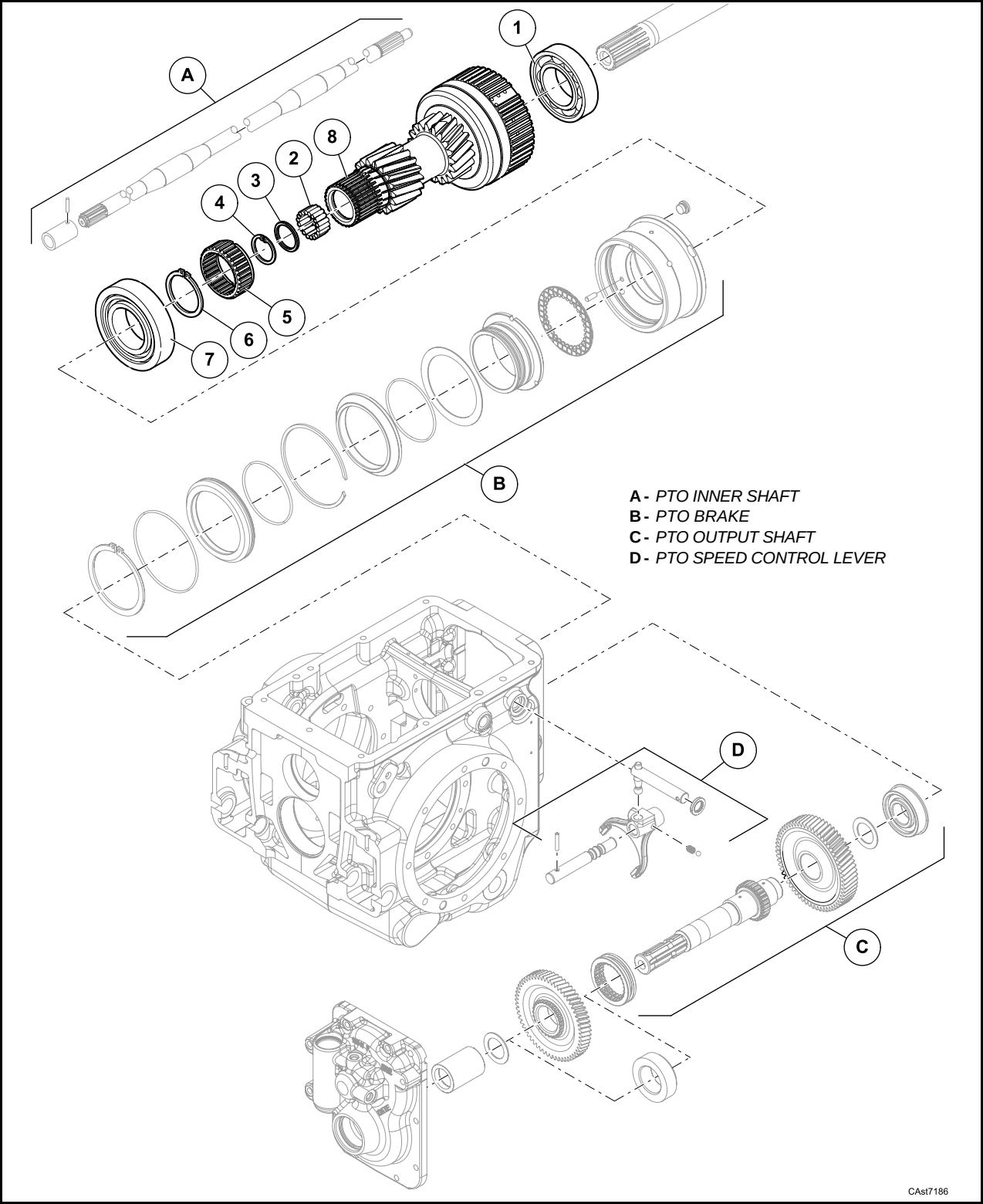
34.



Insert shim (2) and bush (1).  
For insertion of the PTO clutch assy and for assembly of PTO cover, see section D.13.

# Disassembly and Assembly Operations

## PTO INPUT SHAFT



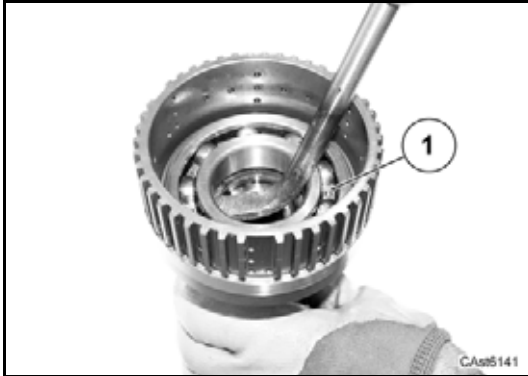
|            |                                    |                                      |                                                               |                                                             |                                    |                                                             |
|------------|------------------------------------|--------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------|------------------------------------|-------------------------------------------------------------|
|            | <b>8+8<br/>synchro<br/>shuttle</b> | <b>12+12<br/>synchro<br/>shuttle</b> | <b>24+24<br/>synchro shuttle<br/>and synchro<br/>splitter</b> | <b>24+24<br/>synchro shuttle<br/>and power<br/>splitter</b> | <b>12+12<br/>power<br/>shuttle</b> | <b>24+24<br/>power shuttle<br/>and synchro<br/>splitter</b> |
| For models |                                    |                                      |                                                               |                                                             |                                    |                                                             |

# Disassembly and Assembly Operations

## Disassembly

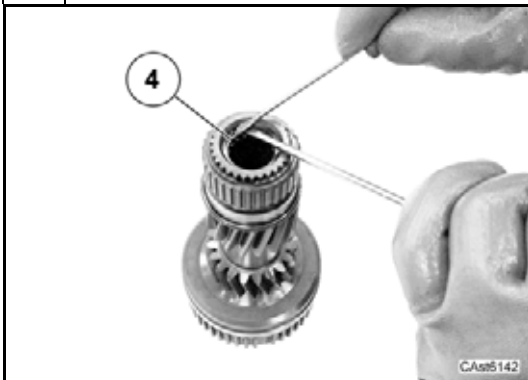
Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

1.



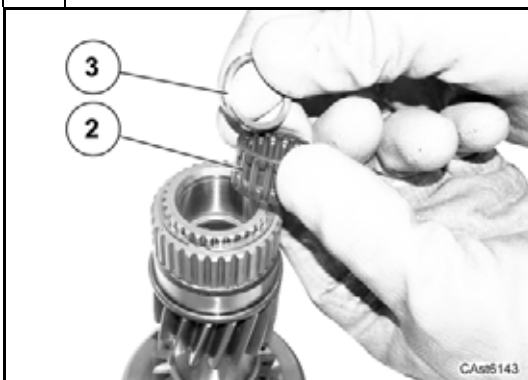
Remove bearing (1).

2.



Turn shaft (8) and remove snap ring (4).

3.



Remove shim (3) and needles bearing (2).

4.



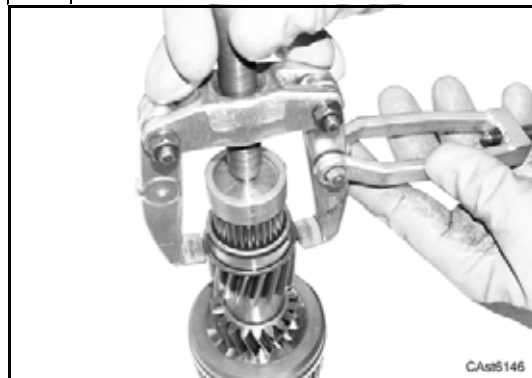
Remove snap ring (6).

5.



Remove shaft coupling (5).

6.



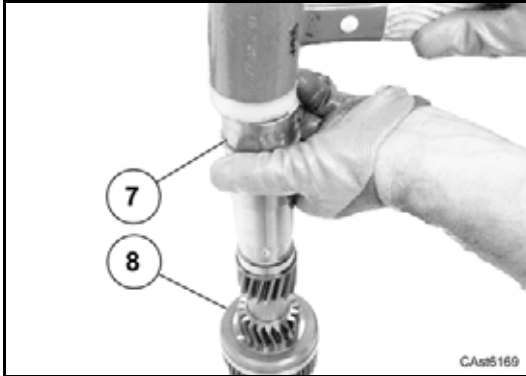
Remove inner race of bearing (7) with a puller.

# Disassembly and Assembly Operations

## Assembly

Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

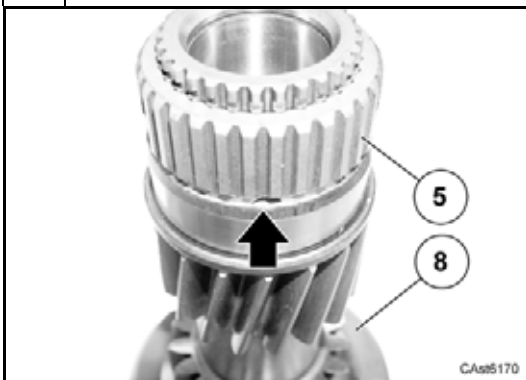
1.



Assemble inner race of bearing (7) with tool CA716108.

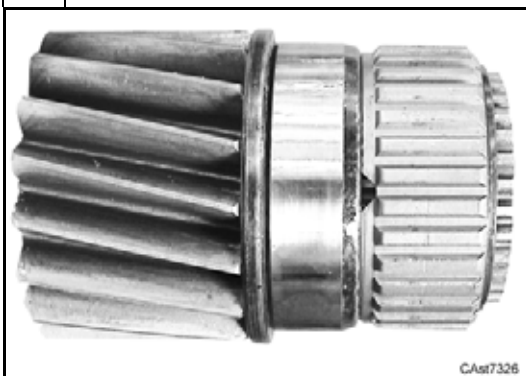
[Refer to: section E.1 \(PTO input shaft\).](#)

7.



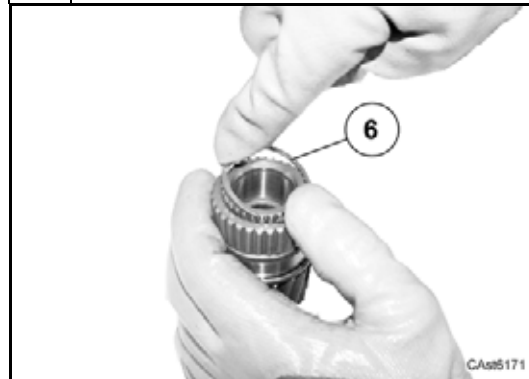
Insert shaft coupling (5) as shown in the figure.

8.



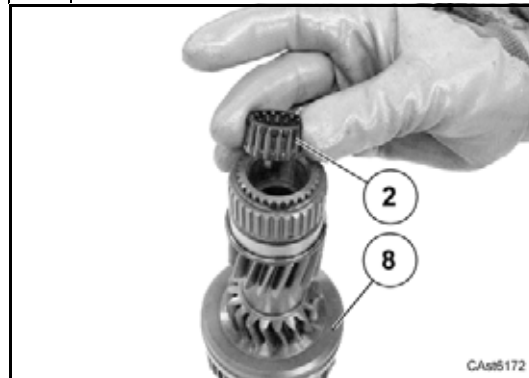
**NOTE:** Correct position of shaft coupling (5) hole.

9.



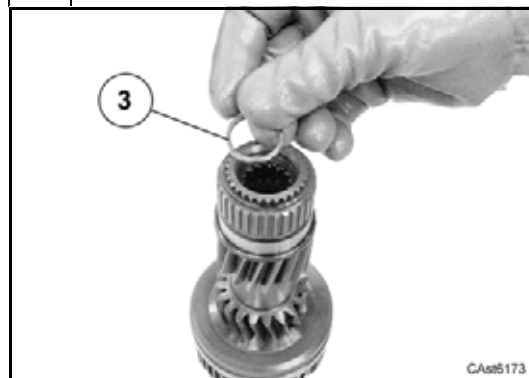
Assemble snap ring (6).

10.



Assemble needles bearing (2).

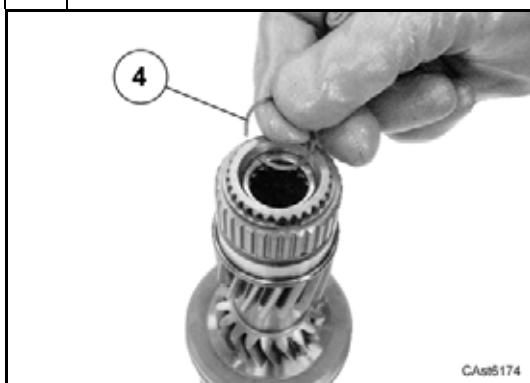
11.



Assemble shim (3).

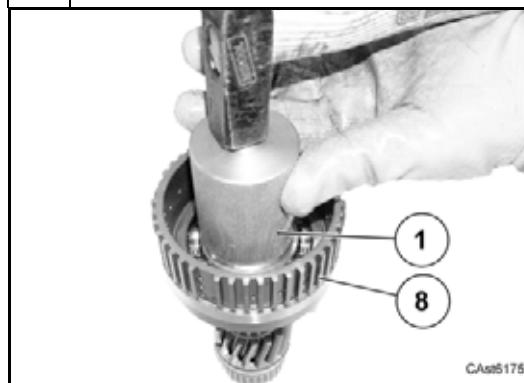
## Disassembly and Assembly Operations

12.



Assemble snap ring (4).

13.

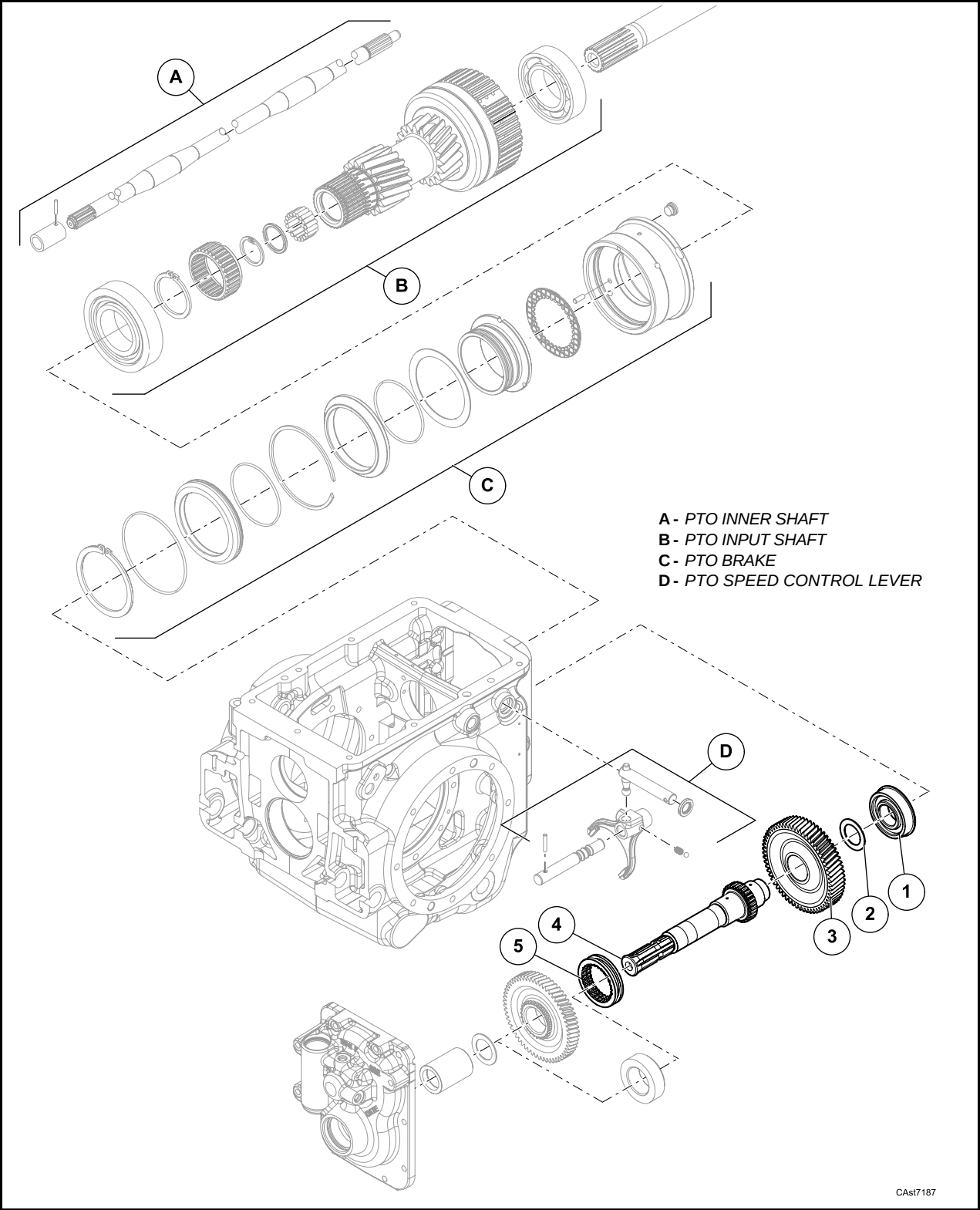


Turn shaft (8). Assemble bearing (1) with tool CA716108.

[Refer to: section E.1 \(PTO input shaft\).](#)

# Disassembly and Assembly Operations

## PTO OUTPUT SHAFT



|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models |                           |                             |                                                     |                                                   |                           |                                                   |

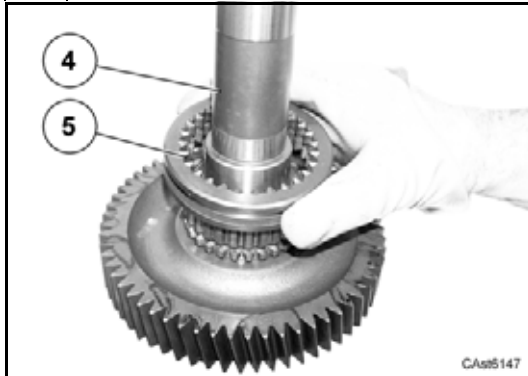


# Disassembly and Assembly Operations

## Disassembly

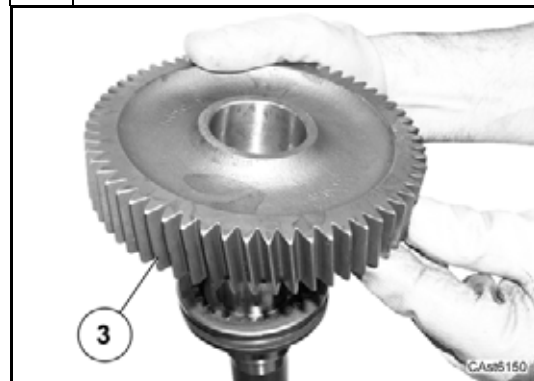
Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

1.



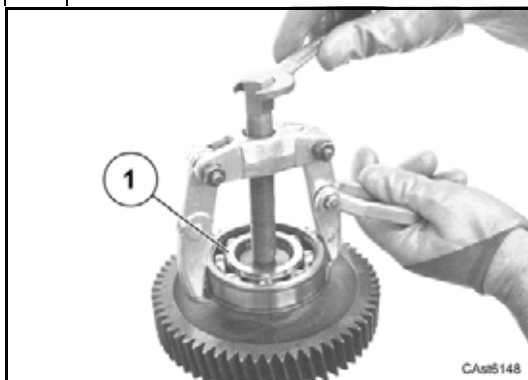
Fasten PTO output shaft (4) on the vice and remove PTO sleeve (5).

4.



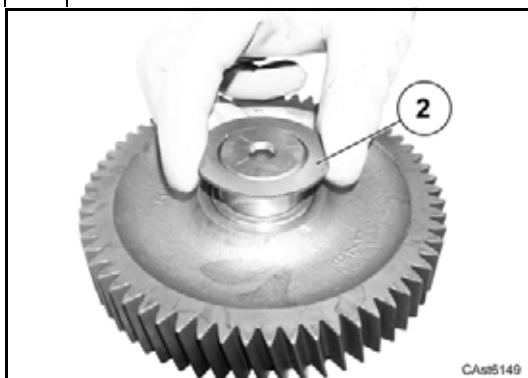
Remove gear (3).

2.



Turn shaft and assemble it on the vice. Disassemble bearing (1) with a puller.

3.



Remove washer (2).

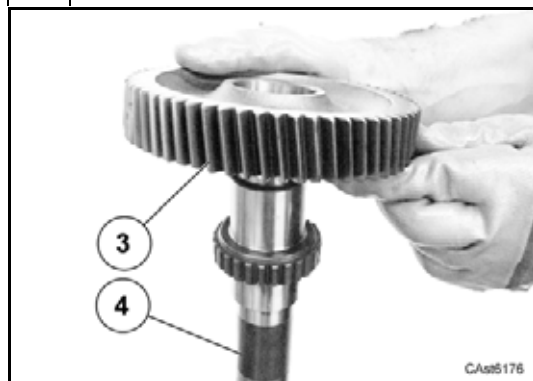


# Disassembly and Assembly Operations

## Assembly

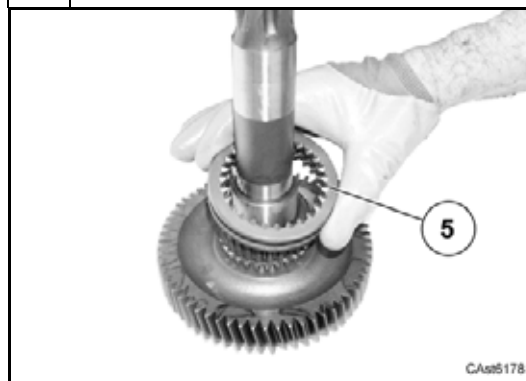
Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

1.



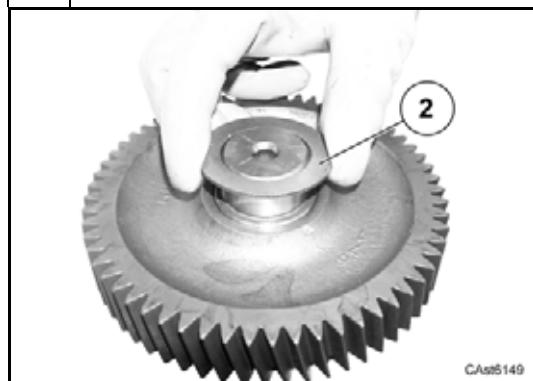
Assemble gear (3) onto shaft (4).

4.



Turn shaft (4). Insert PTO sleeve (5).

2.



Assemble washer (2).

3.

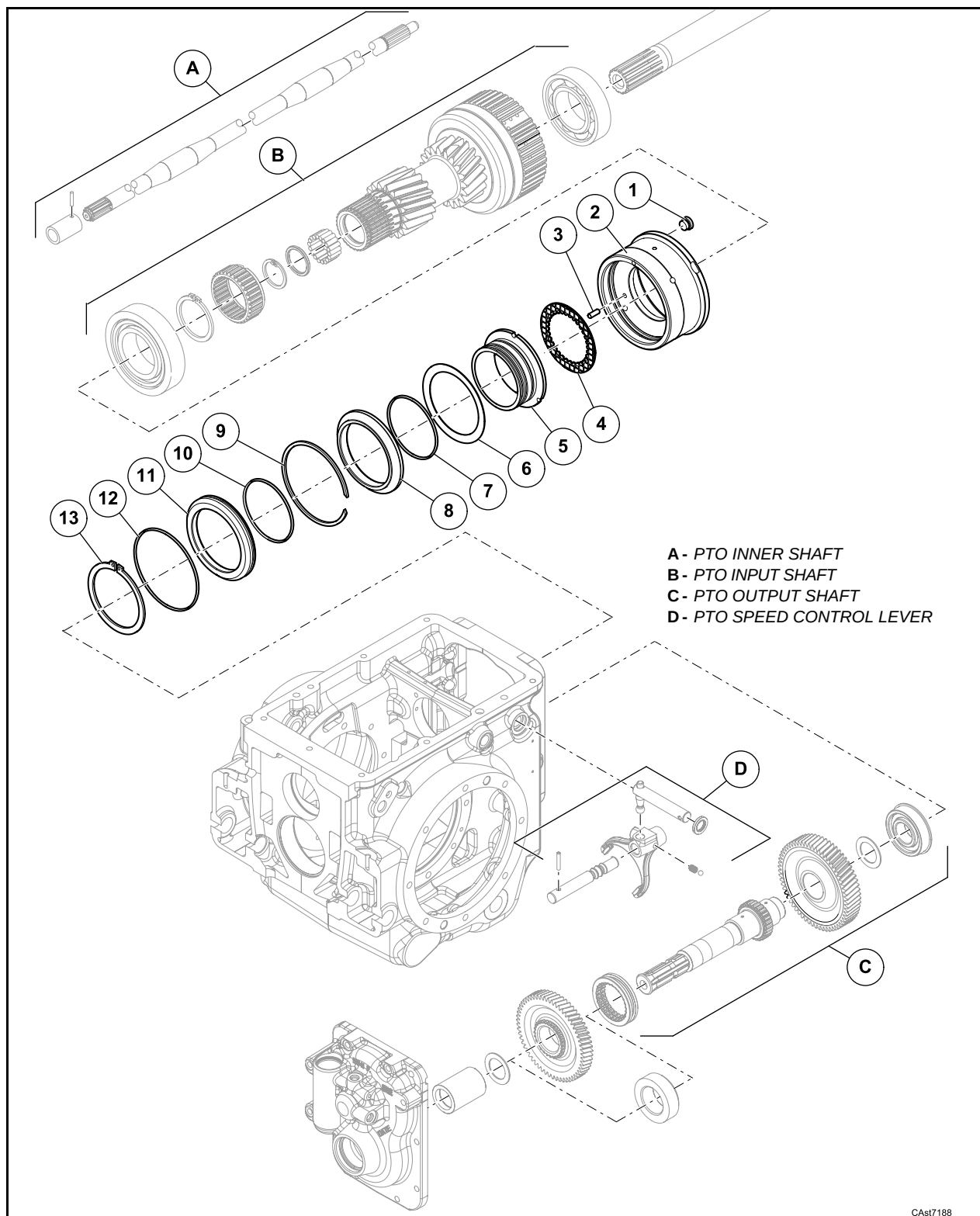


Assemble bearing (1) with tool CA716108.

[Refer to: section E.1 \(PTO output shaft\).](#)

# Disassembly and Assembly Operations

## PTO BRAKE



CAst7188

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and<br>synchro splitter | 24+24<br>synchro shuttle<br>and<br>power splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and<br>synchro splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models |                           |                             |                                                     |                                                   |                           |                                                   |

# Disassembly and Assembly Operations

## Disassembly

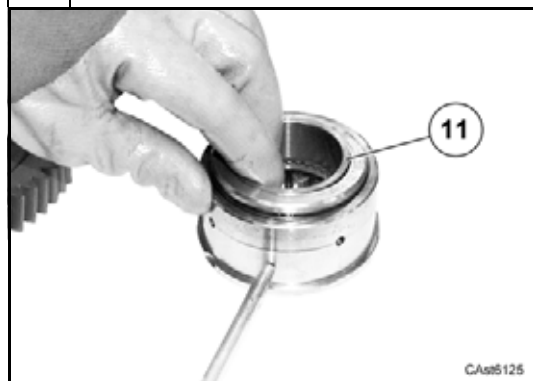
Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

1.



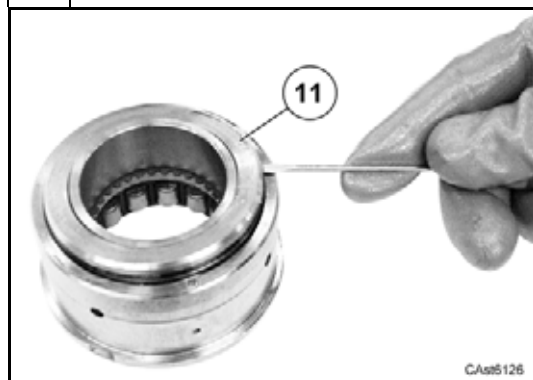
Remove snap ring (13).

2.



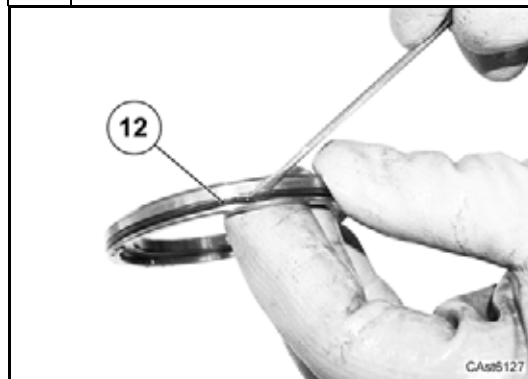
Blow compressed air at 6 bar in the lateral holes to ease extraction of the PTO brake piston (11).

3.



Remove PTO brake piston (11).

4.



Remove O-Ring (12) from piston.

5.

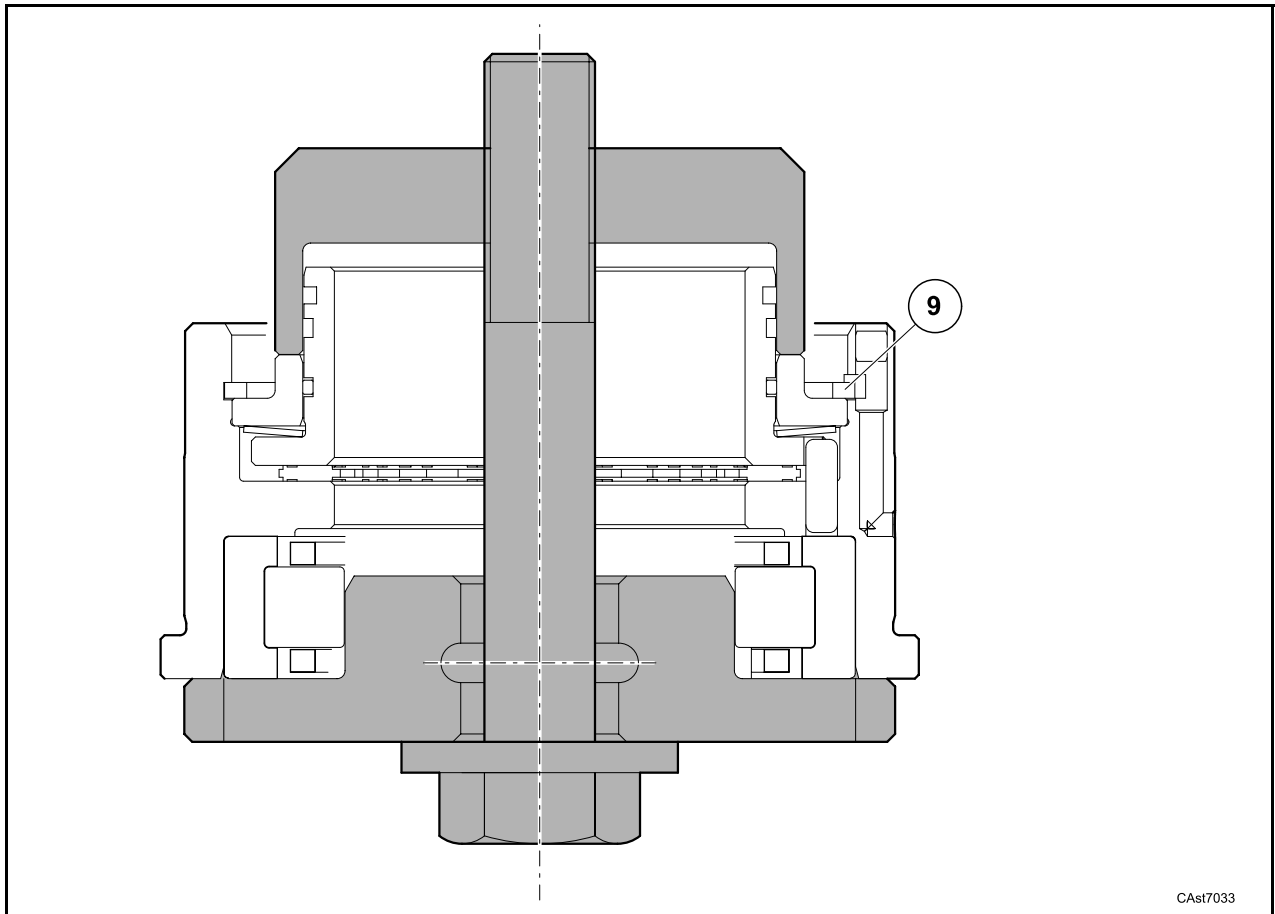


Remove O-Ring (10) from PTO brake ring (5).

# Disassembly and Assembly Operations



6.



CAst7033

Assemble tool CA716111 on PTO brake assy.

Assemble assy on the vice.

Remove snap ring (9).

7.



CAst5133

Remove assy placed inside of the support.

8.

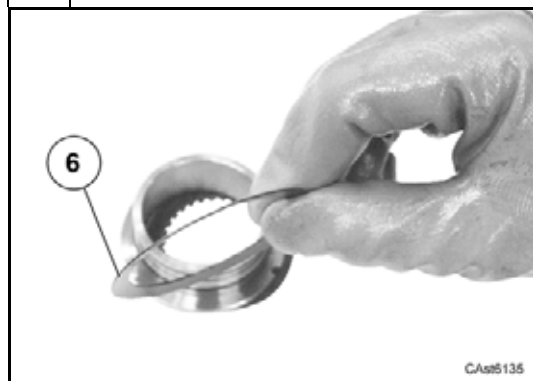


CAst5134

Remove spring reaction ring (8).

# Disassembly and Assembly Operations

9.



Remove Belleville washers (6).

12.



Lay brake support on a supporting bush or fix it in a vice.

10.



Remove O-Ring (7) from PTO brake ring.

13.



Remove outer race of bearing from support (2).

11.



Remove brake disc (4).

14.



Remove pins (3).

## Disassembly and Assembly Operations

### Assembly

1.



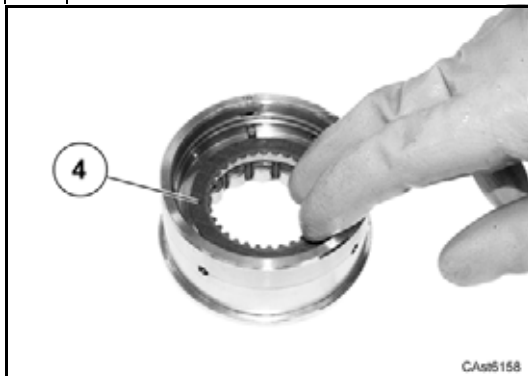
Assemble outer race of bearing in the brake support (8), using tool CA716112.

2.



Turn brake support. Assemble pins (3).

3.



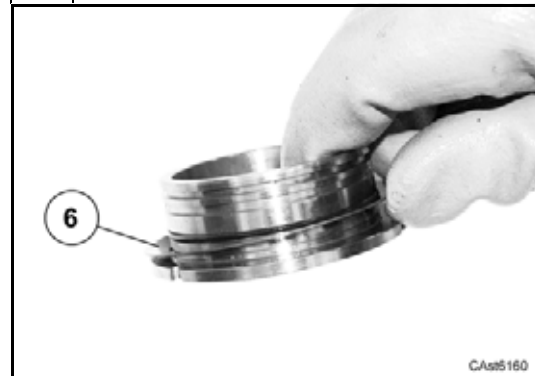
Insert brake disc (4) on the support.

4.



Insert O-Ring (3) in the PTO brake ring (5).

5.



Insert Belleville washer (6) in the PTO brake ring.

6.



Insert spring reaction ring (8).

# Disassembly and Assembly Operations

7.



Insert assy as soon as assembled on the support (2).

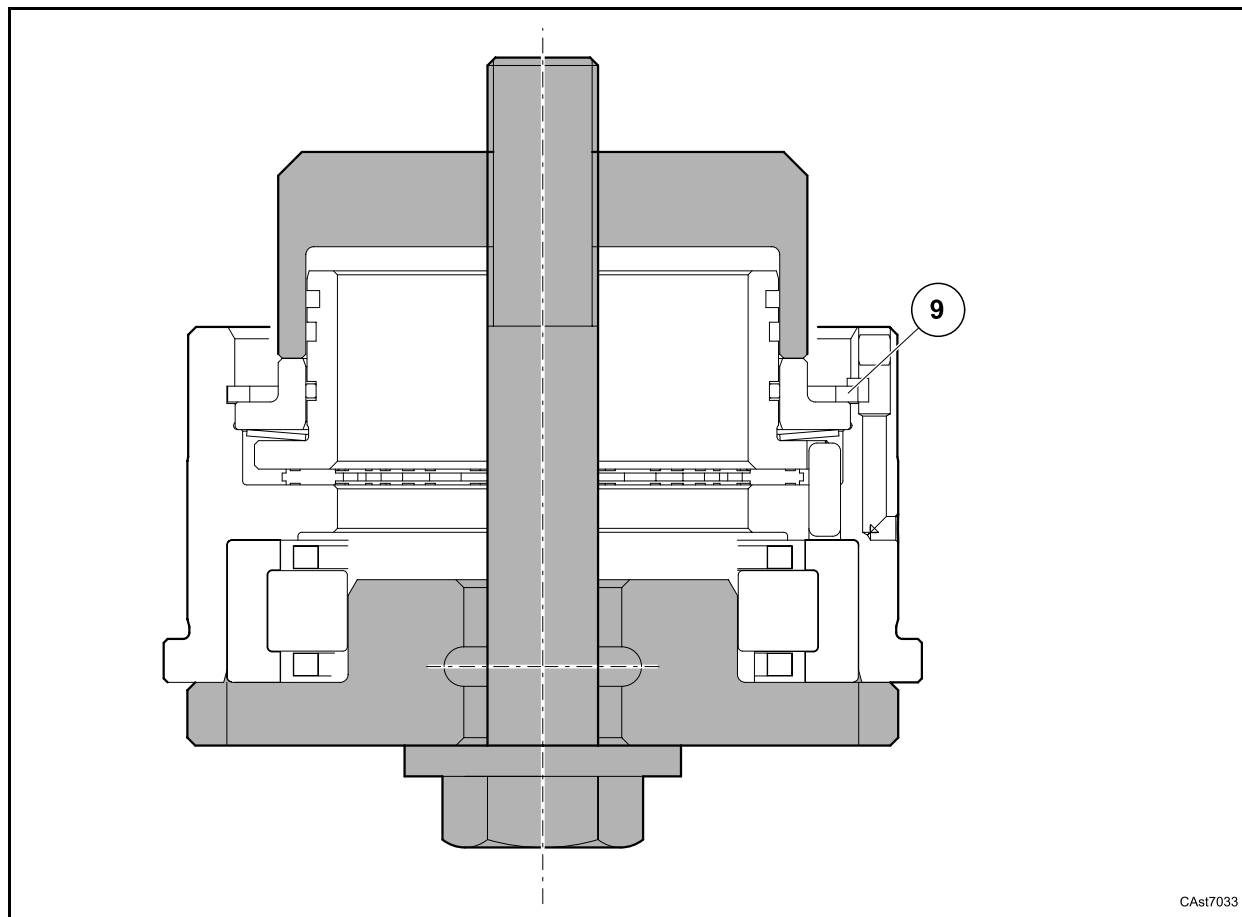
8.



Insert snap ring (9) near its seat (pre-assemble).



9.



Assemble tool CA716111 on PTO brake assy. Fix it in the vice and push the snap ring to its seat (9).



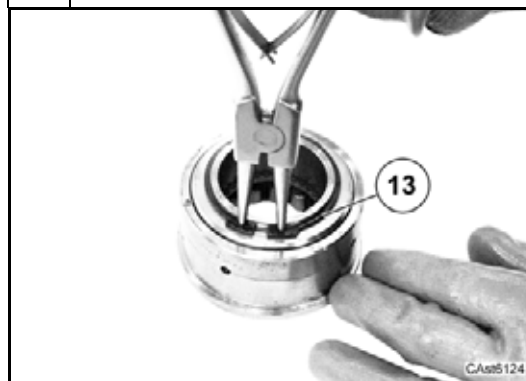
# Disassembly and Assembly Operations

10.



Assemble O-Ring (10) in the PTO brake ring (35).

13.



Assemble snap ring (11).

11.



Assemble O-Ring (12) of the PTO brake piston.

14.



Blow compressed air at 6 bar to check correct assembly of the assembly.

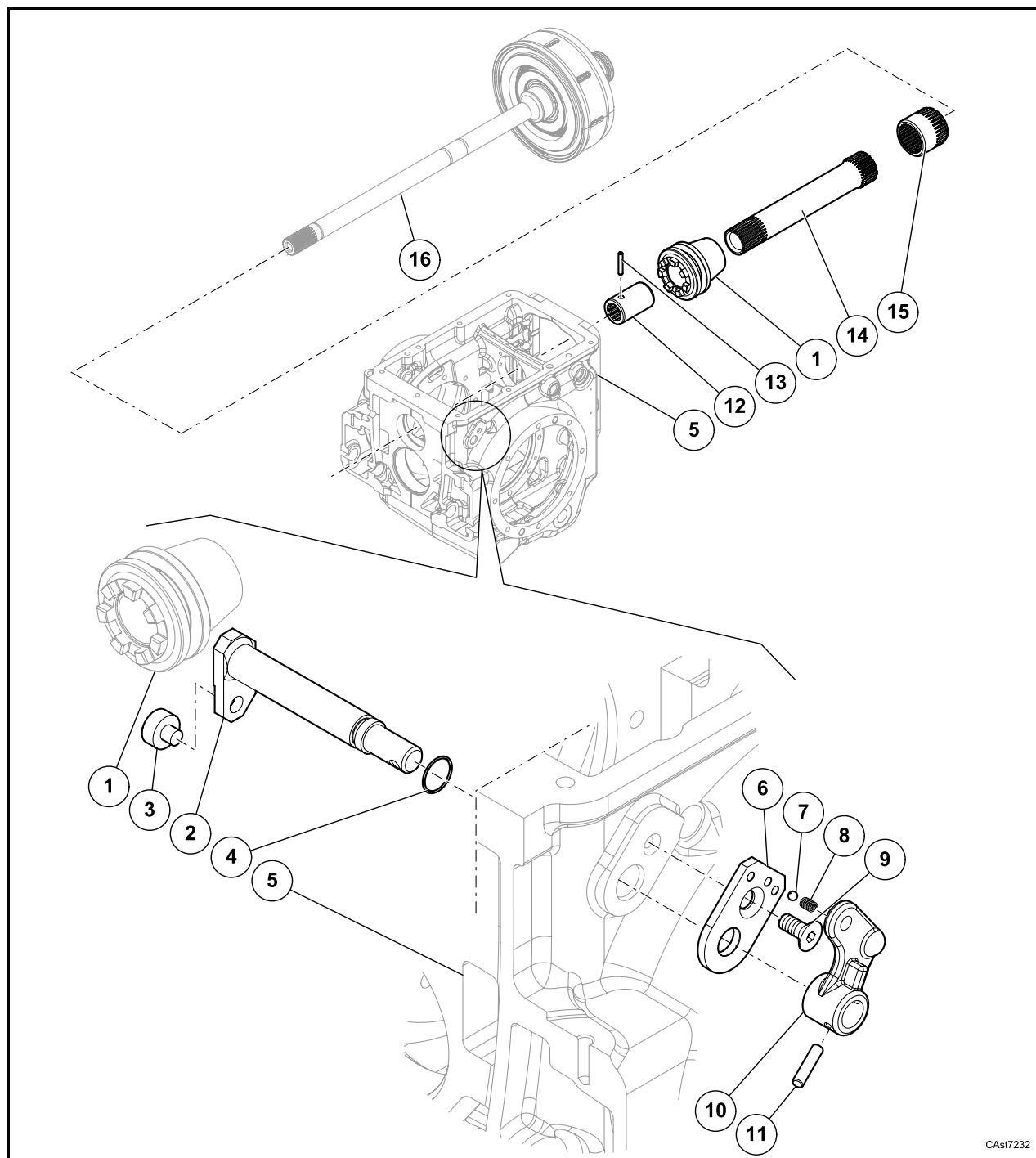
12.



Assemble PTO brake piston (15).

# Disassembly and Assembly Operations

## GROUND DRIVE PTO



|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models | Not available             | optional                    | optional                                            | optional                                          | optional                  | optional                                          |

# Disassembly and Assembly Operations

---

## Disassembly

1. Disassemble pin (11).
2. Remove GD PTO control lever (10).
3. Remove spring (8) and ball (7).
4. Remove screw (9) and GD PTO selection plate (6).
5. Remove coupling sleeve (15).
6. Remove GD PTO shaft (14).
7. Remove GD PTO coupling sleeve (1).
8. Remove pin (13) and sleeve (12).
9. Remove lever (2) from gear box (5).
10. Remove O-Ring (4) from lever (2).

## Assembly

1. Assemble O-Ring (4) on lever (2).
2. Assemble lever (2) on gear box (5).

[Refer to: figure 1.](#)

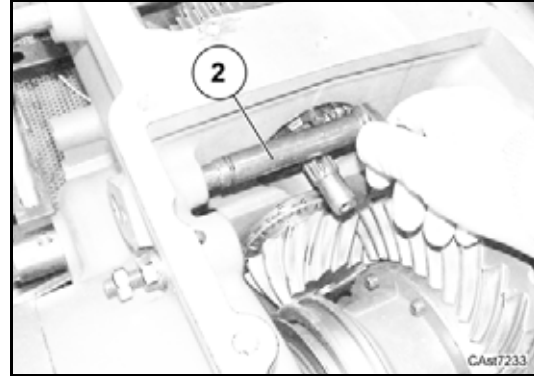


Figure 1

3. Assemble sleeve (12) on PTO shaft.  
Fasten sleeve (12) with pin (13).  
Assemble GD PTO coupling sleeve (1).  
Assemble GD PTO shaft (14).  
Assemble coupling sleeve (15).

[Refer to: figure 2.](#)

# Disassembly and Assembly Operations

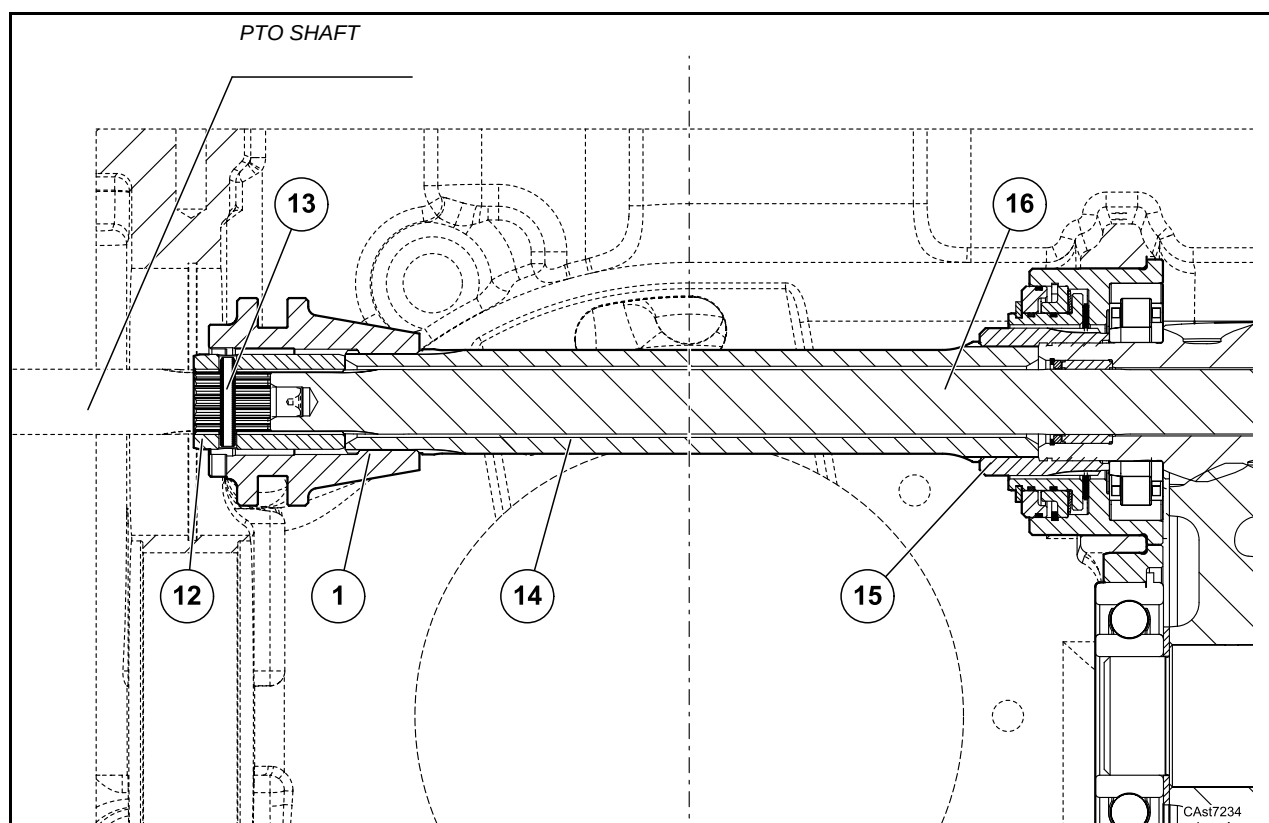


Figure 2

4. Assemble GD PTO selection plate (6).  
Tighten screw (9) to prescribed torque.

[Refer to: section C.4 and figure 3.](#)

5. Grease hole shown in figure and position ball (7).

[Refer to: figure 4.](#)

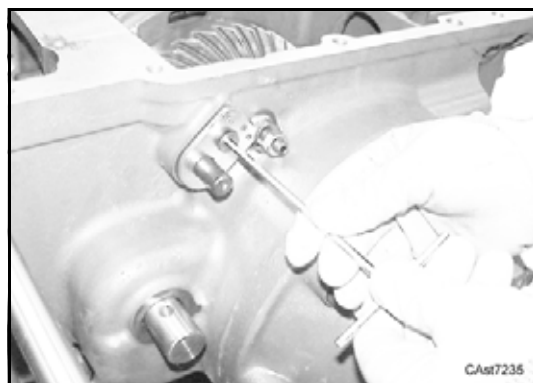


Figure 3

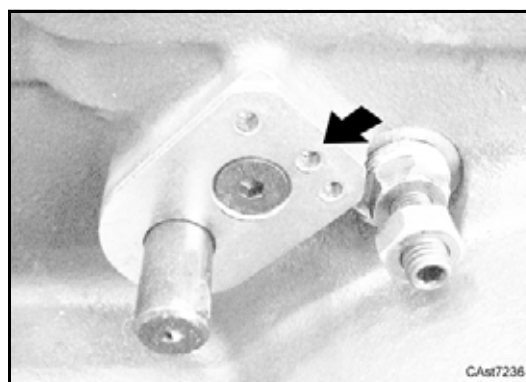


Figure 4

6. Insert spring (8) into the GD PTO control lever (10).

[Refer to: figure 5.](#)

7. Assemble pin (11).

[Refer to: figure 6.](#)

## Disassembly and Assembly Operations

---



Figure 5

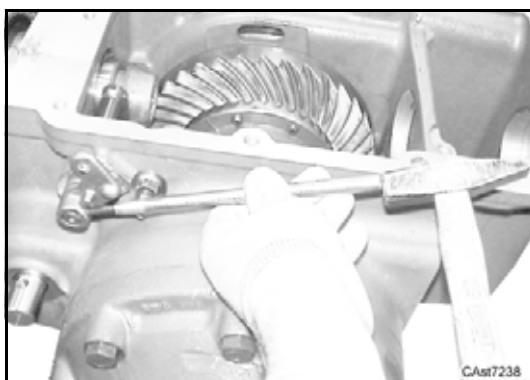


Figure 6

**NOTE:** Correct assembly of GD PTO control lever (10).

Refer to: [figure 7 and 8](#).

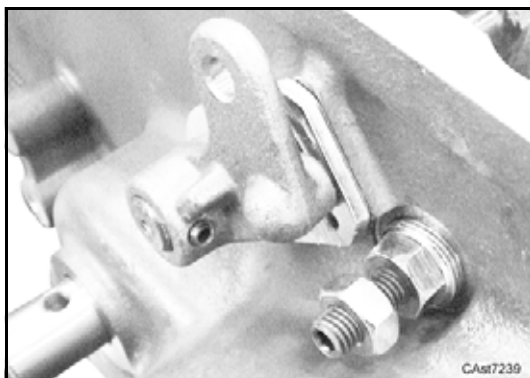


Figure 7

## Disassembly and Assembly Operations

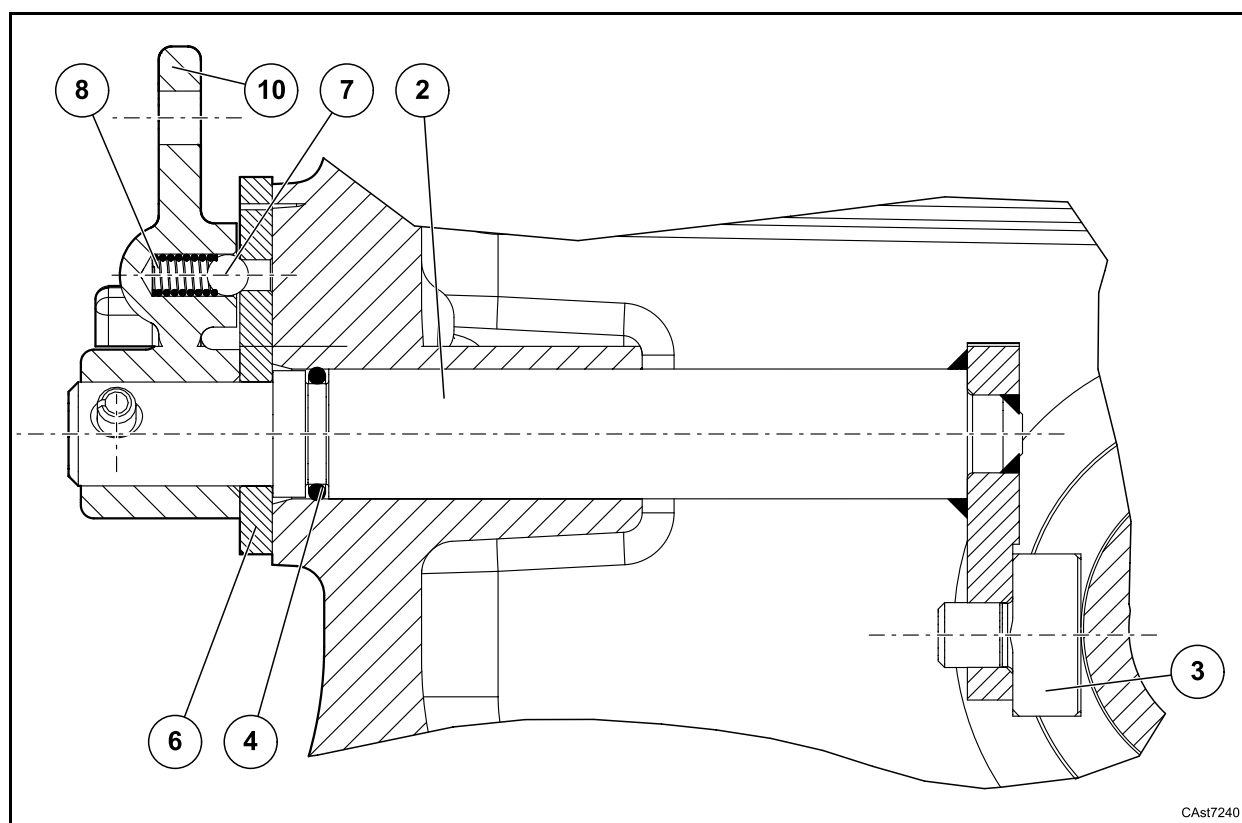


Figure 8

8. GD PTO operation:  
by shifting lever in the shown direction (15°) you switch over to GD PTO operation.

**NOTE:** Hole on plate (6) and shown in the figure is not used.

Refer to: [figure 9 and 10](#).

## Disassembly and Assembly Operations

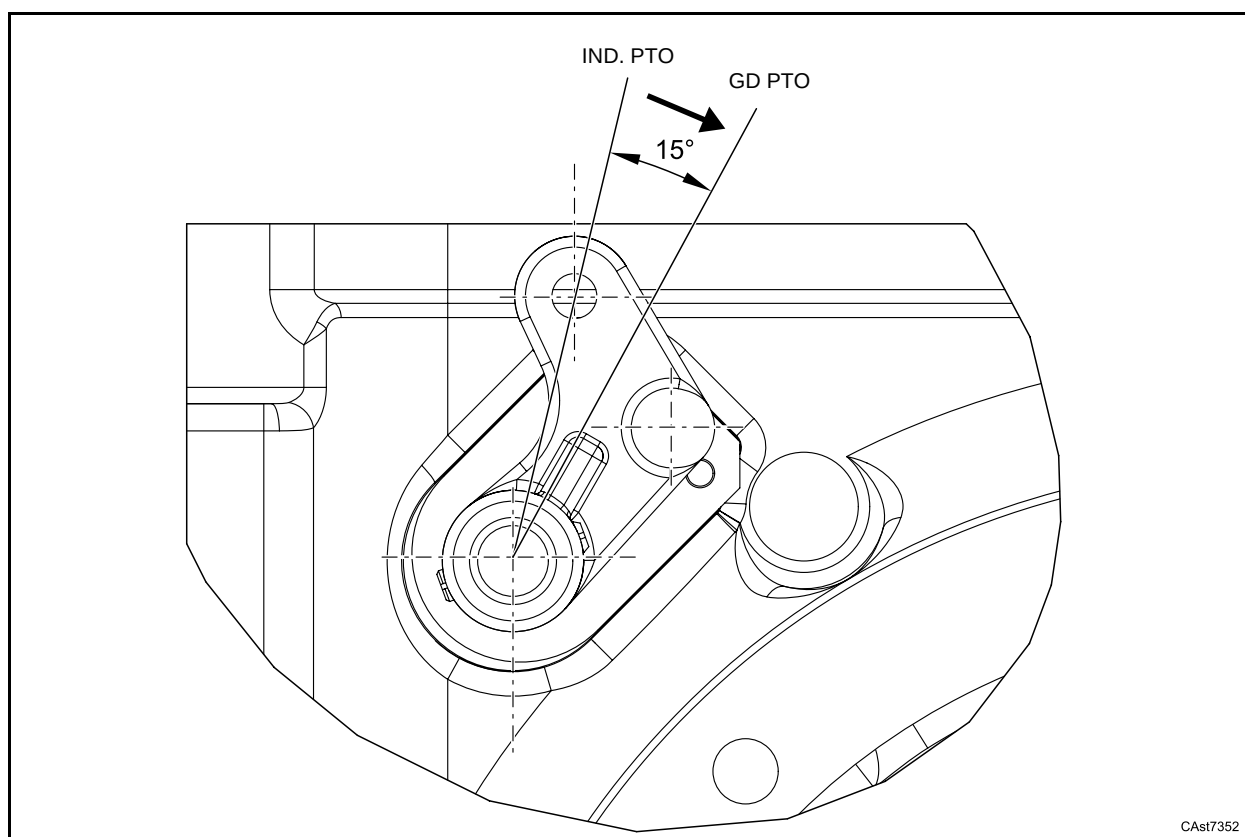


Figure 9

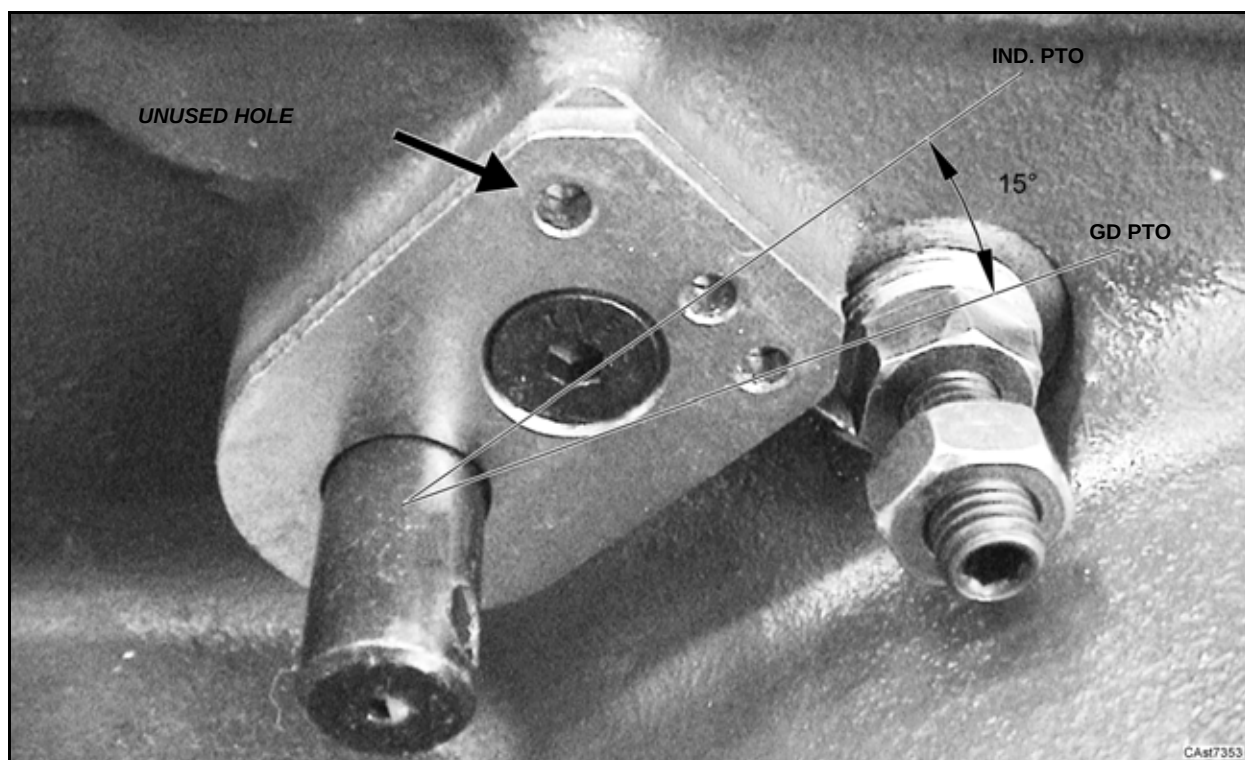
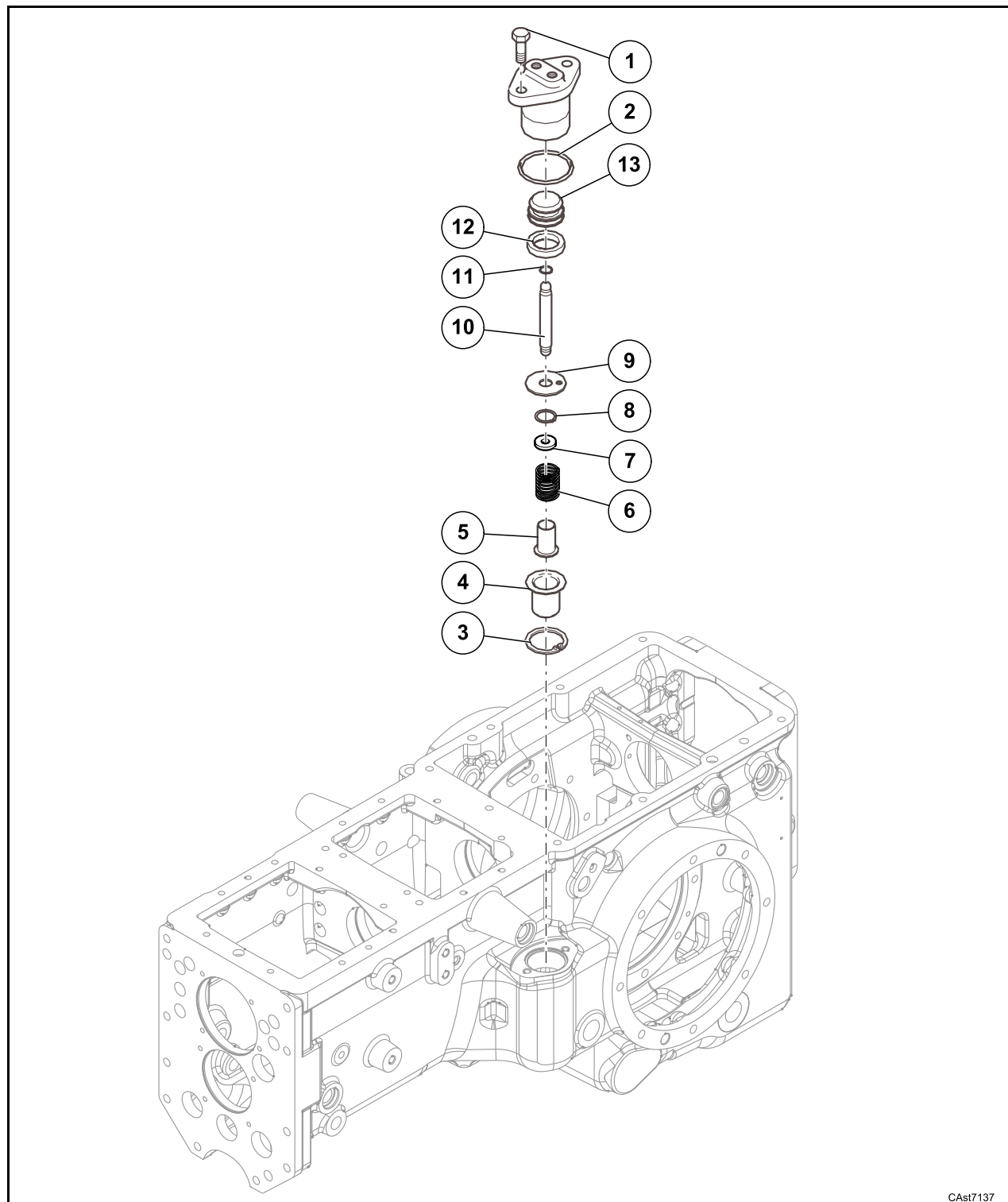


Figure 10



# Disassembly and Assembly Operations

## SLAVE CYLINDER



CAst7137

**8+8  
synchro  
shuttle**

**12+12  
synchro  
shuttle**

**24+24  
synchro shuttle  
and synchro  
splitter**

**24+24  
synchro shuttle  
and power  
splitter**

**12+12  
power  
shuttle**

**24+24  
power shuttle  
and synchro  
splitter**

For models

|

|

|

|

|

|

# Disassembly and Assembly Operations

## Disassembly

Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

1.



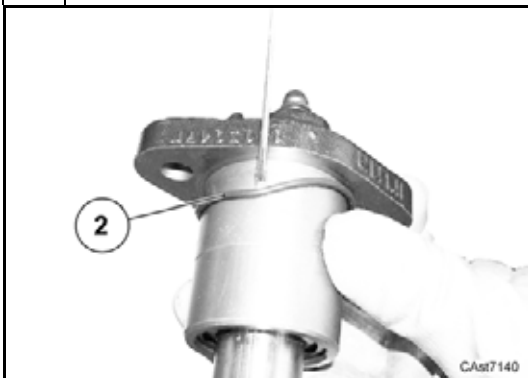
Unscrew fastening screws (1) of actuator.

2.



Remove actuator.

3.



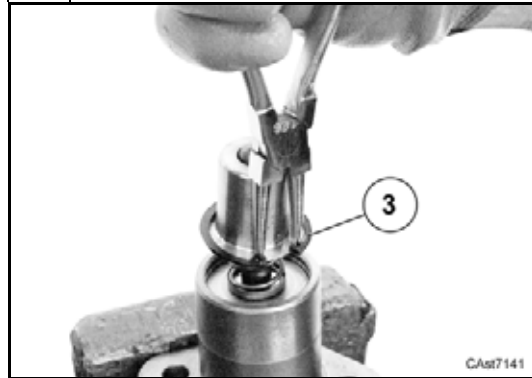
Remove O-Ring (2).

4.



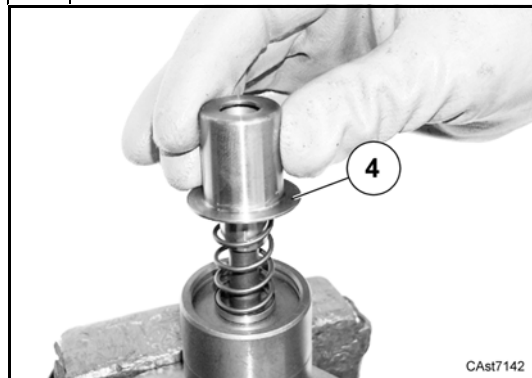
Position actuator in the vice.

5.



Remove snap ring (3).

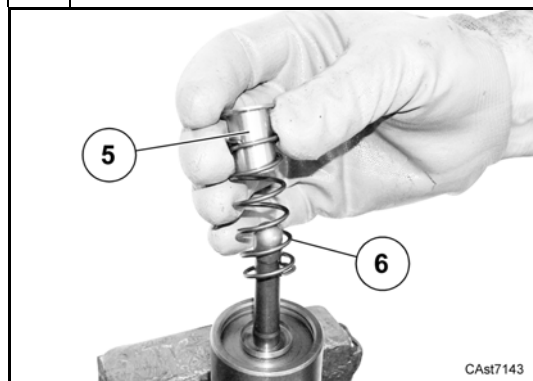
6.



Remove cover (4).

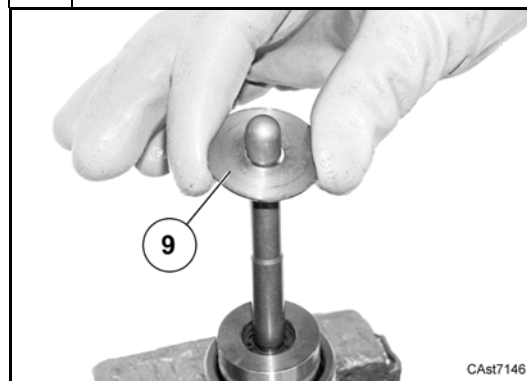
## Disassembly and Assembly Operations

7.



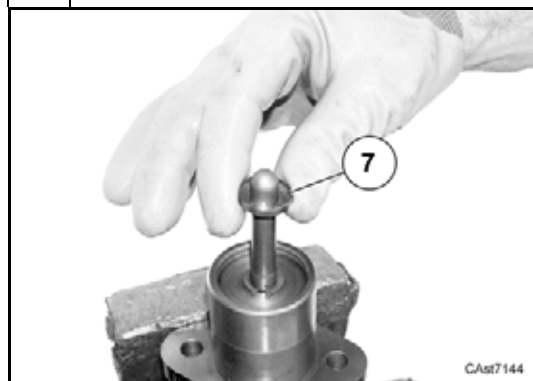
Remove bush (5) and spring (6).

10.



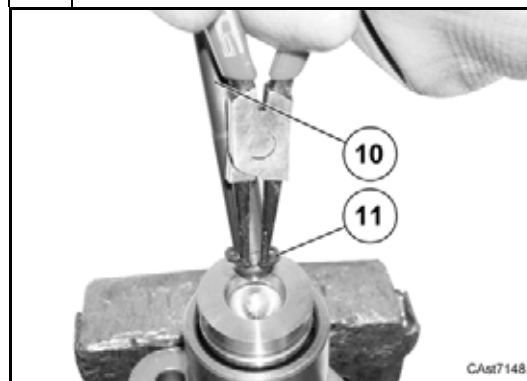
Remove spacer (9).

8.



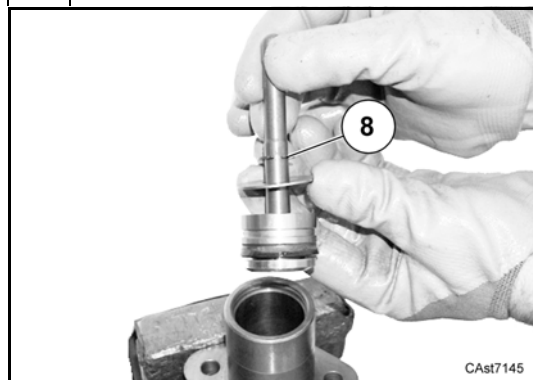
Remove spring screen (7).

11.



Remove snap ring (11) and brake pin (10).

9.



Remove piston assy and snap ring (8).

12.

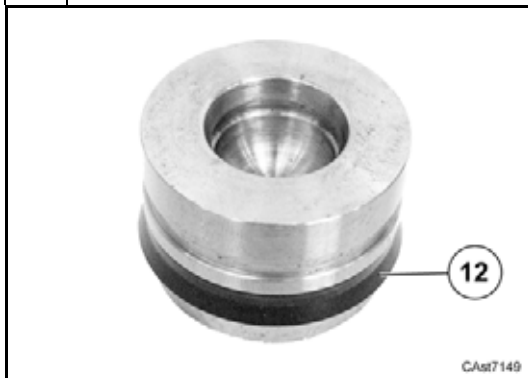


Remove seal (12) from piston (13).

# Disassembly and Assembly Operations

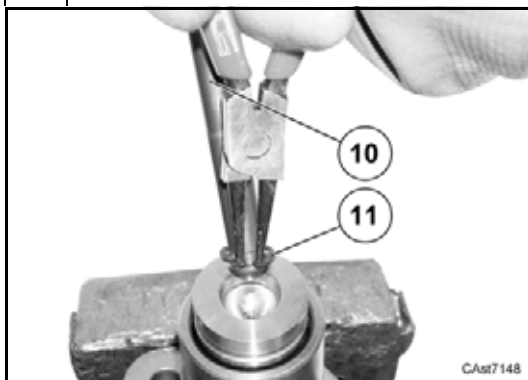
## Actuator assembly

1.



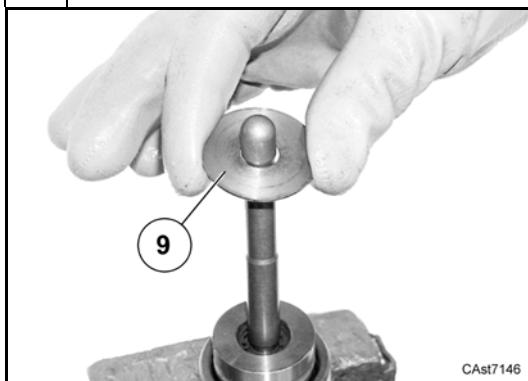
Assemble gasket (12) on piston (13).

2.



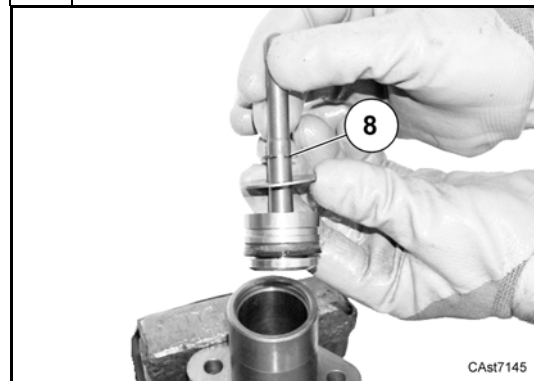
Assemble brake pin (10) and snap ring (11).

3.



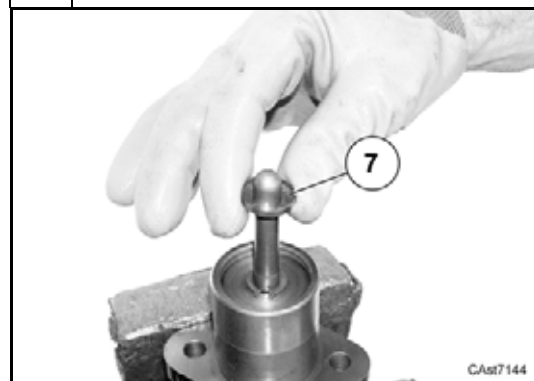
Assemble spacer (9).

4.



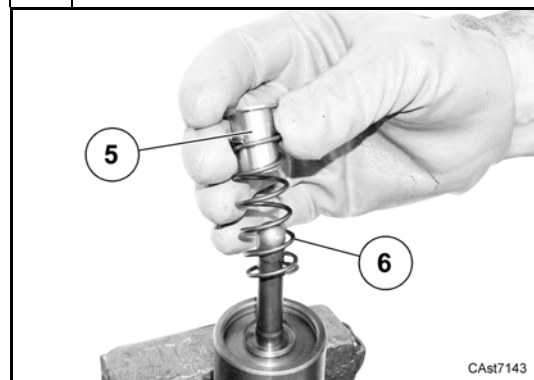
Assemble snap ring (8) and piston assy on the brake support.

5.



Assemble spring screen (7).

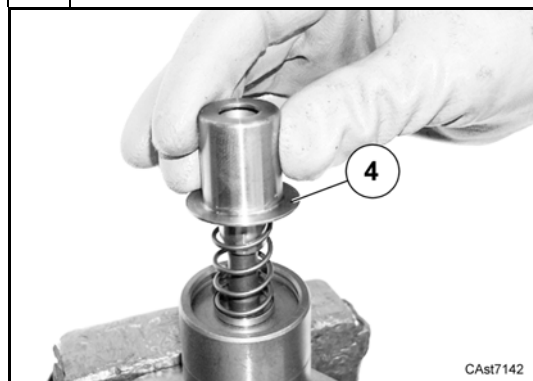
6.



Assemble spring (6) and bush (5).

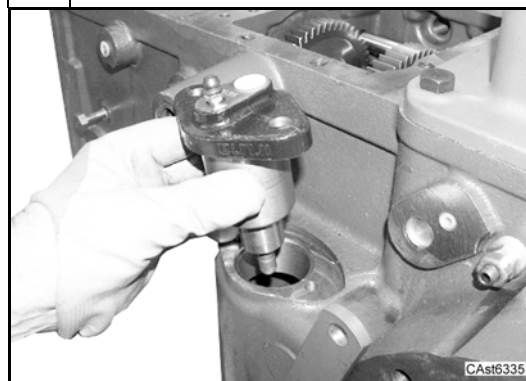
## Disassembly and Assembly Operations

7.



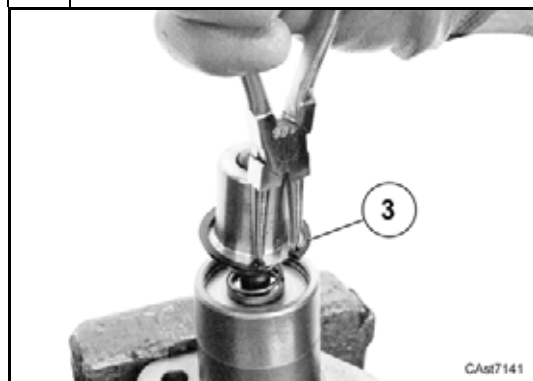
Assemble cover (4).

10.



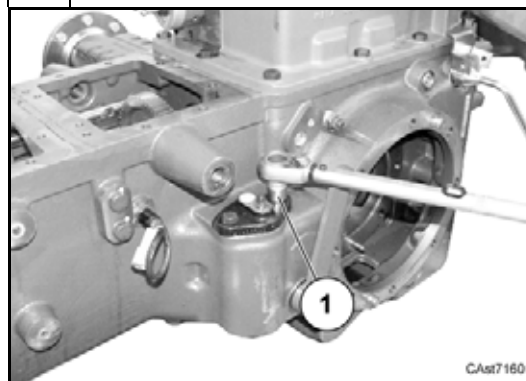
Insert actuator in its seat.

8.



Assemble snap ring (3).

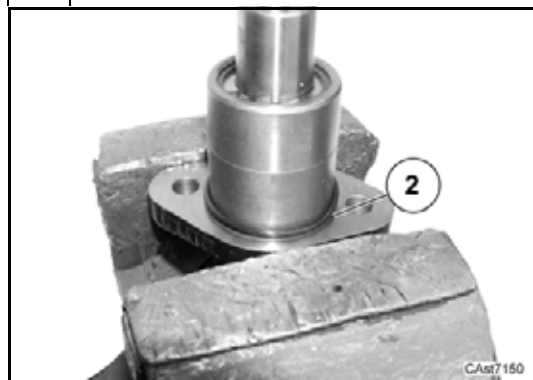
11.



Tighten two fastening screws (1) of actuator to the prescribed torque.

[Refer to: section C.4.](#)

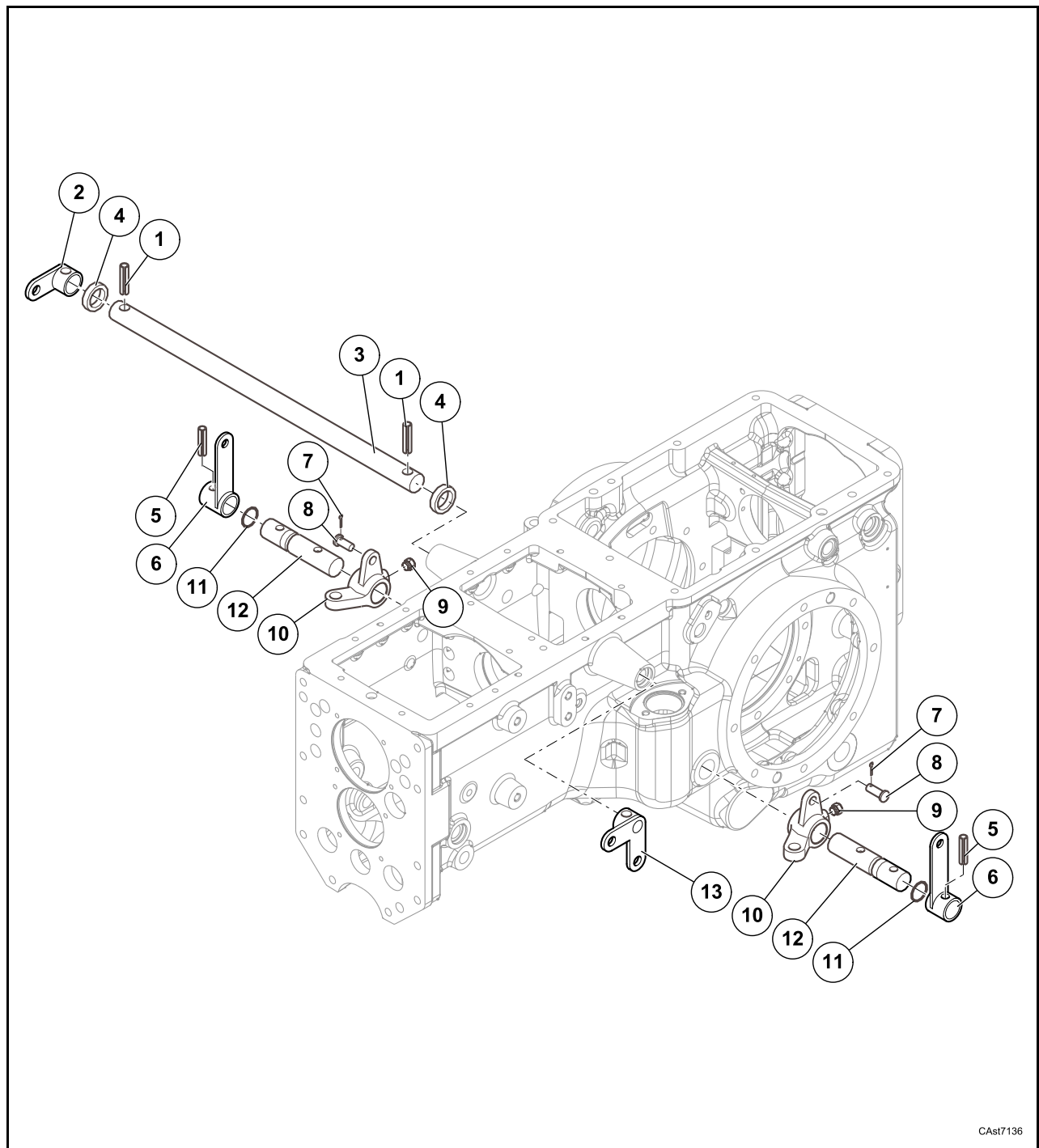
9.



Assemble O-Ring (2).

# Disassembly and Assembly Operations

## PARKING BRAKE



|            |                           |                             |                                                     |                                                   |                           |                                                   |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
| For models |                           |                             |                                                     |                                                   |                           |                                                   |

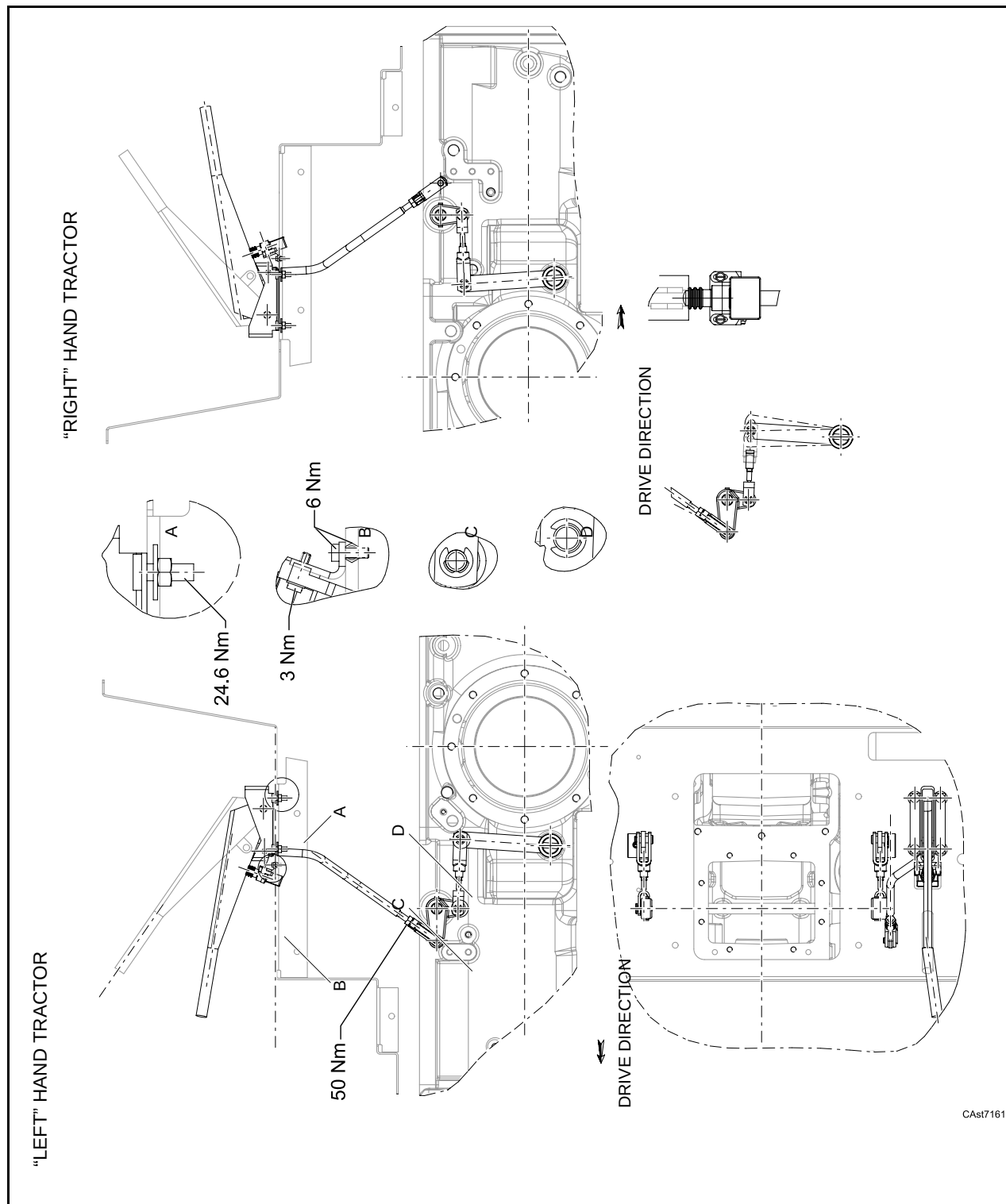
# Disassembly and Assembly Operations

## Disassembly

Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

1.

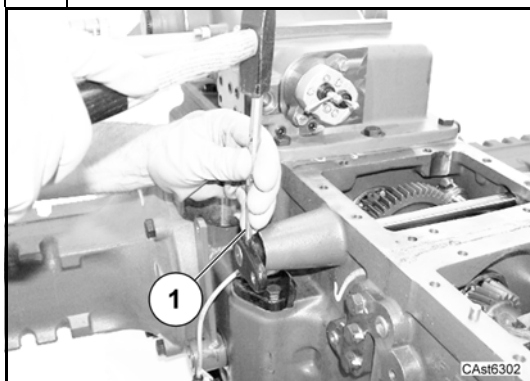
Remove levers and tie-rods of parking brake.





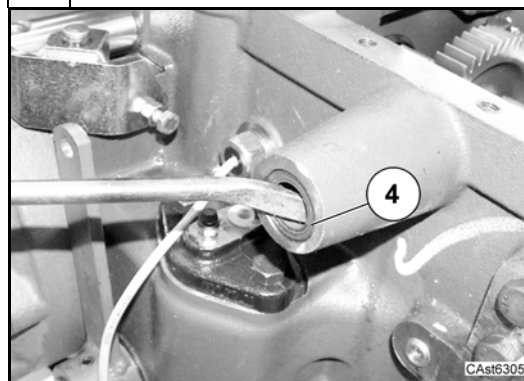
# Disassembly and Assembly Operations

2.



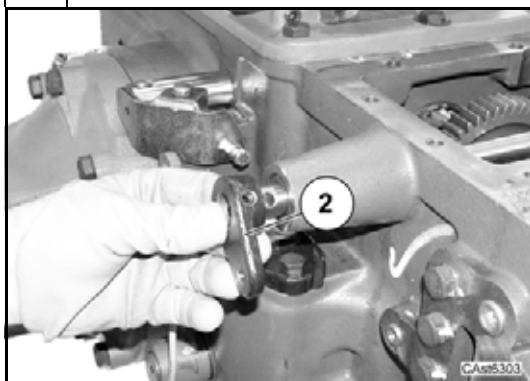
Remove pin (1).

5.



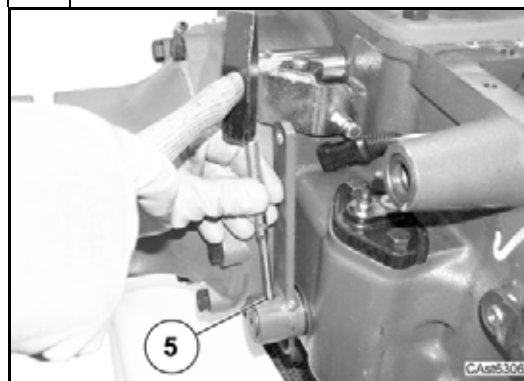
Remove seal (4).

3.



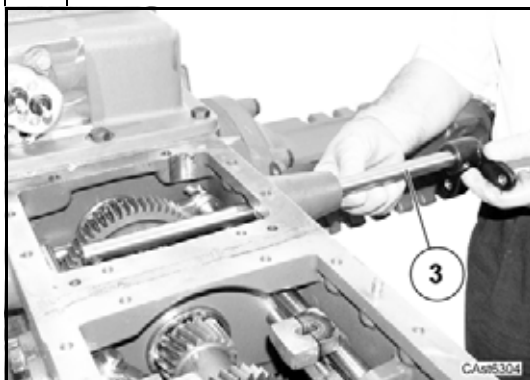
Remove lever (2).

6.



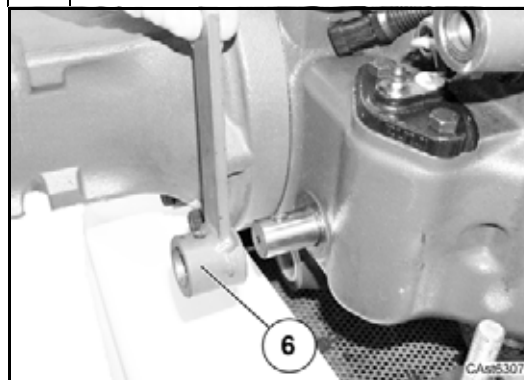
Remove pin (5).

4.



Slide out rod (3).

7.



Slide out lever (6).

Remove slave cylinder.

[Refer to: section D.19.](#)

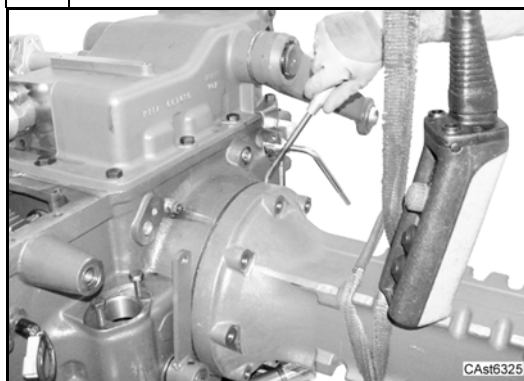
# Disassembly and Assembly Operations

8.



Unscrew fastening screws of final drive.

11.



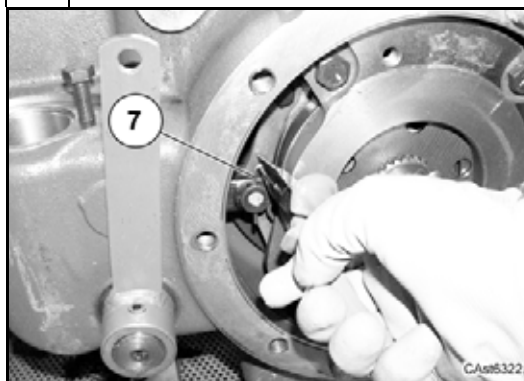
Pry off to take out the final drive.

9.



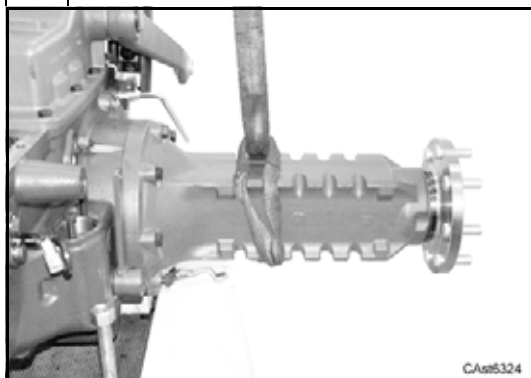
Balance transmission.

12.



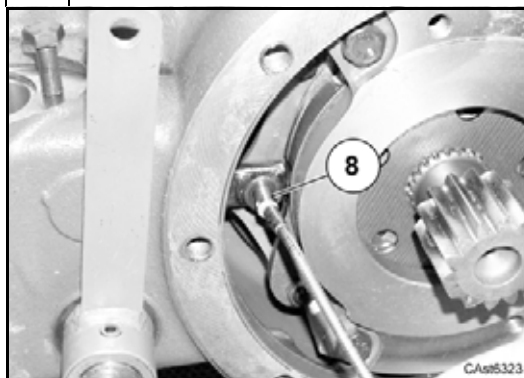
Remove split pin (7).

10.



Secure with a rope the final drive.

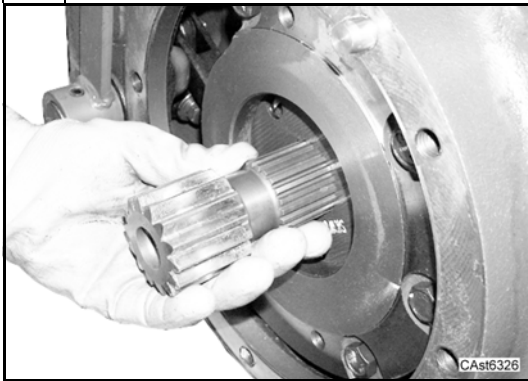
13.



Remove pin (8) by means of a magnet.

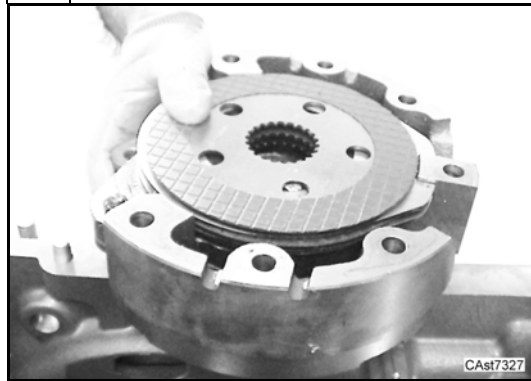
# Disassembly and Assembly Operations

14.



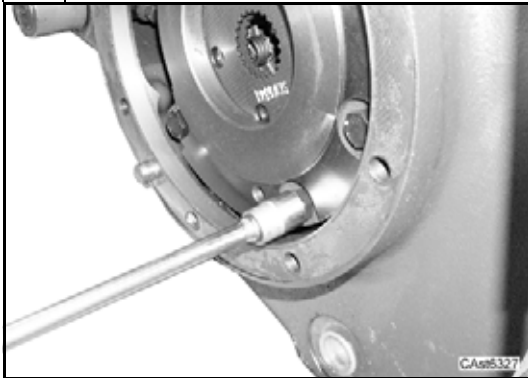
Slide out final drive axle beam.

17.



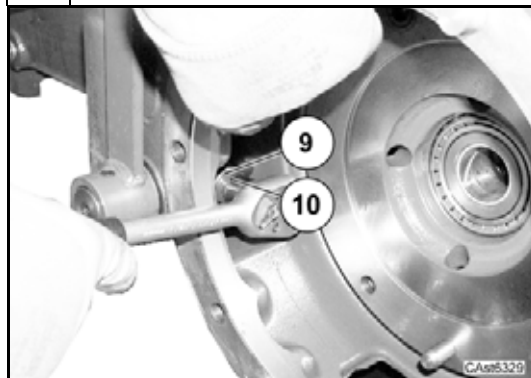
**NOTE:** Brake assy remove.

15.



Unscrew fastening screws of differential brake block.

18.



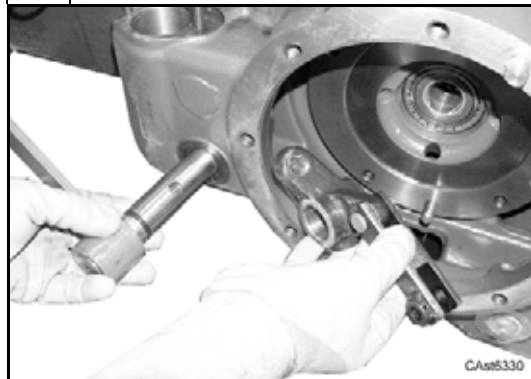
Remove screw (9) locking brake lever (10).

16.



Use two of screws just assembled to remove brake assy.

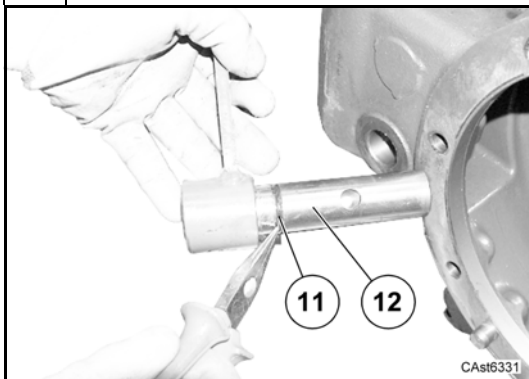
19.



Remove levers assy.

# Disassembly and Assembly Operations

20.

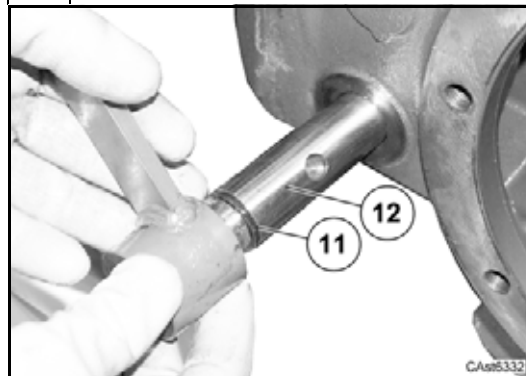


Remove O-Ring (11) from brakes control pin (12).

## Assembly

Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

1.



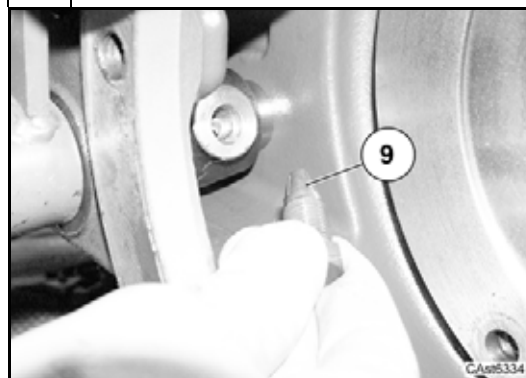
Assemble O-Ring (11) and insert brakes control pin (12).

2.



Assemble levers assy.

3.

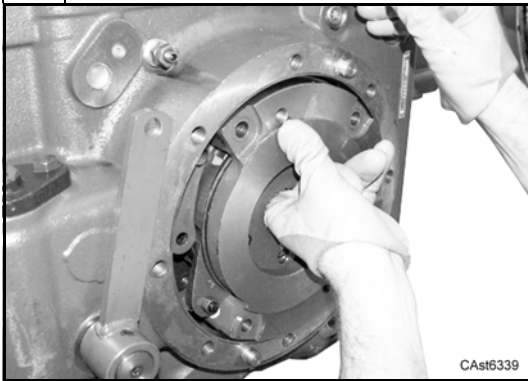


Tighten screw (9) locking brake lever.



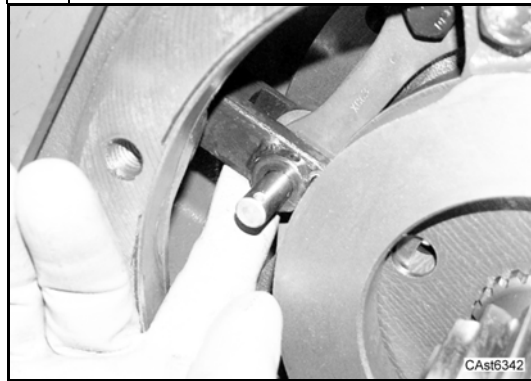
# Disassembly and Assembly Operations

4.



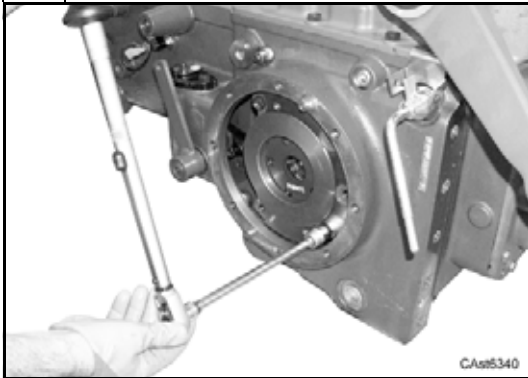
Insert brake assy.

7.



Insert pin (8) on the brake levers.

5.



Tighten two fastening screws of differential brake block to the requested torque.

[Refer to: section C.4.](#)

8.



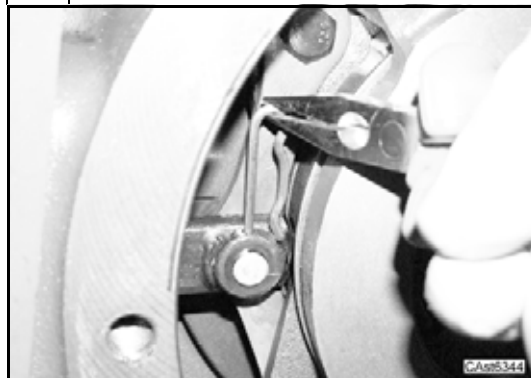
Insert sun drive shaft.

6.



Once brake has been placed to stroke end, check that brake discs are released.

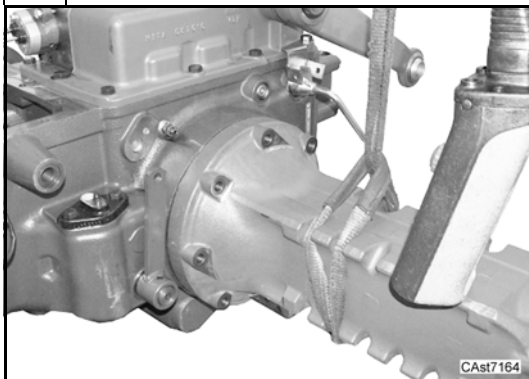
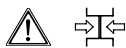
9.



Insert split pin (7) with open side in proper seat.

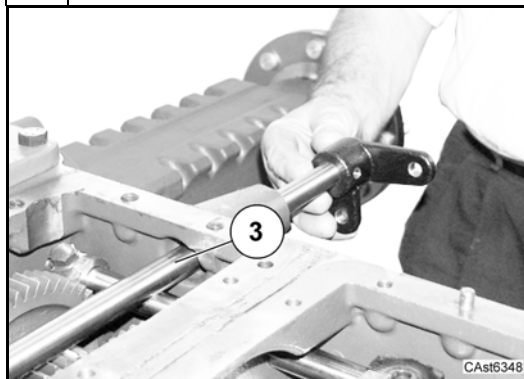
# Disassembly and Assembly Operations

10.



Assemble final drive.

13.



Insert rod (3).

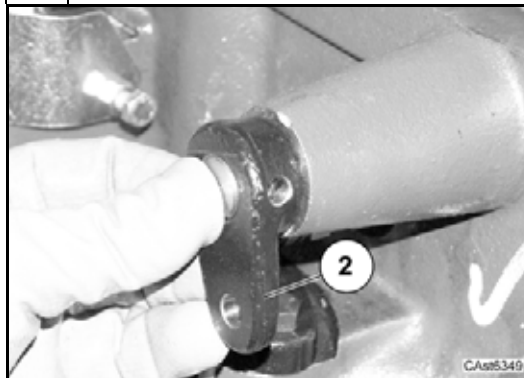
11.



Tighten fastening screws of final drive to the requested torque.

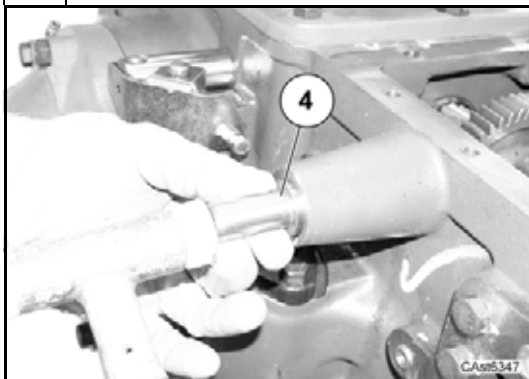
Refer to: [section C.4.](#)

14.



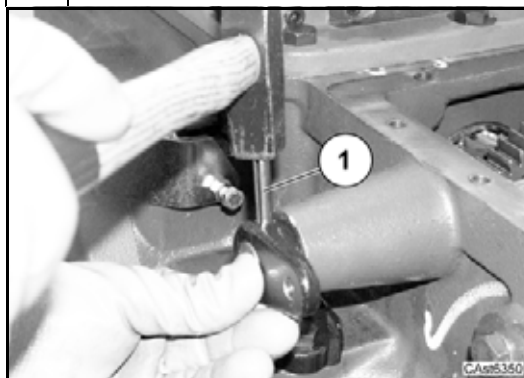
Assemble brake tie rod lever (2).

12.



Insert seals (4) with suitable tool.

15.

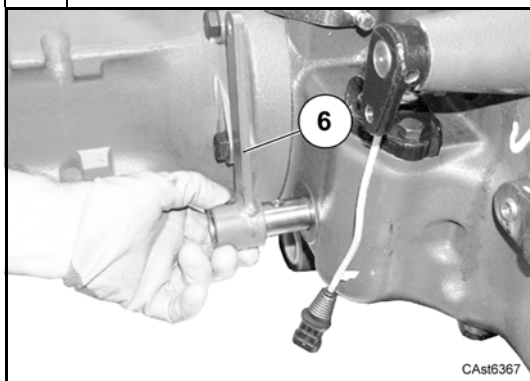


Assemble pin (1).

## Disassembly and Assembly Operations

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16.

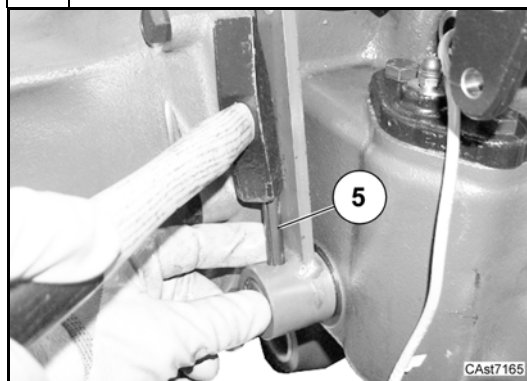


Assemble slave cylinder.

Insert brake pin lever (6).

[Refer to: section D.19](#)

17.

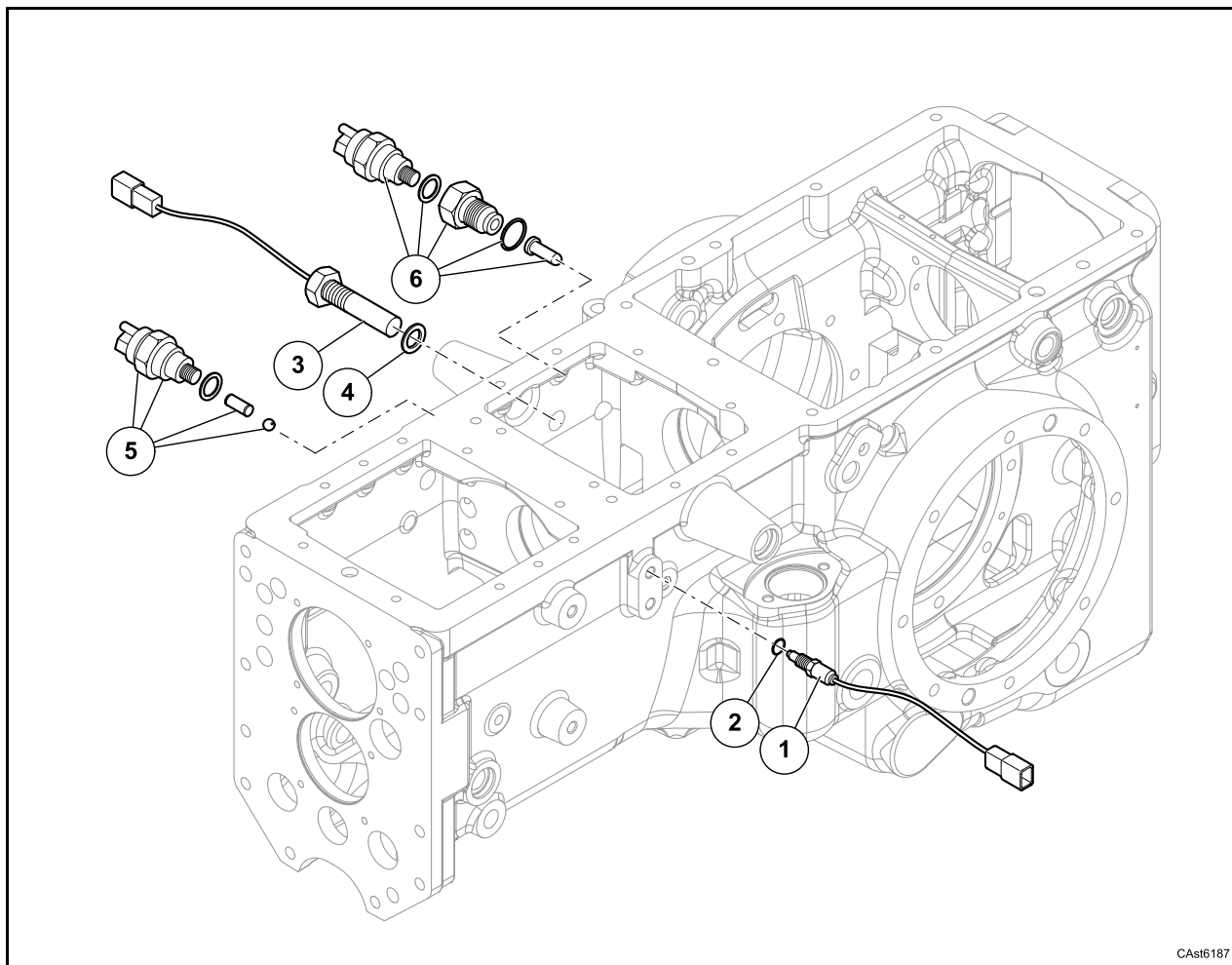


Insert spring pin (5).



# Disassembly and Assembly Operations

## HOUSING SENSORS ASSY



CAst6187

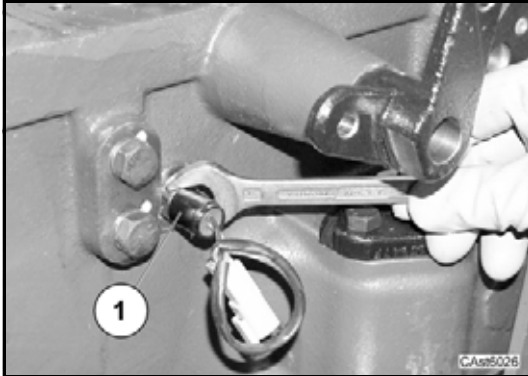
|                                    | <b>8+8<br/>synchro<br/>shuttle</b> | <b>12+12<br/>synchro<br/>shuttle</b> | <b>24+24<br/>synchro shuttle<br/>and synchro<br/>splitter</b> | <b>24+24<br/>synchro shuttle<br/>and power<br/>splitter</b> | <b>12+12<br/>power<br/>shuttle</b> | <b>24+24<br/>power shuttle<br/>and synchro<br/>splitter</b> |
|------------------------------------|------------------------------------|--------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------|------------------------------------|-------------------------------------------------------------|
| Range switch (1)                   | -                                  | -                                    | -                                                             | -                                                           | standard                           | standard                                                    |
| Speed sensor (3)                   | not available                      | optional                             | optional                                                      | optional                                                    | standard                           | standard                                                    |
| Engine neutral start<br>switch (5) | standard                           | standard                             | standard                                                      | standard                                                    | -                                  | -                                                           |
| Engine neutral start<br>switch (6) | -                                  | -                                    | -                                                             | -                                                           | standard                           | standard                                                    |

# Disassembly and Assembly Operations

## Disassembly

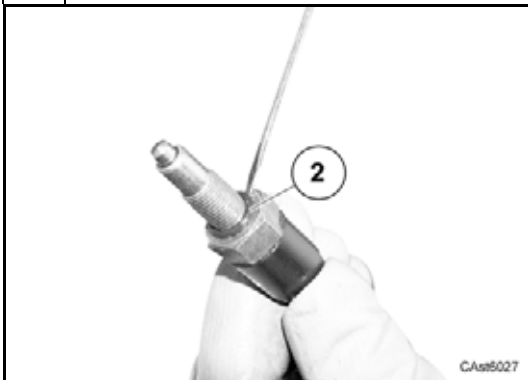
Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

1.



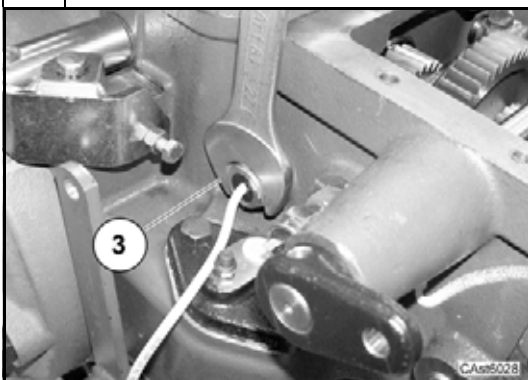
Remove range switch (1).

2.



Remove O-Ring (2).

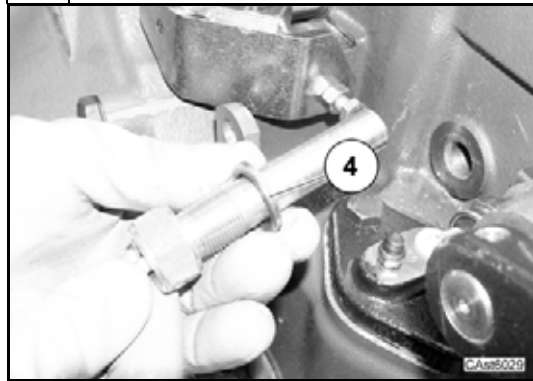
3.



Disassemble speed sensor (3).

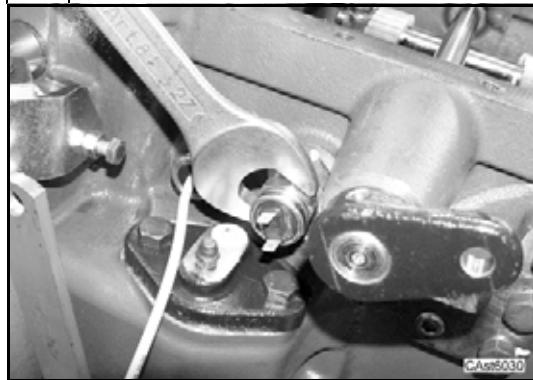
**NOTE:** If not installed a plug tightened at 30 Nm is provided.

4.



Remove washer (4).

5.



Remove engine neutral start switch from the box.

6.

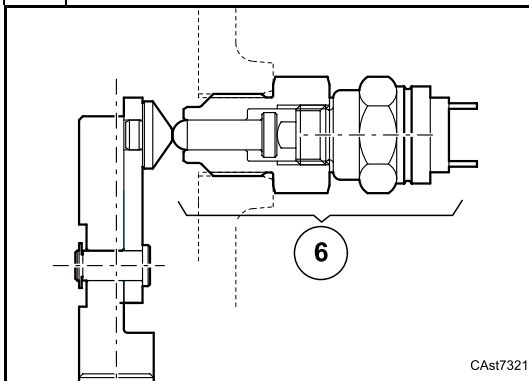


Remove and check condition of all engine neutral start switch components.

**NOTE:** Version installed in power shuttle models.

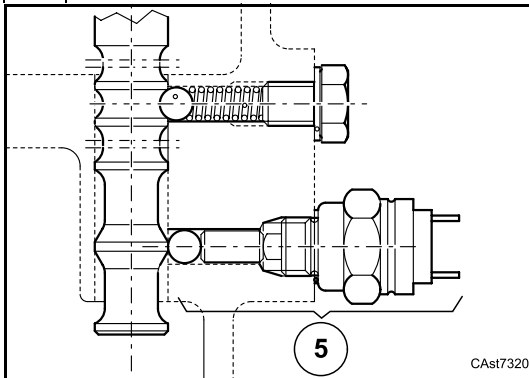
# Disassembly and Assembly Operations

7.



**NOTE:** Neutral start switch sensor details (Power shuttle models).

8.

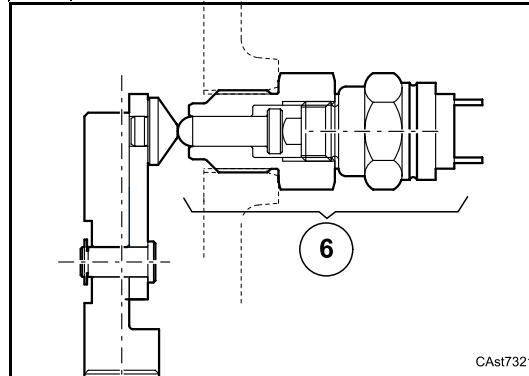


**NOTE:** "Start enable" sensor details (Synchro shuttle models).

## Assembly

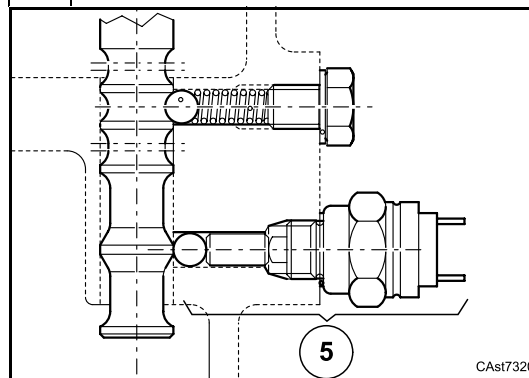
Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

1.



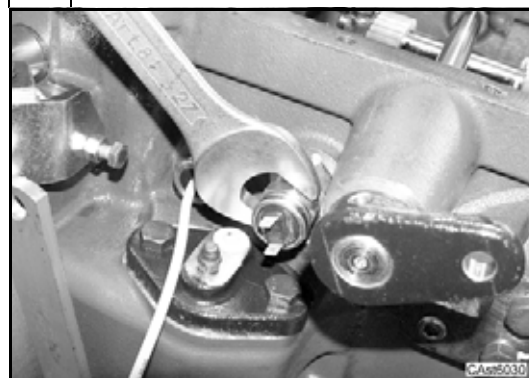
Assemble engine neutral start switch (6) (Power shuttle models).

2.



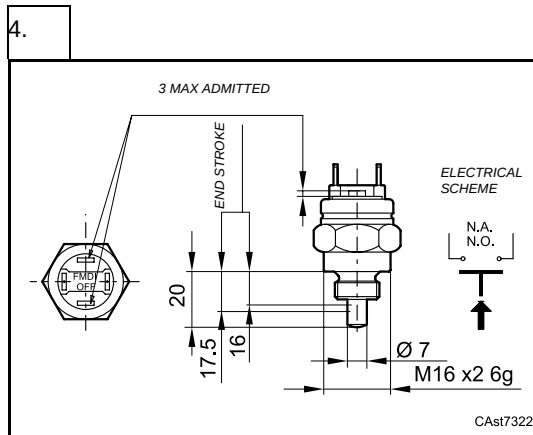
Assemble engine neutral start switch (5) (Synchro shuttle models).

3.

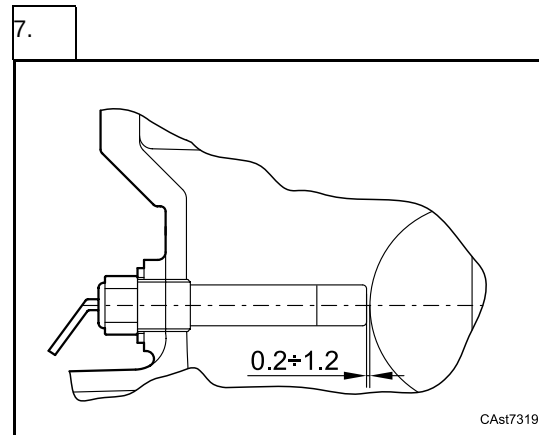


Assemble engine neutral start on the transmission box.

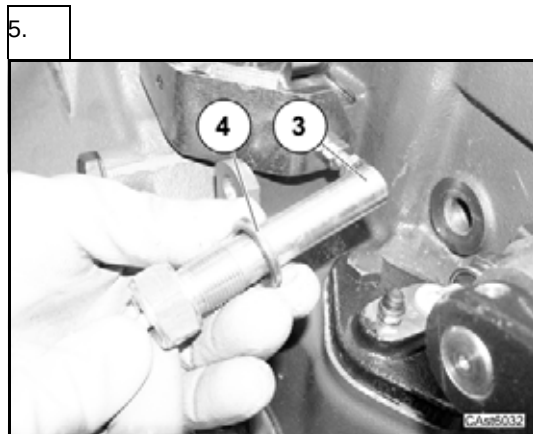
# Disassembly and Assembly Operations



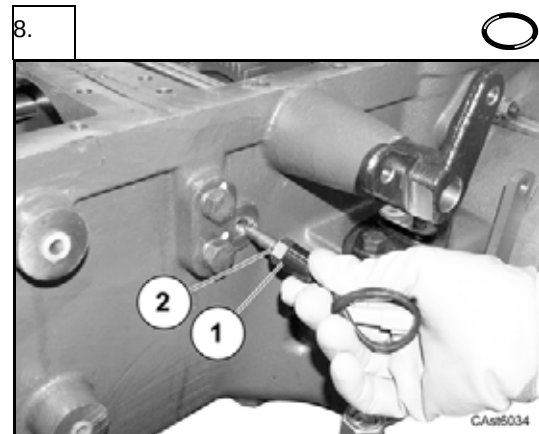
**NOTE:** "Engine neutral start switch technical features.



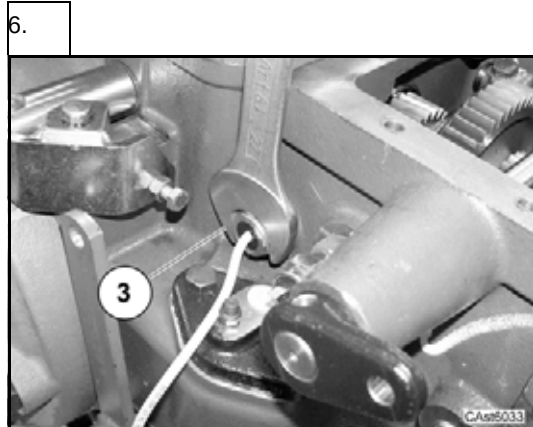
**NOTE:** Correct positioning of speed sensor.



Assemble washer (4) on the speed sensor (3).



Assemble O-Ring (2) on the range switch (1) and fasten it to the box.

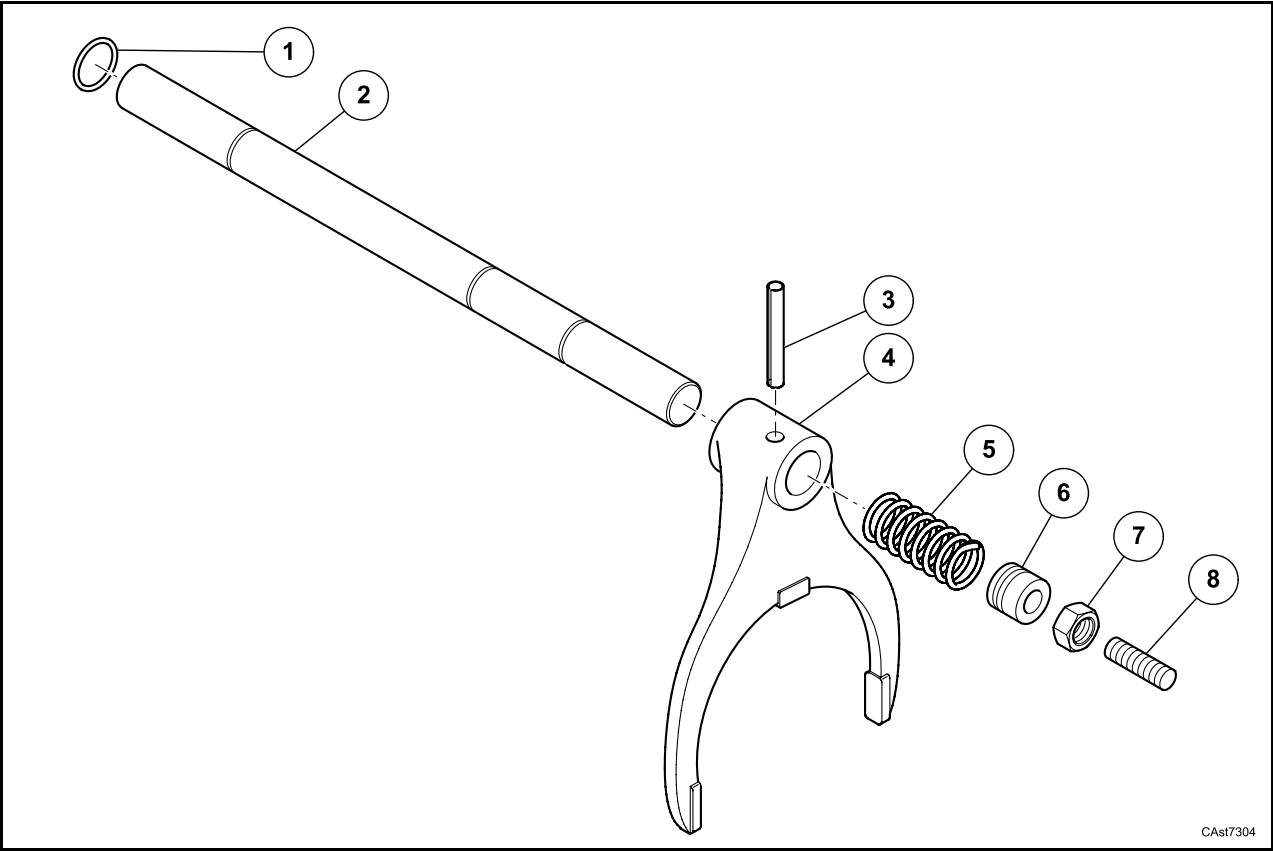


Assemble revolutions sensor (3) on the transmission box.

**NOTE:** if not installed a plug tightened at 30 Nm is provided.

# Disassembly and Assembly Operations

## DIFFERENTIAL LOCKING CONTROL



|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models |                           |                             |                                                     |                                                   |                           |                                                   |

### Disassembly

1. Remove rockshafts. Remove nut (7) and dowel (8).
2. Do not remove plug (6).
3. Remove pin (3).
4. Pull out pin (2) and remove spring (5).
5. Remove fork (4) from differential housing sleeve.
6. Remove O-Ring (9) from pin (2).

### Assembly

1. Assemble plug (6) with prescribed sealant (only for first assembly).  
[Refer to: section C.4.](#)
2. Assemble dowel (8) and nut (7) on plug (6).  
[Refer to: figure 1.](#)
3. Assemble O-Ring (1) on pin (2).
4. Assemble fork (4) on differential housing sleeve.  
[Refer to: figure 2.](#)

# Disassembly and Assembly Operations

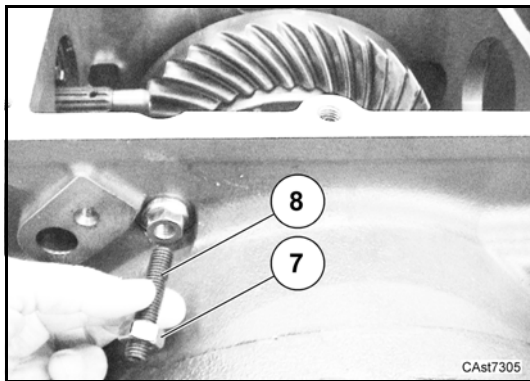


Figure 1

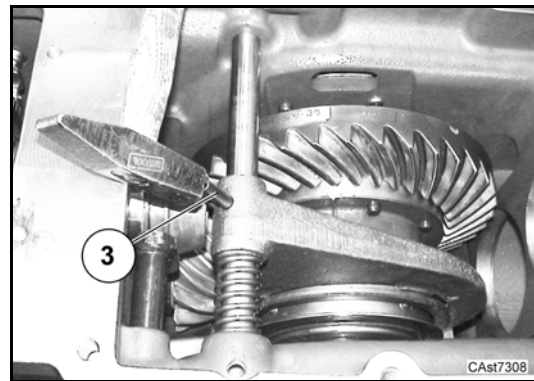


Figure 4

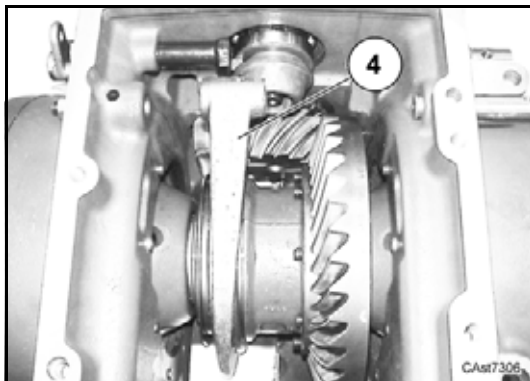


Figure 2

5. Position spring (5) on fork (4) and insert pin (2).

[Refer to: figure 3.](#)

6. Assemble pin (2) up to stroke end and assemble pin (3).

[Refer to: figure 4.](#)

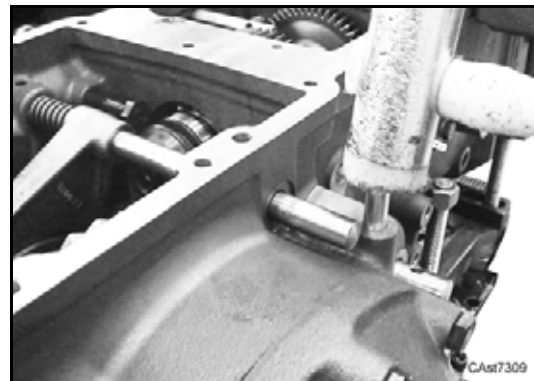


Figure 5

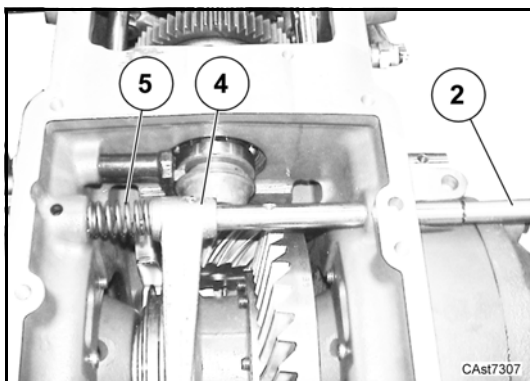


Figure 3

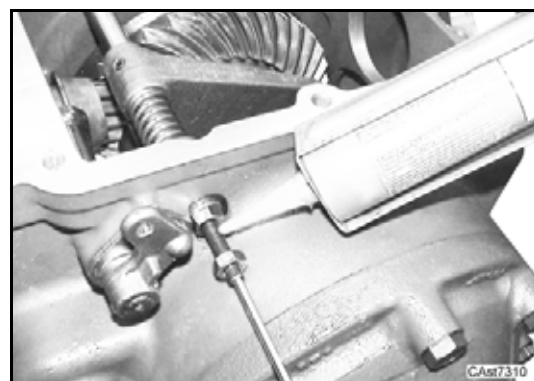


Figure 6

9. Adjust clutch position of fork as follows:

- with a screwdriver pry off pin. Shift pin (2) to the left and check with a thickness gauge the correct dimension of figure.

[Refer to: figure 7, 8 and 9.](#)



# Disassembly and Assembly Operations

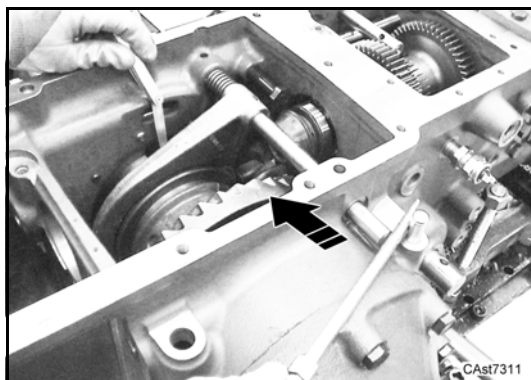


Figure 7

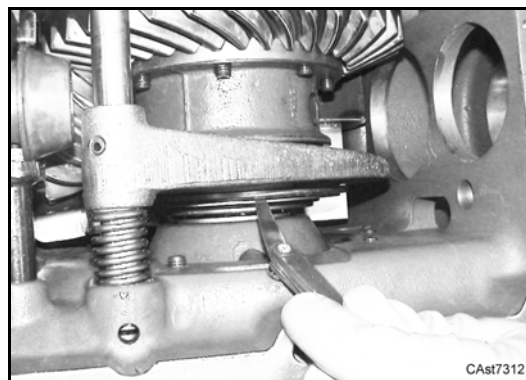


Figure 8

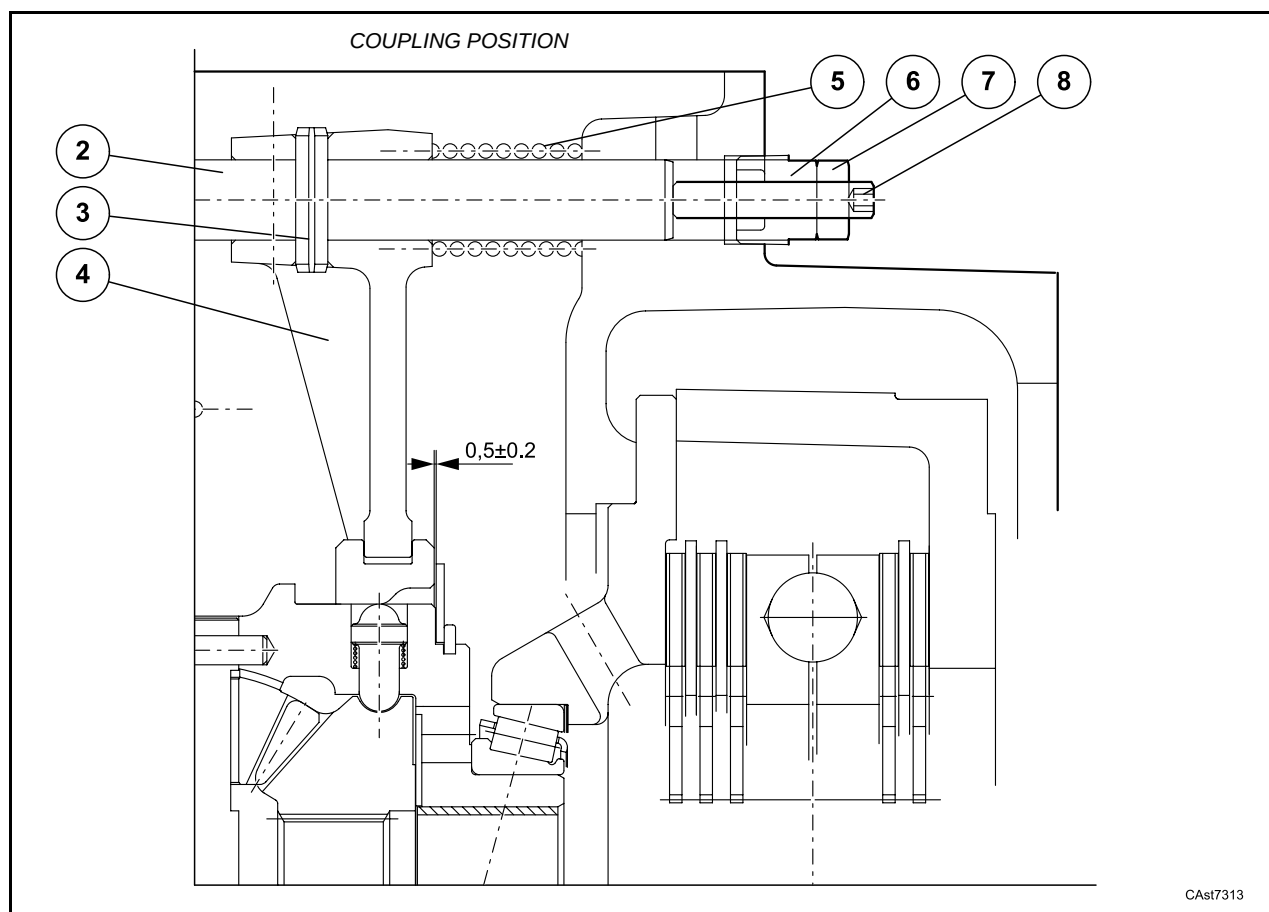


Figure 9

- if end float turns out bigger than 0.5 mm dowel (8) has to be unscrewed.
- if end float turns out smaller than 0.5 mm dowel (8) has to be tightened.

Refer to: figure 10.

- fasten nut (7) by keeping the dowel (8) locked.

Refer to: figure 11.



# Disassembly and Assembly Operations

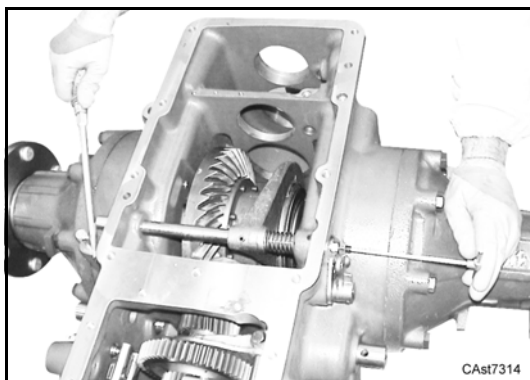


Figure 10

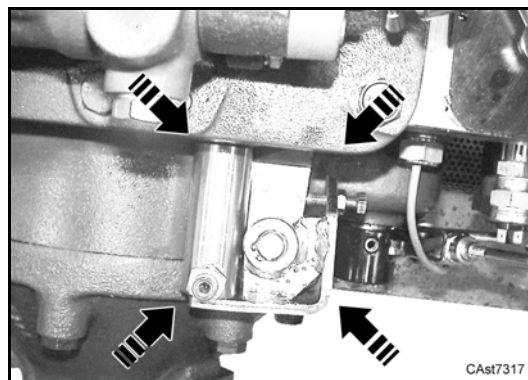


Figure 13

11. Assemble rockshaft.

**NOTE:** Stroke of fork (4).

Refer to: figure 14.



Figure 11

- recheck end float.

Refer to: figure 12.

10. Complete assembly with of the indicated components.

Refer to: figure 13.

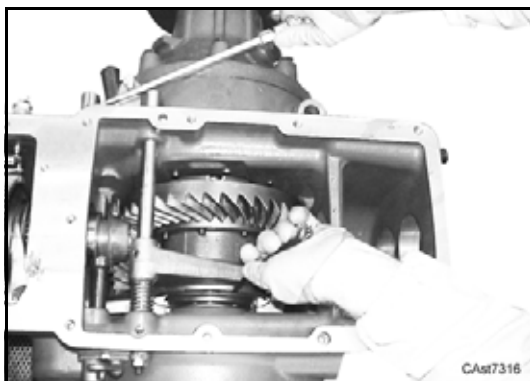


Figure 12

## Disassembly and Assembly Operations

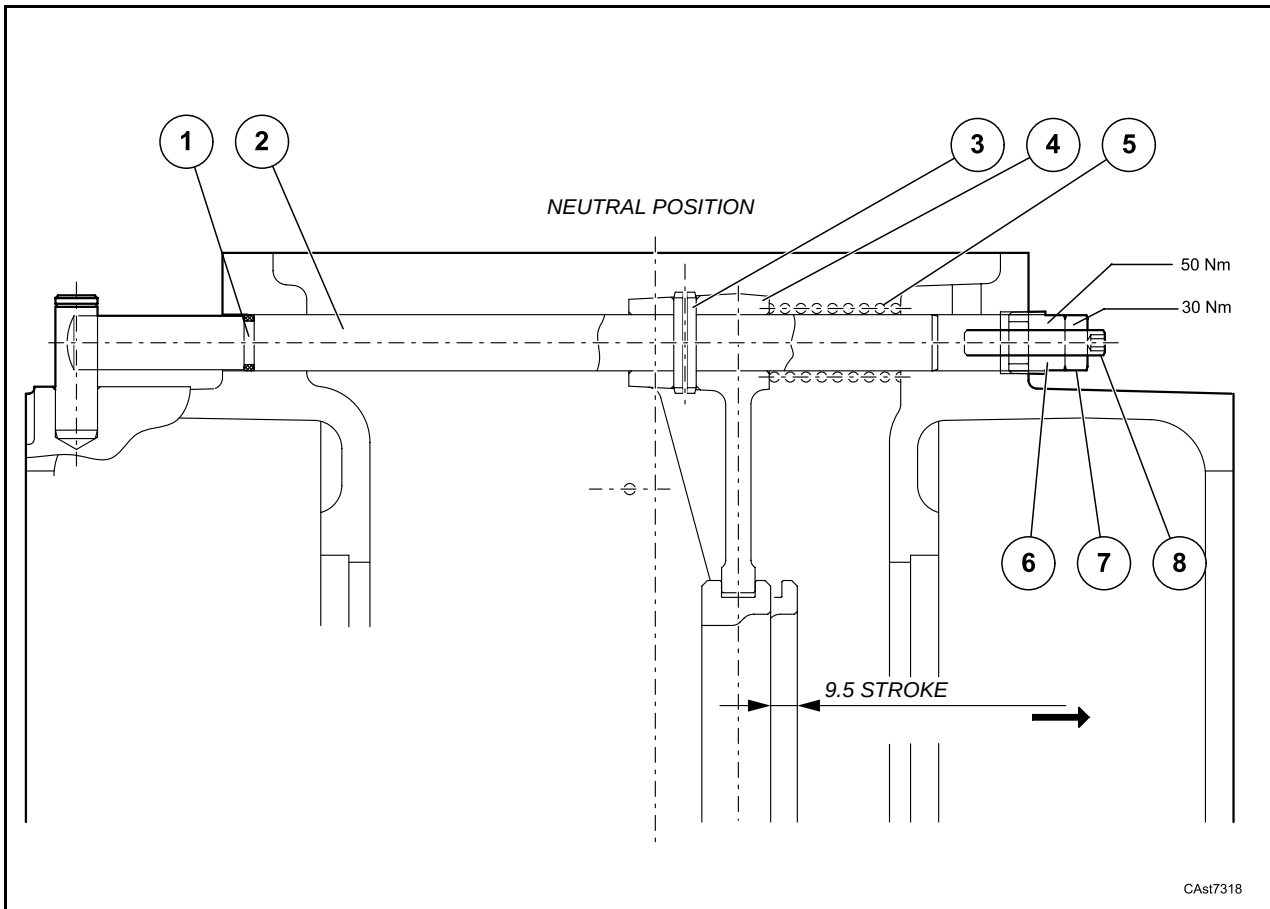
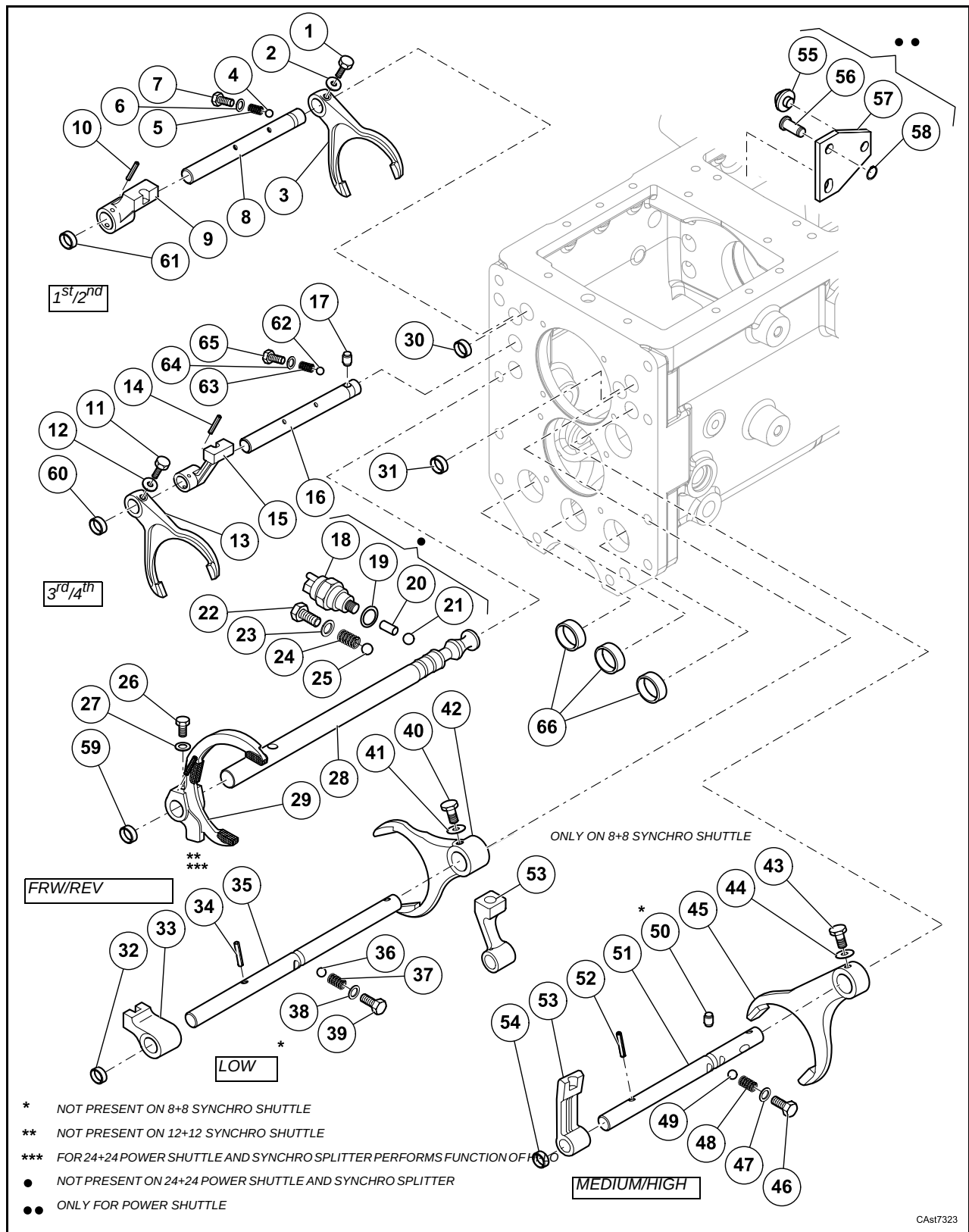


Figure 14

# Disassembly and Assembly Operations

## INNER CONTROL ASSY



# Disassembly and Assembly Operations

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models | I                         | I                           | I                                                   | I                                                 | I                         | I                                                 |

## Disassembly

12. Remove screw (40) and washer (41).
13. Remove screw (39), washer (38), spring (37) and ball (36).
14. Remove split pin (34).
15. Remove plug (32). Remove pin (35) from fork (42).
16. Remove block (33) from pin (35).

**NOTE:** Steps from 1 to 5 are not valid for 8+8 synchro shuttle models.

17. Remove lock pin (50) with the help of a magnet.

**NOTE:** Not present on 8+8 synchro shuttle models.

18. Remove plug (54).
19. Remove split pin (52).
20. Remove screw (43) and washer (44).
21. Remove screw (46), washer (47), spring (48) and ball (49).
22. Remove screw (1) and washer (2).
23. Remove split pin (10).
24. Remove screw (7), washer (6), spring (5) and ball (4).
25. Remove plug (61).
26. Remove pin (8) from fork (3).
27. Remove block (9) from pin (8).
28. Remove plug (60).
29. Remove lock pin (17) with the help of a magnet.
30. Remove screw (11) and washer (12).
31. Remove screw (65), washer (64), spring (63) and ball (62).
32. Remove split pin (14).
33. Remove split pin (16) from fork (13).
34. Remove plug (59).
35. Remove screw (26) and washer (27).
36. Remove screw (22), washer (23), spring (24) and ball (25).
37. Remove parts (18), (19), (20) and (21).

**NOTE:** Not present on 24+24 power shuttle and synchro splitter.

38. Remove fork (29).

**NOTE:** Steps from 23 to 27 are not valid for 12+12 power shuttle models.

39. Remove pin (51) and block (53).
40. Remove fork (45).
41. Remove idle gear.
42. Remove input shaft.
43. Remove front cover. Remove plugs (30) and (31).
44. Remove block (15) from pin (16).
45. Remove pins (16) and (28).
46. Remove primary shaft.
47. Remove forks (3) and (13).

## Assembly

1. Assemble forks (3) and (13).

[Refer to: figure 1.](#)

## Disassembly and Assembly Operations

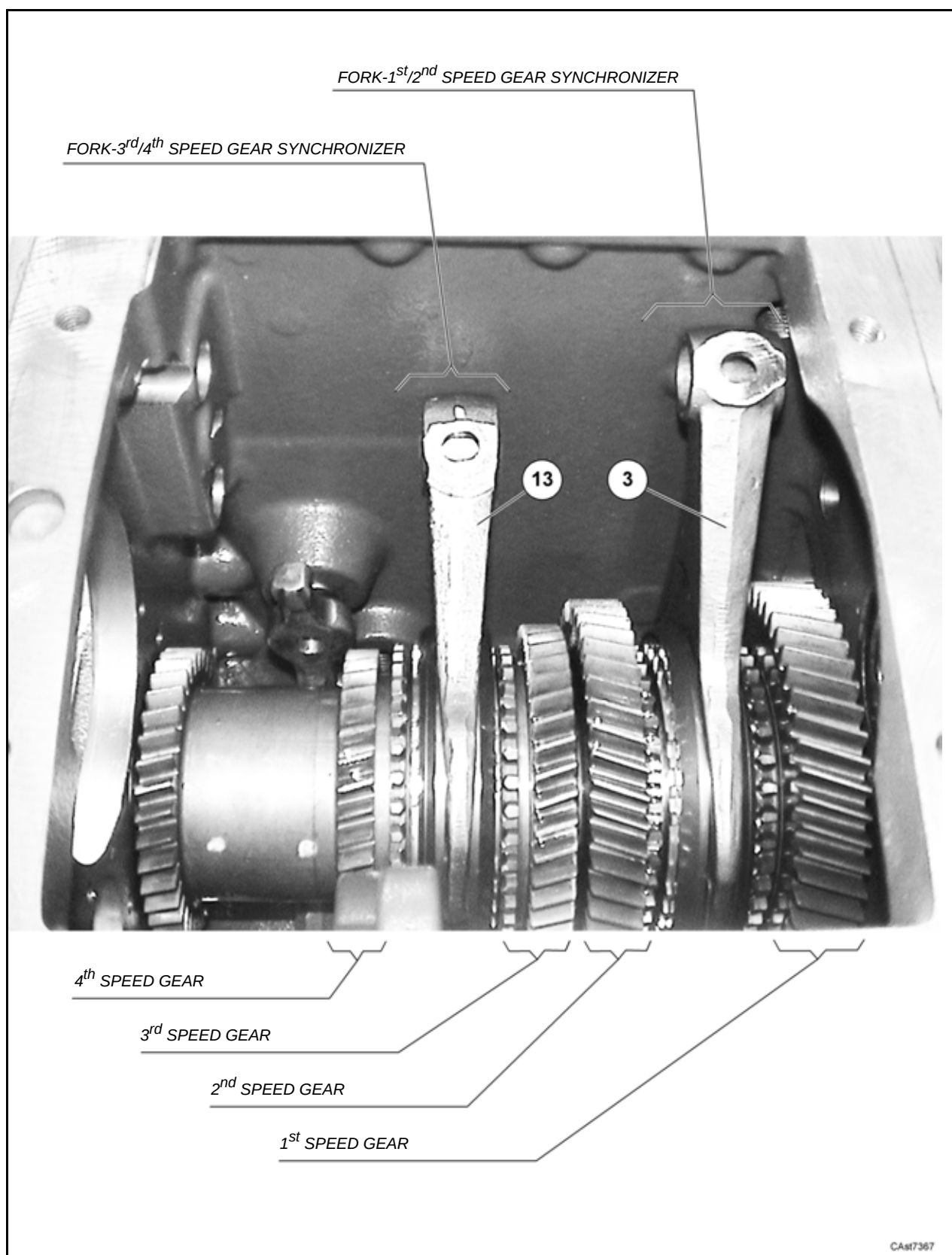


Figure 1

2. Assemble primary shaft (b).

[Refer to: figure 2.](#)

# Disassembly and Assembly Operations

3. Before cover assembly, slide through the two holes shown in the figure pins (28) and (16).

Refer to: figure 3.

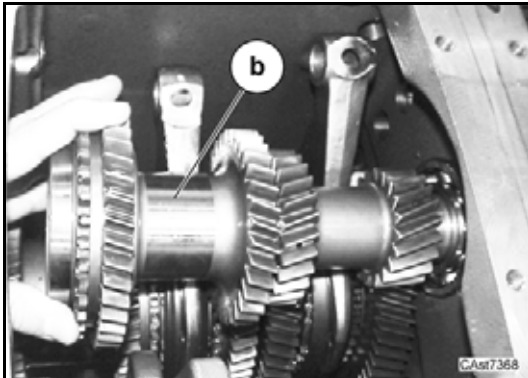


Figure 2



Figure 3

4. Assemble block (15) in the pin (16).

Refer to: figure 4 and 5.

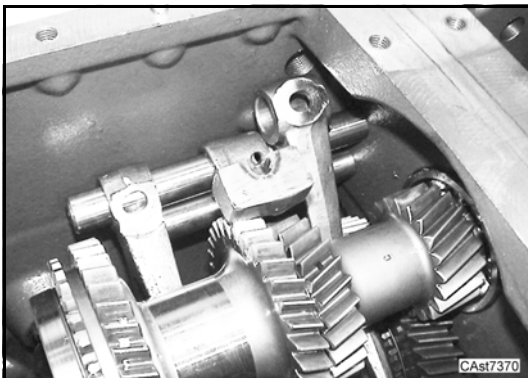


Figure 4

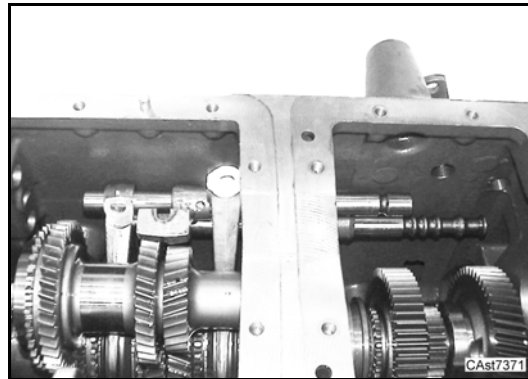


Figure 5

**NOTE:** After cover assembly pins (16) and (28) cannot slide though.

Refer to: figure 6.

5. Assemble plugs (30) and (31) using tool CA715801.

Refer to: figure 7 and section E.1.



Figure 6

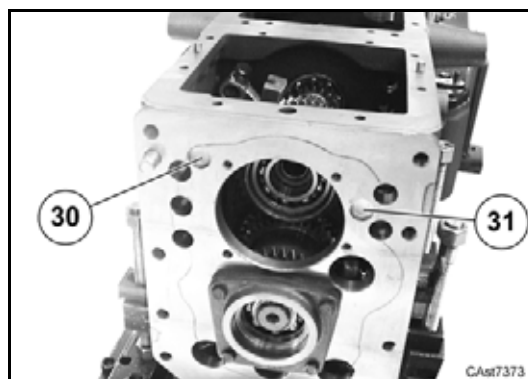


Figure 7

6. Complete assembly of speed gears-primary shaft and input shaft.

Refer to: figure 8 and 9 and section D.28 and D.26.



## Disassembly and Assembly Operations



Figure 8

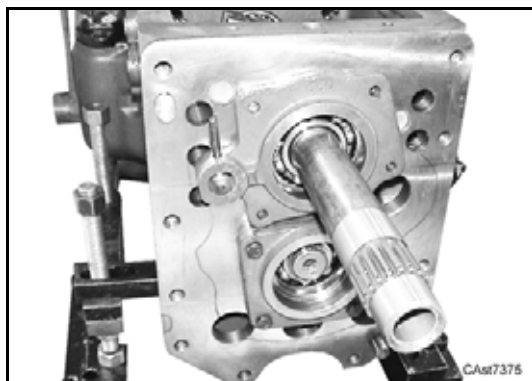


Figure 9

7. Assemble idle gear.

[Refer to: figure 10 and section D.24.](#)

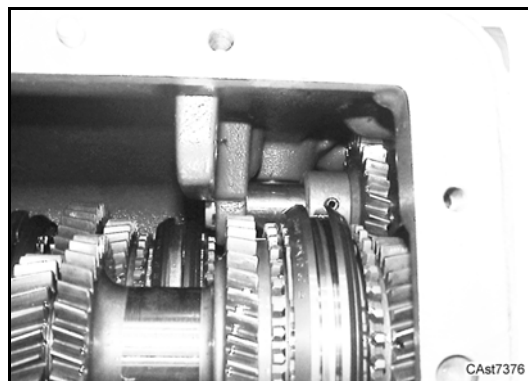


Figure 10

8. Assemble fork (45) (high-medium speed range synchronizer).

[Refer to: figure 11.](#)



# Disassembly and Assembly Operations

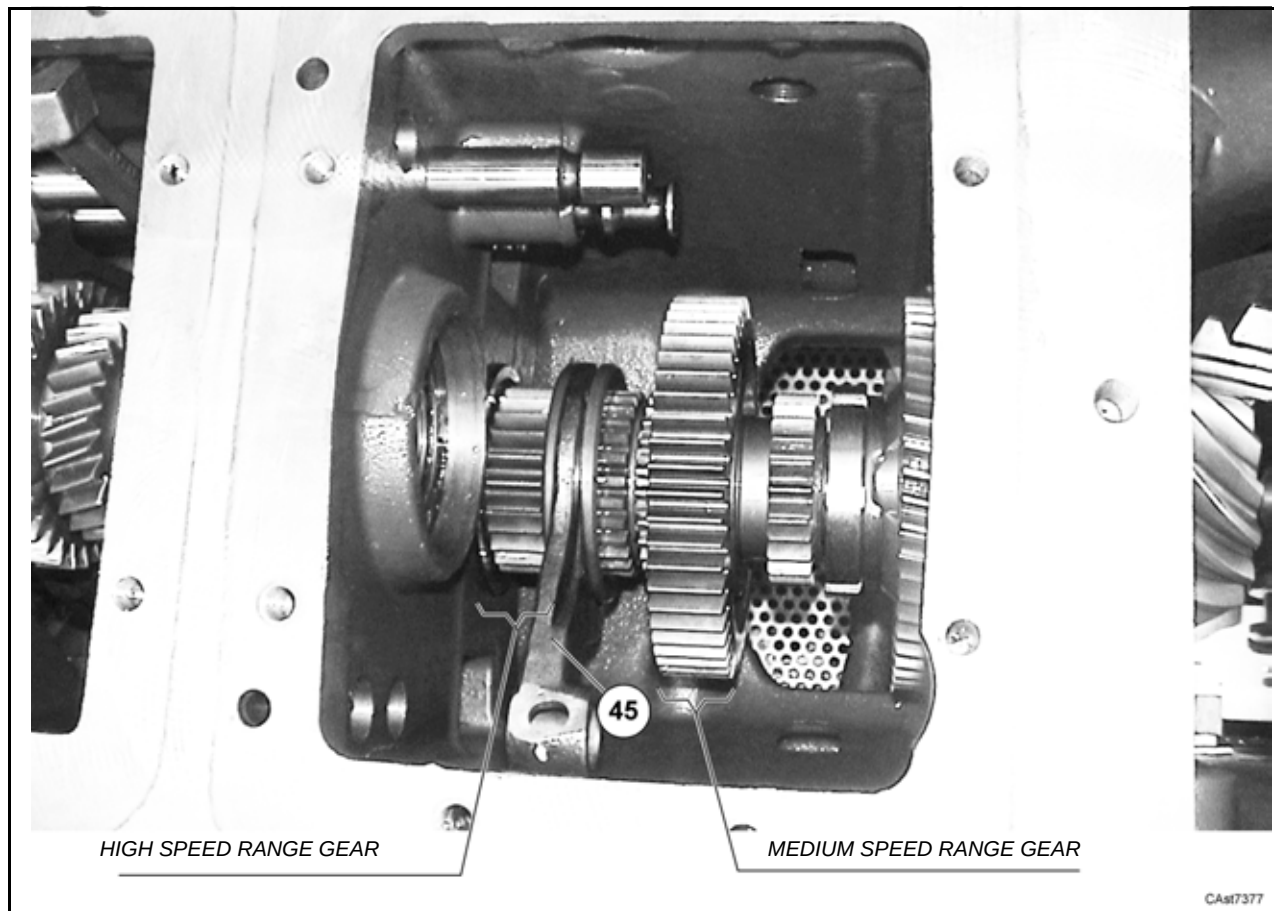


Figure 11

9. Assemble pin (51) and block (53).

[Refer to: figure 12.](#)

10. Assemble range gears (primary shaft).

[Refer to: figure 13 and section D.25.](#)

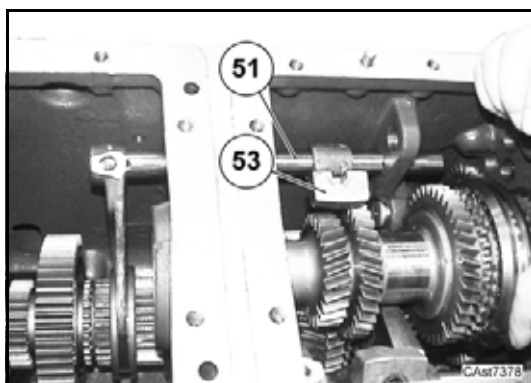


Figure 12



Figure 13

11. Assemble FRW-REV fork (29).

[Refer to: figure 14.](#)

**NOTE:** With 24+24 power shuttle and synchro splitter models it is the synchro splitter fork, because the shuttle is in the clutch housing. In 12+12 power shuttle model is not present.

12. Assemble washer (27) and screw (26) on fork (29).

[Refer to: figure 15.](#)

# Disassembly and Assembly Operations

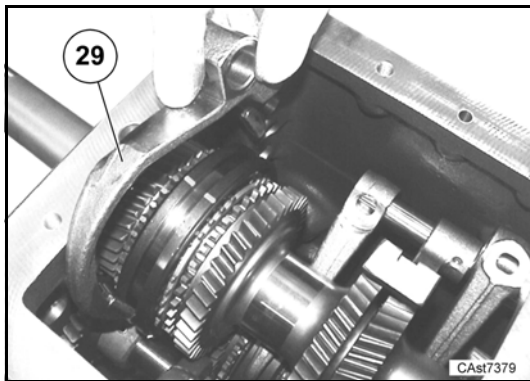


Figure 14

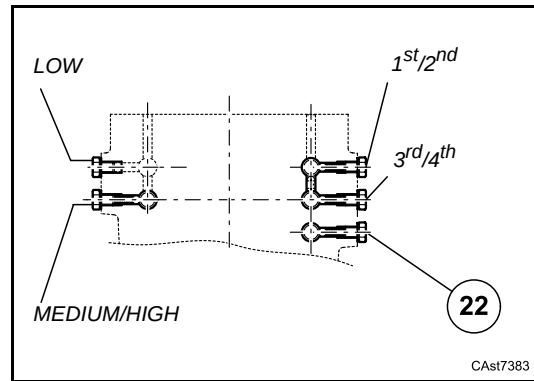


Figure 17

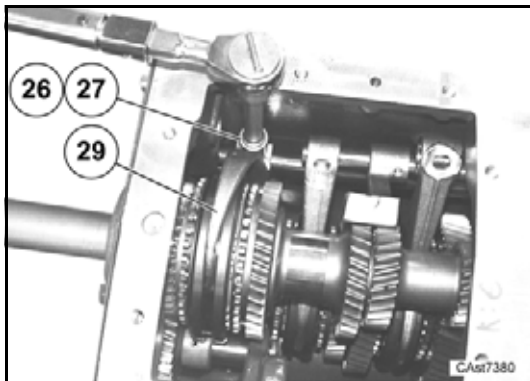


Figure 15

13. Assemble in the following order: ball (25), spring (24), washer (23) and screw (22).

[Refer to: figure 16 and 17.](#)

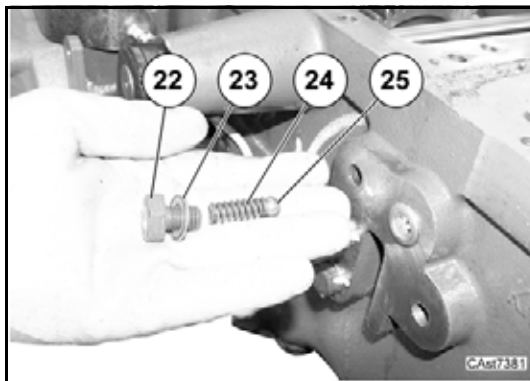


Figure 16

14. Centre fork (29) in neutral position.

15. Tighten screw (26) to the requested torque.

[Refer to: section C.4.](#)

[Assemble plug \(59\). Assemble parts \(18\), \(19\), \(20\) and \(21\).](#)

**NOTE:** Not present on 24+24 power shuttle and synchro splitter models.

16. Verify that shuttle lever moves freely (synchro splitter lever for 24+24 power shuttle and synchro splitter models).

17. Assemble pin (16) to fork (13).

[Refer to: figure 18.](#)

18. Assemble washer (12) and screw (11) on the fork (13).

19. Insert pin (14) in the block (15).

20. Assemble in the following order: ball (62), spring (63), washer (64) and screw (65).

[Refer to: figure 19.](#)

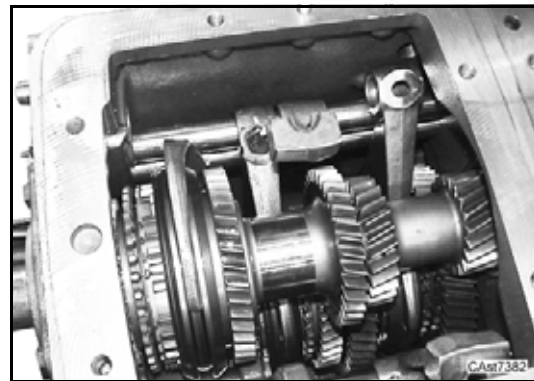


Figure 18

# Disassembly and Assembly Operations

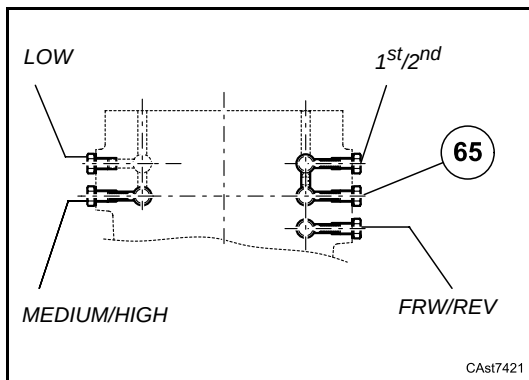


Figure 19

21. Centre fork (13) in neutral position.

22. Tighten screw (11) to the requested torque.

[Refer to: figure 20 and section C.4.](#)

23. Verify that 3<sup>rd</sup>/4<sup>th</sup> speed control lever moves freely.

24. Insert lock pin (17).

[Refer to: figure 21.](#)

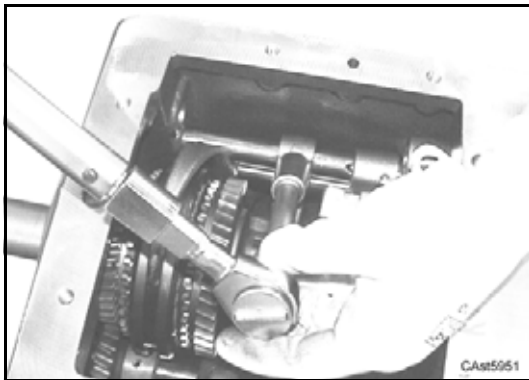


Figure 20

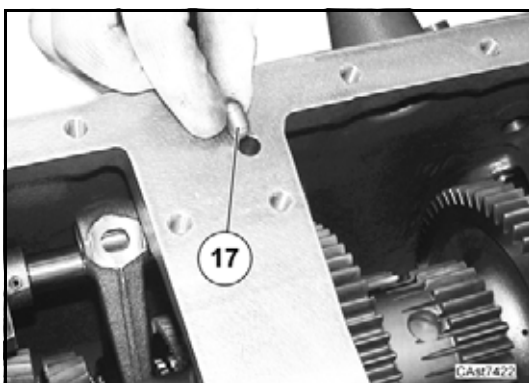


Figure 21

25. Assemble plug (60).

26. Insert pin (8) into block (9).

[Refer to: figure 22.](#)

27. Assemble pin (8) in the fork (3).

28. Assemble washer (2) and screw (1) in the fork (3).

29. Assemble in the following order: ball (4), spring (5), washer (6) and screw (7).

[Refer to: figure 23.](#)

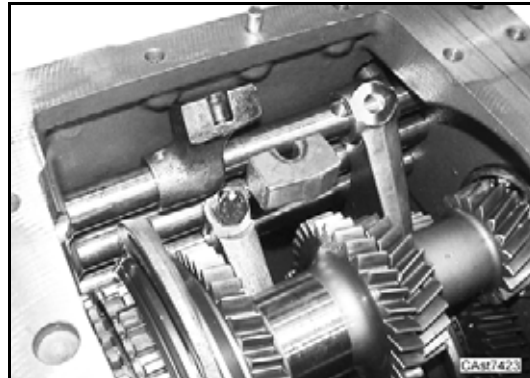


Figure 22

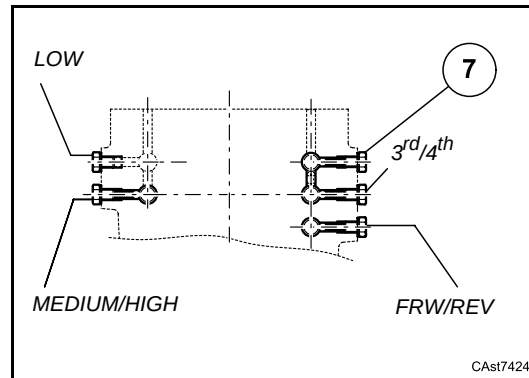


Figure 23

30. Insert pin (10).

31. Centre fork (3) in neutral position.

32. Tighten screw (1) to the requested torque.

[Refer to: section C.4.](#)

33. Check that 1<sup>st</sup>/2<sup>nd</sup> speeds control lever moves freely.

34. Assemble plug (61). Assemble pin (51) and fork (45).

[Refer to: figure 24.](#)

35. Assemble washer (44) and screw (43) to the fork (45).

36. Assemble in the following order: ball (49), spring (48), washer (47) and screw (46).

[Refer to: figure 25.](#)

# Disassembly and Assembly Operations

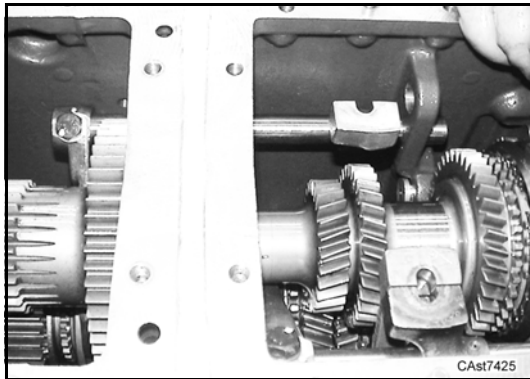


Figure 24

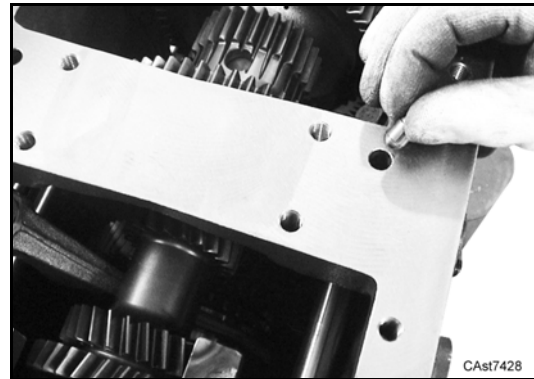


Figure 27

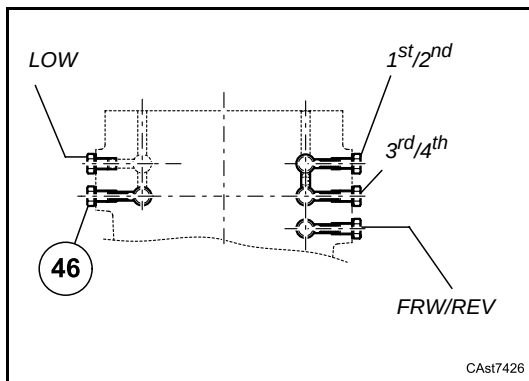


Figure 25

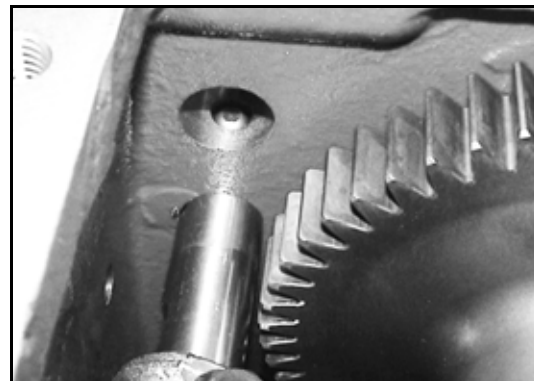


Figure 28

37. Centre fork (45) in neutral position.
38. Tighten screw (43) to the requested torque.  
[Refer to: figure 26 and section C.4.](#)
39. Insert split pin (52) into the block (53).
40. Check that the middle/high speeds control lever moves freely.
41. Assemble plug (54).
42. Insert lock pin (50)  
[Refer to: figure 27 and 28.](#)

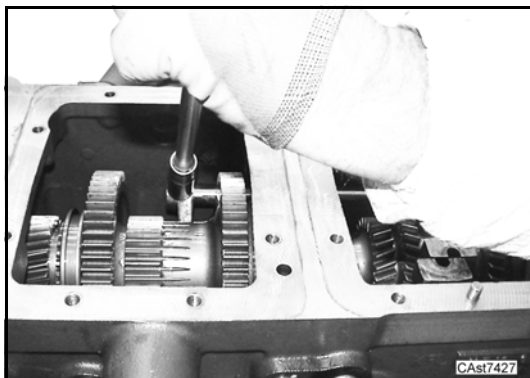


fig. 26

43. Assemble pin (35) and block (33).
  44. Position fork (42) and block (33).
1. Assemble pin (35) on the fork (42).  
[Refer to: figure 29.](#)
  2. Assemble washer (41) and screw (40) on the fork (42).
  3. Insert split pin (35).
  4. Assemble in the following order: ball (36), spring (37), washer (38) and screw (39).  
[Refer to: figure 30.](#)

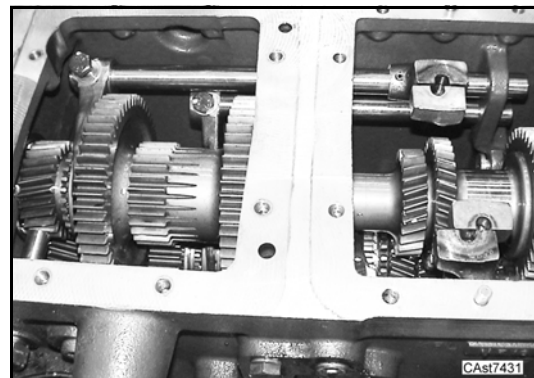


Figure 29



# Disassembly and Assembly Operations

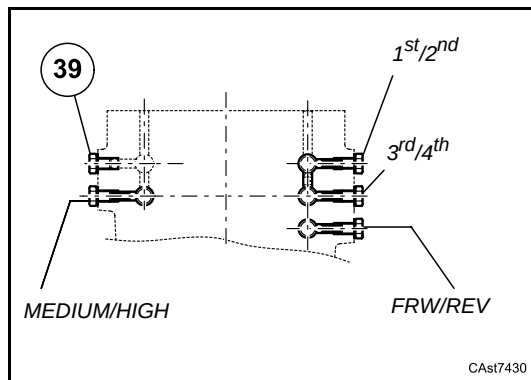


Figure 30

5. Tighten screw (39) to the requested torque.

[Refer to: section C.4.](#)

6. Centre fork (42) in neutral position.

7. Tighten screw (40) to the requested torque.

[Refer to: figure 31 and section C.4.](#)

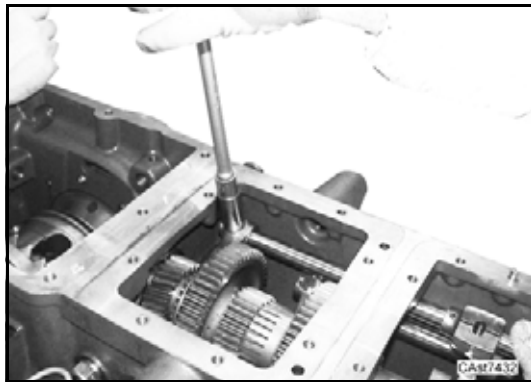


Figure 31

8. Check that low speeds control lever moves freely.

9. Assemble plug (32).

**NOTE:** Parts (55), (56), (57) and (58) are assembled only on power shuttle transmission models.

[Refer to: figure 32 and 33.](#)



Figure 32

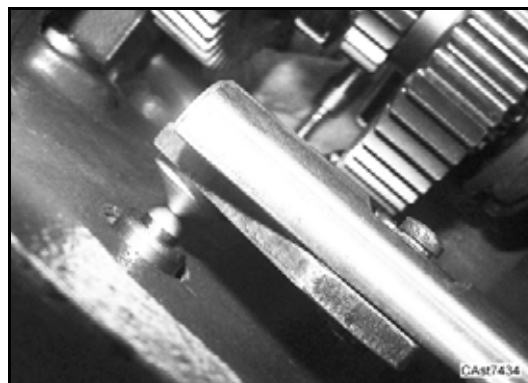


Figure 33

**NOTE:** Blocks displacement on various transmission models.

[Refer to: figure 34.](#)

## Disassembly and Assembly Operations

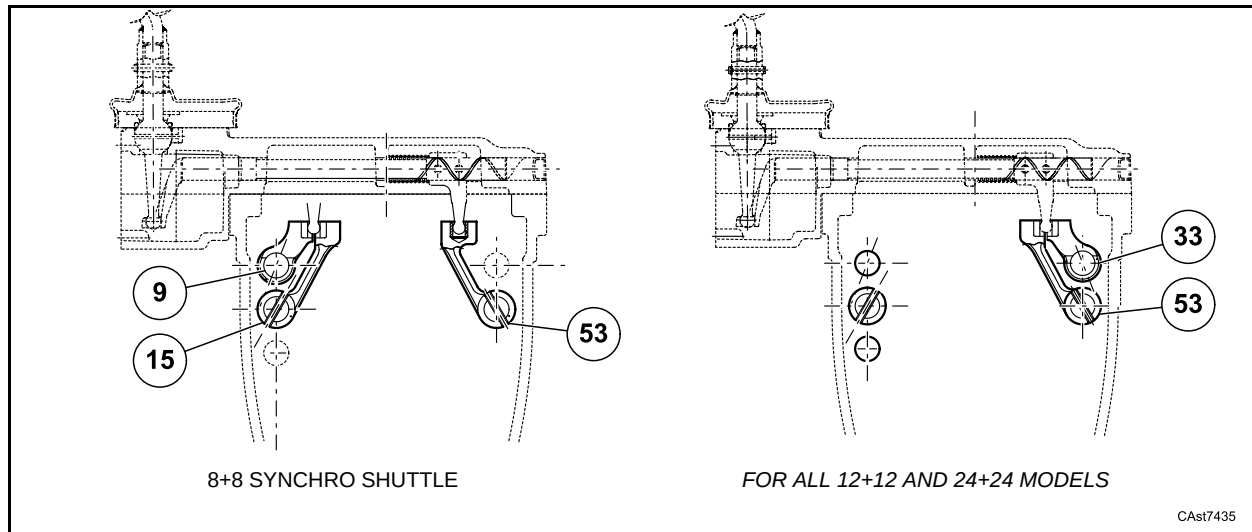
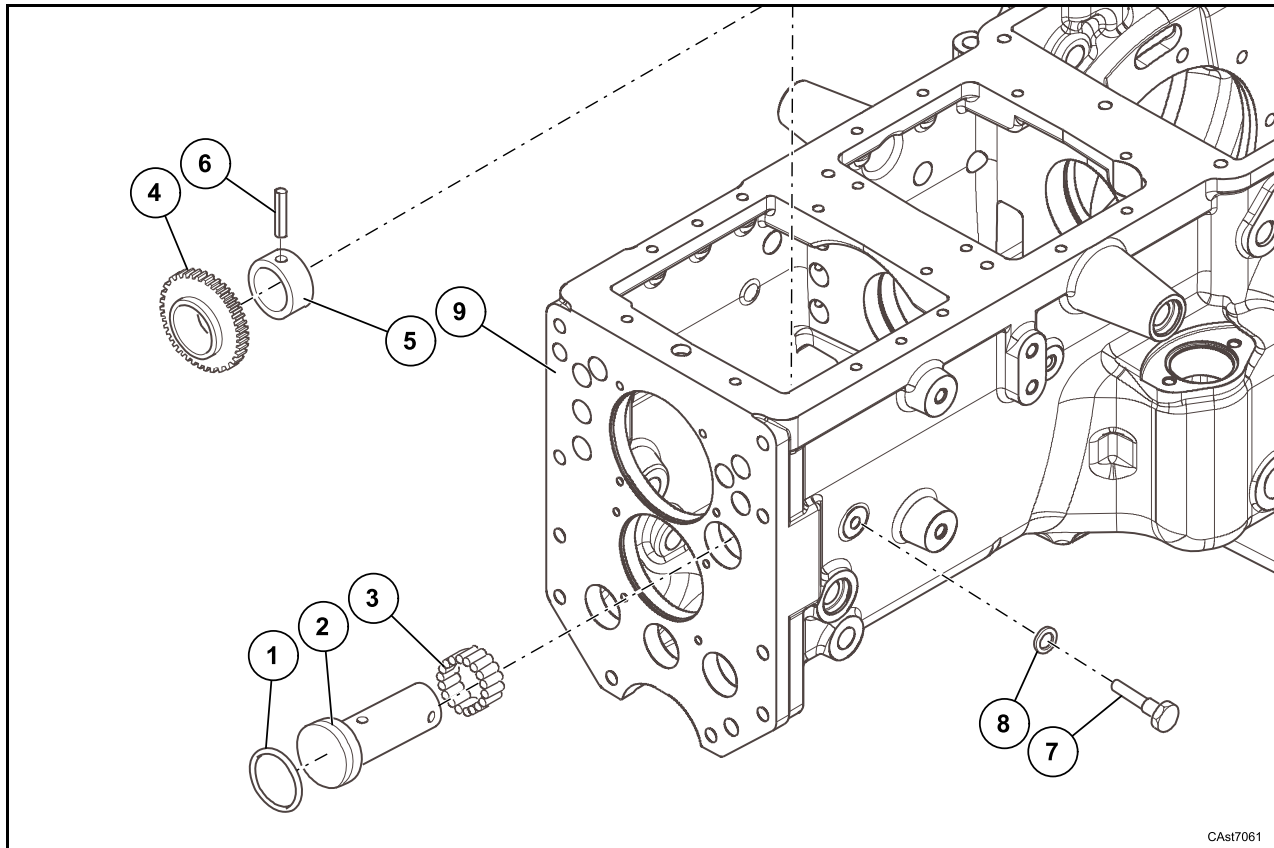


Figure 34

# Disassembly and Assembly Operations

## IDLE GEAR

### Synchro Shuttle



CAst7061

**8+8  
synchro  
shuttle**

**12+12  
synchro  
shuttle**

**24+24  
synchro shuttle  
and synchro  
splitter**

**24+24  
synchro shuttle  
and power  
splitter**

**12+12  
power  
shuttle**

**24+24  
power shuttle  
and synchro  
splitter**

For models

|

|

|

|

-

-

### Disassembly

**NOTE:** to disassemble the idle gear the primary shaft does not need to be disassembled.

1. Remove split pin (6) from bush (5).
- Refer to: [figure 2](#)
2. Remove screw (7) and washer (8).
3. Collect gear (4) and bush (5) from the gear box (9).
4. Remove shaft (2) from the gear box (9).
5. Remove needle bearing (3) and O-Ring (1) from the shaft (2).

### Assembly

**NOTE:** To assemble idle gear primary shaft does not need to be disassembled.

1. Lubricate new O-Ring (1) and assemble on the shaft (2).
2. Assemble needle bearing (3) on the shaft (2).
3. Position gear (4) and bush (6) in the inside of the gear box.
4. Assemble shaft (2) to the gear box.
- Refer to: [figure 1](#).
5. Assemble washer (8) and screw (7). Tighten screw to the requested torque.

Refer to: [section C.4](#).

6. Assemble split pin (6) on the bush (5) with prescribed special tool.

Refer to: [section E.1 and figure 2](#).

7. Check gear rotation be free.



# Disassembly and Assembly Operations

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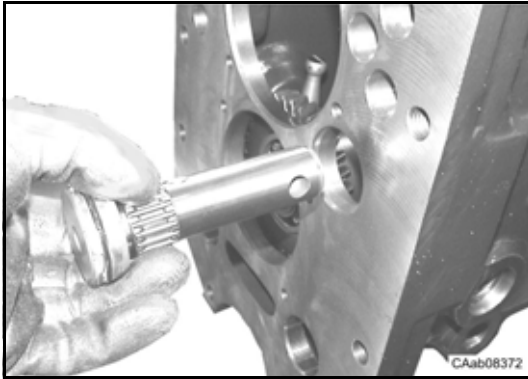


Figure 1

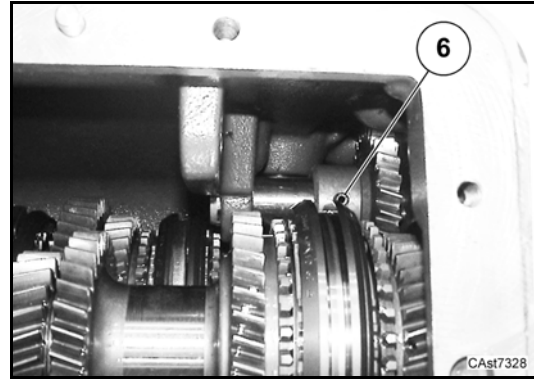
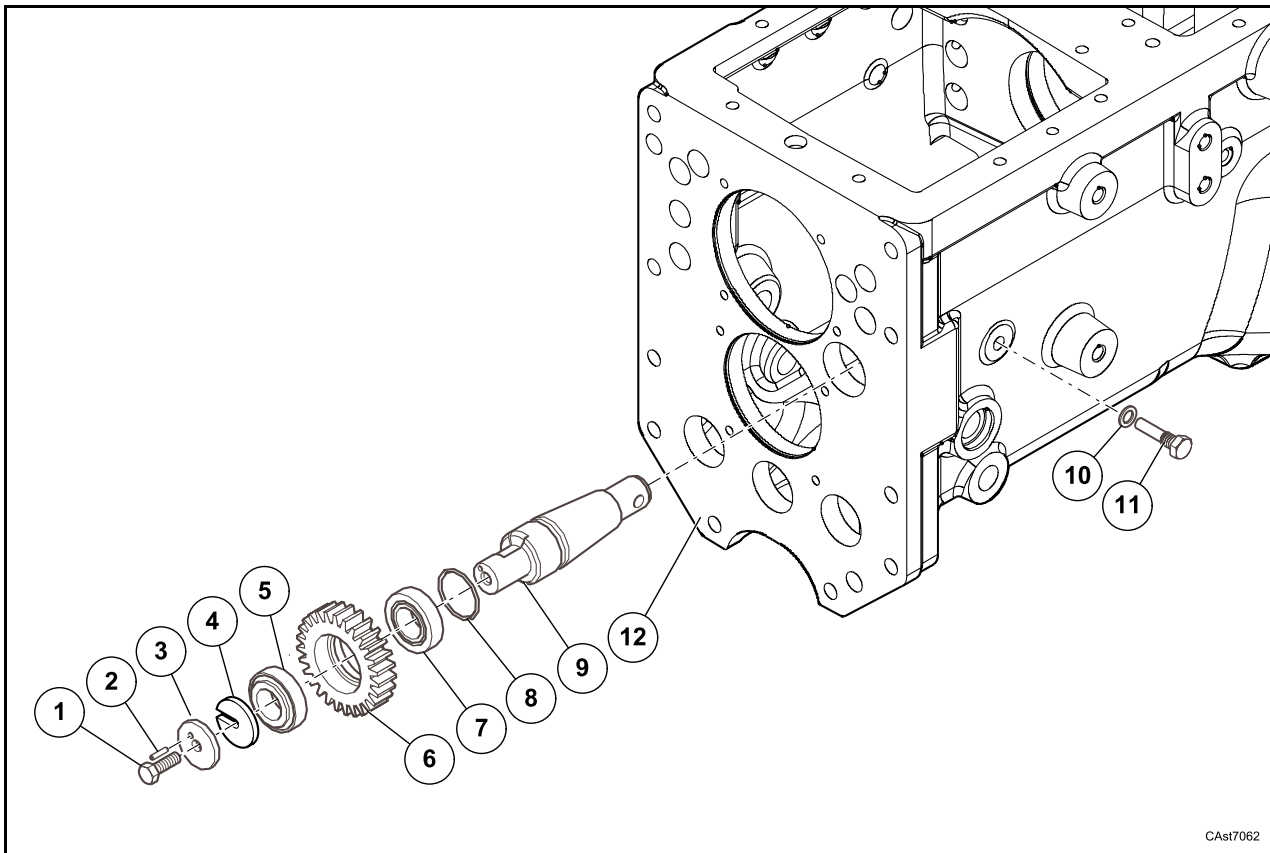


Figure 2

# Disassembly and Assembly Operations

## POWER SHUTTLE



CAst7062

**8+8  
synchro  
shuttle**

**12+12  
synchro  
shuttle**

**24+24  
synchro shuttle  
and synchro  
splitter**

**24+24  
synchro shuttle  
and power  
splitter**

**12+12  
power  
shuttle**

**24+24  
power shuttle  
and synchro  
splitter**

For models

-

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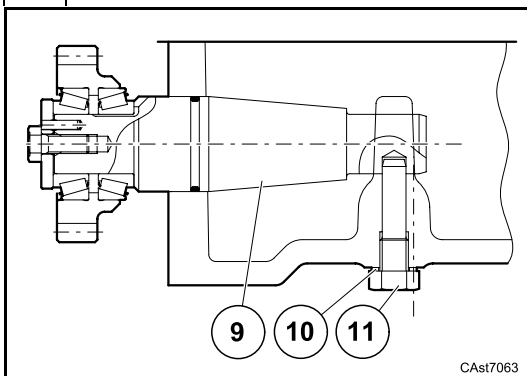
|

### Disassembly

Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

**NOTE:** To disassemble idle gear primary shaft does not need to be disassembled.

1.



CAst7063

Remove screw (11) and washer (10).

Remove idle gear assy.

2.

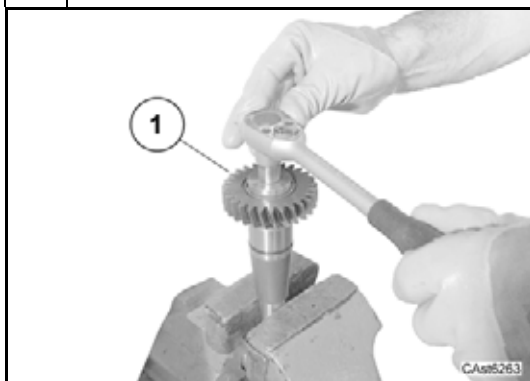


CAst6274

Fix gear in a vice as shown in the figure.

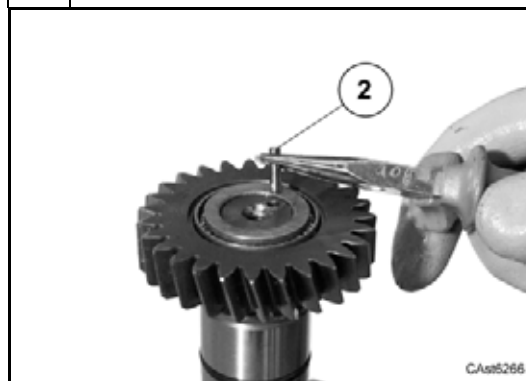
# Disassembly and Assembly Operations

3.



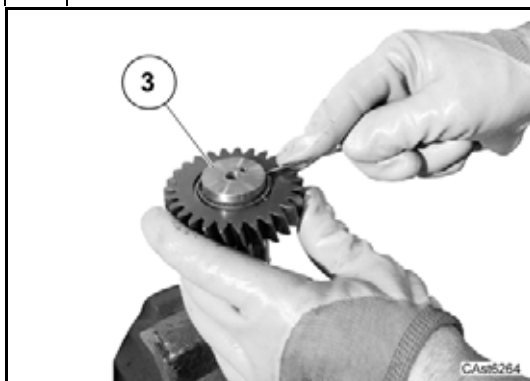
Remove screw (1).

6.



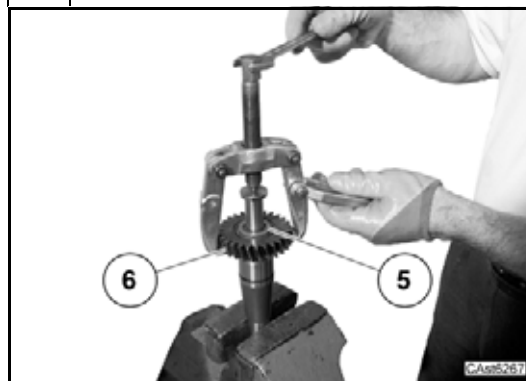
Remove pin (2).

4.



Remove adjusting washer (3) by means of a screwdriver.

7.



Remove gear (6) and bearing (5) with a puller.

5.



Remove shims (4).

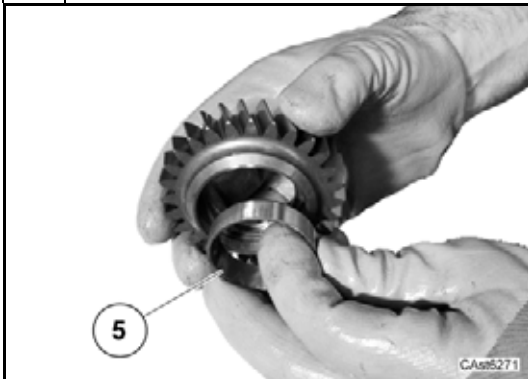
8.



Remove bearing cup (7).

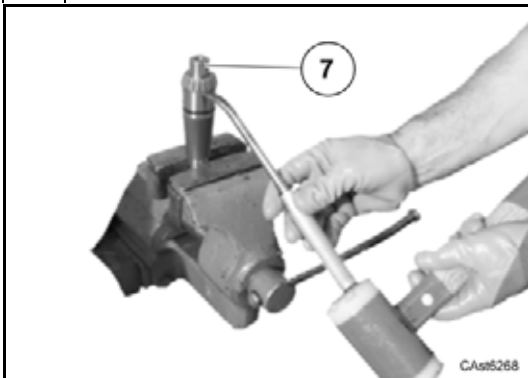
# Disassembly and Assembly Operations

9.



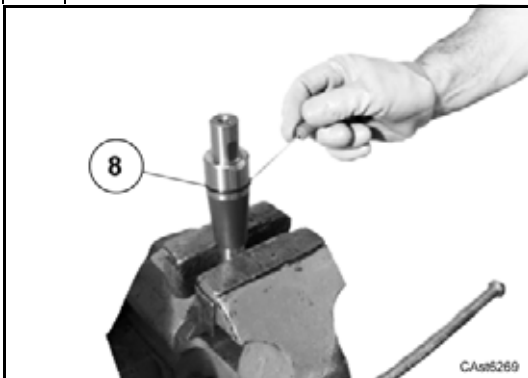
Remove bearing cup (5).

10.



Remove bearing cone (7).

11.



Remove O-Ring (8).

## Assembly

Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

**NOTE:** To assembly idle gear the primary shaft does not need to be disassembled.

1.



Assemble a new O-Ring (8).

2.



Heat bearing (7) to 80÷100 °C for a few minutes.

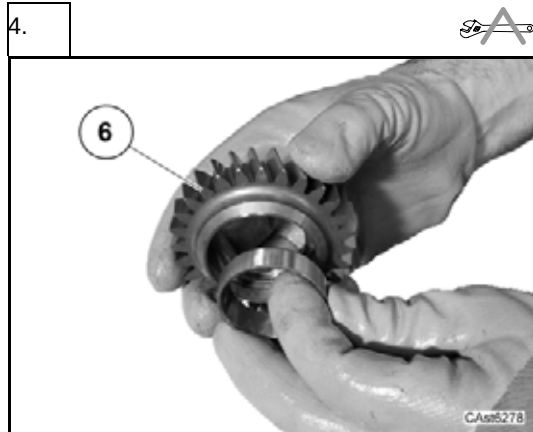
3.



Insert bearing cone (7). Alternatively use tool CA715243.

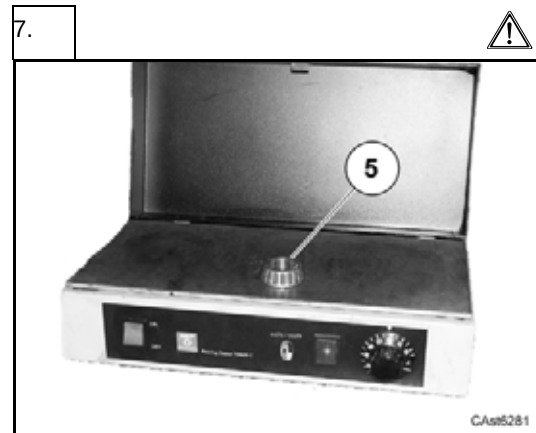
Refer to: [section E.1.](#)

# Disassembly and Assembly Operations

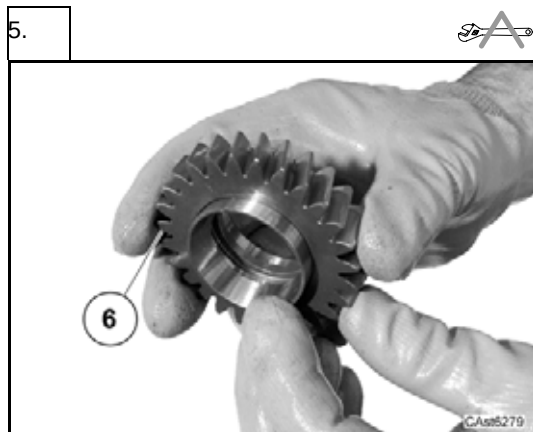


Insert bearing cup (7) on the gear (6). Use tool CA119029.

[Refer to: section E.1.](#)



Heat bearing cone (5) to  $80 \div 100$  °C.

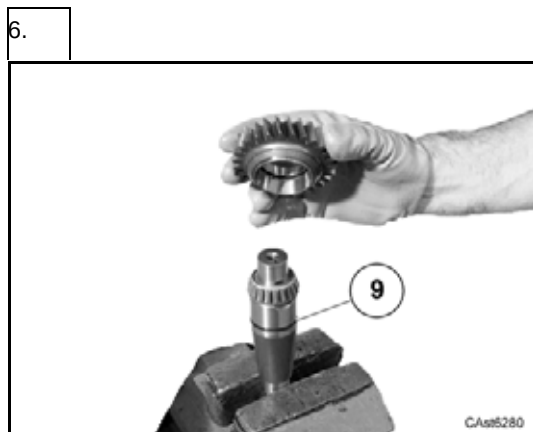


Insert bearing cup (5) on the gear (6). Use tool CA119029.

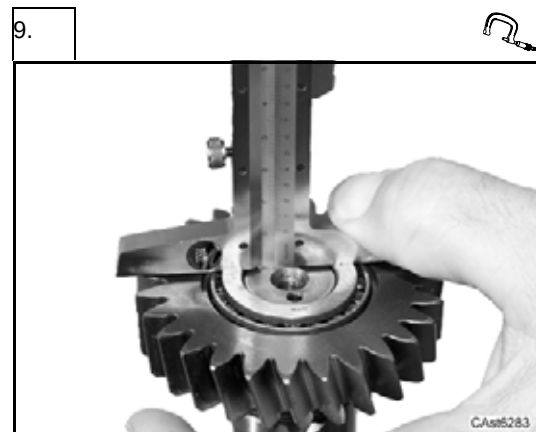


Assemble bearing (5). Use if necessary tool CA715423.

[Refer to: section E.1.](#)



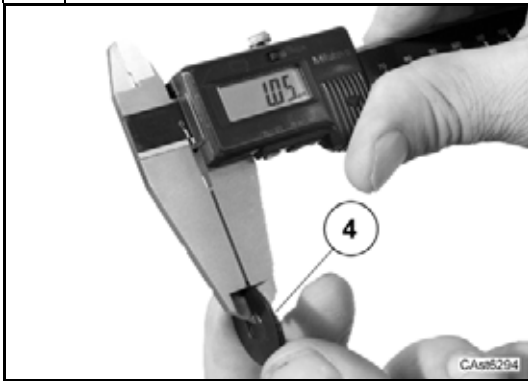
Assemble gear with the cups on shaft (9).



Pre-load bearing in this way: measure the depth (A) between bearing and pin without end float and pre-load.

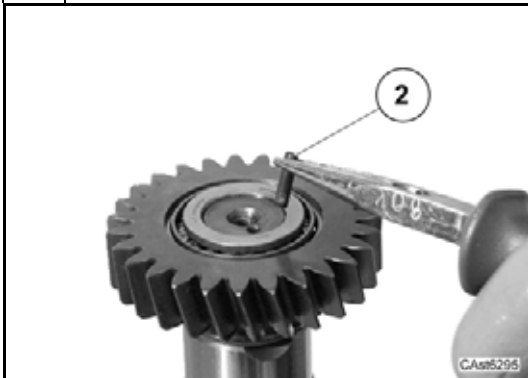
# Disassembly and Assembly Operations

10.



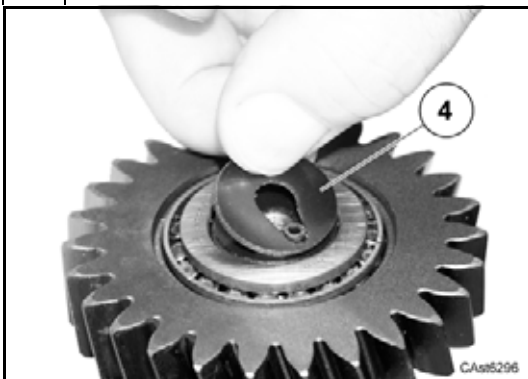
Decrease 0.05 mm from the value of dimension (A), obtaining dimension (B) ( $B = A - 0.05 \text{ mm}$ ). Use a quantity of shims (4) until you reach value (B). In this way you achieve a pre-load of  $0.6 \pm 1 \text{ daN}$ .

11.



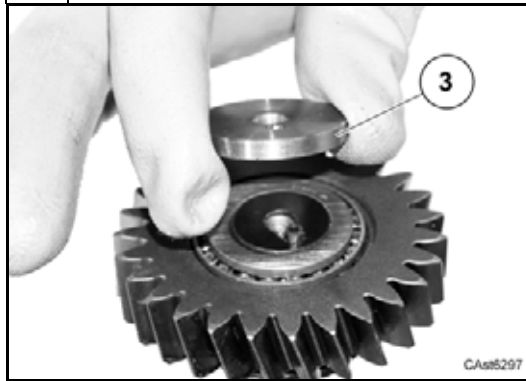
Insert pin (2).

12.



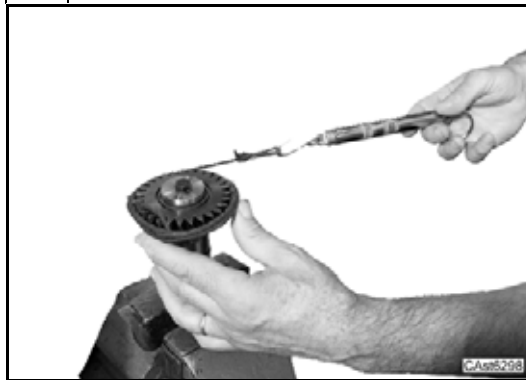
Insert shims (4).

13.



Insert washer (3).

14.



Tighten screw (1) to the prescribed torque without sealing. Check pre-load obtained. If it differs from that requested ( $0.6 \pm 1 \text{ daN}$  on the 57 mm of the gear diameter), change quantity of shims (4) inserted.

[Refer to: section C.4.](#)

## Disassembly and Assembly Operations

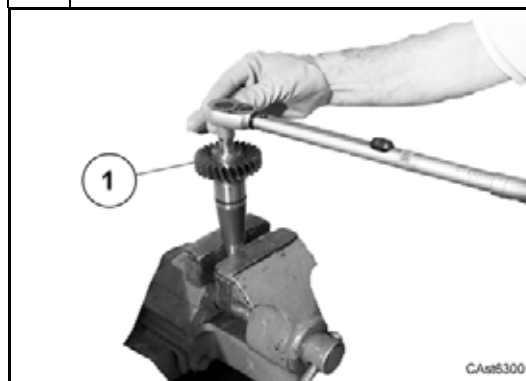
15.



Remove screw (1) and apply prescribed sealing on it.

[Refer to: section C.4.](#)

16.



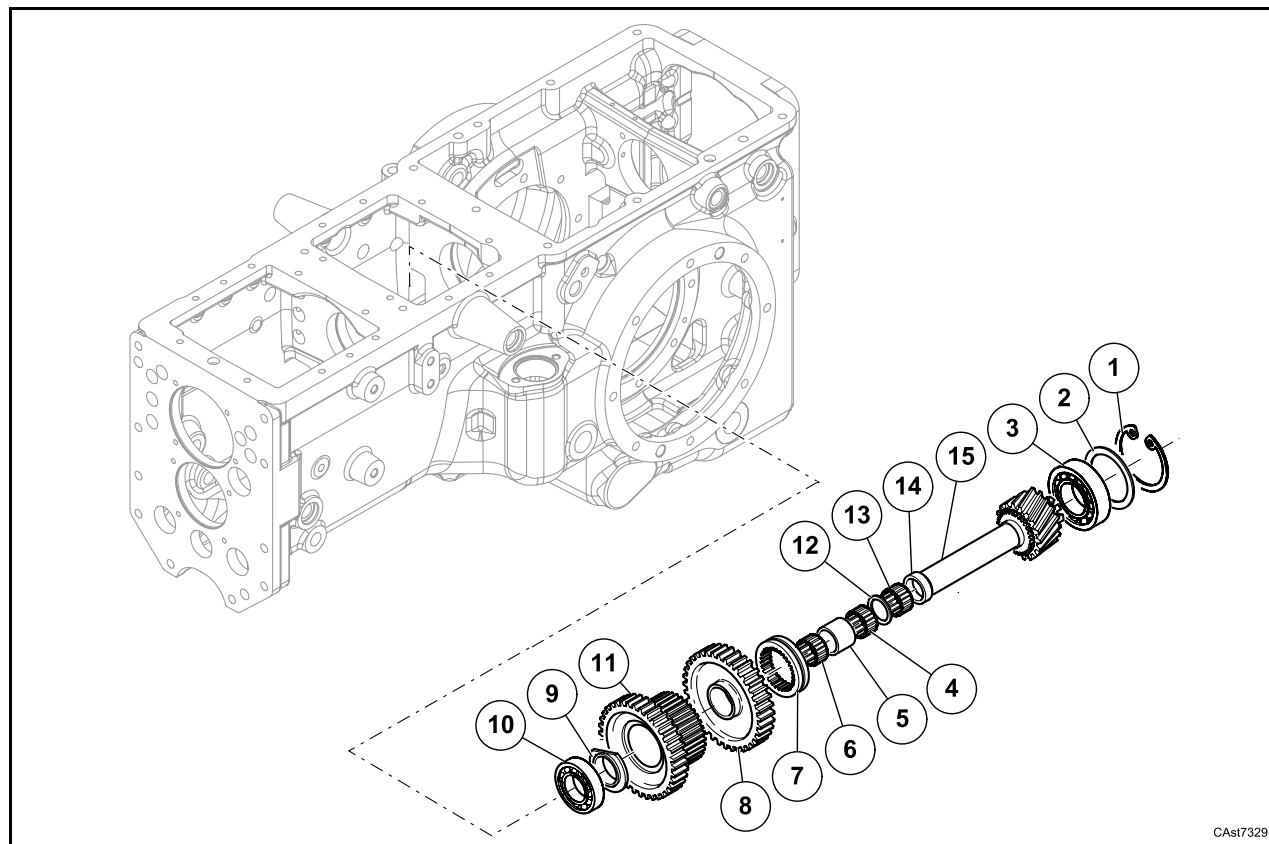
Tighten fastening screw (1) to the prescribed torque.

[Refer to: section C.4.](#)



# Disassembly and Assembly Operations

## RANGE GEARS (PRIMARY SHAFT)



**8+8  
synchro  
shuttle**

**12+12  
synchro  
shuttle**

**24+24  
synchro shuttle  
and synchro  
splitter**

**24+24  
synchro shuttle  
and power  
splitter**

**12+12  
power  
shuttle**

**24+24  
power shuttle  
and synchro  
splitter**

For models

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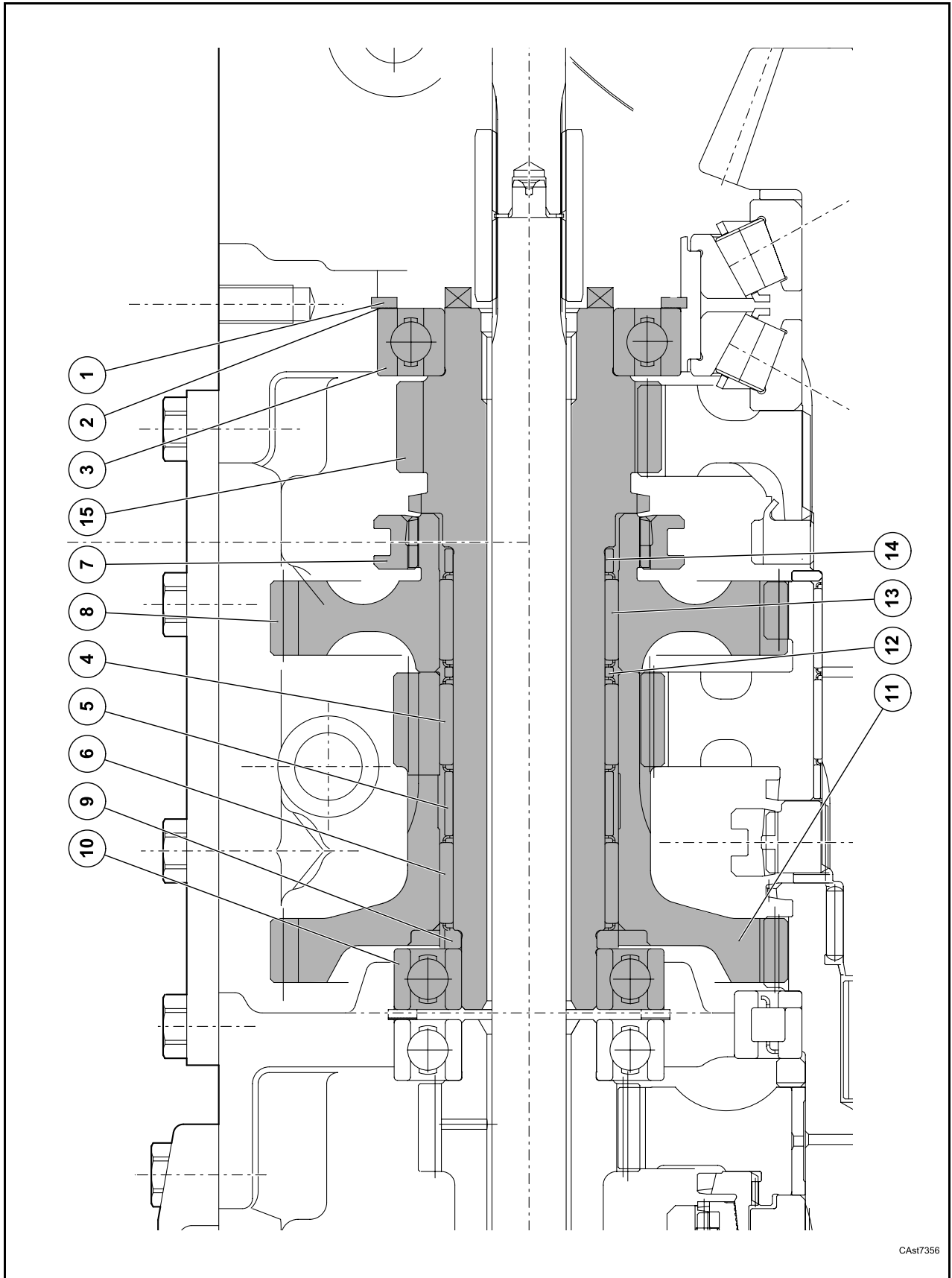
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## Disassembly and Assembly Operations



# Disassembly and Assembly Operations

## Disassembly

1. Disassemble snap ring (1) from the gear box.

Refer to: figure 1.

2. Remove shims (2).

Refer to: figure 2.

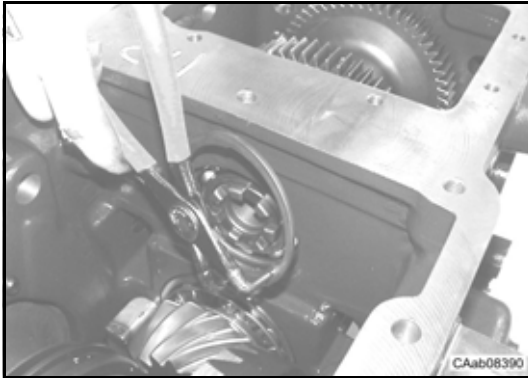


Figure 1

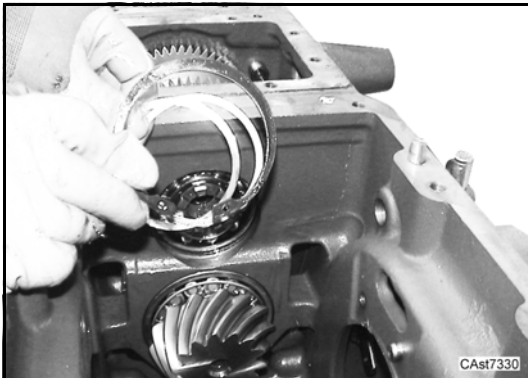


Figure 2

3. Extract bearing (3) and shaft (15).

Refer to: figure 3.

**IMPORTANT:** When removing shaft assy (15) the flat part on shaft must be at the top and horizontal, otherwise it cannot be removed.

Refer to: figure 3 and 4.

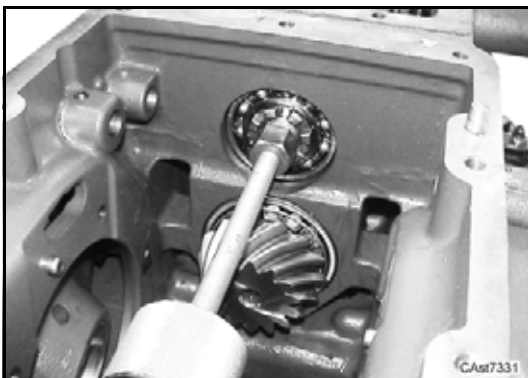


Figure 3

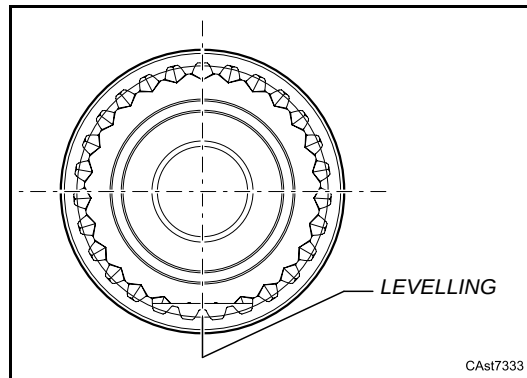


Figure 4

4. Disassemble from shaft (15) in the gear box from the differential side in the following order: needles bearing (6), spacer (5), needles bearing (4), spacer (12), needles bearing (13) and spacer (14).

Refer to: figure 5.

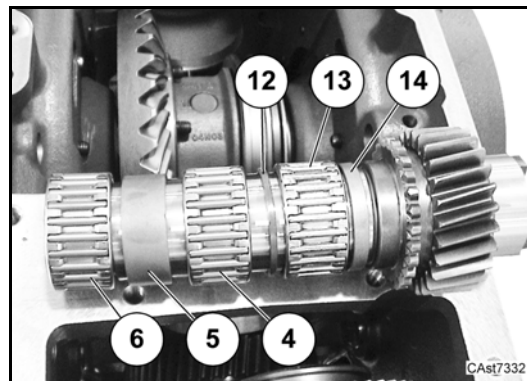


Figure 5

5. Remove gear (11) with washer (9) and gear (8) with sleeve (7) from the gear box.
6. Remove bearing (10) from the gear box.

# Disassembly and Assembly Operations

## Assembly

1. Assemble bearing (10).

Refer to: [figure 6](#).

2. Grease washer (9) and assemble it on gear (11).
3. Assemble sleeve (7) on gear (8).

**NOTE:** Sleeve correct assembly.

Refer to: [figure 7](#).

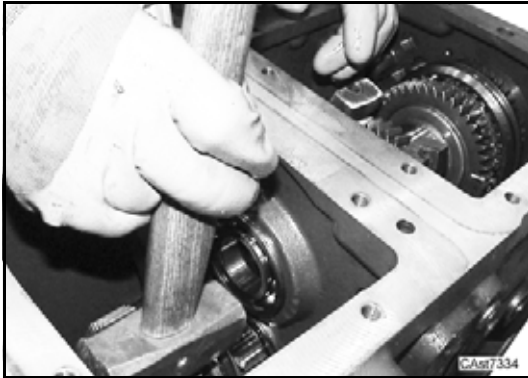


Figure 6

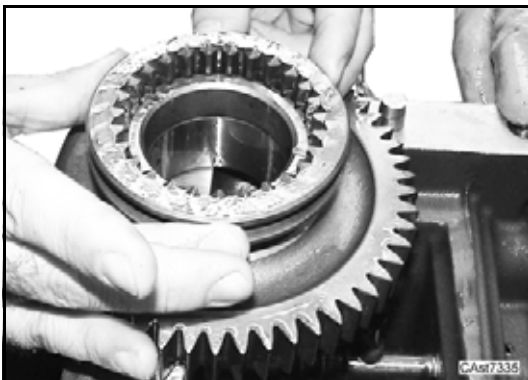


Figure 7

4. Assemble in the shaft (15): spacer (14), roller bearing (13), spacer (12), roller bearing (4), spacer (5) and roller bearing (6).

Refer to: [figure 8](#).

5. Assemble in the gear box the gears (11) and (8) assembled.

Refer to: [figure 9](#).

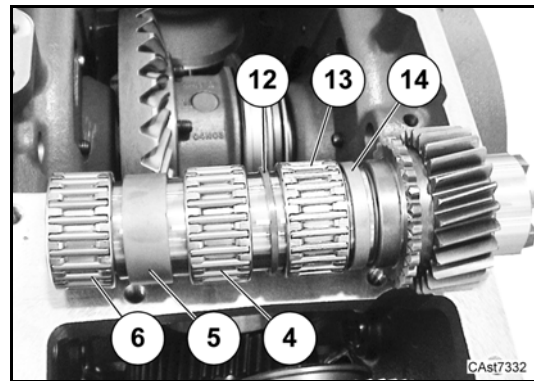


Figure 8

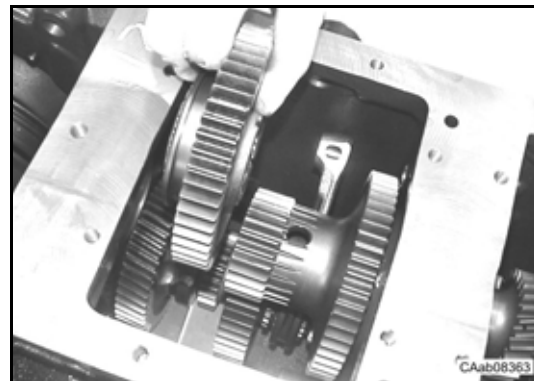


Figure 9

6. Insert shaft (15) with levelling downward assembled on gears (11) and (8).
7. Settle shaft (15) using a soft hammer up to stroke end.

Refer to: [figure 10 and 11](#).

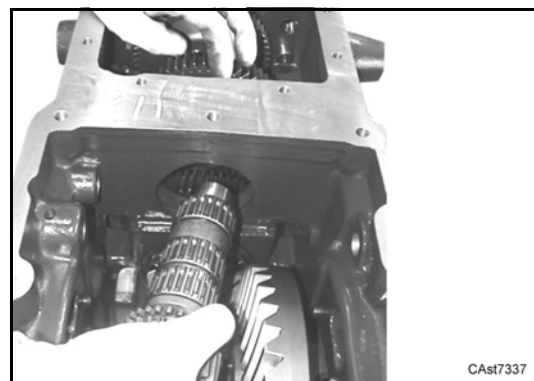


Figure 10

# Disassembly and Assembly Operations

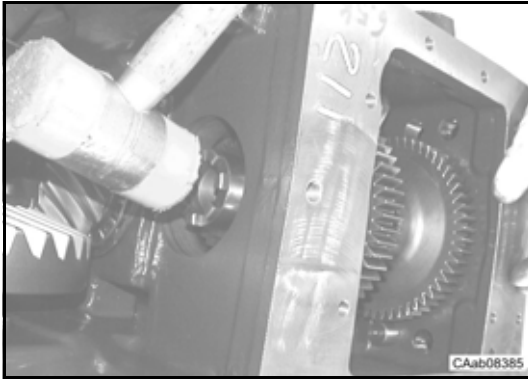


Figure 11

8. Assemble bearing (3) using the tools CA715821 and CA715830.

Refer to: figure 12 and 13.

Alternatively you can use a punch paying attention not to damage the bearing (3).

Refer to: figure 14.

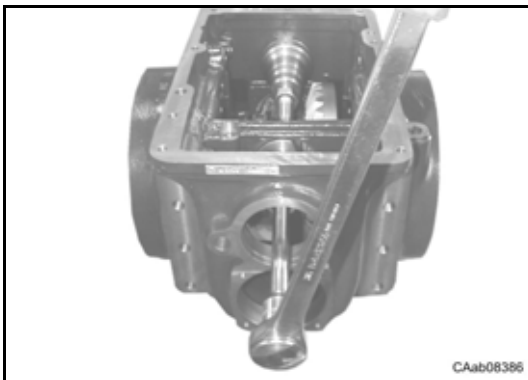


Figure 12

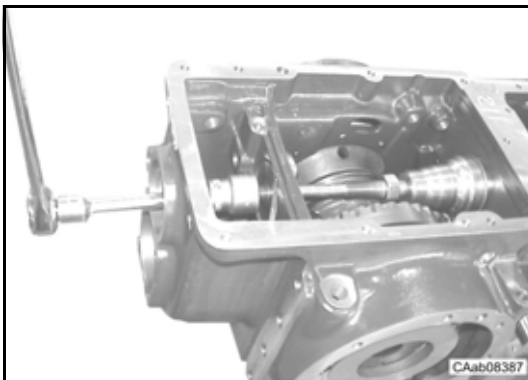


Figure 13

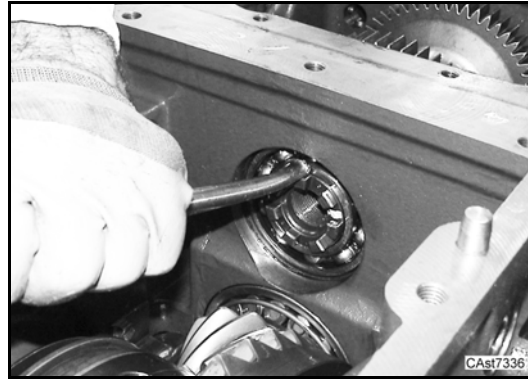


Figure 14

9. Assemble snap ring (1).

10. Proceed as follows to determine end float [4]: measure value (B) with a thickness gauge, that is end float between bearing (3) and snap ring (1). Remove snap ring (1). Lubricate and assemble shim (2). Reassemble snap ring (1). Check again value (B) and repeat operations described previously so as to obtain a end float value included in the prescribed range:  $0.15 \div 0.25$  mm.

Refer to: section C.6 and figure 15, 16.

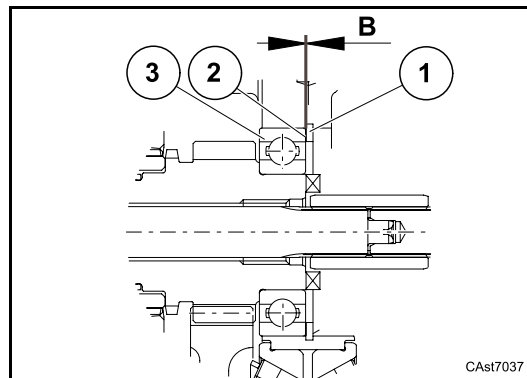


Figure 15

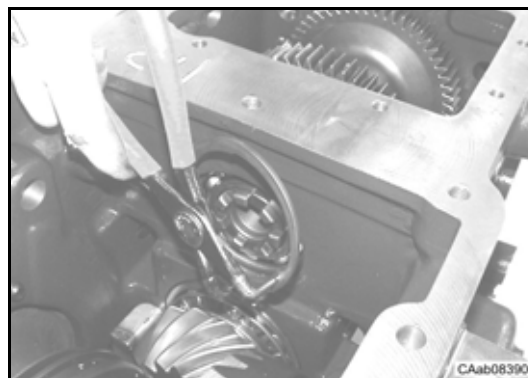


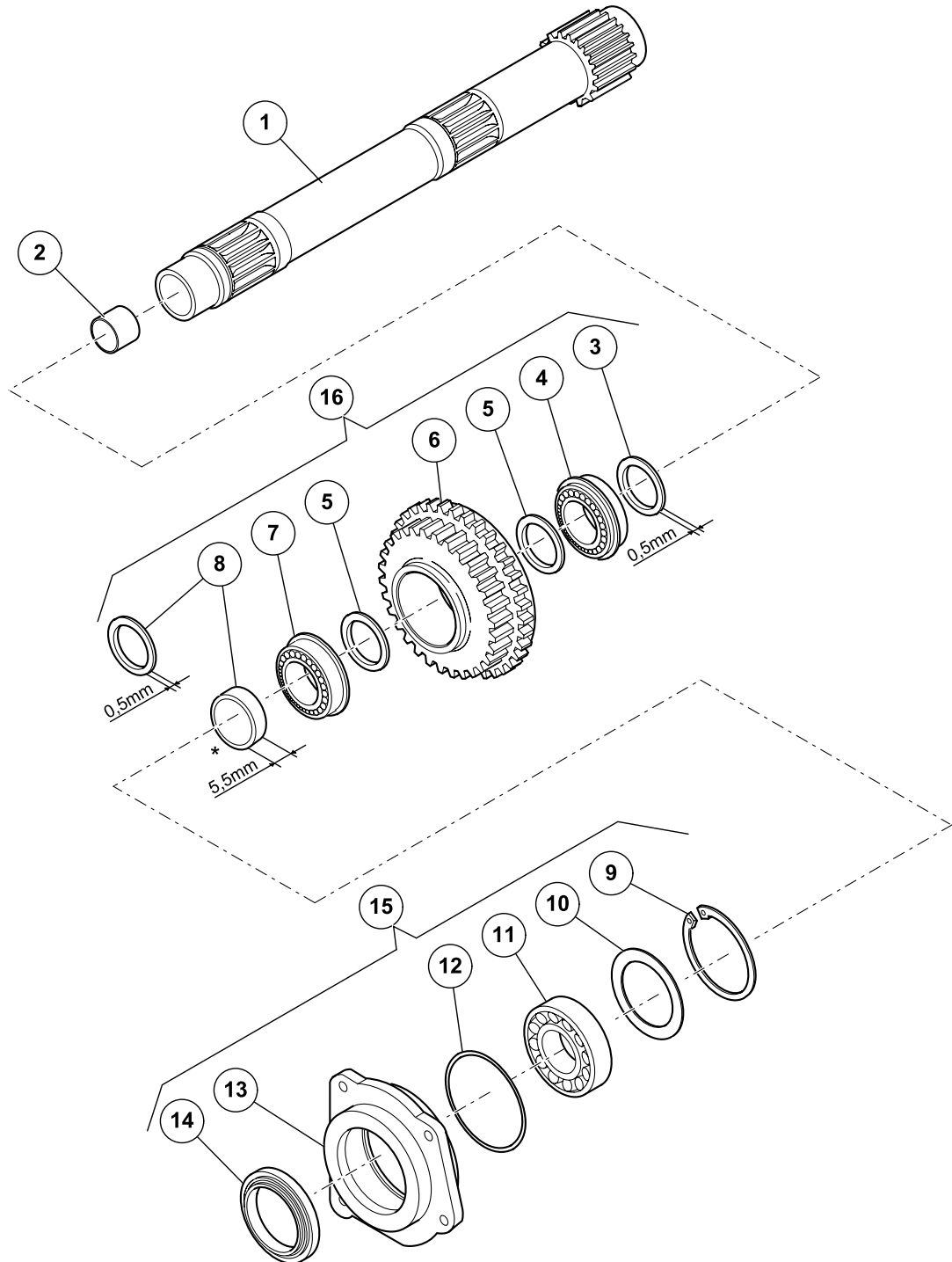
Figure 16

11. Check that gears rotate freely.

# Disassembly and Assembly Operations

## INPUT SHAFT - SYNCHRO SHUTTLE

\*FOR MODELS 24+24 POWER SHUTTLE AND SYNCHRO SPLITTER



CAst7392

**8+8  
synchro  
shuttle**

**12+12  
synchro  
shuttle**

**24+24  
synchro shuttle  
and synchro  
splitter**

**24+24  
synchro shuttle  
and power  
splitter**

**12+12  
power  
shuttle**

**24+24  
power shuttle  
and synchro  
splitter**

For models

|

|

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# Disassembly and Assembly Operations

## Disassembly

Remove four screws of input shaft cover. Remove recovery oil pipe and relevant O-Ring (only for model 24+24 power shuttle and synchro splitter).

1. Position on work bench assembled input shaft.

Refer to: figure 1.

2. Remove bushing (2) if necessary.

Refer to: figure 2.



Figure 1

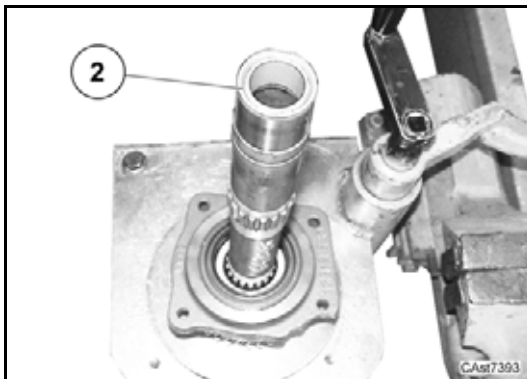


Figure 2

3. Use a commercial puller to remove the assy (15).

Refer to: figure 3.

4. Remove assy (15) and shim (8).

5. Remove snap ring (9).

Refer to: figure 4.

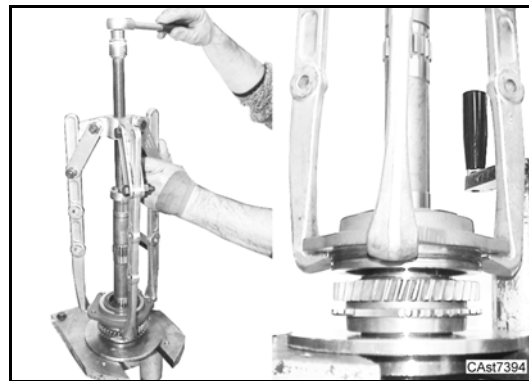


Figure 3

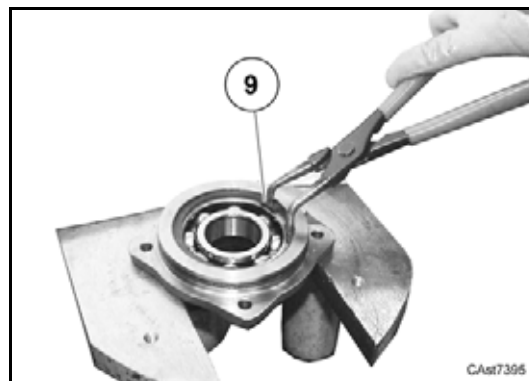


Figure 4

6. Use a support for cover (13). With a buffer remove bearing (11). Collect shims (10).

Refer to: figure 5.

7. Remove seal (14) and O-Ring (12).

**NOTE:** Destructive operation for seals.

Refer to: figure 6.



Figure 5



# Disassembly and Assembly Operations

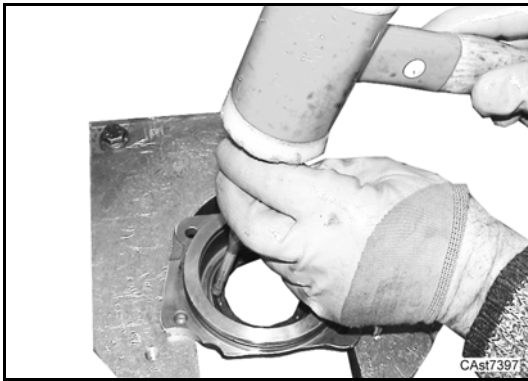


Figure 6

8. Use a commercial puller to remove assy (16).

[Refer to: figure 7.](#)

9. Remove assy (16) and shim (3).

[Refer to: figure 8.](#)

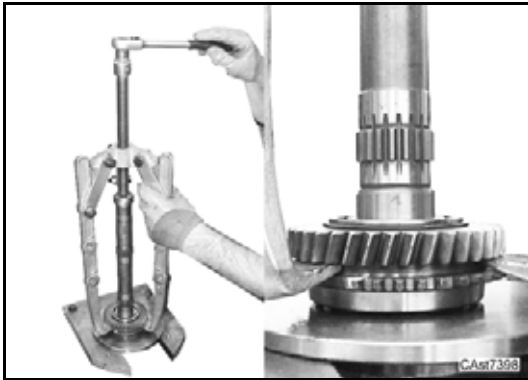


Figure 7



Figure 8

10. Use a support for gear (6). Remove bearing (7).

[Refer to: figure 9.](#)

11. Collect shims (5).

[Refer to: figure 10.](#)

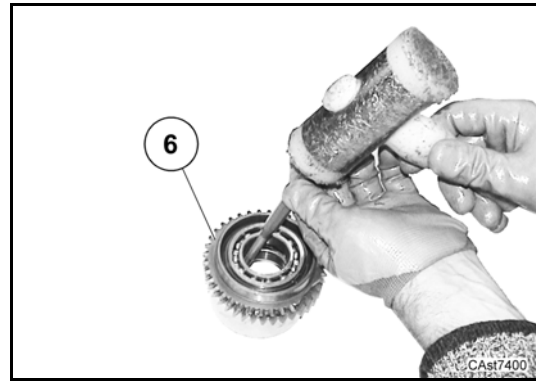


Figure 9

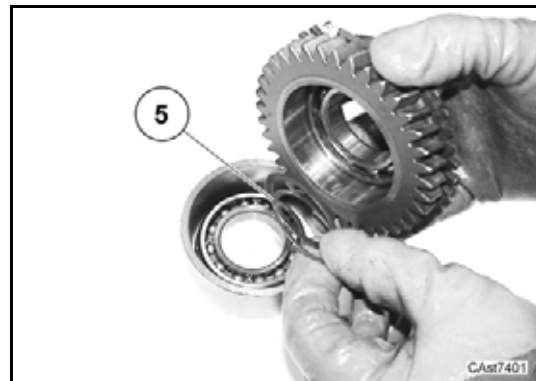


Figure 10

12. Remove bearing (4).

[Refer to: figure 11.](#)

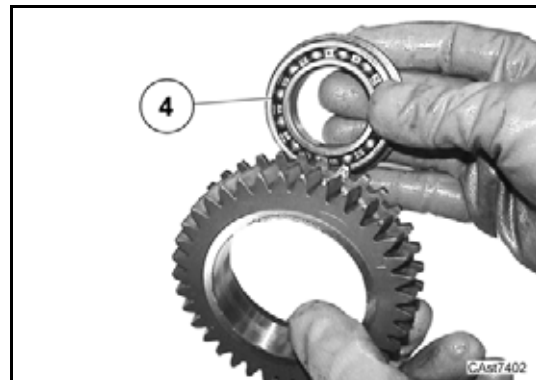


Figure 11

# Disassembly and Assembly Operations

## L.00.1 Assembly

1. Assemble bearing (4) on gear (6).

Refer to: figure 12.

2. Determine end float [5a].

Refer to: section C.6.

Measure dimension (A) with a gauge.

Example A= 11.8 mm

Refer to: figure 13.

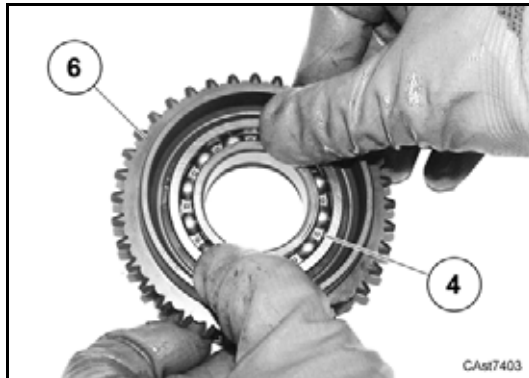


Figure 12

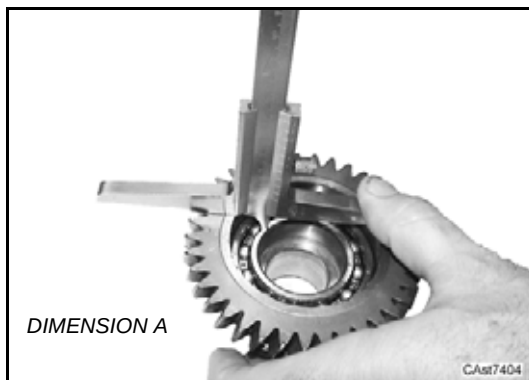


Figure 13

3. Measure dimension (B) on bearing (7) with a gauge.  
Example B= 11 mm

Refer to: figure 14.

4. Determine shim (5) with dimension (S) to insert between bearings (4) and (7).

$$S = (A-B) + (0 \div 0.1) = 0.8 + (0 \div 0.1) \text{ mm}$$

Refer to: figure 15.

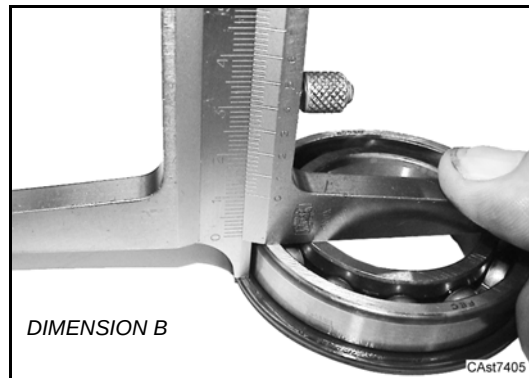


Figure 14



Figure 15

5. Select shims within shims range available.

### SHIMS RANGE

|                |      |      |      |
|----------------|------|------|------|
| Thickness - mm | 0.10 | 0.30 | 0.50 |
| Quantity       | ---  | ---  | ---  |

6. Position a shim (5) with dimension (S) on bearing (4).

Refer to: figure 16.

7. Assemble bearing (7) with a soft hammer.

Refer to: figure 17.

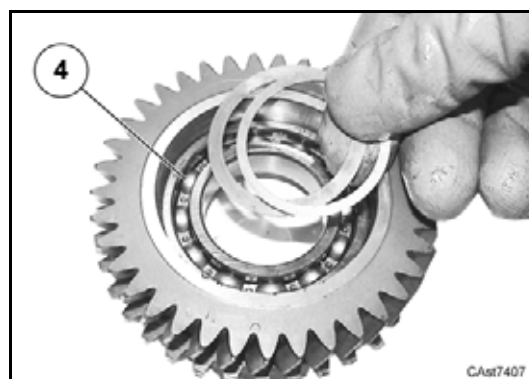


Figure 16

# Disassembly and Assembly Operations

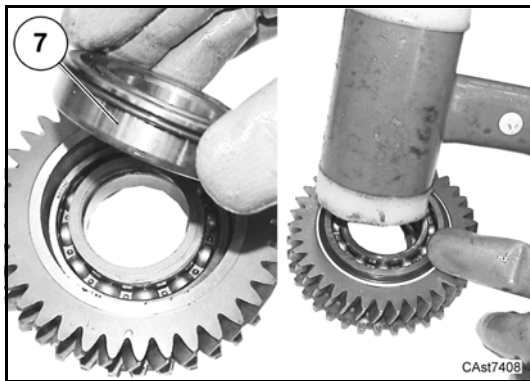


Figure 17

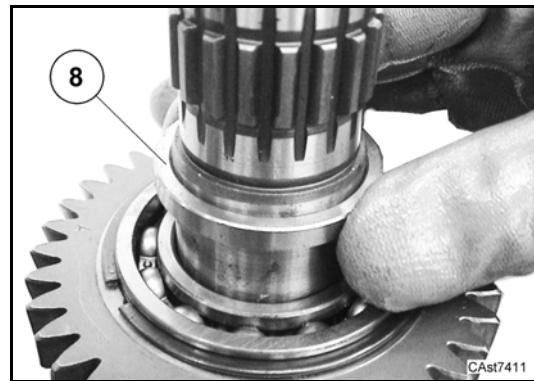


Figure 20

8. Assemble on shaft (1) shim (3) 0.5 mm thickness.

[Refer to: figure 18.](#)

9. Assemble assy (16) with buffer CA715848.

[Refer to: figure 19 and section E.1 \(.....\).](#)

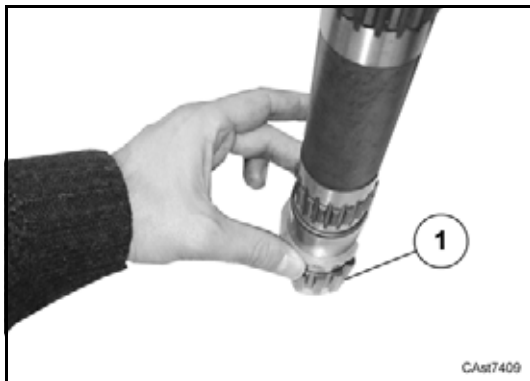


Figure 18



Figure 21

12. Turn cover (13). Use a support for cover.

[Refer to: figure 22.](#)

13. Assemble bearing (11) with tool CA715848.

[Refer to: figure 23 and section E.1 \(.....\).](#)

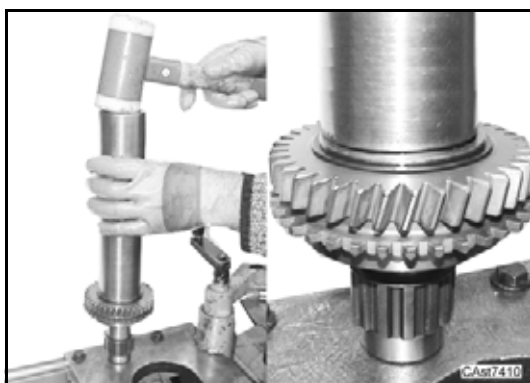


Figure 19



Figure 22

10. Assemble shim (8).

[Refer to: figure 20.](#)

11. Assemble seal (14) with prescribed tool.

[Refer to: figure 21 and section E.1 \(.....\).](#)

# Disassembly and Assembly Operations

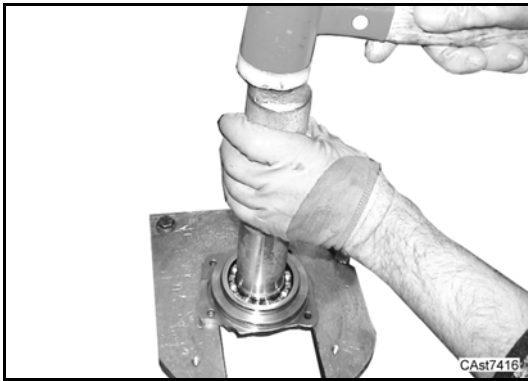


Figure 23

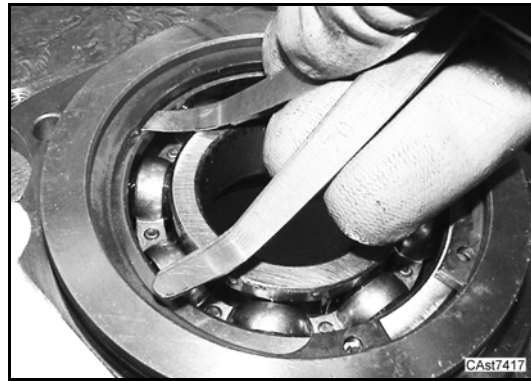


Figure 26

14. Assemble snap ring (9).

[Refer to: figure 24.](#)

15. Assemble a new O-Ring (12).

[Refer to: figure 25.](#)

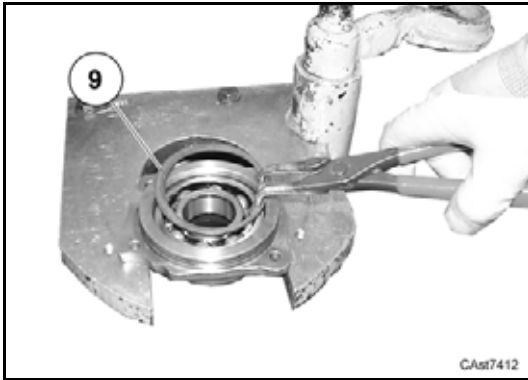


Figure 24

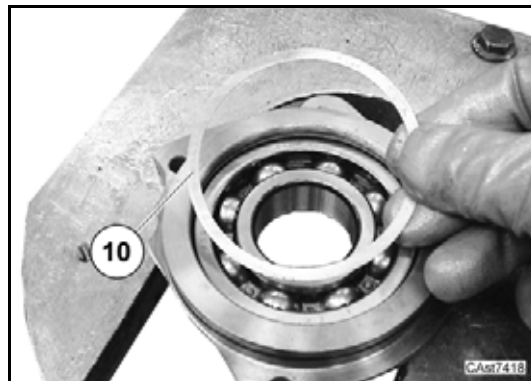


Figure 27

18. Assemble pre-assembled shaft on flange.

[Refer to: figure 28.](#)

19. Use a soft hammer.

[Refer to: figure 29.](#)

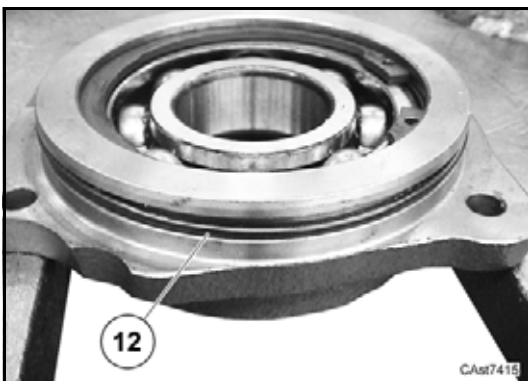


Figure 25

16. With thickness gauge, determine play between bearing (11) and snap ring (9).

[Refer to: figure 26.](#)

17. Remove snap ring (9). Insert shim (10) from range of shims available until you obtain an end float value between 0 and 0,1 mm. Reassemble snap ring (9).

[Refer to: figure 27 and section C.6 \[5a\].](#)

## Disassembly and Assembly Operations

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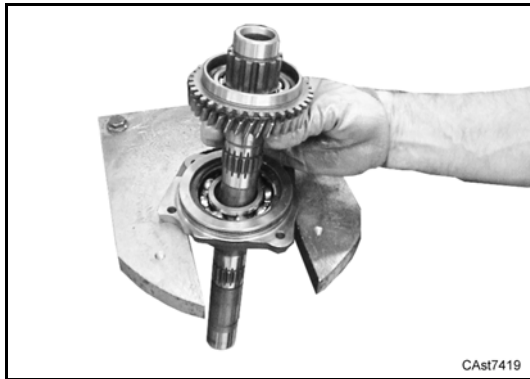


Figure 28

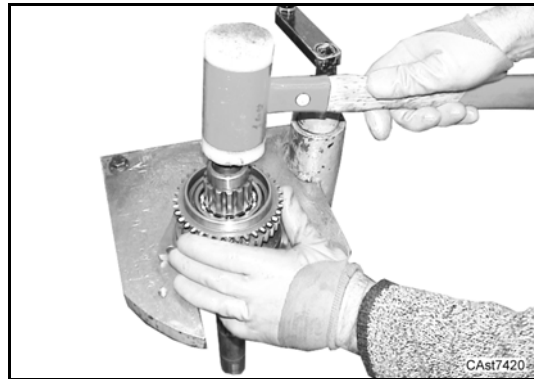


Figure 29

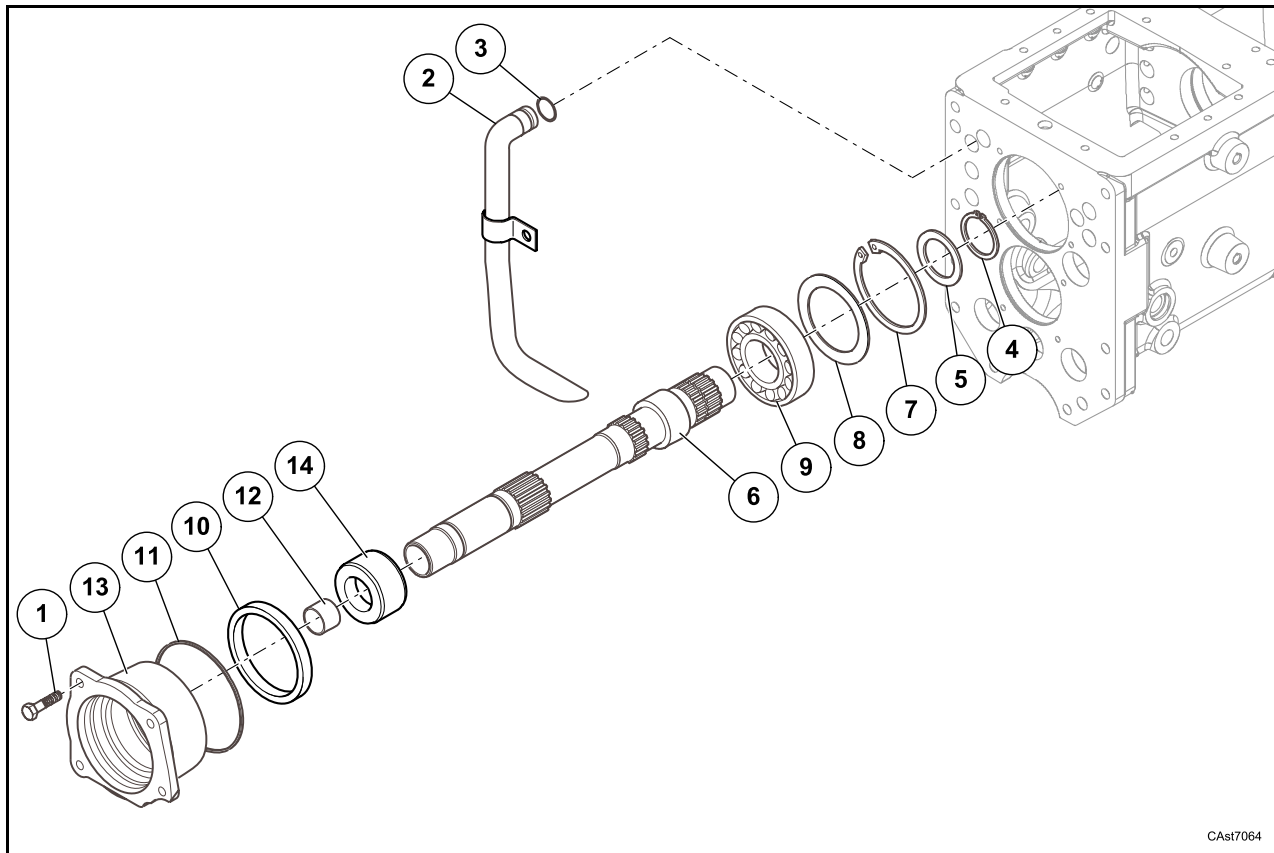
20. Assemble assy on gear box. Assemble recovery oil pipe and relevant O-Ring, only for models 24+24 power shuttle and synchro splitter. Assemble four fastening screws of cover to prescribed torque.

[Refer to: section C.4.](#)



# Disassembly and Assembly Operations

## INPUT SHAFT - 12+12 POWER SHUTTLE



**8+8  
synchro  
shuttle**

**12+12  
synchro  
shuttle**

**24+24  
synchro shuttle  
and synchro  
splitter**

**24+24  
synchro shuttle  
and power  
splitter**

**12+12  
power  
shuttle**

**24+24  
power shuttle  
and synchro  
splitter**

For models

-

-

-

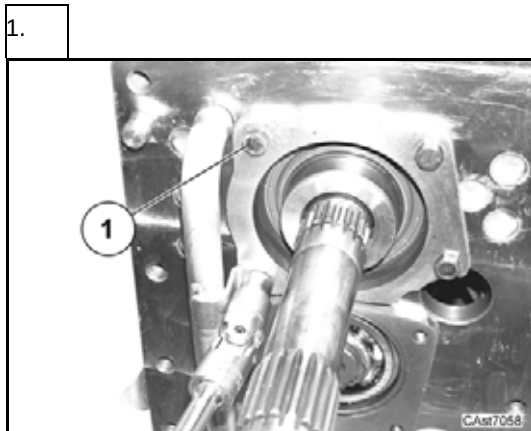
-

|

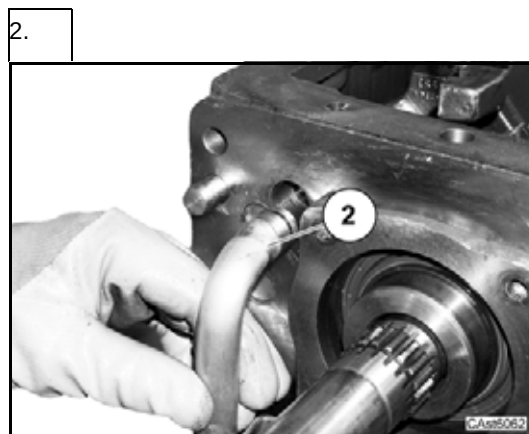
-

### Disassembly

Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

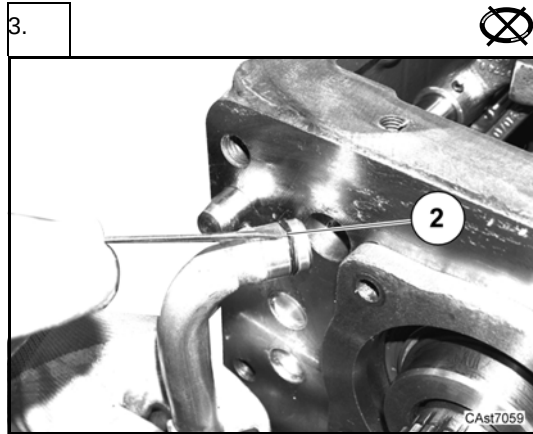


Remove four screws (1) of input shaft support.

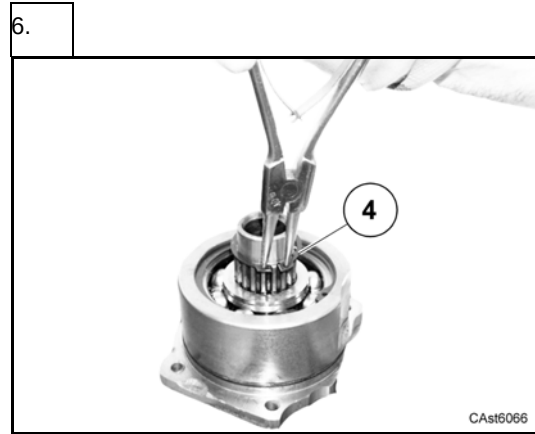


Remove recovery oil pipe (2).

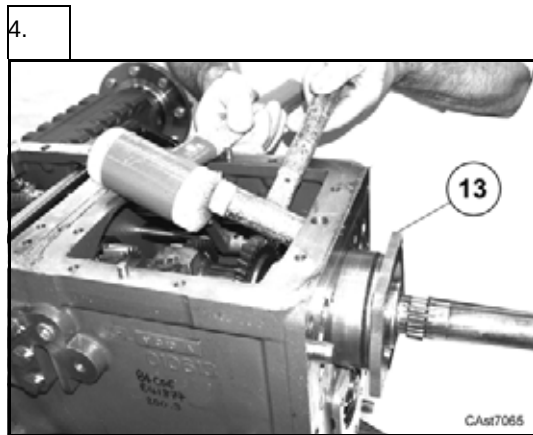
# Disassembly and Assembly Operations



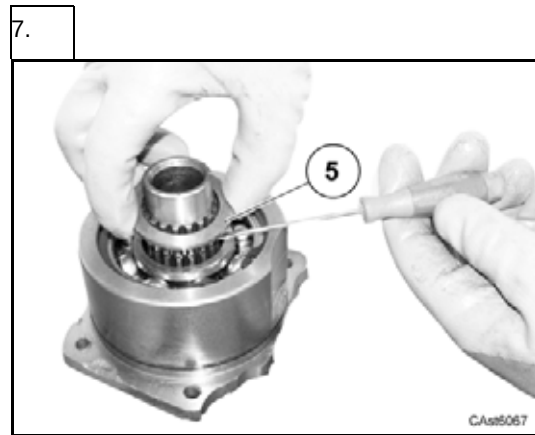
Remove O-Ring (3) from pipe.



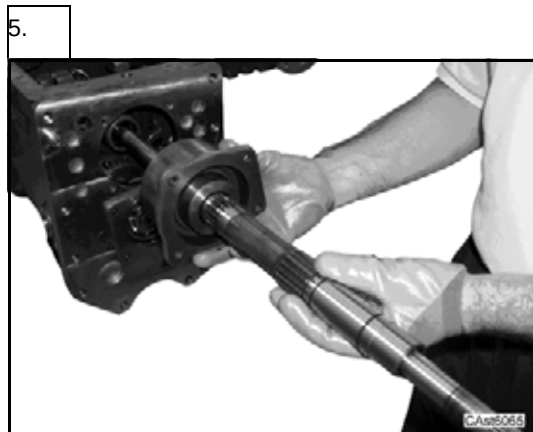
Assemble assy on the vice and remove snap ring (4).



Remove support (13) of the input shaft from gear box.



Remove shim (5).



Remove assembled assy.

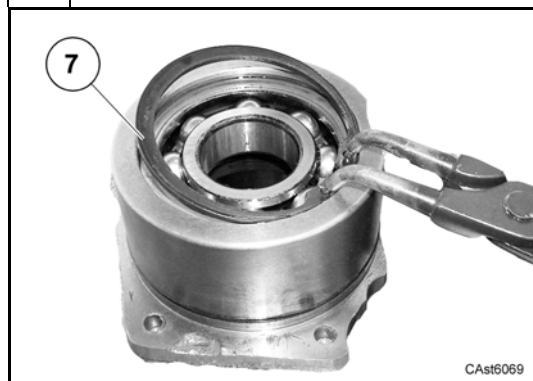


Pull out shaft (6) by means of an hammer.



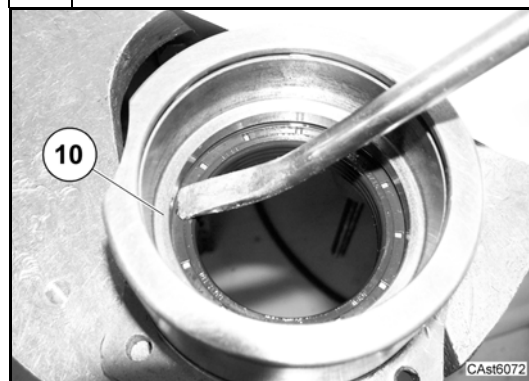
# Disassembly and Assembly Operations

9.



Remove snap ring (7) from the support.

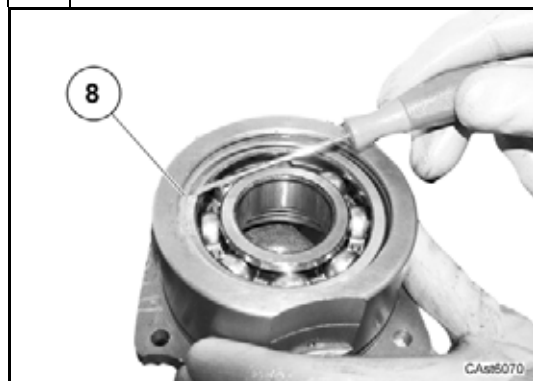
12.



Remove seal ring (10).

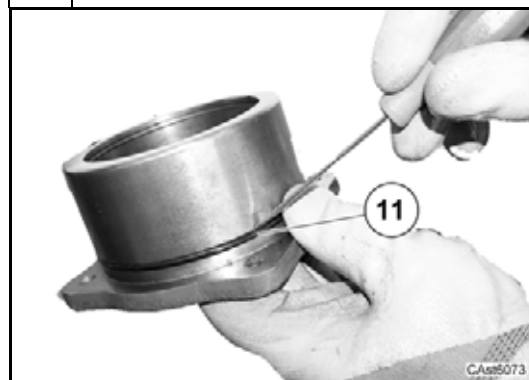
**NOTE:** Destructive operation for seal ring.

10.



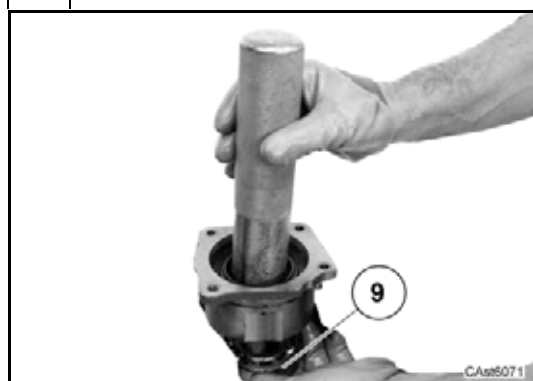
Remove shim (8).

13.



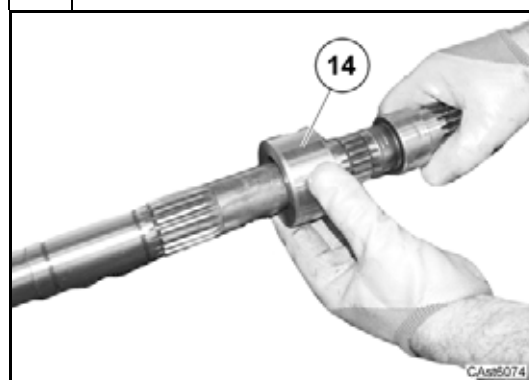
Remove O-Ring (11) from support (13) of input shaft.

11.



Remove bearing (9) using a suitable buffer.

14.



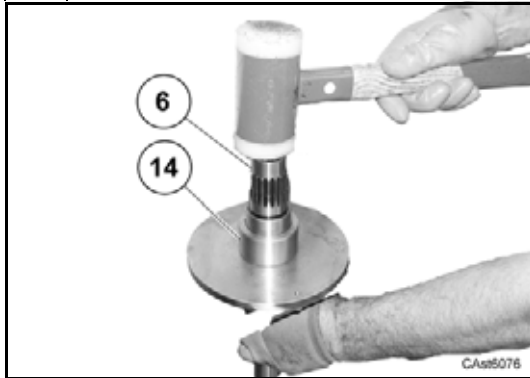
Remove bush (14) from the shaft with a suitable buffer.

# Disassembly and Assembly Operations

## Assembly

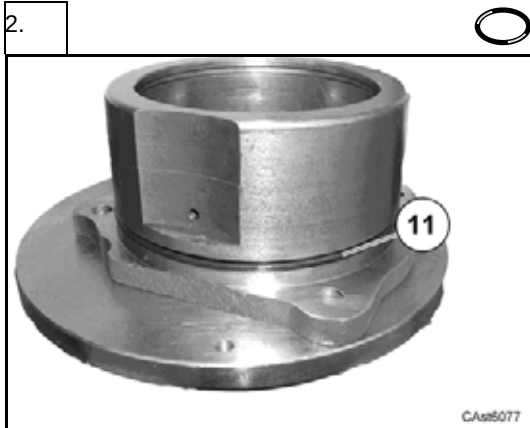
Some of the following pictures may not show exactly your transmission, but the indicated operations are correct anyway.

1.



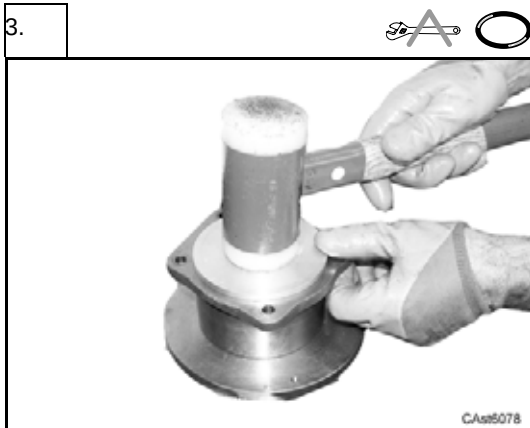
Assemble bush (14) on the shaft (6).

2.



Assemble O-Ring (11) on support (13) of input shaft.

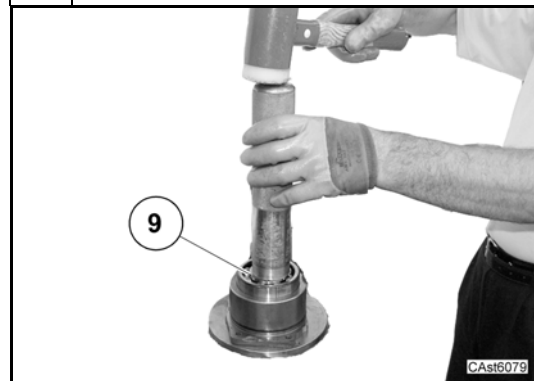
3.



Assemble seal ring (10) by means of proper buffer CA716151.

[Refer to: section E.1.](#)

4.



Assemble bearing (9) using tool CA716108.

[Refer to: section E.1.](#)

5.



To guarantee an end float value between 0 and 0.1 mm proceed as follows. Insert snap ring (7).

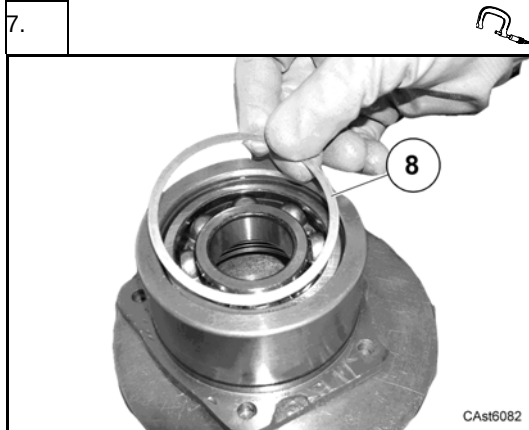
[Refer to: section C.6 \[5\] type A.](#)

6.



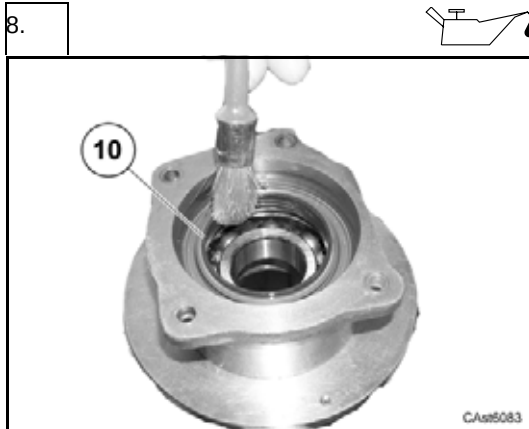
Measure with a thickness gauge value of the an end float between snap ring (7) and bearing.

# Disassembly and Assembly Operations

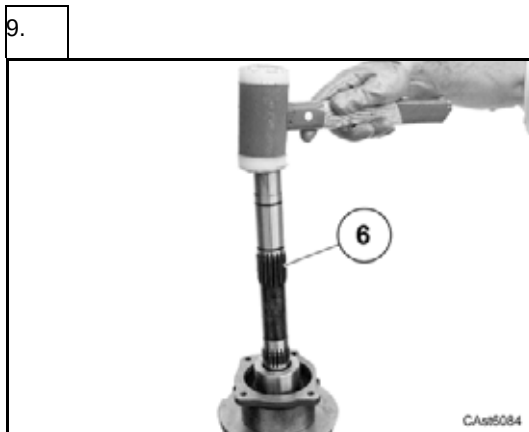


Remove snap ring (7). Insert shim (8) from the range of shims available until you obtain an end float value between 0 and 0.1 mm. Reassemble snap ring (7).

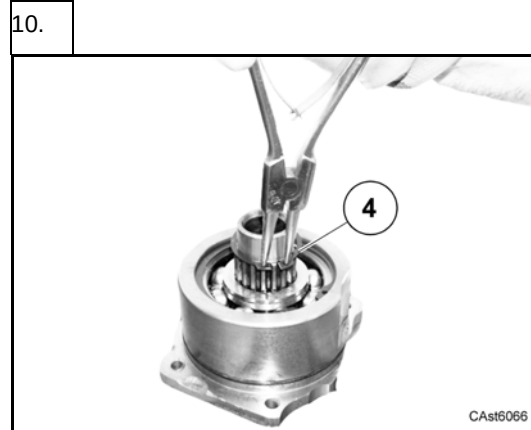
[Refer to: section C.6 \[5\] type A.](#)



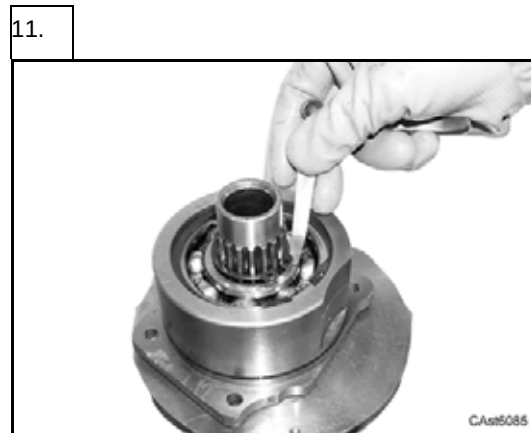
Turn assy. Lubricate seal ring lip (10).



Assemble shaft (6).

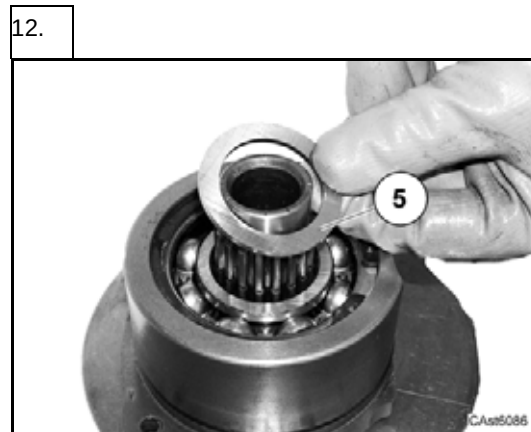


Turn assy and insert snap ring (4).



To guarantee an end float value between 0 and 0.1 mm proceed as follows. Measure with a thickness gauge value of end float between snap ring (4) and bearing (9).

[Refer to: section C.6 \[5\] type B.](#)

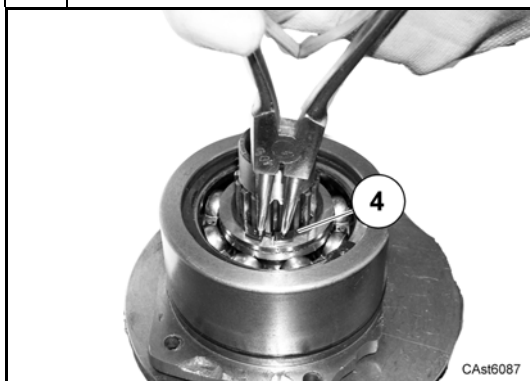


Remove snap ring (4). Insert shim (5) between shims range available until you obtain an end float value within 0 and 0.1 mm.

[Refer to: section C.6 \[5\] type B.](#)

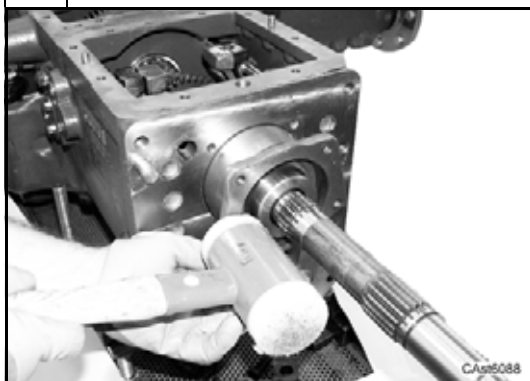
# Disassembly and Assembly Operations

13.



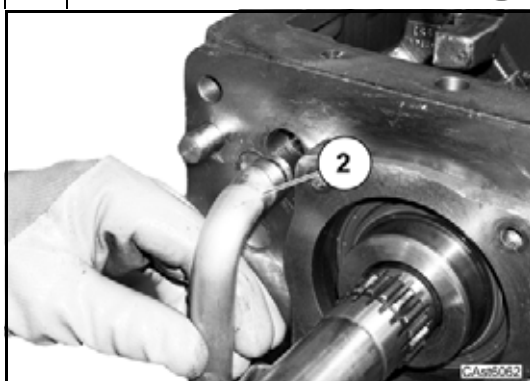
Assemble snap ring (4).

14.



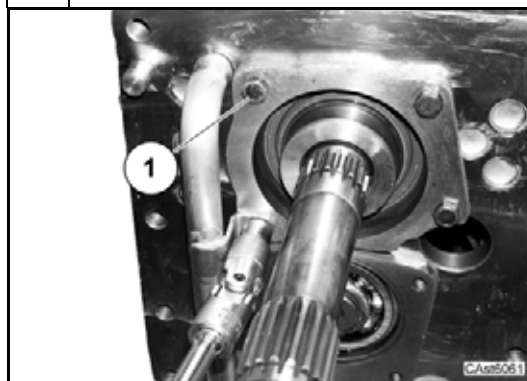
Assemble assy on the transmission box.

15.



Assemble recovery oil pipe (2) and relevant O-Ring.

16.

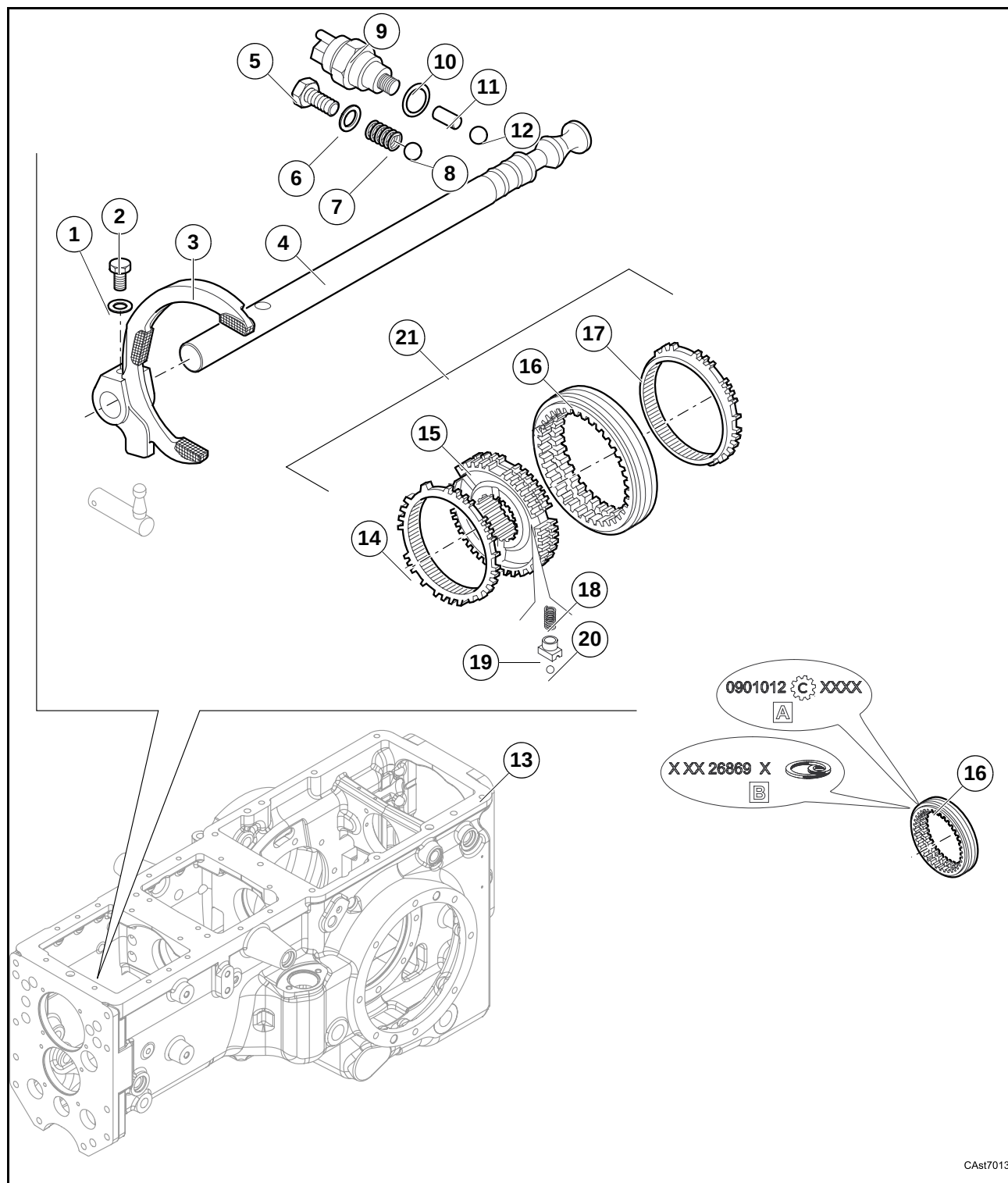


Assemble four fastening screws (1) to the requested torque.

[Refer to: section C.4.](#)

# Disassembly and Assembly Operations

## SYNCHRONIZER SHUTTLE (REPLACEMENT)



CAst7013

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models |                           |                             |                                                     |                                                   | -                         | Hi-LO                                             |



# Disassembly and Assembly Operations

## Disassembly



### Warning

**Always apply reference marks between lever and pin to be able to identify their correct position during assembly.**

Refer to: figure 1.

1. Remove screw (2) and washer (1) of the reverser fork (3), 3<sup>rd</sup>/4<sup>th</sup> (a) and 1<sup>st</sup>/2<sup>nd</sup> speed (b).

Refer to: figure 2.

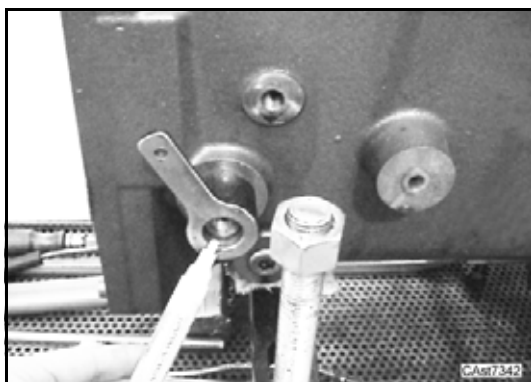


Figure 1

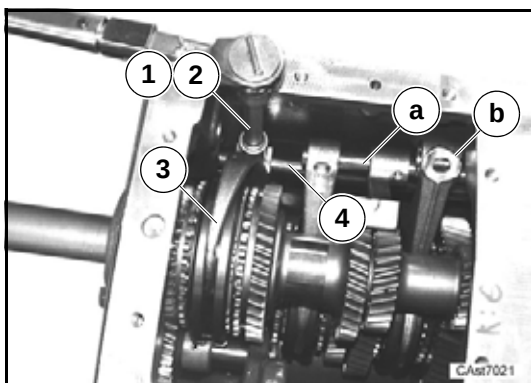


Figure 2

2. To release the reverser pin and the 1<sup>st</sup>/2<sup>nd</sup> (a) and 3<sup>rd</sup>/4<sup>th</sup> (b) speed pins:
  - Remove dowel pins from gear block 3<sup>rd</sup>/4<sup>th</sup> (a) and 1<sup>st</sup>/2<sup>nd</sup> speed (b).

Refer to: figure 3.

3. Remove sensor (9).

4. Unscrew control position screw (5) of the reverser pin (4), pin 3<sup>rd</sup>/4<sup>th</sup> screw and 1<sup>st</sup>/2<sup>nd</sup> speed screw.

Refer to: figure 4.

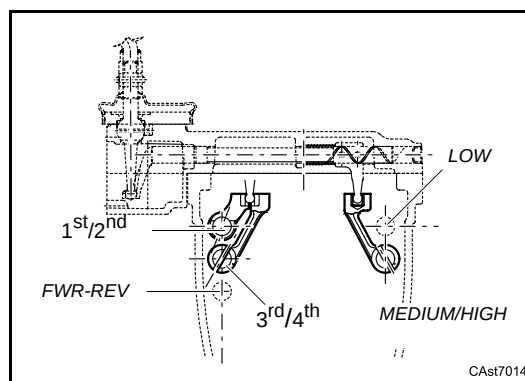


Figure 3

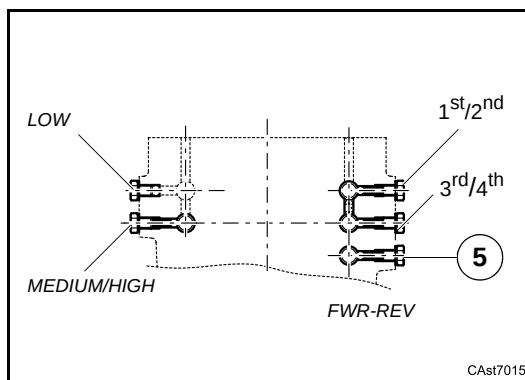


Figure 4

1. Move 3 rods.

**NOTE:** Move speed control pins (low speed control pin not available for 8+8 model).

2. Remove reverser fork (3), replace it if worn.

Refer to: figure 5.

3. Remove clutch housing.

Refer to: section D.9.

4. Remove idle gear.

Refer to: section D.24.

5. Remove the 4 cover's screws (input shaft).

Refer to: figure 6.

**NOTE:** In transmission model 12+12 power shuttle/ 24+24 power shuttle-synchro splitter there is a recovery oil pipe (from clutch housing to gear box). Remove the pipe. Remove O-Ring.

Refer to: figure 7.

# Disassembly and Assembly Operations

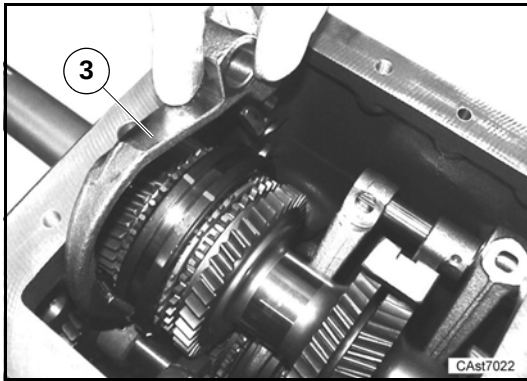


Figure 5

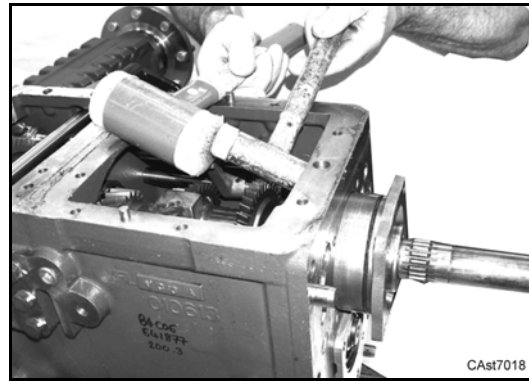


Figure 8

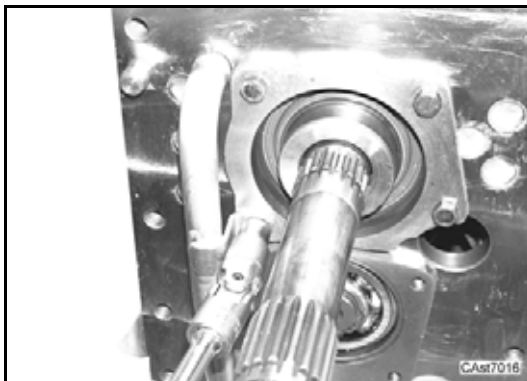


Figure 6

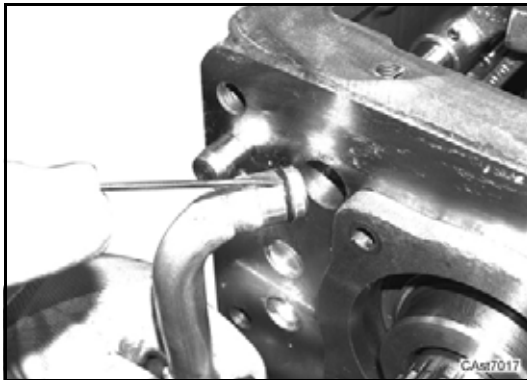


Figure 7

1. Extract the input shaft.

Refer to: figure 8.

2. Remove reverser synchronizer kit (21). Replace it if necessary.

**NOTE:** With model 24+24 power shuttle and synchro splitter synchronizer performs function of a Hi-LO synchro splitter.

## Warning

**We wish to advise that transmissions could be equipped with two kind of synchronizer.**

figure 9 and 10.

The synchronizer assemblies are interchangeable but single components are not interchangeable.

For more detailed information look spare parts catalogue.

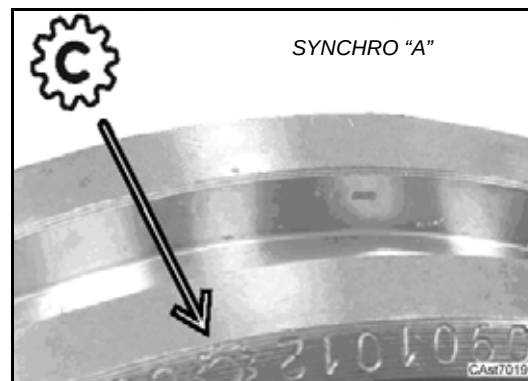


Figure 9

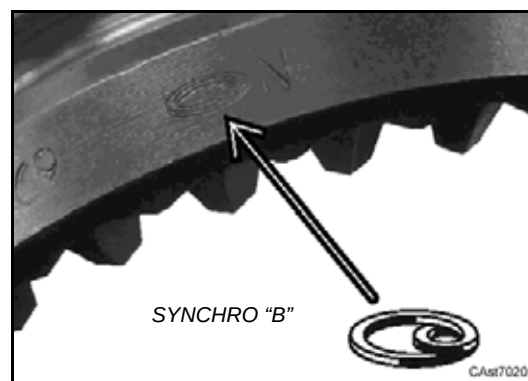


Figure 10

**IMPORTANT:** If replacement of one of the synchronizer parts is needed, look at the symbol located on the sleeve to identify if the synchronizer assembly is A or B model.

**NOTE:** Components of synchronizer reverser.

Refer to: figure 11.



# Disassembly and Assembly Operations

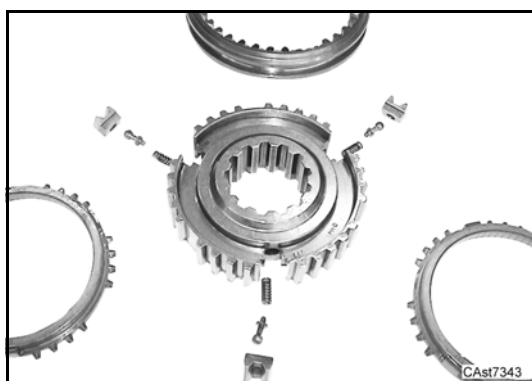


Figure 11

## Assembly

1. Assemble reverser synchronizer kit (21) on the primary shaft.

**NOTE:** *Correct assembly of synchronizer reverser inserts.*

[Refer to: figure 12.](#)



Figure 12

2. Assemble input shaft.
3. Check end float [5].

[Refer to: section C.6.](#)

4. Tighten 4 cover screws to prescribed torque.

[Refer to: section C.4. and figure 6.](#)

**NOTE:** *In transmission model 12+12 power shuttle/ 24+24 power shuttle-synchro splitter there is a recovery oil pipe (from clutch housing to gear box).*

5. Assemble a new O-Ring on the pipe.

[Refer to: figure 7.](#)

6. Assemble pipe on the gear box.

[Refer to: figure 7.](#)

7. Assemble idle gear.

[Refer to: section D.24.](#)

8. Assemble clutch housing.

[Refer to: section D.9.](#)

9. Assemble reverser fork (3) on the rod.

[Refer to: figure 5.](#)

10. Assemble screw (2) and washer (1) on the reverser fork (3).

11. Tighten control position screw of the reverser pin.  
Requested torque: section C.4.

[Refer to: figure 4.](#)

12. Adjust reverser fork (3) with screw (2).

[Refer to: figure 2.](#)

13. Restore initial position of the fork rods 3rd / 4th (a) and 1st / 2nd speed (b) with relevant washers and screws.

[Refer to: section C.4.](#)

## Disassembly and Assembly Operations

---

14. Tighten 3<sup>rd</sup>/4<sup>th</sup> speed pin screw and 1<sup>st</sup>/2<sup>nd</sup> speed pin screw.

[Refer to: figure 4.](#)

15. Assemble the dowel pins of 3<sup>rd</sup>/4<sup>th</sup> and 1<sup>st</sup>/2<sup>nd</sup> gears control block.

[Refer to: figure 3.](#)

16. Assemble reverser pin control screw, 3<sup>rd</sup>/4<sup>th</sup> speed pin screw and 1<sup>st</sup>/2<sup>nd</sup> speed pin screw.

[Refer to: section C.4.](#)

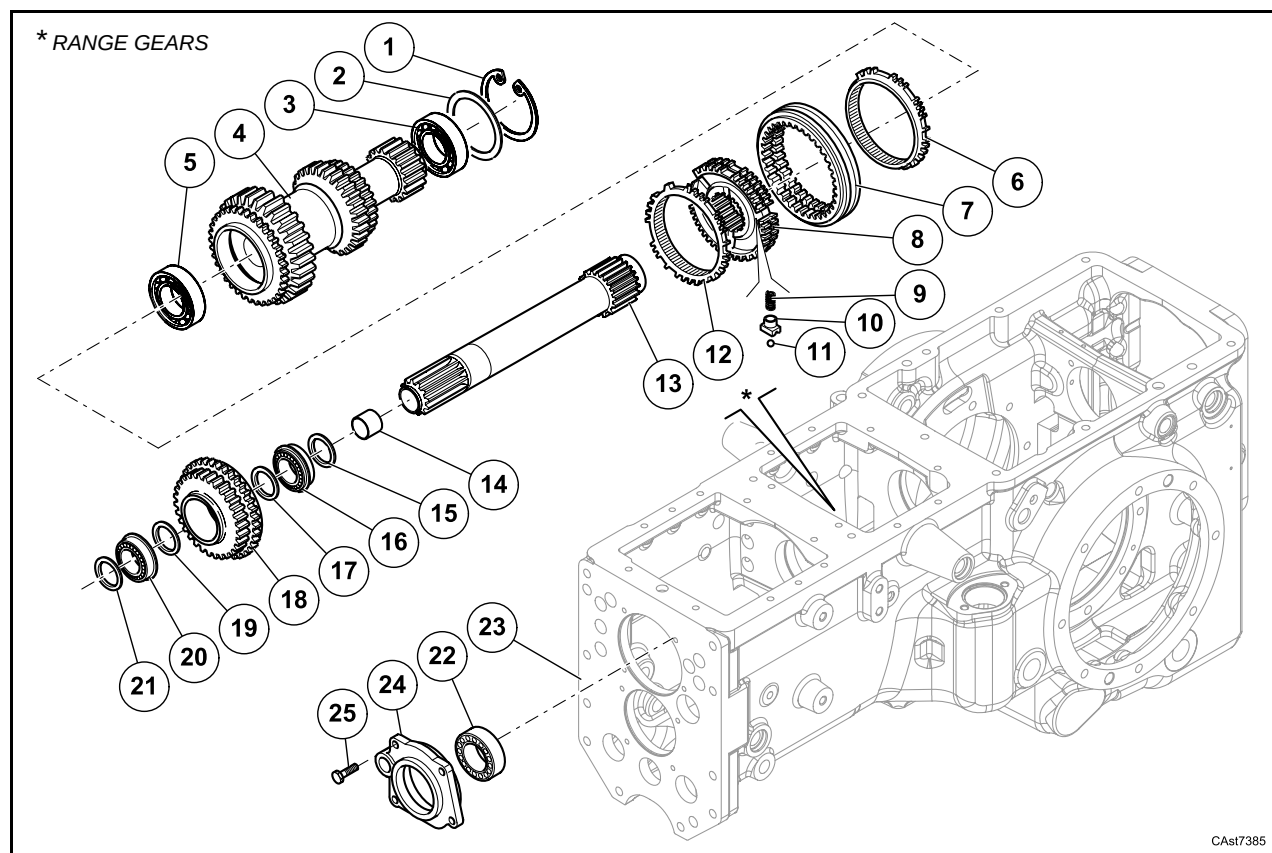
17. Repeat steps 10-16 also for speed control pins.

18. Assemble sensor (9) to prescribed torque.

[Refer to: section C.4.](#)

# Disassembly and Assembly Operations

## SPEED GEARS (PRIMARY SHAFT)



|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models |                           |                             |                                                     |                                                   |                           |                                                   |

### Disassembly

1. Remove snap ring (1).

Refer to: figure 1.

2. Remove shim (2).
3. Remove middle bearing (3).

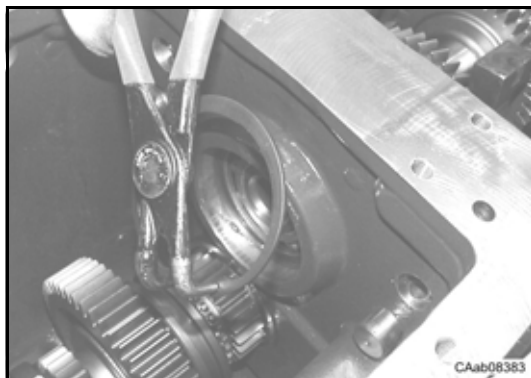


Figure 1

5. Remove cover (24).
6. Remove input shaft (13) assembled with its components from the gear box.
7. Remove from input shaft (13) FRW-REV synchronizer (12, 11, 10, 9, 8, 7, 6), bearing (22), shim (21), bearing (20), shim (19), gear (18), shim (17), bearing (16) and shim (15).
8. Remove primary shaft (4). Remove bearing (5) from the primary shaft (4).
9. If necessary remove bush (14) from the input shaft (13).

4. Remove screws (25).

# Disassembly and Assembly Operations

## Assembly

1. Assemble bush (14) on the input shaft (13) with special tool CA715829.

Refer to: [section E.1](#).

2. Assemble bearing (16) in the gear (18). Insert shims (17) and (19).
3. Assemble bearing (20) in the gear (18).
4. Check end float [5a].

Refer to: [section C.6 and figure 2](#).

5. Assemble gear (18) assembled on the primary shaft (13), spacer (21) and bearing (22) with a suitable tool.
6. Assemble synchronizer kit (12, 11, 10, 9, 8, 7, 6).

Refer to: [figure 3](#).

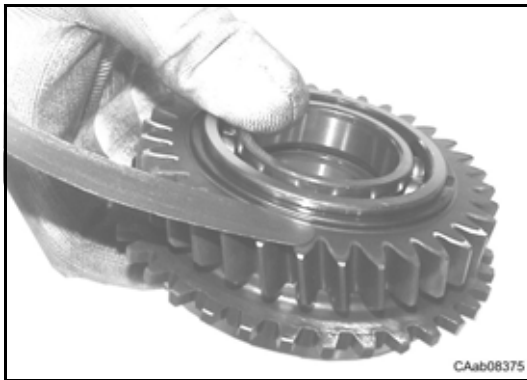


Figure 2

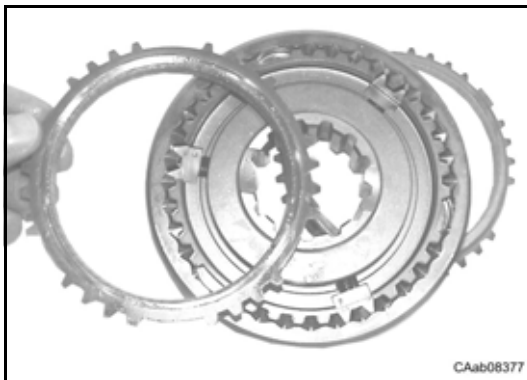


Figure 3

7. Turn input shaft (13) and assemble synchronizer kit.
8. Assemble input shaft assembled in the gear box (23).
9. Assemble bearing (5) on the primary shaft (4) using an appropriate tool.
1. Assemble primary shaft (4).

Refer to: [figure 4](#).

2. Settle groups with special tool CA715821 and CA715830. Check that groups rotate freely.

Refer to: [section E.1 and figure 5](#).

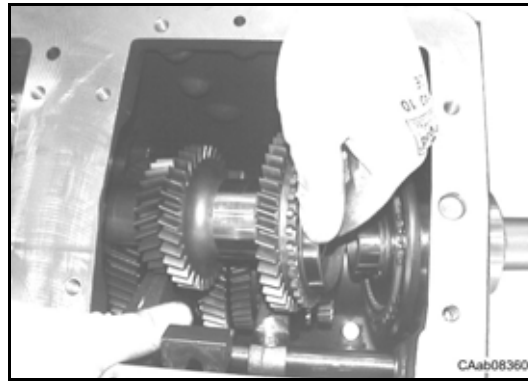


Figure 4

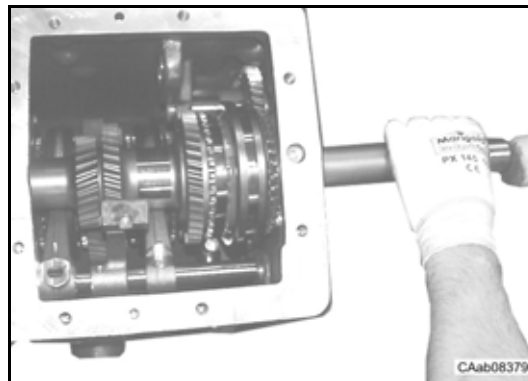


Figure 5

3. Assemble cover (24).
4. Tighten screws (25) to the requested torque.

Refer to: [section C.4](#).

5. Assemble bearing (3) on the opposite side of the primary shaft (4) with special tool CA715821 and CA715830.

Refer to: [figure 6](#).

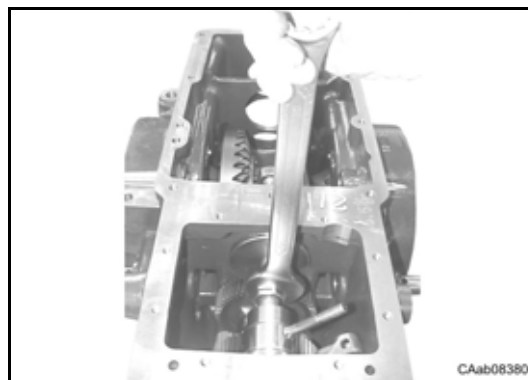


Figure 6

6. Assemble snap ring (1).
7. Proceed as follows to determine end float [3]: measure value (A) with a thickness gauge, that is end float between bearing (3) and snap ring (1). Lubricate and assemble shim (2). Reassemble snap ring (1). Check again value (A) and repeat operations described

## Disassembly and Assembly Operations

previously so as to obtain an end float value included in the prescribed range:  $0.15 \div 0.25$  mm.

Refer to: section C.6 and figure 7 and 8.

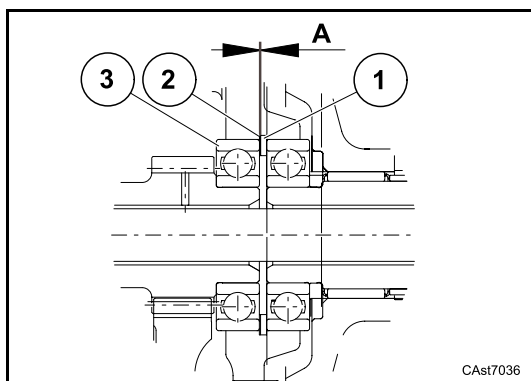


Figure 7

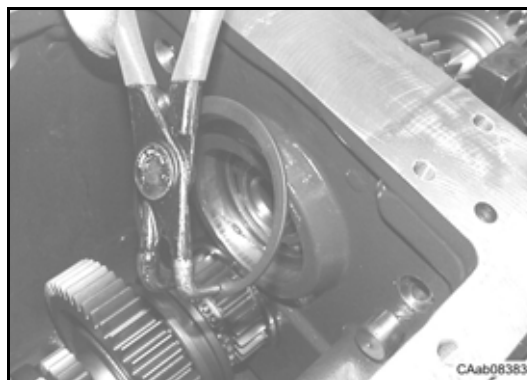


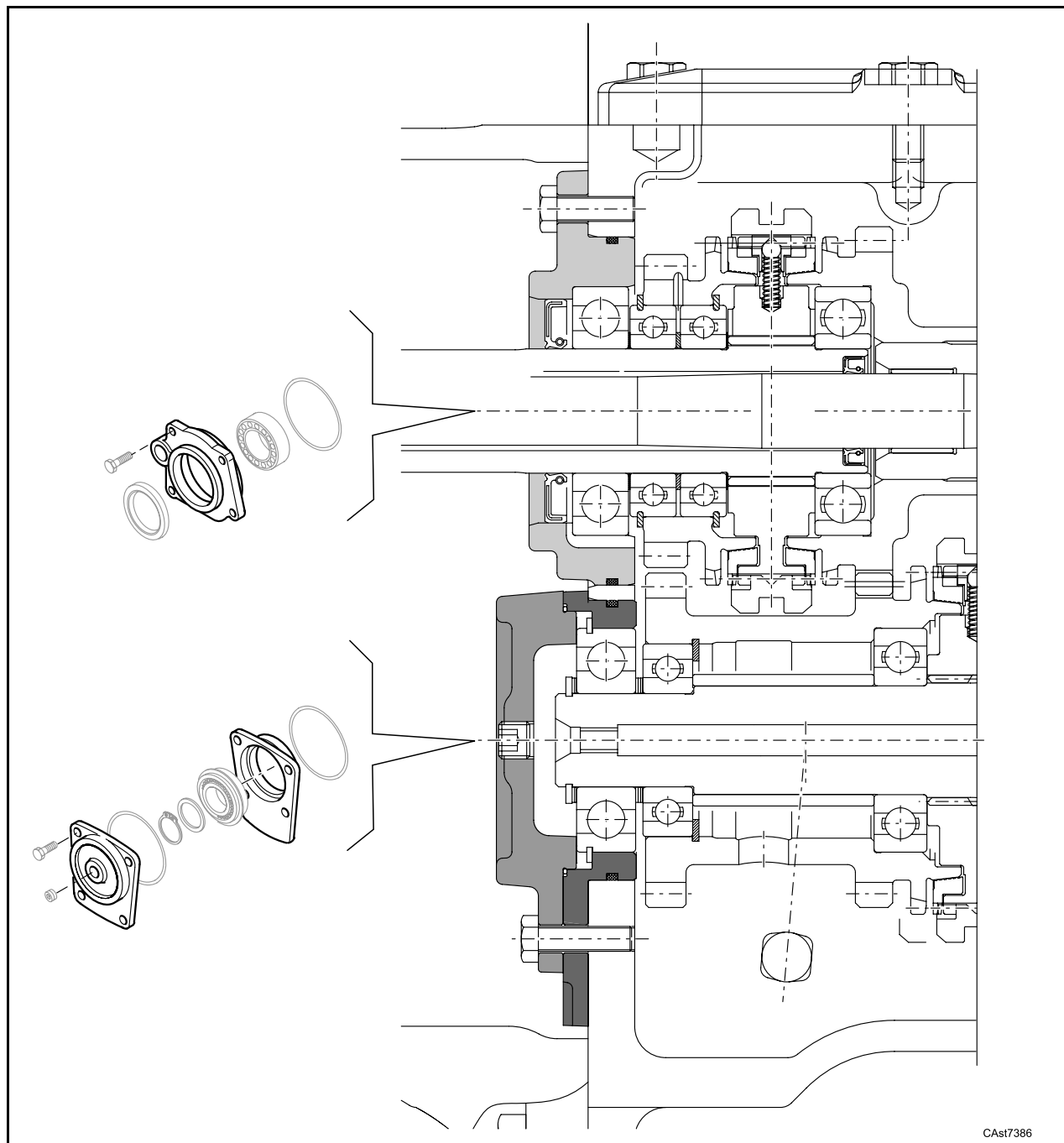
Figure 8

# Disassembly and Assembly Operations

## Primary shaft covers

**NOTE:** Covers assembled on transmission models 8+8 and 12+12 synchro shuttle.

Refer to: figure 9.



CAst7386

Figure 9

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models |                           |                             | -                                                   | -                                                 | -                         | -                                                 |

# Disassembly and Assembly Operations

**NOTE:** Covers assembled on transmission model 24+24 synchro shuttle and synchro splitter.

Refer to: figure 10.

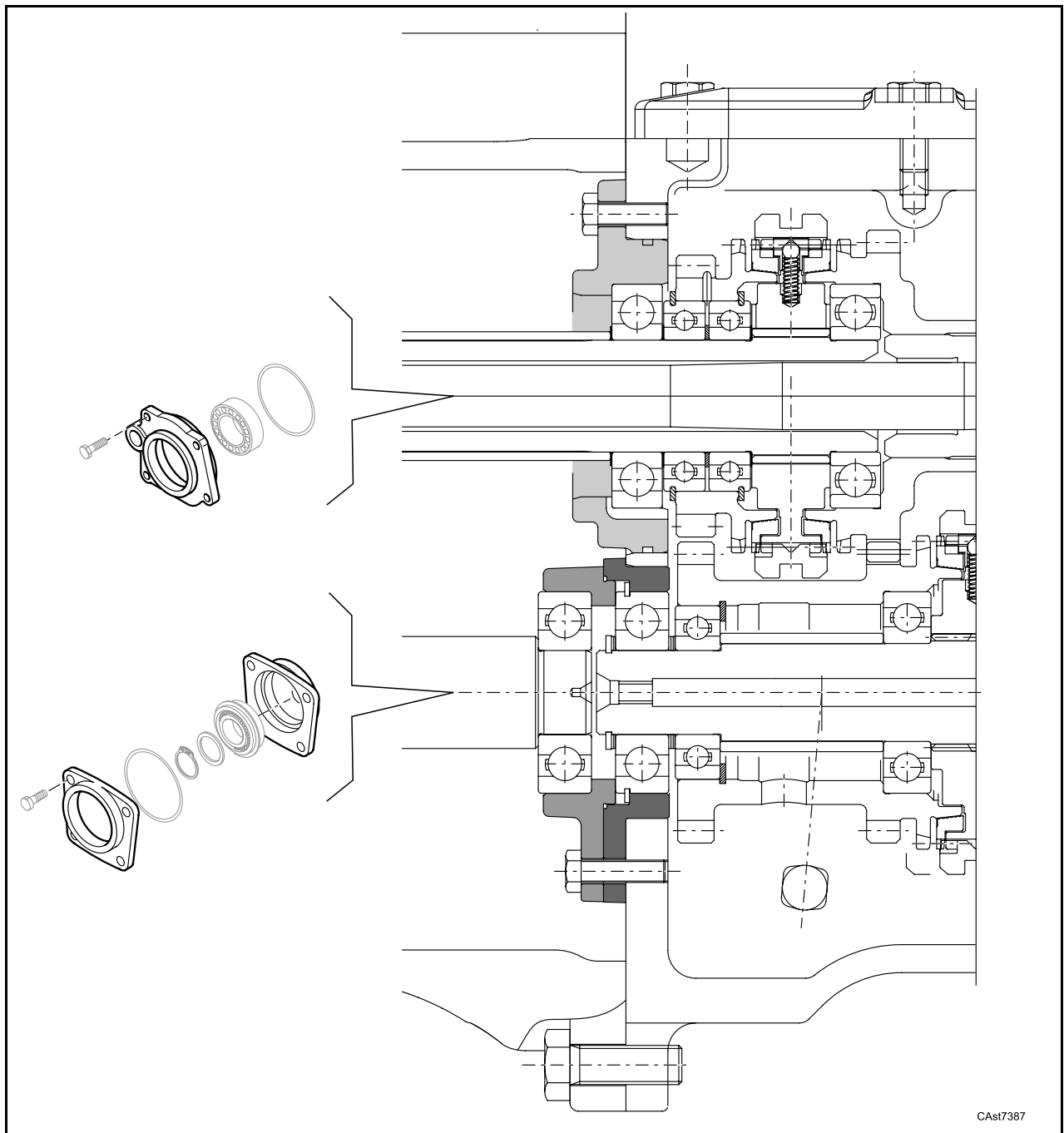


Figure 10

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models | -                         | -                           |                                                     | -                                                 | -                         | -                                                 |



# Disassembly and Assembly Operations

**NOTE:** Covers assembled on transmission model 24+24 synchro shuttle and synchro splitter.

Refer to: figure 11.

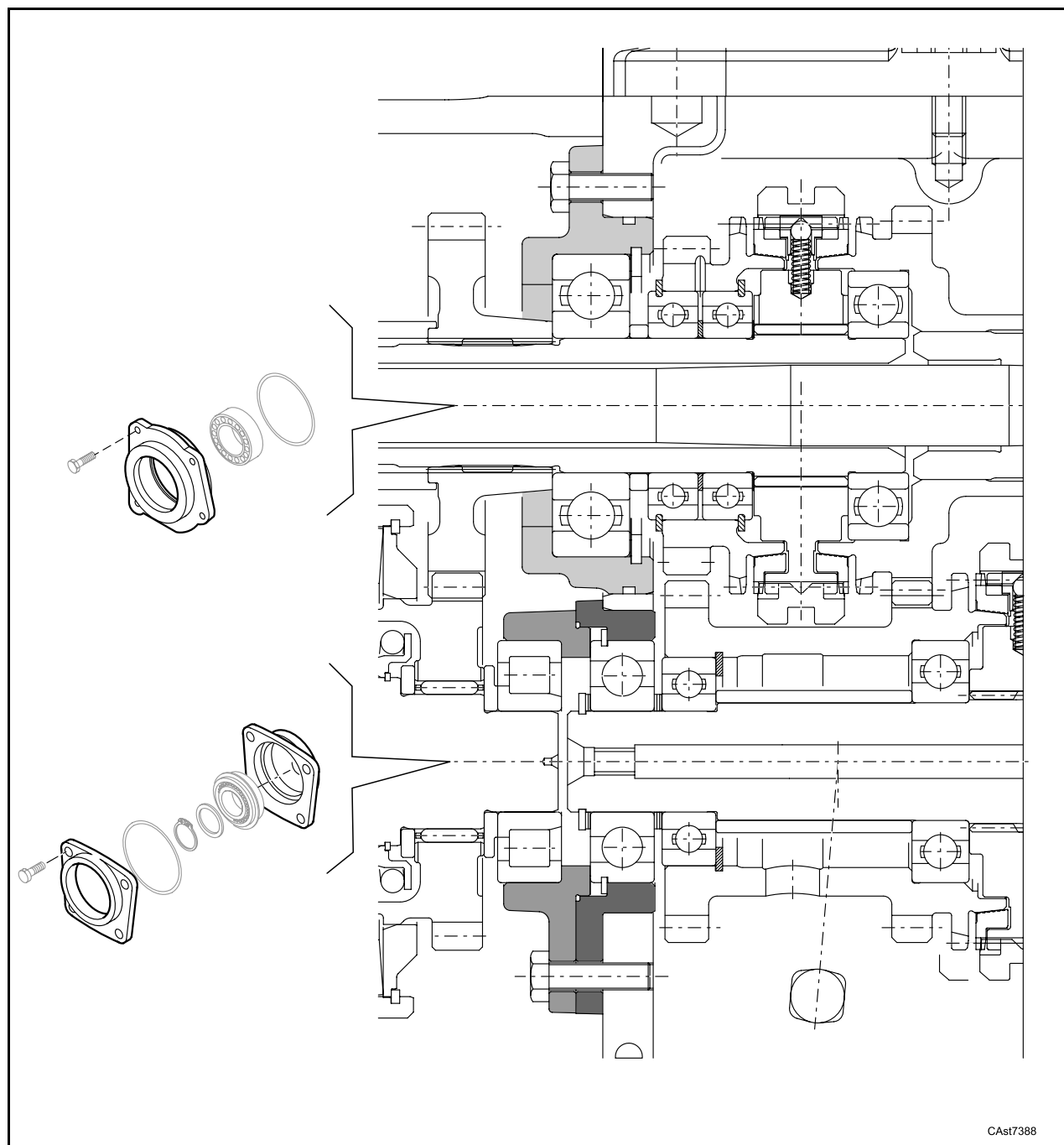


Figure 11

| 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|

For models

- - - | - -

# Disassembly and Assembly Operations

**NOTE:** Covers assembled on transmission model 12+12 synchro shuttle.

Refer to: figure 12.

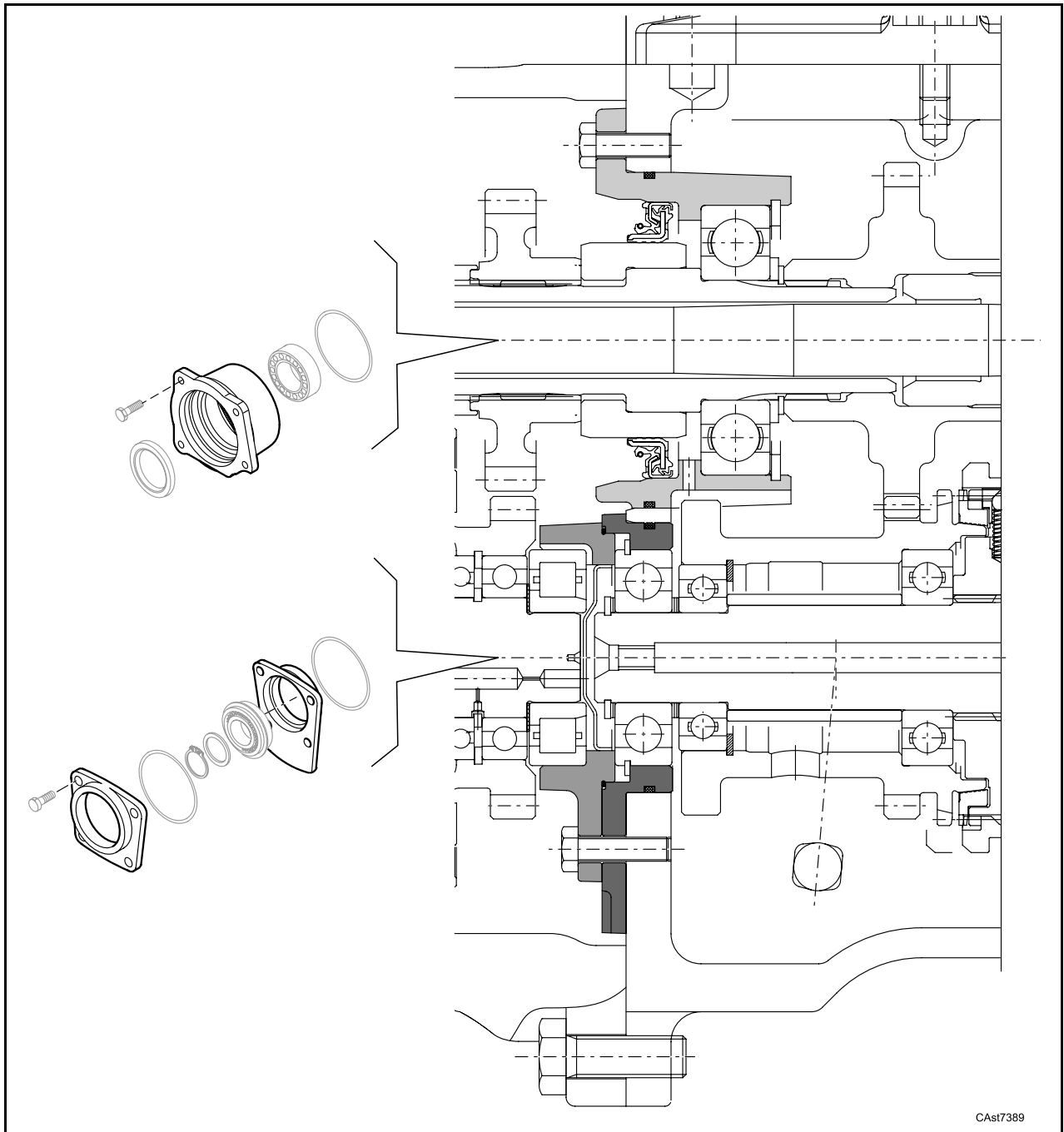


Figure 12

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models | -                         | -                           | -                                                   | -                                                 |                           | -                                                 |

# Disassembly and Assembly Operations

**NOTE:** Covers assembled on transmission model 24+24 power shuttle and synchro splitter.

Refer to: figure 13.

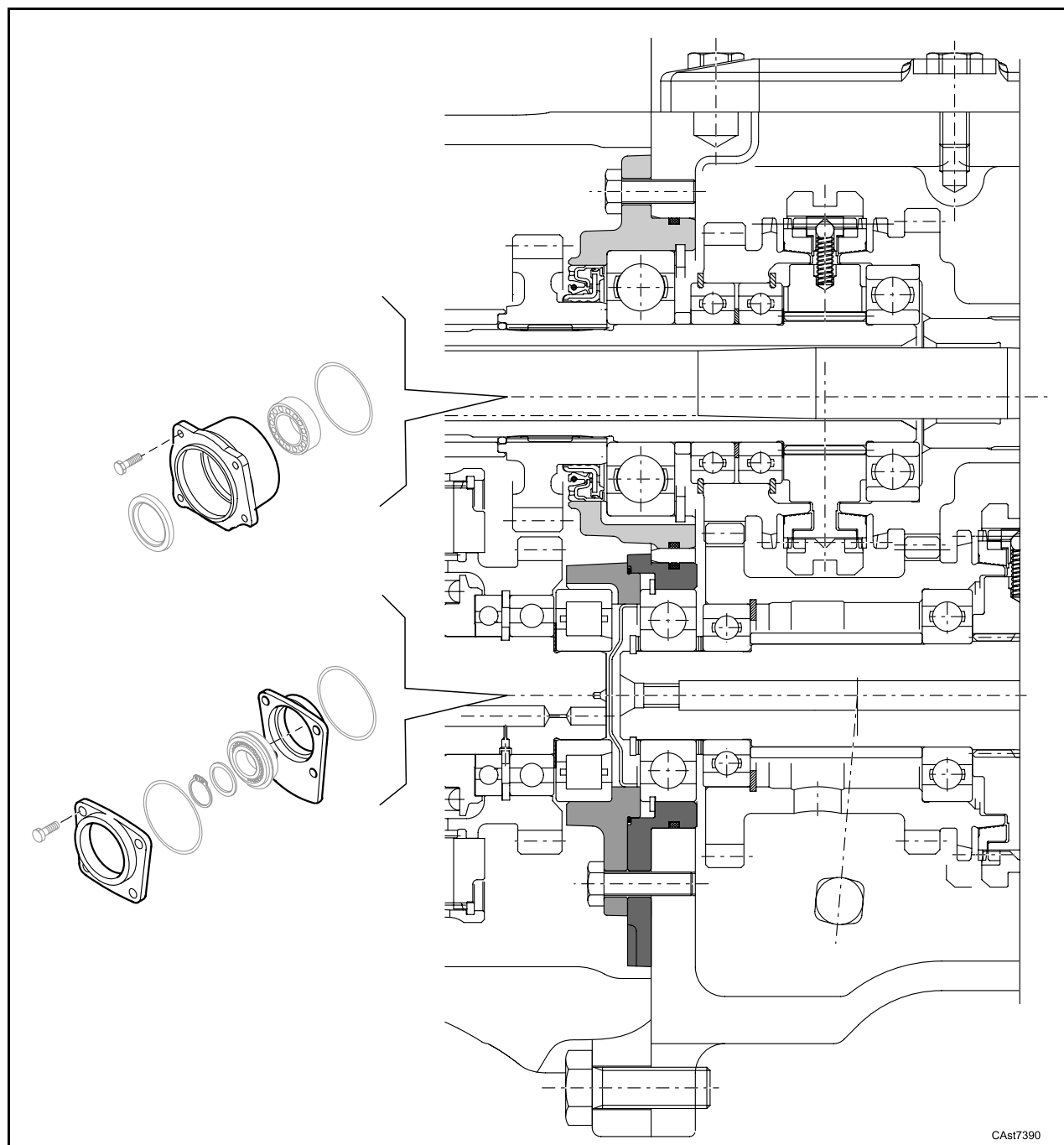
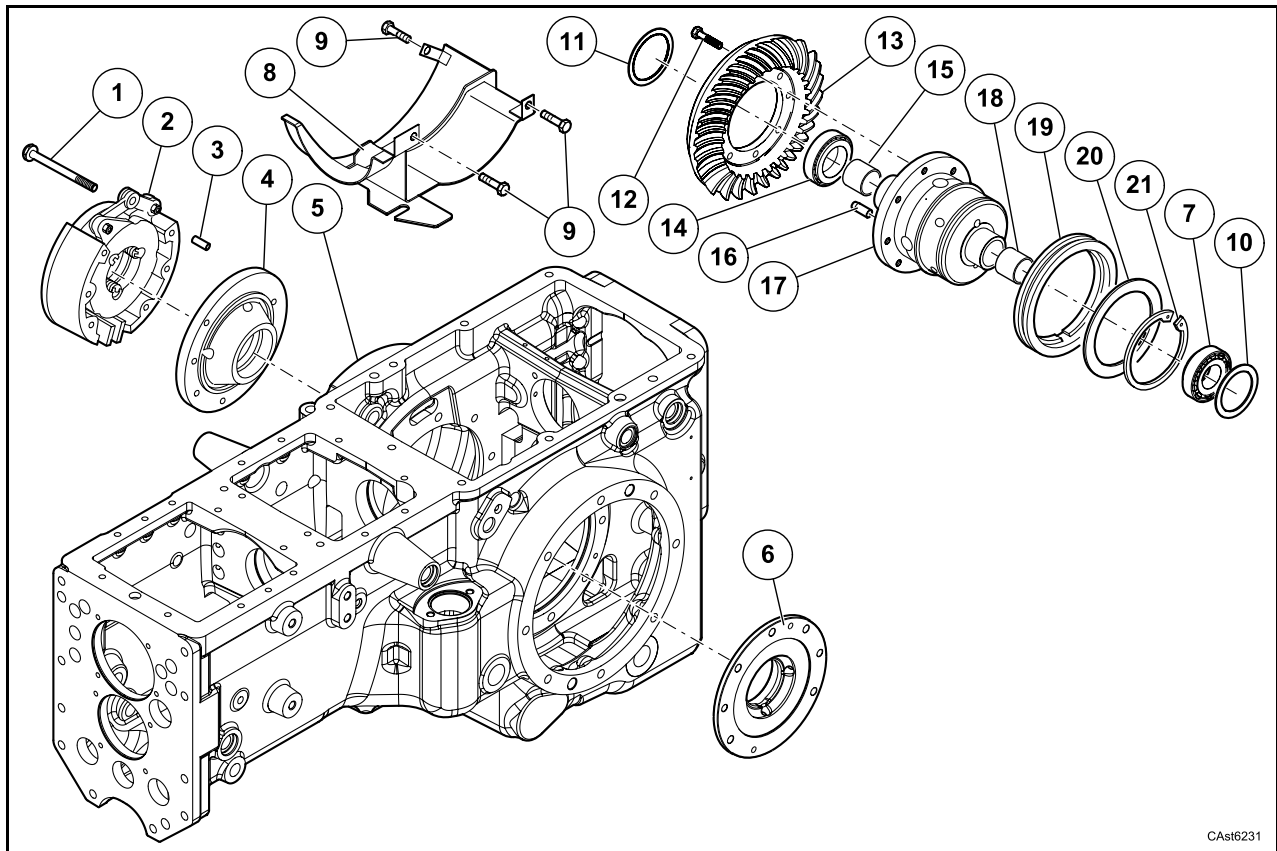


Figure 13

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models | -                         | -                           | -                                                   | -                                                 | -                         |                                                   |

# Disassembly and Assembly Operations

## DIFFERENTIAL ASSY



CAst6231

**8+8  
synchro  
shuttle**

**12+12  
synchro  
shuttle**

**24+24  
synchro shuttle  
and synchro  
splitter**

**24+24  
synchro shuttle  
and power  
splitter**

**12+12  
power  
shuttle**

**24+24  
power shuttle  
and synchro  
splitter**

For models

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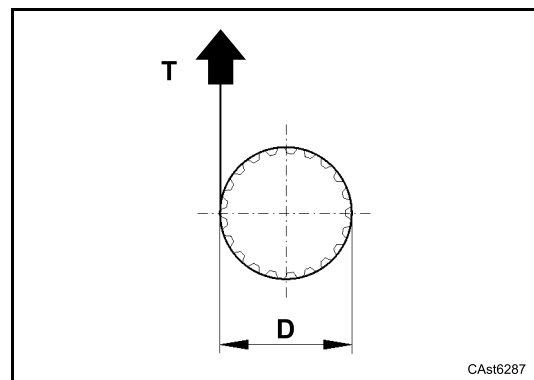
### Disassembly

- Before starting disassembly, use a dynamometer whose cord is wound on the pinion ring nut with diameter  $D = 80$  mm to check for bearing preload. If during assembly bearings are not changed, expected load will have a value 40-50% lower than expected for new bearings.

Refer to: figure 1 and 2.



Figure 14



CAst6287

Figure 15

- Disconnect brake control.
- Disassembly screws (1).
- Remove brake (2).
- Remove right flange (4).
- Remove bearing cup (14) from right flange (4).

# Disassembly and Assembly Operations

7. Repeat same operations from the other side (left side).
8. Remove bearings cones (14) and (7) from differential box (17).
9. Remove screws (12) and disassemble bevel gear crown (13).
10. Remove screws (9).
11. Remove guard (8).

## Assembly

1. Assemble guard (8).

[Refer to: figure 3.](#)

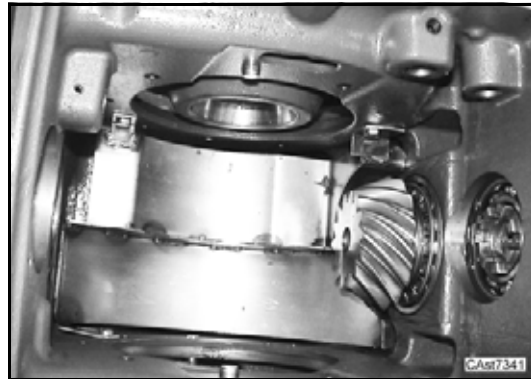


Figure 16

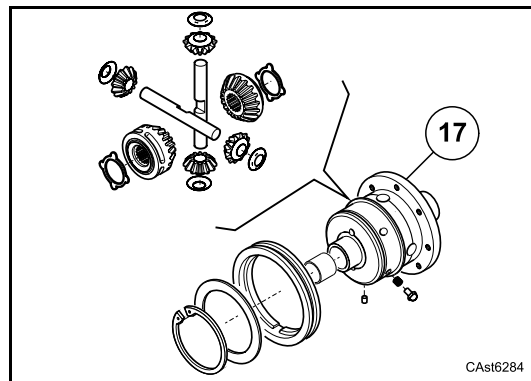


Figure 17

2. Assemble screws (9) to requested torque.  
[Refer to: section C.4.](#)
3. Check guard adjustment (it must not chatter).
4. Assemble differential box (17) as shown in the figure.  
[Refer to: figure 4.](#)

**NOTE:** Position of pin on differential gear.

[Refer to: figure 5.](#)

**NOTE:** Correct assembly of springs and pins of differential box.

[Refer to: figure 6.](#)

# Disassembly and Assembly Operations

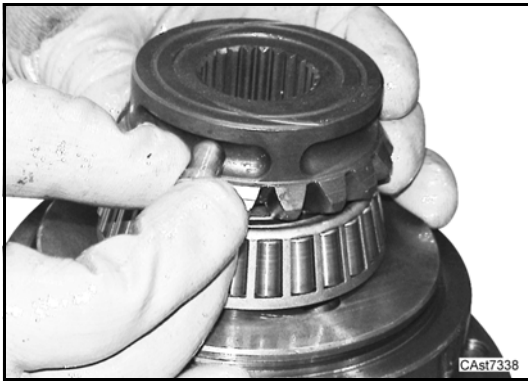


Figure 18

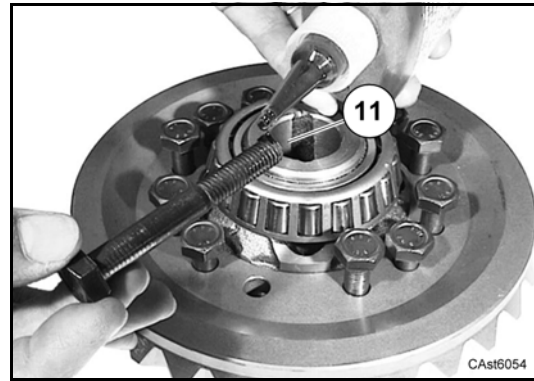


Figure 21

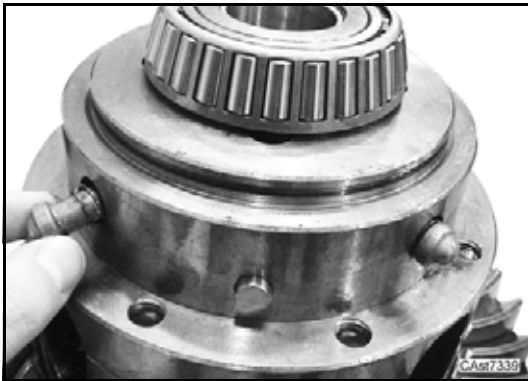


Figure 19

**NOTE:** Correct position of differential locking sleeve on differential box.

Refer to: figure 7.

5. Before matching surfaces, make sure that they are perfectly clean, de-grease and clean them with appropriate detergents.
6. Place bevel gear crown (13) on differential half box (17).
7. Apply prescribed sealant on the thread and tighten screws (12) to the requested torque.

Refer to: figure 8 and section C.4.

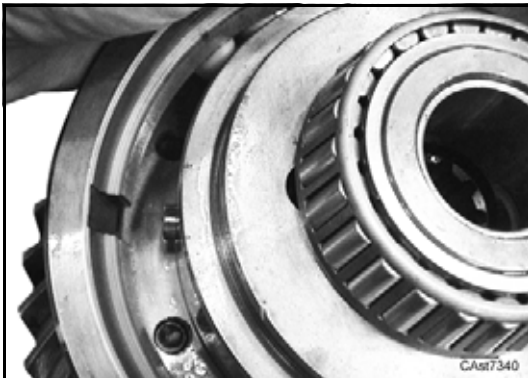


Figure 20

8. Assemble cones of bearings (14) and (7) on the differential box (17) with the special tool CA715093.

**NOTE:** Calculate shims quantity (11) and (10) to be used if replaced or flanges (4) and (6) or differential (17). If parts (4), (6) or (17) are not replaced, use shims collected during disassembly.

9. Choose shims (11) and (10) with total thickness of 1.0 mm (necessary for first check), among available shims range. Assemble into flanges (4) and (6) shims (11) and (10).

Refer to: figure 9.

## SHIMS RANGE

|                |      |      |      |      |
|----------------|------|------|------|------|
| Thickness - mm | 0.05 | 0.10 | 0.30 | 0.50 |
| Quantity       | ---  | ---  | ---  | ---  |

10. Assemble bearings cups (14) and (7) to differential support flanges. If necessary use special tool CA715583.

Refer to: figure 10.

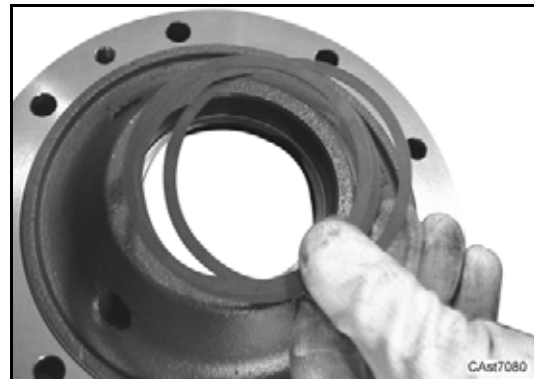


Figure 22



# Disassembly and Assembly Operations



Figure 23

11. Assemble differential assy.

Refer to: figure 11.

12. Assemble flanges (4) and (6).

Refer to: figure 12.

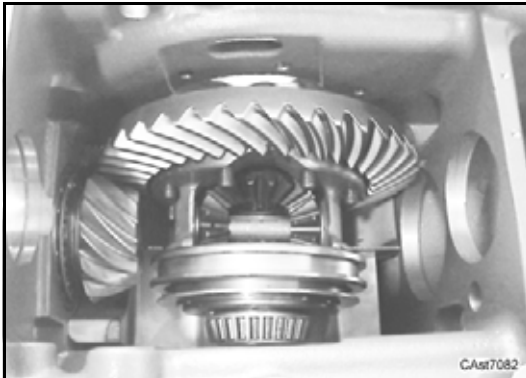


Figure 24

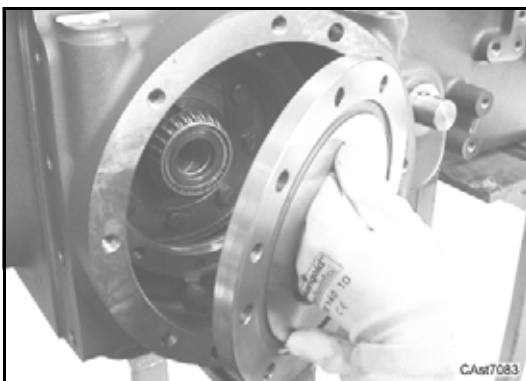


Figure 25

13. Assemble brake flange without brake assy. Tighten 5 screws (1).

Refer to: figure 13.

14. Measure pinion-bevel gear crown backlash.

The measured backlash value must be within the prescribed range:

0.10÷0.30 mm

Refer to: figure 14

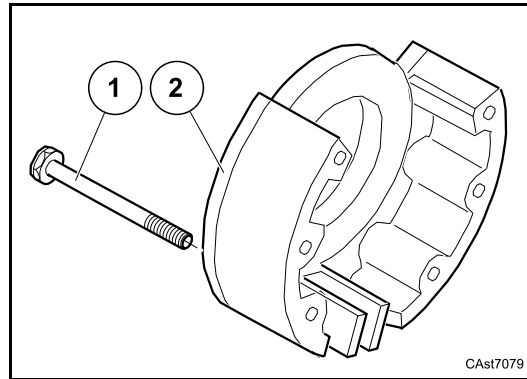


Figure 26

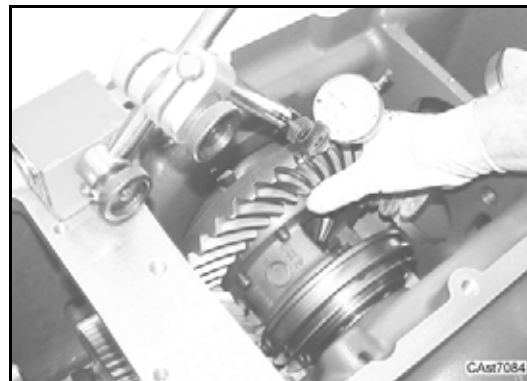


Figure 27

15. Choose shims (11) and (10) among the range available.

## SHIMS RANGE

|                |      |      |      |      |
|----------------|------|------|------|------|
| Thickness - mm | 0.05 | 0.10 | 0.30 | 0.50 |
| Quantity       | ---  | ---  | ---  | ---  |

Refer to: figure 15.

16. Adjust shims (11) and (10), remembering that:

[a] if the measured backlash is less than given tolerance range, increase shims (10) from the side opposite to bevel gear crown and decrease shims (11) of the same measure;

[b] if the measured backlash is greater than given tolerance range, increase shims (11) from the side of bevel gear crown and decrease shims (10) of the same measure.

Refer to: figure 16.



# Disassembly and Assembly Operations

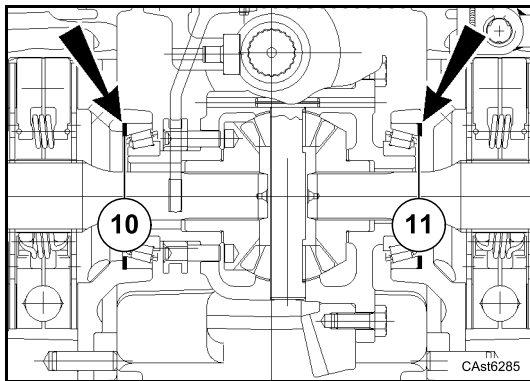


Figure 28



Figure 30

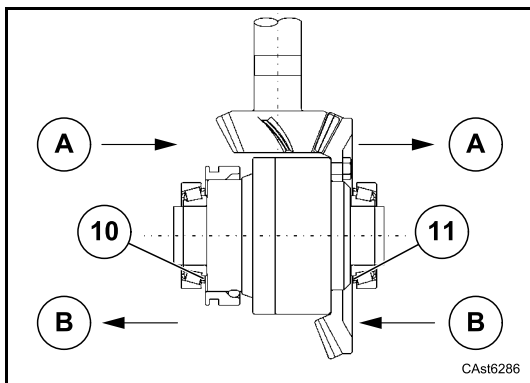


Figure 29

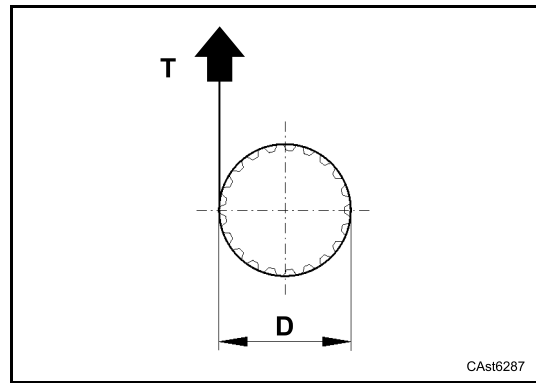


Figure 31

17. Once pinion-bevel gear crown backlash has been established, measure total preloading T of bearings (pinion-bevel gear crown system).

Use a dynamometer whose cord is wound on the pinion ring nut with diameter D= 80 mm.

The measured value should be within following range:

$$T = (P+5.8) \div (P+8.8) \text{ N}$$



## Warning

**Values for new bearings.**

Refer to: figure 17 and 18.

If bearings are not new, measured value should be starting value.

Refer to: section D.29.1.1.

18. If the measurement is not within the requested range, check well the assembly of each component and operate on the shims (11) and (10) remembering that:

[c] if the total preloading is less than given range, increase shims (11) and (10) by same measure, keeping pinion-bevel gear crown backlash value unchanged;

[d] if the total preloading is greater than given range, decrease shims (11) and (10) by same measure, keeping pinion-bevel gear crown backlash value unchanged.

Refer to: figure 19.

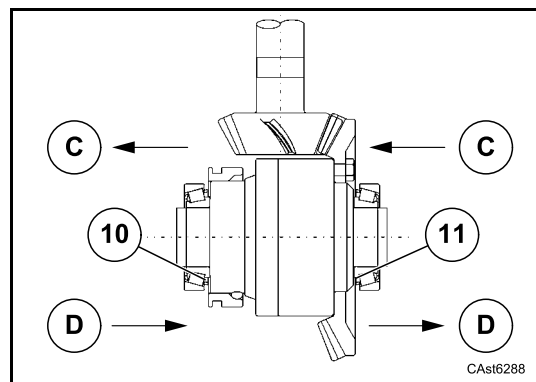


Figure 32

19. Remove screws (1) and brake flange (2).

20. Fasten with screws differential support flange (4).

# Disassembly and Assembly Operations

21. Assemble with tool 2 pins (3) using tool CA715815.

[Refer to: figure 20 and section E.1.](#)

22. Remove screws.

[Refer to: figure 21.](#)

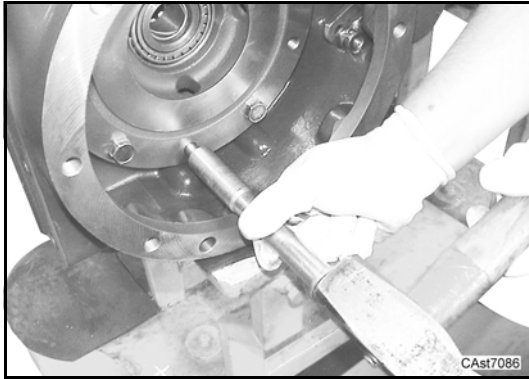


Figure 33

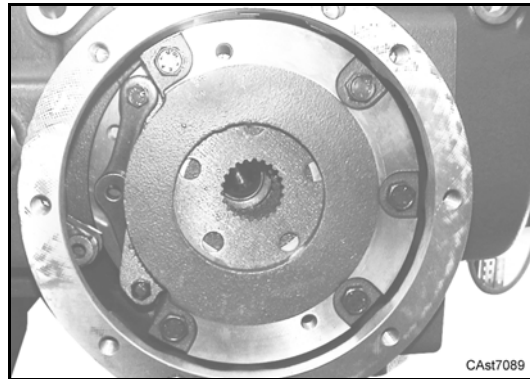


Figure 36

26. Check bevel gear crown backlash.

27. Connect brake control.

[Refer to: figure 24.](#)

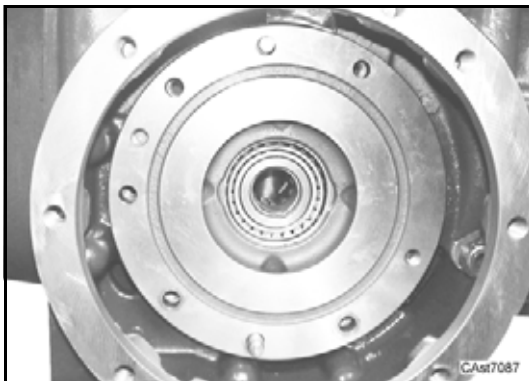


Figure 34

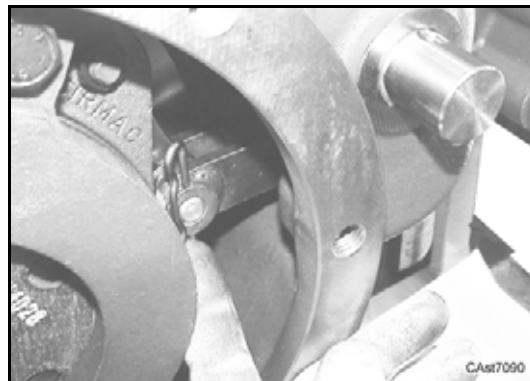


Figure 37

23. Assemble pre-assembled brake (2).

[Refer to: figure 22.](#)

24. Look for position of screw holes.

25. Assemble 5 screws (1) and tighten to the requested torque.

[Refer to: figure 23 and section C.4.](#)

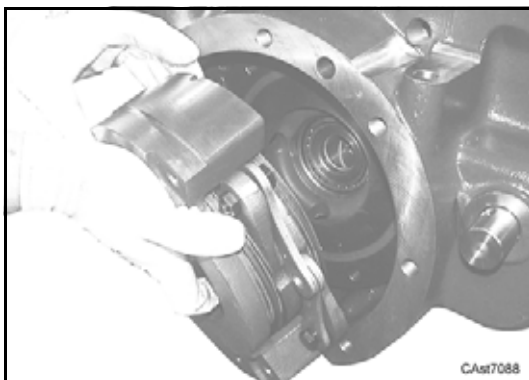
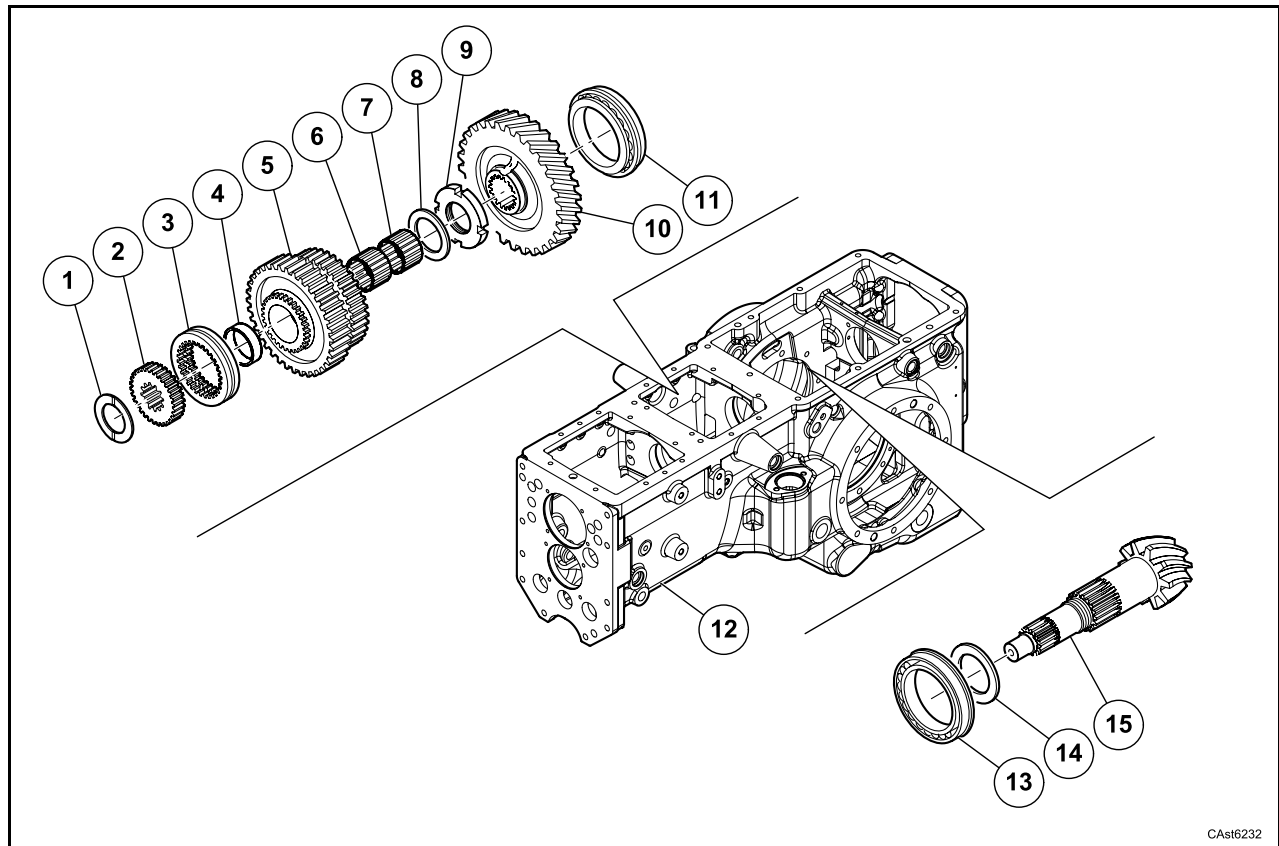


Figure 35

# Disassembly and Assembly Operations

## PINION - RANGES PINION - RANGES (SECONDARY SHAFT)



CAst6232

**8+8  
synchro  
shuttle**

**12+12  
synchro  
shuttle**

**24+24  
synchro shuttle  
and synchro  
splitter**

**24+24  
synchro shuttle  
and power  
splitter**

**12+12  
power  
shuttle**

**24+24  
power shuttle  
and synchro  
splitter**

For models

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### Disassembly

1. To disassemble pinion assy, it is necessary to remove: final drives, differential and shaft for slow speeds assy.
2. Use a dynamometer whose cord is wound on the pinion ring nut with diameter D= 80 mm to check for bearing preload.  
If during assembly bearings are not changed, expected load will have a value 40-50% lower than expected for new bearings.

Refer to: [figure 1](#) and [2](#).



Figure 1

# Disassembly and Assembly Operations

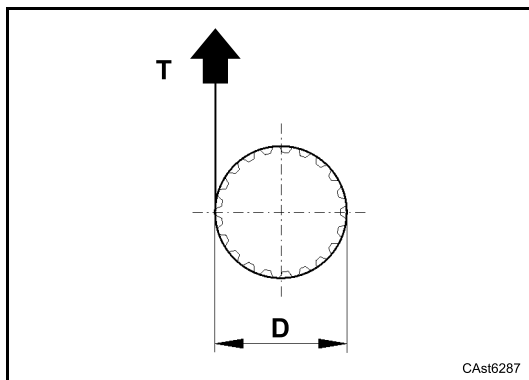


Figure 2

3. Unscrew ring nut (9).

**NOTE:** Destructive operation for ring nut.

4. Remove pinion (15).
5. Collect: bearing (11), gear (10), ring nut (9), thrust washer (8), roller bearings (6) and (7), gear (5), spacer (4), collar (3), central clutch (2) and thrust washer (1).
6. Remove inner cups of the bearings (11) and (13).
7. Remove spacer (14) and bearing (13) from the pinion (15).

## Assembly

1. Assemble outer cups of the bearings (11) and (13) using the tool CA715808.

Refer to: [section E.1 \(gear box\)](#).

2. The value of bevel distance (V) to be obtained is printed on pinion (15) head and corresponds to distance between differential axis and pinion head base.

Refer to: [figure 3](#).

3. Assemble differential box supports and fasten them with screws M12.
4. Prepare kit "false pinion" consisting of the special tool (s1) CA715800 with nut ring (s2), kit "false differential box" CA715810 consisting of the special tools (s3) and (s4) and a depth gauge.

Refer to: [figure 4](#).

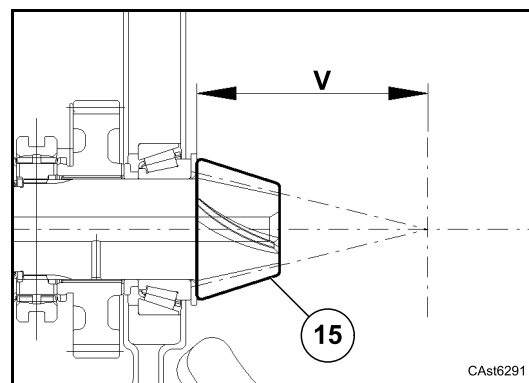


Figure 3

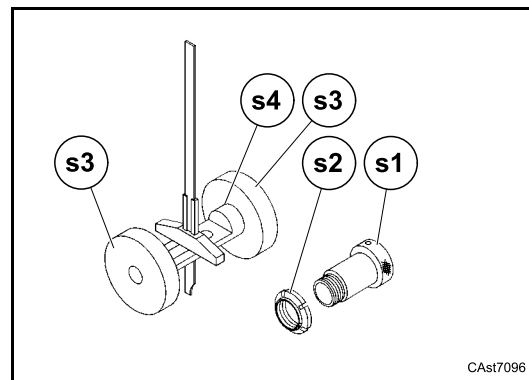


Figure 4

5. Insert false pinion (s1) with bearing cones (11) and (13) in the related housings then assemble nut ring (s2).  
Screw in without exceeding nut ring (s2) till the end float is eliminated.  
Install false differential box (s3, s4).

Refer to: [figure 5](#).

6. Measure distance X (distance between the axis of the differential bearings and the base of pinion head) with a depth gauge.

Refer to: [figure 5](#).

# Disassembly and Assembly Operations

7. In order to determine necessary thickness value (S) between pinion and bearing, subtract value (V), stamped on the pinion head (V=requested distance), from the measured value (X).

$$S = X - V \text{ mm}$$

Refer to: figure 6.

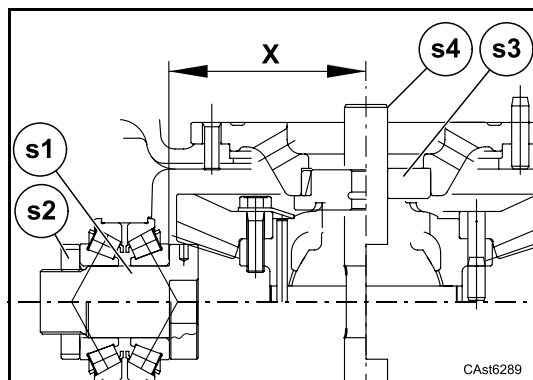


Figure 5

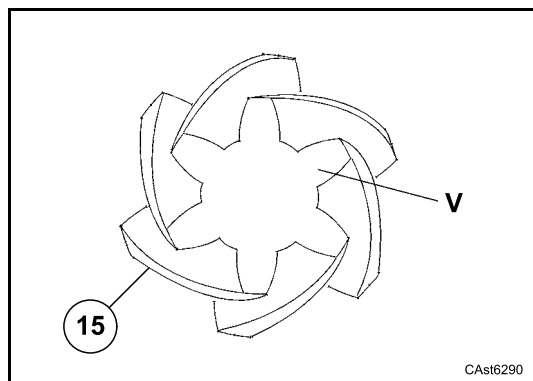


Figure 6

8. Choose shim (14) with thickness value (S) among range available and fit it on the shaft under the pinion head.

## SHIMS RANGE

|             |     |     |     |     |     |     |     |     |     |     |     |
|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Thick<br>mm | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 |
| Quantity    | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |

9. Remove false differential box (s3, s4). Unscrew ring nut (s2) and remove false pinion (s1) and bearing cones (11) and (13).
10. Once you have chosen and inserted suitable shim (14) with chamfer against the gear, force bearing cone (13) into the pinion shaft (15) using special tool CA716171.
11. Assemble pinion assy to the transmission.
- Refer to: figure 7.
12. Assemble inner cup of the bearing (11) into the box (12).
13. Assemble following group (g): gear (10), ring nut (9), thrust washer (8), roller bearings (6) and (7), gear (5),

spacer (4), collar (3), central clutch (2) and thrust washer (1).

**NOTE:** Right position for central clutch (2).

Refer to: figure 9.

**NOTE:** Grease thrust washers (8) and (1) so that they do not fall on the gear box.

Refer to: figure 10 and 11.

14. Settle group (g) into the gear box (12) and insert pinion (15) into the box (12) and in the group (g).

Refer to: figure 8 and 9.

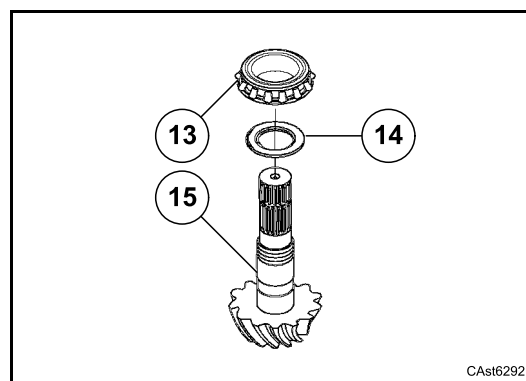


Figure 7

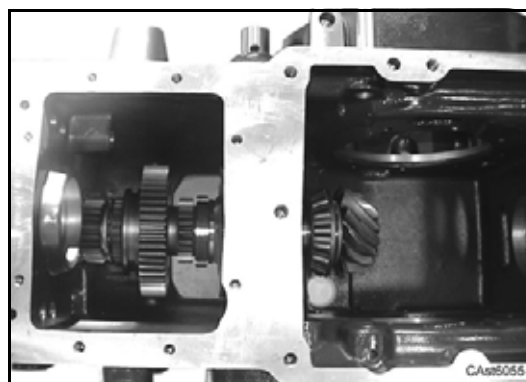


Figure 8

15. To assemble pinion assy use special tool CA716144.

Refer to: figure 9.

# Disassembly and Assembly Operations

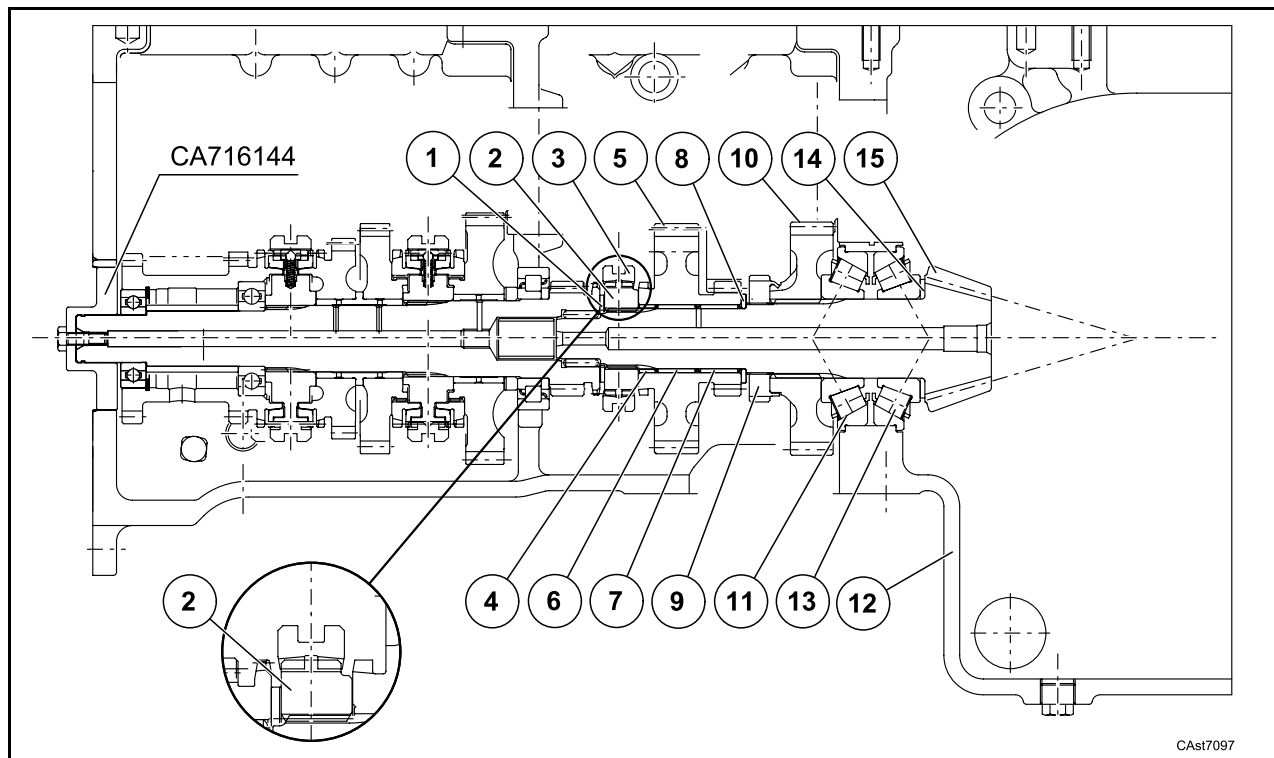


Figure 9



Figure 10



Figure 11



## Warning

**Torque setting is given by preloading measurement on the ring nut (9); tighten ring nut gradually.**

**NOTE:** When you check preloading, it is advisable to beat slightly both pinion ends with a soft hammer, so as to help setting bearings.

17. Alternatively, to fasten ring nut use commercial key as shown in the figure.

Refer to: figure 14.

16. Screw ring nut (9) on the pinion shaft using prescribed tool.

Refer to: figure 12, 13 and section E.1 (gear box).



# Disassembly and Assembly Operations

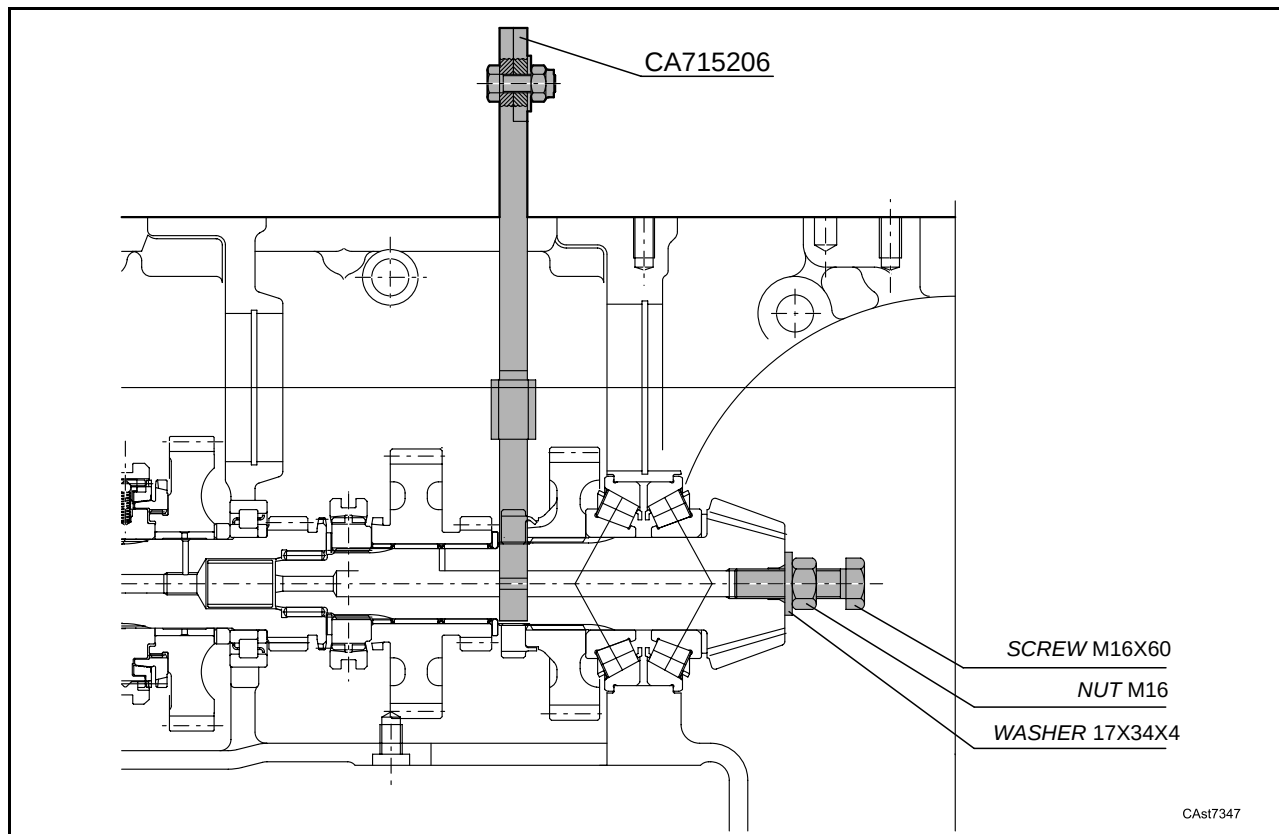


Figure 12

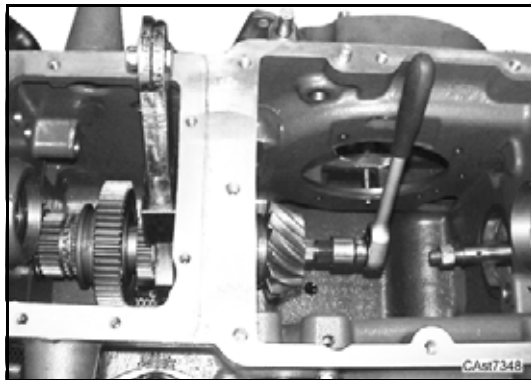


Figure 13

18. To measure preloading (P) of the pinion taper roller bearings, use a dynamometer whose cord is wound on the ring nut (9).

The effectively preloading (P) is measured on  $D = 80$  mm.

The measured value should be within following range:

$$P = 40 \div 60 \text{ N}$$



## Warning

**Values valid for new bearings.**

[Refer to: figure 15.](#)

If bearings are not new, measured value should be starting value.

[Refer to: section D.30.1.2.](#)

19. Once requested preloading value is achieved, caulk ring nut (9), using a hammer and a chisel from both sides.

[Refer to: figure 16.](#)

**NOTE:** Caulk as shown.

[Refer to: figure 17.](#)

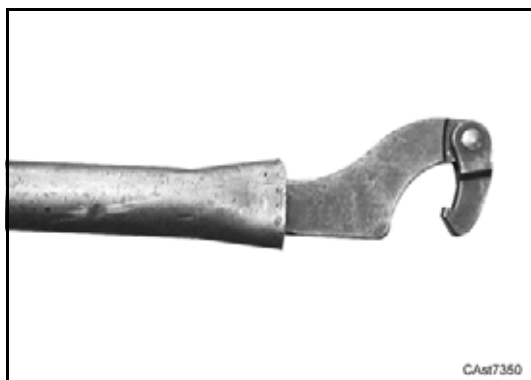


Figure 14



# Disassembly and Assembly Operations

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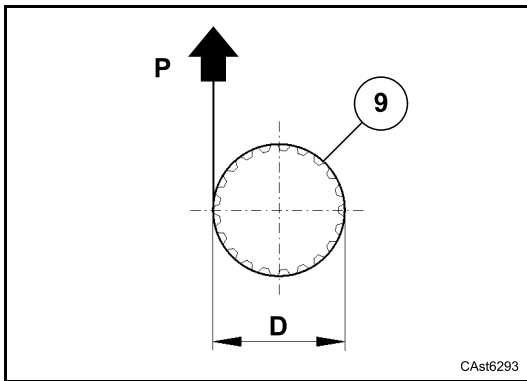


Figure 15

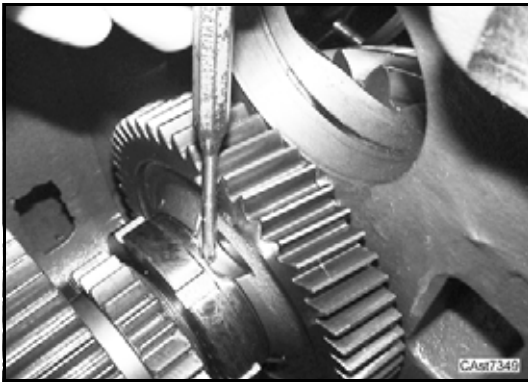


Figure 16

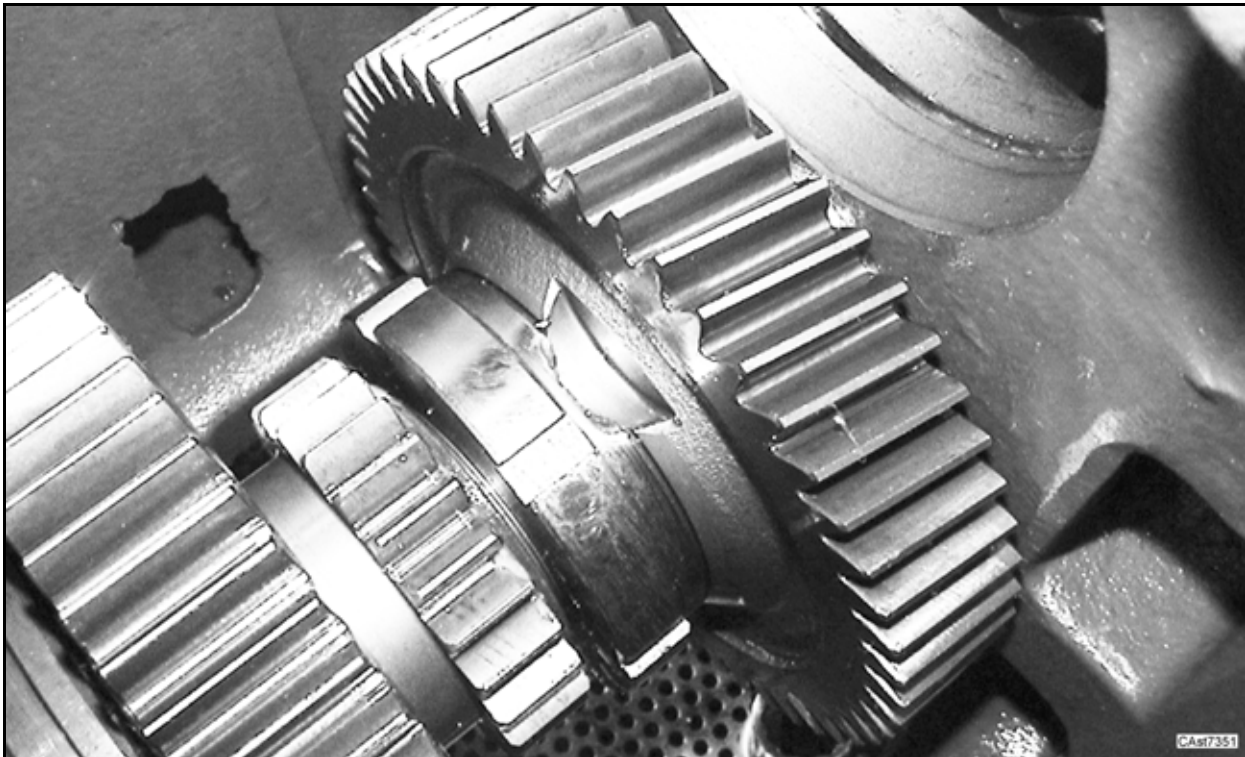
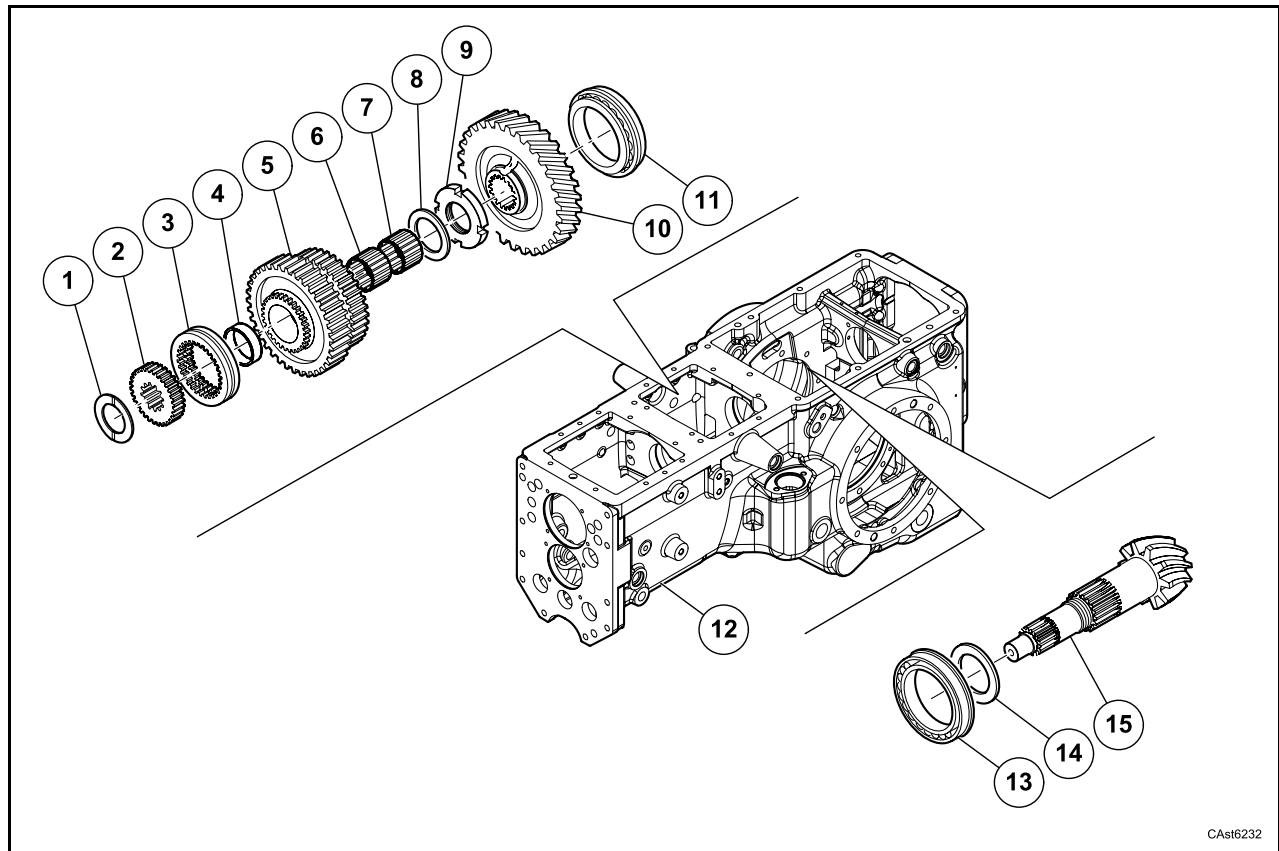


Figure 17

# Disassembly and Assembly Operations

## SECONDARY SHAFT



CAst6232

**8+8  
synchro  
shuttle**

**12+12  
synchro  
shuttle**

**24+24  
synchro shuttle  
and synchro  
splitter**

**24+24  
synchro shuttle  
and power  
splitter**

**12+12  
power  
shuttle**

**24+24  
power shuttle  
and synchro  
splitter**

For models

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### Disassembly

1. To disassemble pinion assy, it is necessary to remove: final drives, differential and shaft for slow speeds assy.
2. Use a dynamometer whose cord is wound on the pinion ring nut with diameter D= 80 mm to check for bearing preload.  
If during assembly bearings are not changed, expected load will have a value 40-50% lower than expected for new bearings.

Refer to: figure 1 and 2.



CAst7085

Figure 1

# Disassembly and Assembly Operations

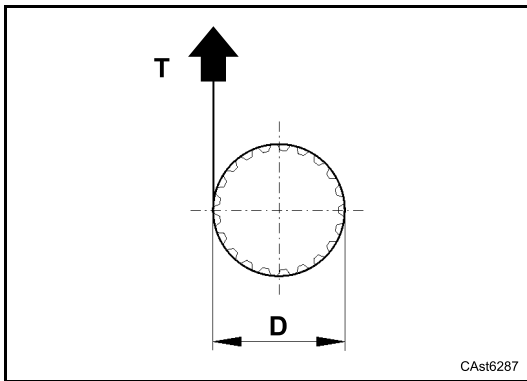


Figure 2

3. Unscrew ring nut (9).

**NOTE:** Destructive operation for ring nut.

4. Remove pinion (15).
5. Collect: bearing (11), gear (10), ring nut (9), thrust washer (8), roller bearings (6) and (7), gear (5), spacer (4), collar (3), central clutch (2) and thrust washer (1).
6. Remove inner cups of the bearings (11) and (13).
7. Remove spacer (14) and bearing (13) from the pinion (15).

## Assembly

1. Assemble outer cups of the bearings (11) and (13) using the tool CA715808.

Refer to: [section E.1 \(gear box\)](#).

2. The value of bevel distance (V) to be obtained is printed on pinion (15) head and corresponds to distance between differential axis and pinion head base.

Refer to: [figure 3](#).

3. Assemble differential box supports and fasten them with screws M12.

4. Prepare kit "false pinion" consisting of the special tool (s1) CA715800 with nut ring (s2), kit "false differential box" CA715810 consisting of the special tools (s3) and (s4) and a depth gauge.

Refer to: [figure 4](#).

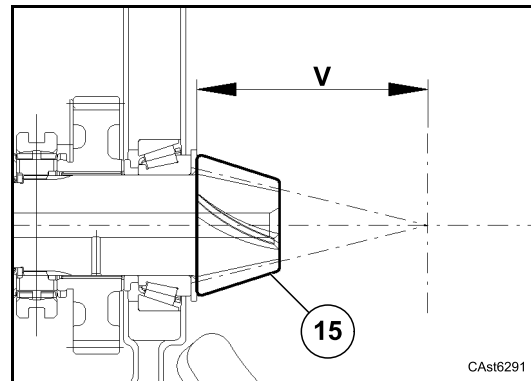


Figure 3

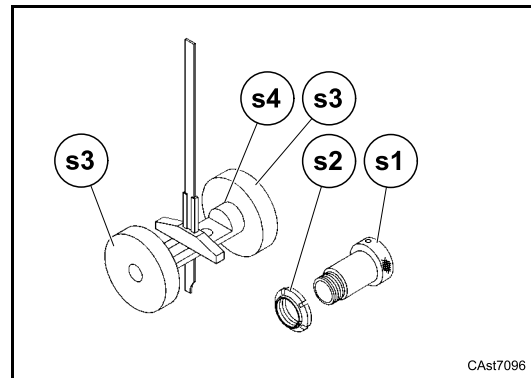


Figure 4

5. Insert false pinion (s1) with bearing cones (11) and (13) in the related housings then assemble nut ring (s2).  
Screw in without exceeding nut ring (s2) till the end float is eliminated.  
Install false differential box (s3, s4).

Refer to: [figure 5](#).

6. Measure distance X (distance between the axis of the differential bearings and the base of pinion head) with a depth gauge.

Refer to: [figure 5](#).

# Disassembly and Assembly Operations

7. In order to determine necessary thickness value (S) between pinion and bearing, subtract value (V), stamped on the pinion head (V=requested distance), from the measured value (X).

$$S = X - V \text{ mm}$$

Refer to: figure 6.

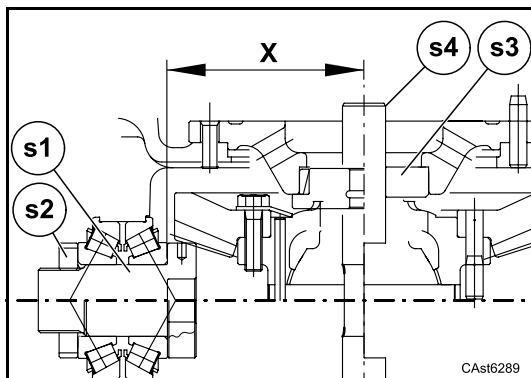


Figure 5

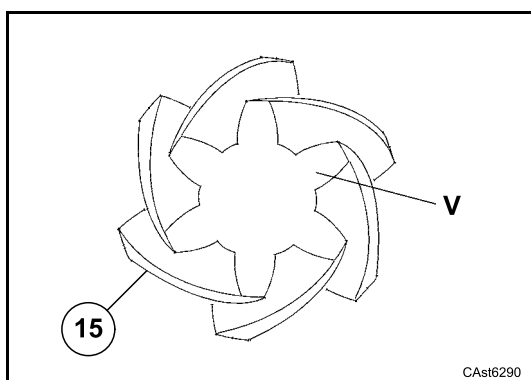


Figure 6

8. Choose shim (14) with thickness value (S) among range available and fit it on the shaft under the pinion head.

## SHIMS RANGE

|             |     |     |     |     |     |     |     |     |     |     |     |
|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Thick<br>mm | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 |
| Quantity    | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |

9. Remove false differential box (s3, s4). Unscrew ring nut (s2) and remove false pinion (s1) and bearing cones (11) and (13).
10. Once you have chosen and inserted suitable shim (14) with chamfer against the gear, force bearing cone (13) into the pinion shaft (15) using special tool CA716171.

Assemble pinion assy to the transmission.

Refer to: figure 7.

11. Assemble inner cup of the bearing (11) into the box (12).
12. Assemble following group (g): gear (10), ring nut (9), thrust washer (8), roller bearings (6) and (7), gear (5),

spacer (4), collar (3), central clutch (2) and thrust washer (1).

**NOTE:** Right position for central clutch (2).

Refer to: figure 9.

**NOTE:** Grease thrust washers (8) and (1) so that they do not fall on the gear box.

Refer to: figure 10 and 11.

13. Settle group (g) into the gear box (12) and insert pinion (15) into the box (12) and in the group (g).

Refer to: figure 8 and 9.

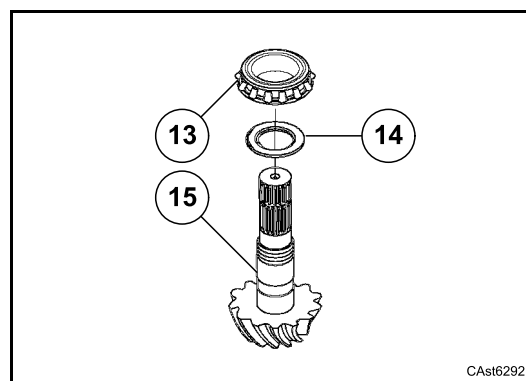


Figure 7

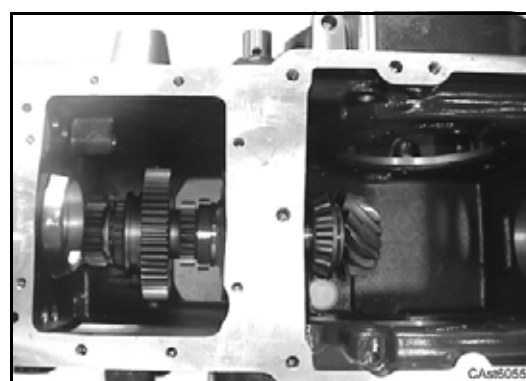


Figure 8

14. To assemble pinion assy use special tool CA716144.

Refer to: figure 9.

# Disassembly and Assembly Operations

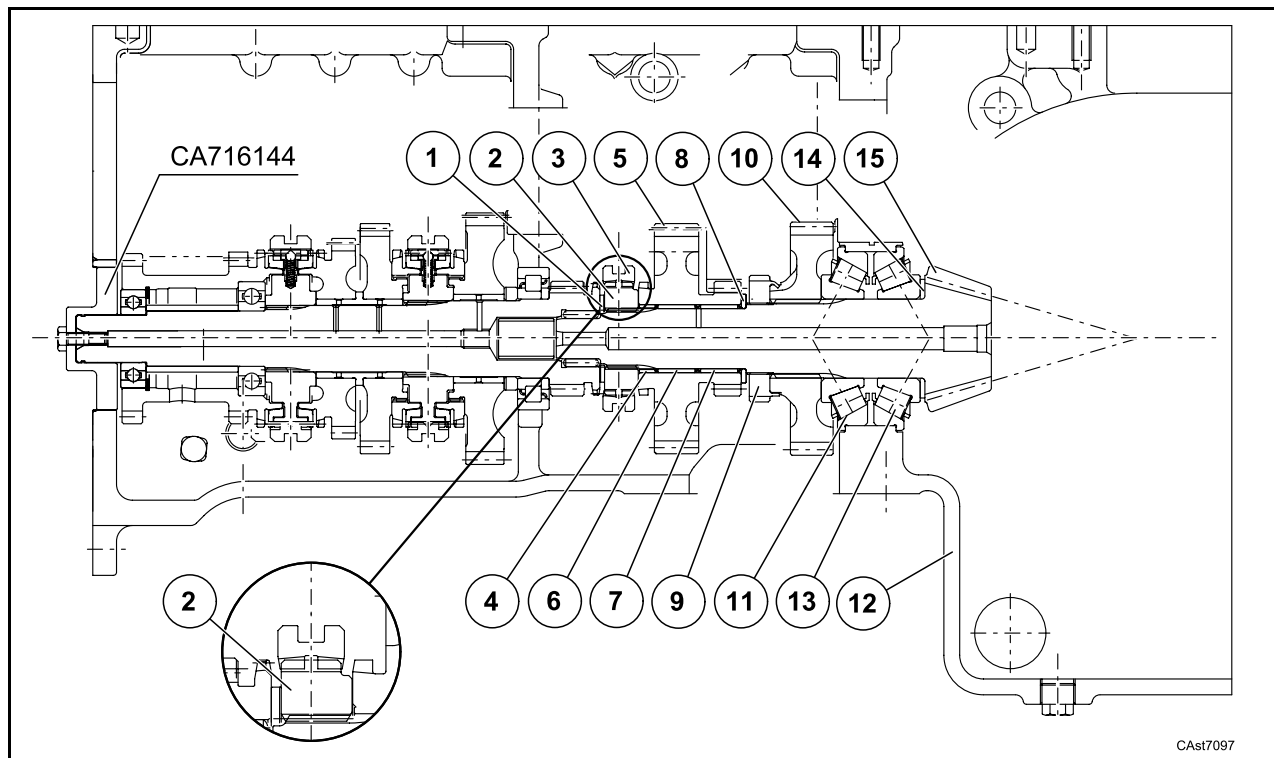


Figure 9



Figure 10



Figure 11



## Warning

**Torque setting is given by preloading measurement on the ring nut (9); tighten ring nut gradually.**

**NOTE:** When you check preloading, it is advisable to beat slightly both pinion ends with a soft hammer, so as to help setting bearings.

2. Alternatively, to fasten ring nut use commercial key as shown in the figure.

Refer to: figure 14.

1. Screw ring nut (9) on the pinion shaft using prescribed tool.

Refer to: figure 12, 13 and section E.1 (gear box).

# Disassembly and Assembly Operations

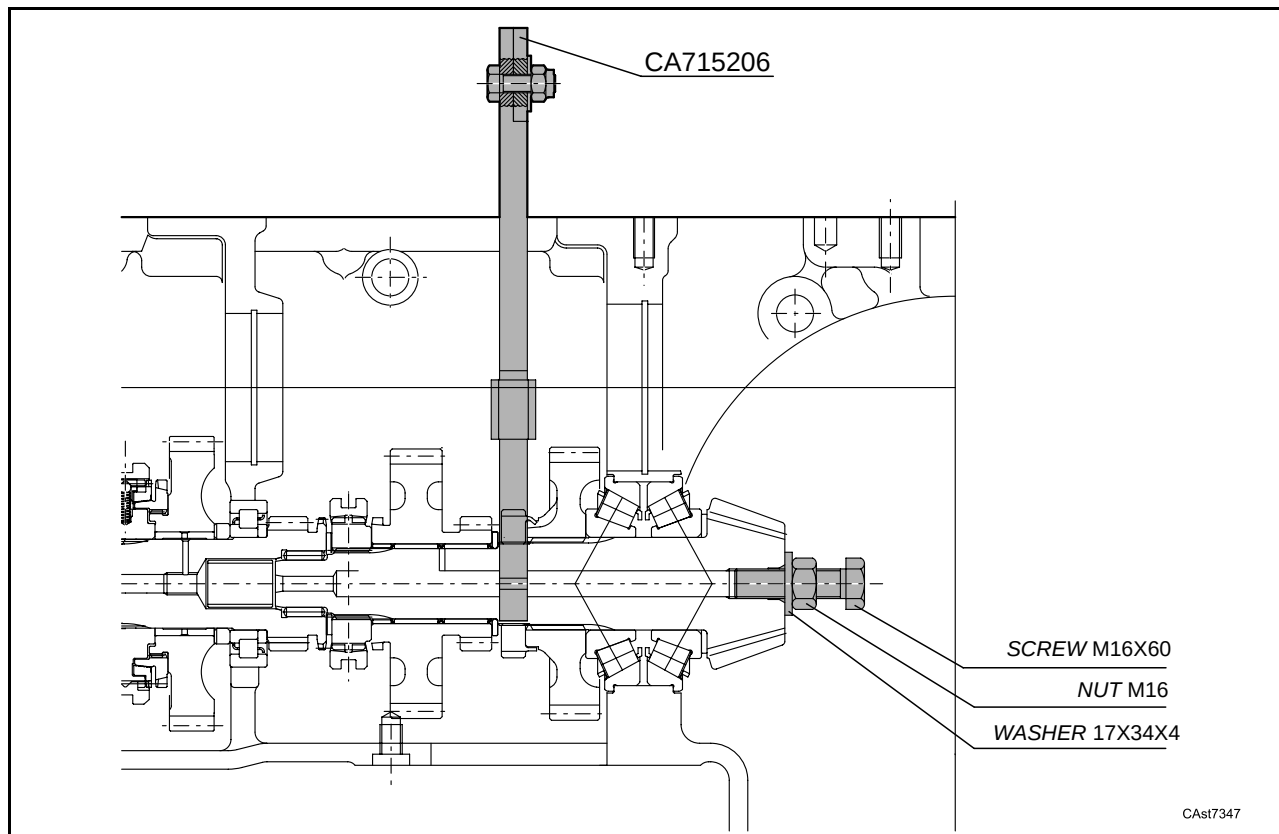


Figure 12

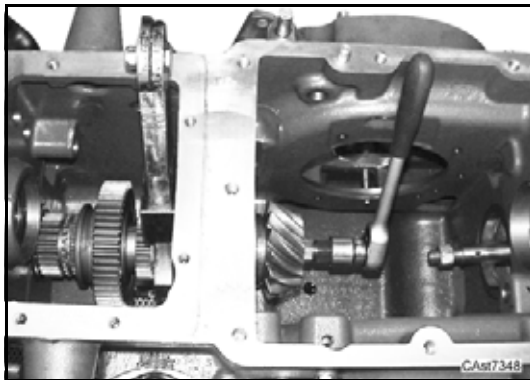


Figure 13

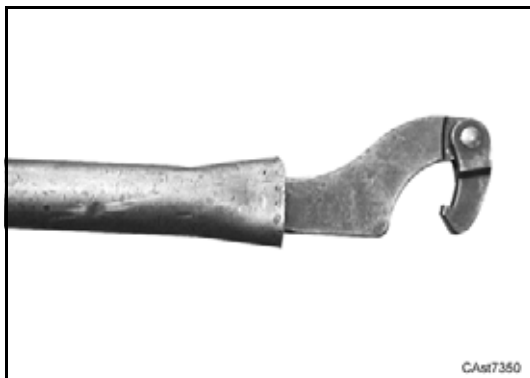


Figure 14

3. To measure preloading (P) of the pinion taper roller bearings, use a dynamometer whose cord is wound on the ring nut (9).

The effectively preloading (P) is measured on  $D = 80$  mm.

The measured value should be within following range:

$$P = 40 \div 60 \text{ N}$$



## Warning

**Values valid for new bearings.**

[Refer to: figure 15.](#)

If bearings are not new, measured value should be starting value.

[Refer to: section D.30.1.2.](#)

4. Once requested preloading value is achieved, caulk ring nut (9), using a hammer and a chisel from both sides.

[Refer to: figure 16.](#)

**NOTE:** Caulk as shown.

[Refer to: figure 17.](#)



# Disassembly and Assembly Operations

---

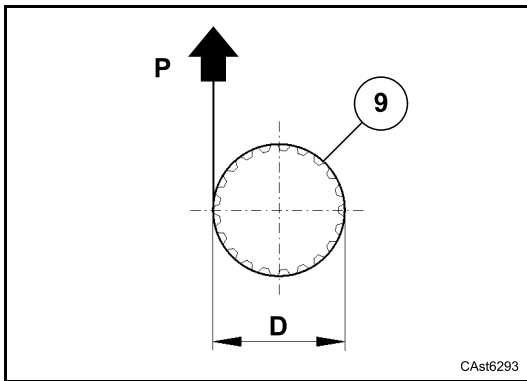


Figure 15

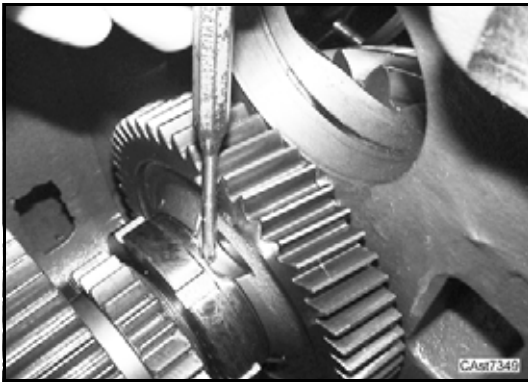


Figure 16

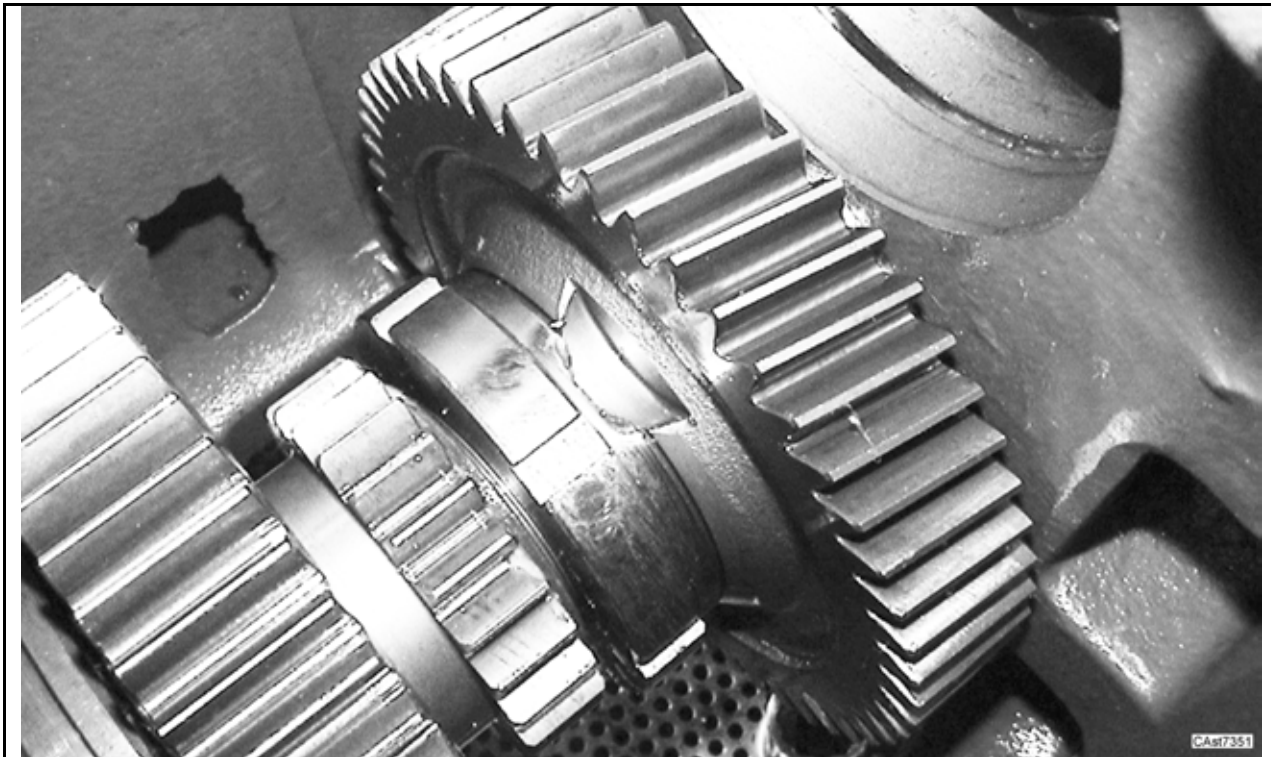
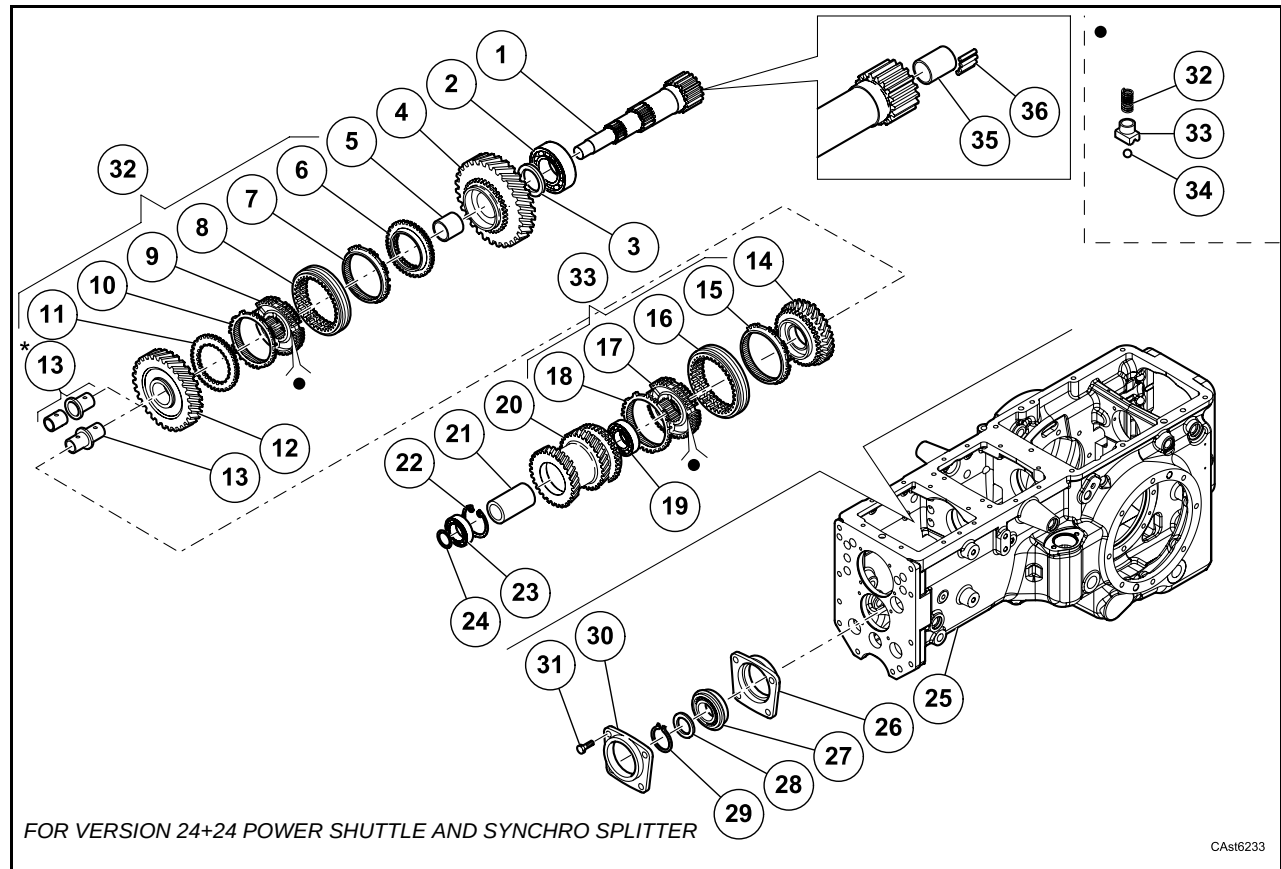


Figure 17



# Disassembly and Assembly Operations

## SPEED GEARS (SECONDARY SHAFT)



**8+8  
synchro  
shuttle**

**12+12  
synchro  
shuttle**

**24+24  
synchro shuttle  
and synchro  
splitter**

**24+24  
synchro shuttle  
and power  
splitter**

**12+12  
power  
shuttle**

**24+24  
power shuttle  
and synchro  
splitter**

For models

### Disassembly

**NOTE:** To remove secondary shaft (1) it is necessary to remove pinion assy.

Refer to: [section D.30.](#)

1. Remove cover (30) with relevant screws (31).
2. Remove snap ring (29).
3. Remove spacer (28).
4. Remove cover (26) from gear box (25).
5. Take bearing (27) out of cover (26).
6. Remove shim (24).
7. Move shaft (1) backward and remove secondary shaft assy (1+2+3) from the opposite side.

Refer to: [figure 1.](#)

# Disassembly and Assembly Operations

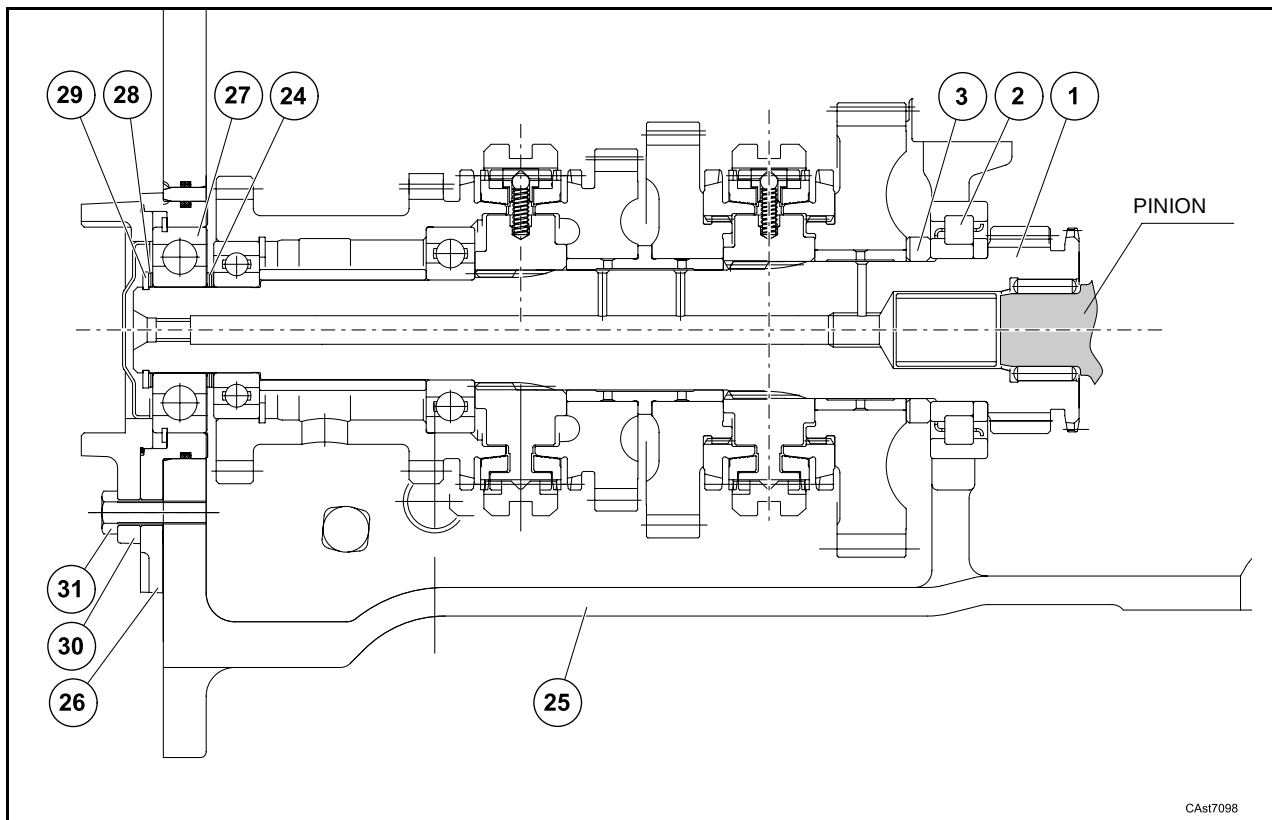


Figure 1

8. Take bearing (23) out.
9. Remove snap ring (22).
10. Remove bush (21).
11. Remove gear (20).
12. Remove assy (C) from gear box (25).
13. Assy (C) disassembly.  
Disassemble assy (C) in the following order: synchro ring (18), hub (17), sleeve (16), synchro ring (15), gear (14), bush (13), gear (12), sleeve (11), synchro ring (10), hub (9), sleeve (8), synchro ring (7), clutch ring (6), bush (5) and gear (4).
14. Remove spacer (3) and bearing (2) from secondary shaft (1).
15. Remove needles (36) and bush (35).

## Assembly

1. Assemble bearing (2) and spacer (3) on secondary shaft (1).
2. Lubricate needles (36) and insert them in the shaft.
3. Lubricate bush (35) and insert it in the shaft.
4. Assy (C) pre-assembly.  
Assemble assy (C) in the following order: assemble bush (5) into gear (4); assemble 1<sup>st</sup>-2<sup>nd</sup> speed synchro kit (32) made of: snap ring (6), synchro ring (7), sleeve (8), hub (9), synchro ring (10), sleeve (11); assemble gear (12), bush (13), gear (14); assemble 3<sup>rd</sup>-4<sup>th</sup> speed kit synchro (33) made of: synchro ring (15), sleeve (16), hub (17) and synchro ring (18).

Refer to: figure 2, 3, 4, 5 and 6.

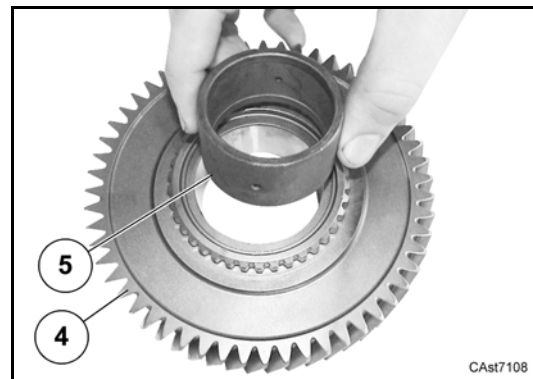


Figure 2

# Disassembly and Assembly Operations

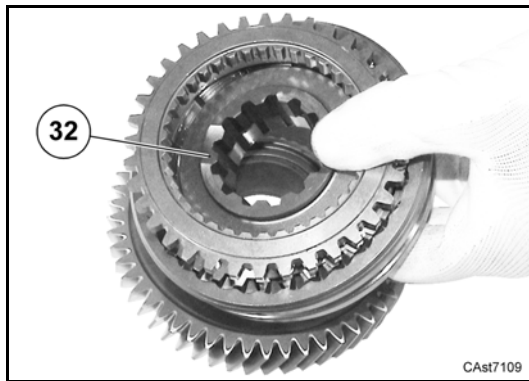


Figure 3

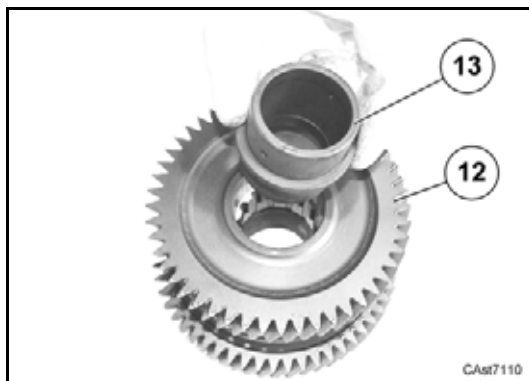


Figure 4

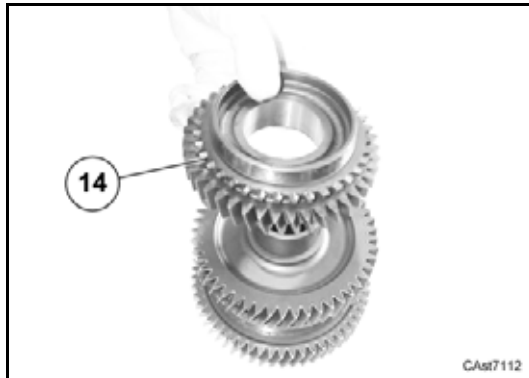


Figure 5

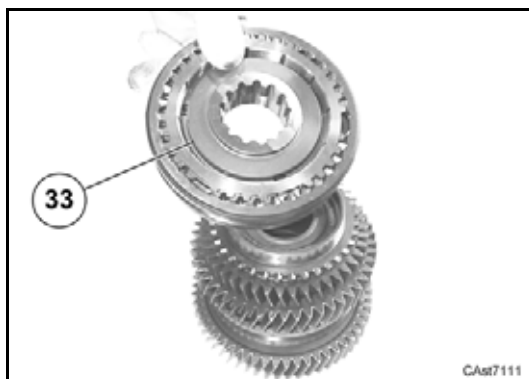


Figure 6

5. Insert assy (C) in the gear box (25).

Refer to: figure 7.

6. Assemble gear (20) and bearing (19) with tool "CA715843" on page 318.

Refer to: figure 8 and section E.1 (gear box).



Figure 7

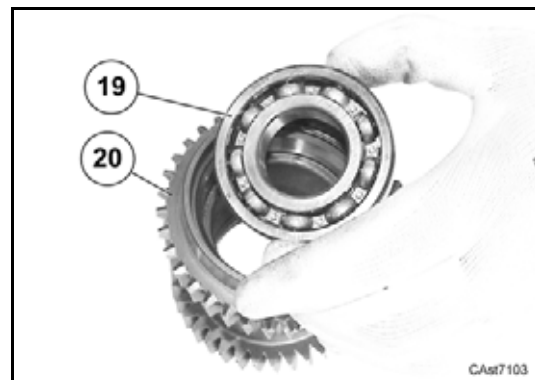


Figure 8

7. Overturn gear (20) then assemble snap ring (22).

Refer to: figure 9.

8. Assemble bearing (23) using tool "CA715843" on page 318.

Refer to: figure 10 and section E.1 (gear box).

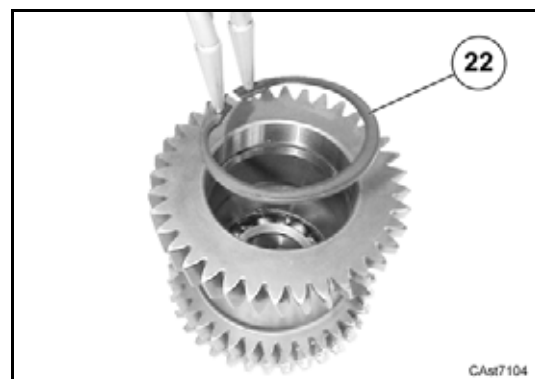


Figure 9

# Disassembly and Assembly Operations

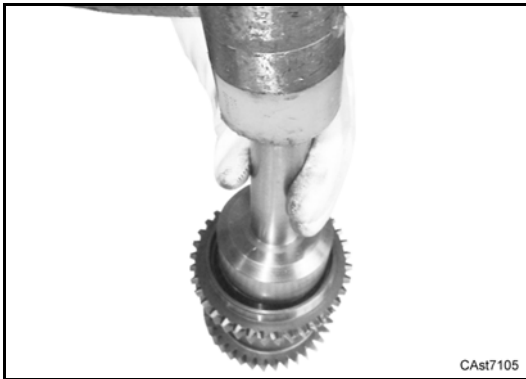


Figure 10

9. Assemble secondary shaft assy (1+2+3) from the opposite side.

Refer to: figure 11.

10. Insert bush (21).

Refer to: figure 12.

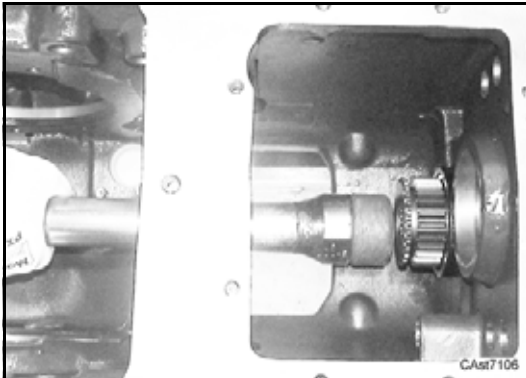


Figure 11



Figure 12

11. Assemble pinion assy.

Refer to: section D.30.

**IMPORTANT:** with model 24+24 power shuttle and synchro splitter, gear (20) does not pass through upper hole of gear box.

In fact, double gear (20) in this case is made of a gear with 36 teeth and with a 40 teeth gear and not of two gear with 36 teeth, like for other five transmission

models.

The 40 toothed gear has a diameter bigger than upper hole of the gear box, therefore assembly must be performed from above, by positioning on the box bottom first gears pre-assembled and 1<sup>st</sup>/2<sup>nd</sup> speed synchro with one of two halves of supporting bush (13), then gears pre-assembled and 3<sup>rd</sup>/4<sup>th</sup> speed synchro with second half of bush (13).

Refer to: figure 13.

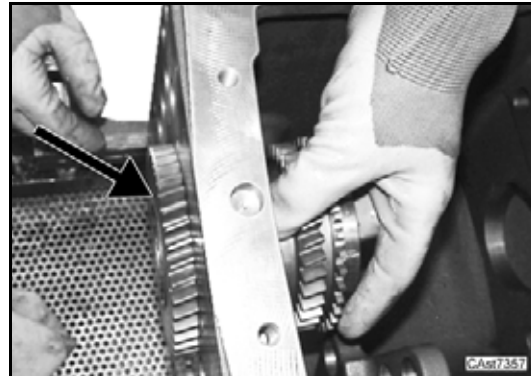
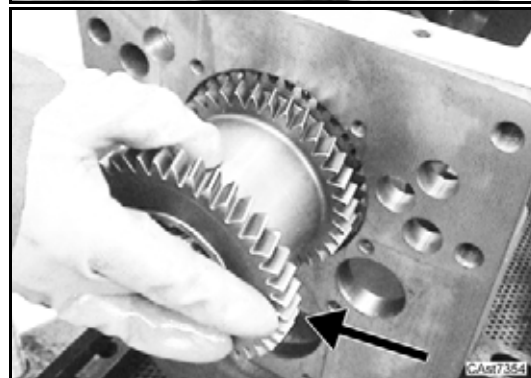
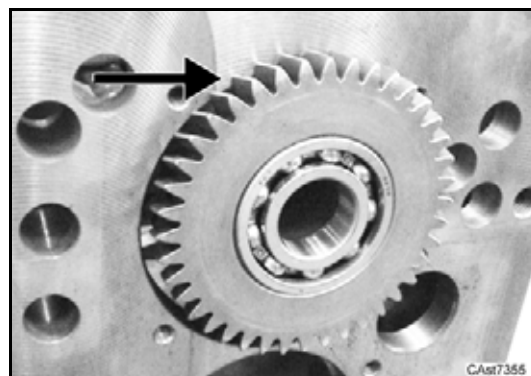


Figure 13





# Disassembly and Assembly Operations

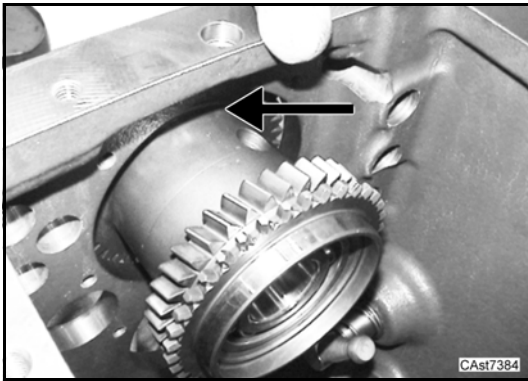


Figure 14



Figure 15

Proceed as follows:

- Assemble bearing (2) and spacer (3) on secondary shaft (1);
- Grease needles (36) and insert them on the shaft.
- Grease bush (35) and insert it on shaft;
- Assemble bush (5) on gear (4);
- Assemble 1<sup>st</sup>/2<sup>nd</sup> speed synchro kit (32) consisting of: snap ring (6), synchro ring (7), sleeve (8), hub (9), synchro ring (10) and sleeve (11);
- Assemble gear (12) and first half of supporting bush (13).

Refer to: figure 14 and 15.

- Assemble assy and position it as shown.

Refer to: figure 16 and 17.

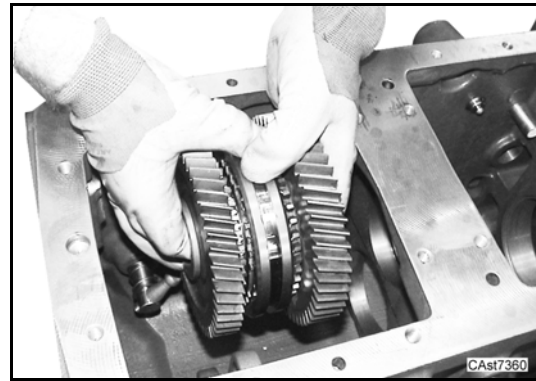


Figure 16

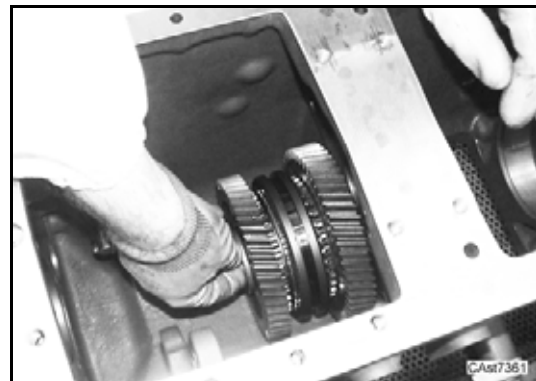


Figure 17

- Assemble 3<sup>rd</sup>/4<sup>th</sup> speed synchro kit (33) made of: synchro ring (15), sleeve (16), hub (17) and synchro ring (18).
- Assemble gear (14) on just assembled kit.
- Assemble other half of bush (13) on assy.

Refer to: figure 18 and 19.

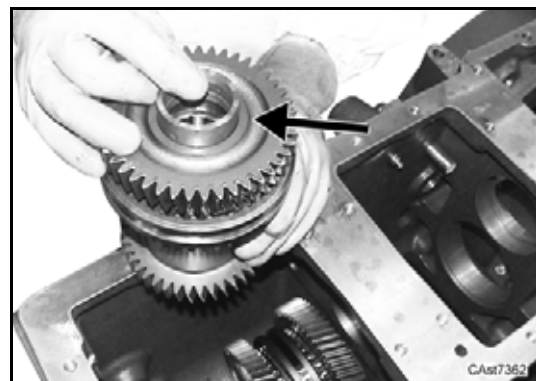


fig. 18

# Disassembly and Assembly Operations

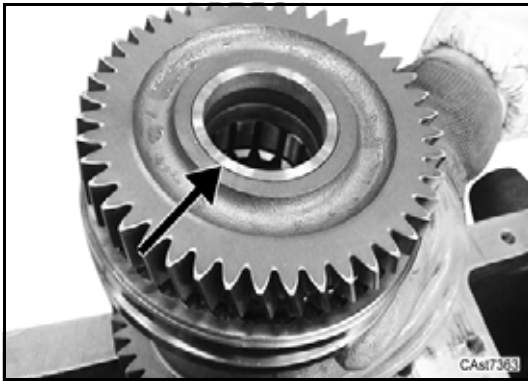


fig. 19

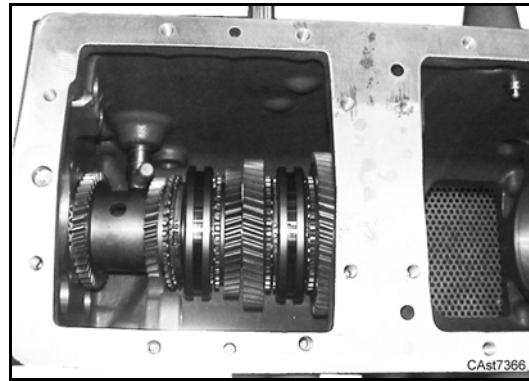


fig. 22

- Assemble on gear (20) bearing (19) with tool "CA715843" on page 311.
- Overturn gear (20) and assemble snap ring (22).
- Assemble bearing (23) with tool "CA715843" on page 311.
- Assemble gear (20) on 3<sup>rd</sup>/4<sup>th</sup> speed synchro kit
- Assemble assy as shown in the figure.

Refer to: figure 20, 21 and 22.

- Insert bush (21).
- Assemble pinion assy.



fig. 20

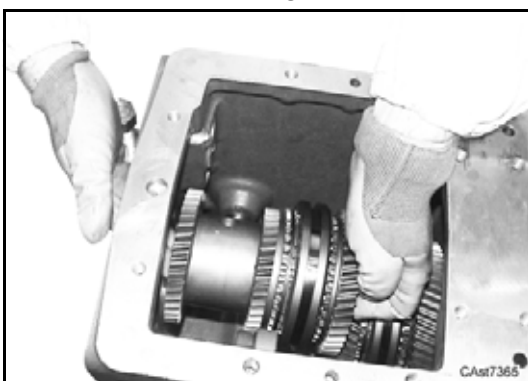


fig. 21

# Disassembly and Assembly Operations

## End floats 1 and 2 determination

1. Make sure that secondary shaft assy rests on the gear box. Use if necessary tool CA716144.

Refer to: [figure 23](#).

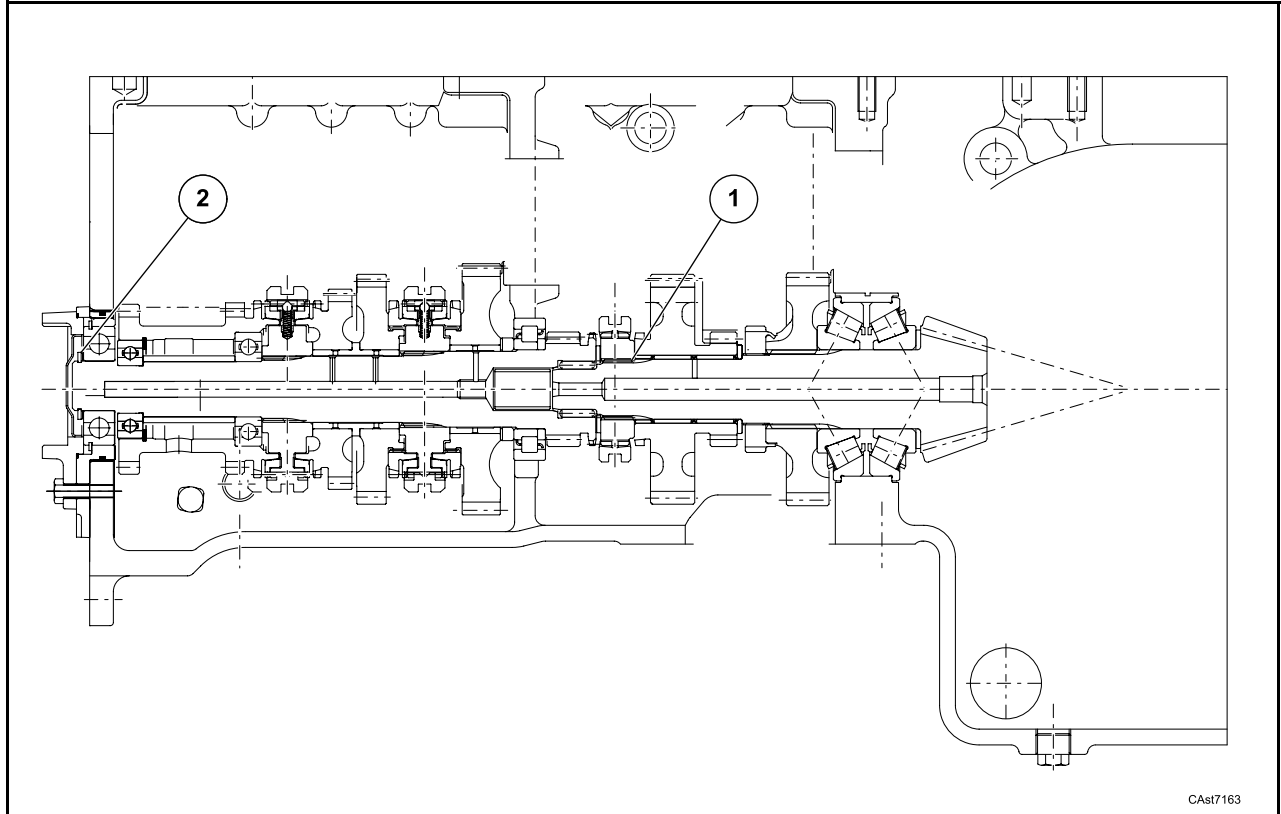


Figure 23

2. Assemble spacer (24).

Refer to: [figure 24](#).

3. Assemble bearing (27) into the cover (26) using prescribed tool.

Refer to: [figure 25](#).

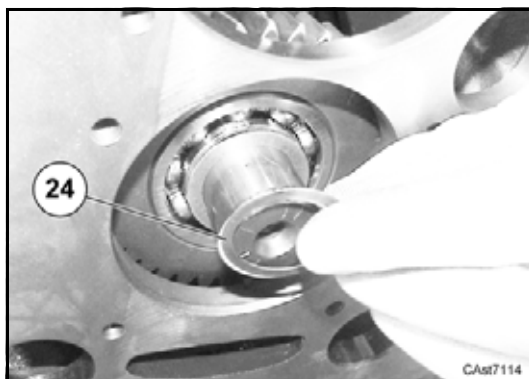


Figure 24



Figure 25

4. Assemble cover (26) to the gear box (25).
5. Assemble spacer (28).
6. Assemble snap ring (29).

Refer to: [figure 26](#).



# Disassembly and Assembly Operations



Figure 26

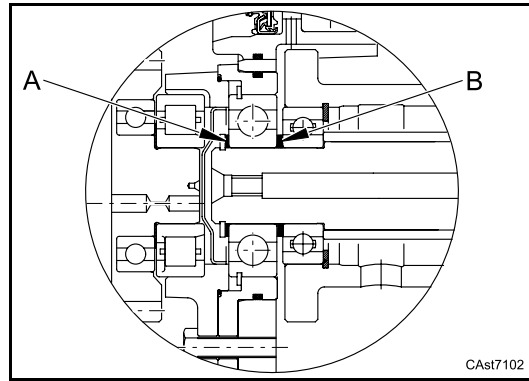


Figure 28

7. Assemble cover (30) with at least two screws.

8. Check end float 1 and 2.

If end float is lower than expected  $0.2 \div 0.3$  mm, remove shims from B and place them to A.

If end float is higher than expected  $0.2 \div 0.3$  mm, remove shims from A and place them to B.

Then proceed as follows: remove cover (30) and screws (31); remove snap ring (29) and shims (28); Remove cover (26) using tool CA715814; assemble shims (24) to position B.

Repeat steps from 3 to 7.

Refer to: [figure 27 and 28](#).

9. Tighten screw (31) to the prescribed torque.

Refer to: [section C.4](#).

10. Check preload of bearings on the pinion ring nut.

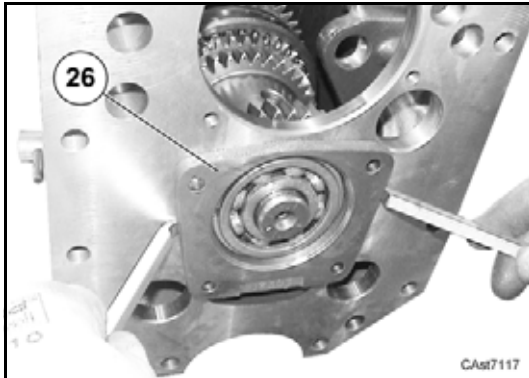


Figure 27

## Special Tools

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### Special Tools

#### Section 4A

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# Special Tools

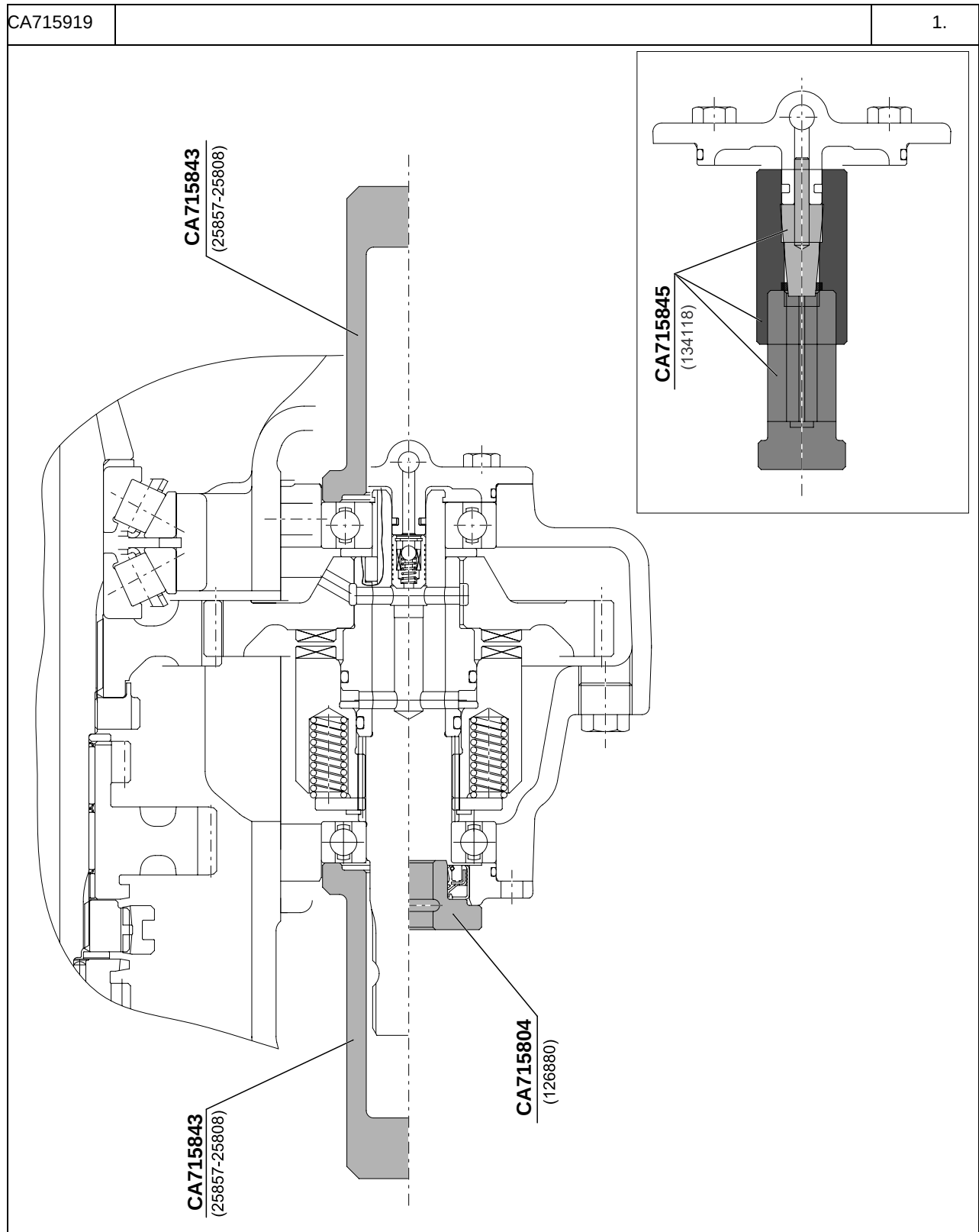
## SPECIAL TOOLS

The special drifts/pad used to assembly the seals, bearings and bushes should always be used with the interchangeable handle CA119033; its use is recommended together with a suitable safety handle in order to protect the hands.

Drop box

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models |                           |                             |                                                     |                                                   |                           |                                                   |

## Special Tools



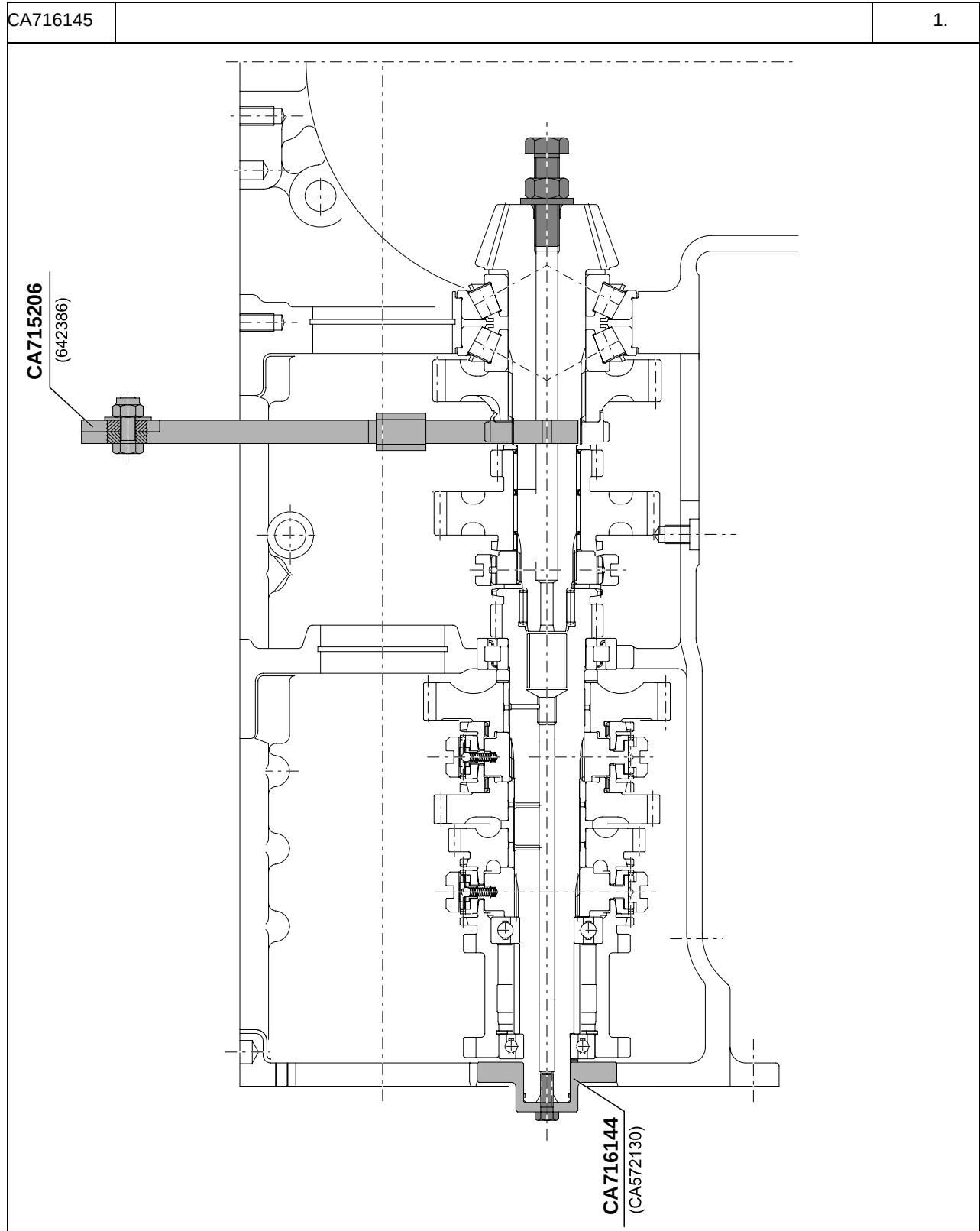
# Special Tools

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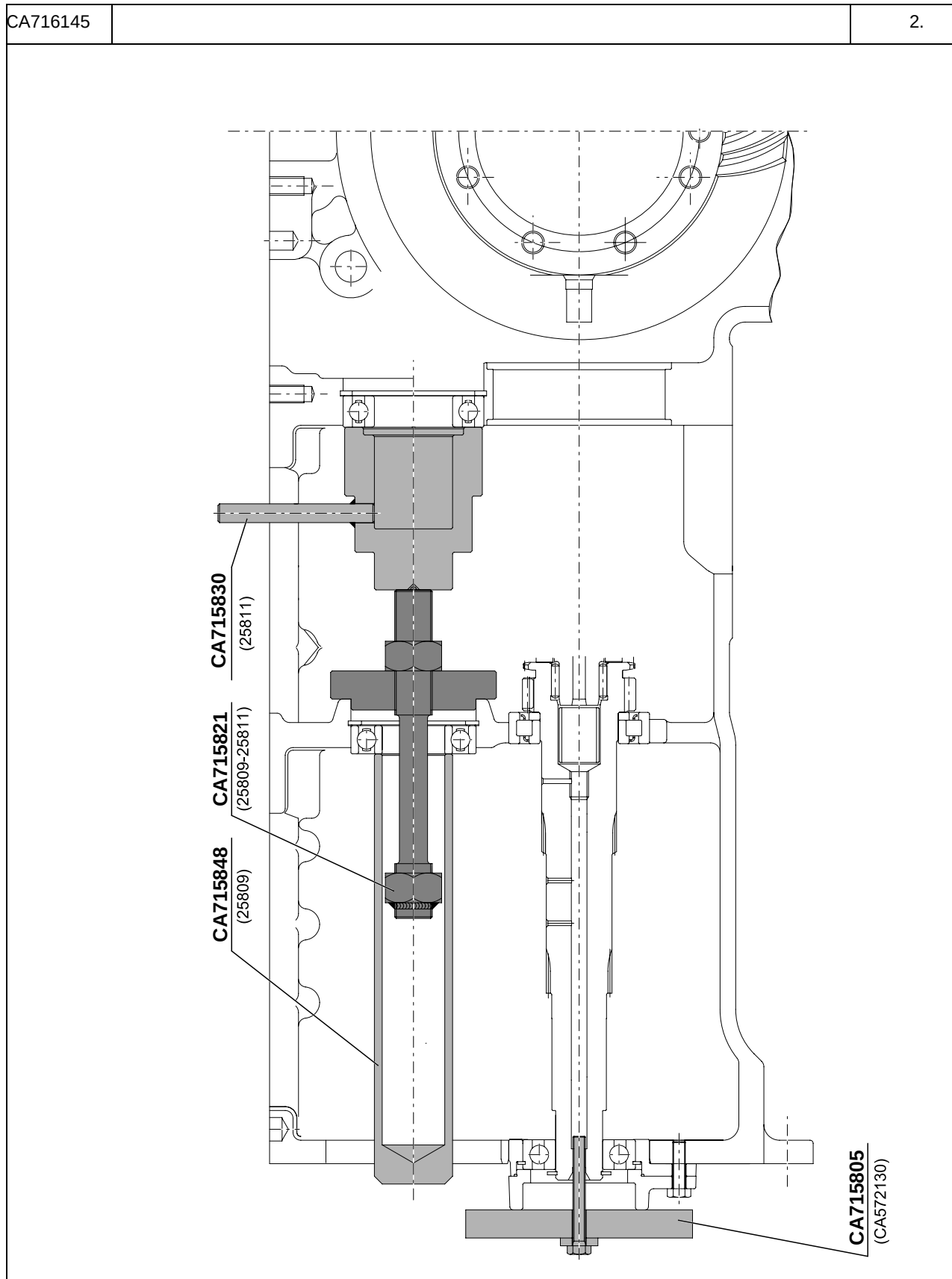
Gear box

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro<br>shuttle and<br>synchro<br>splitter | 24+24<br>synchro<br>shuttle and<br>power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power<br>shuttle and<br>synchro<br>splitter |            |
|------------|---------------------------|-----------------------------|--------------------------------------------------------|------------------------------------------------------|---------------------------|------------------------------------------------------|------------|
| For models |                           |                             |                                                        |                                                      |                           |                                                      | For models |

## Special Tools



## Special Tools

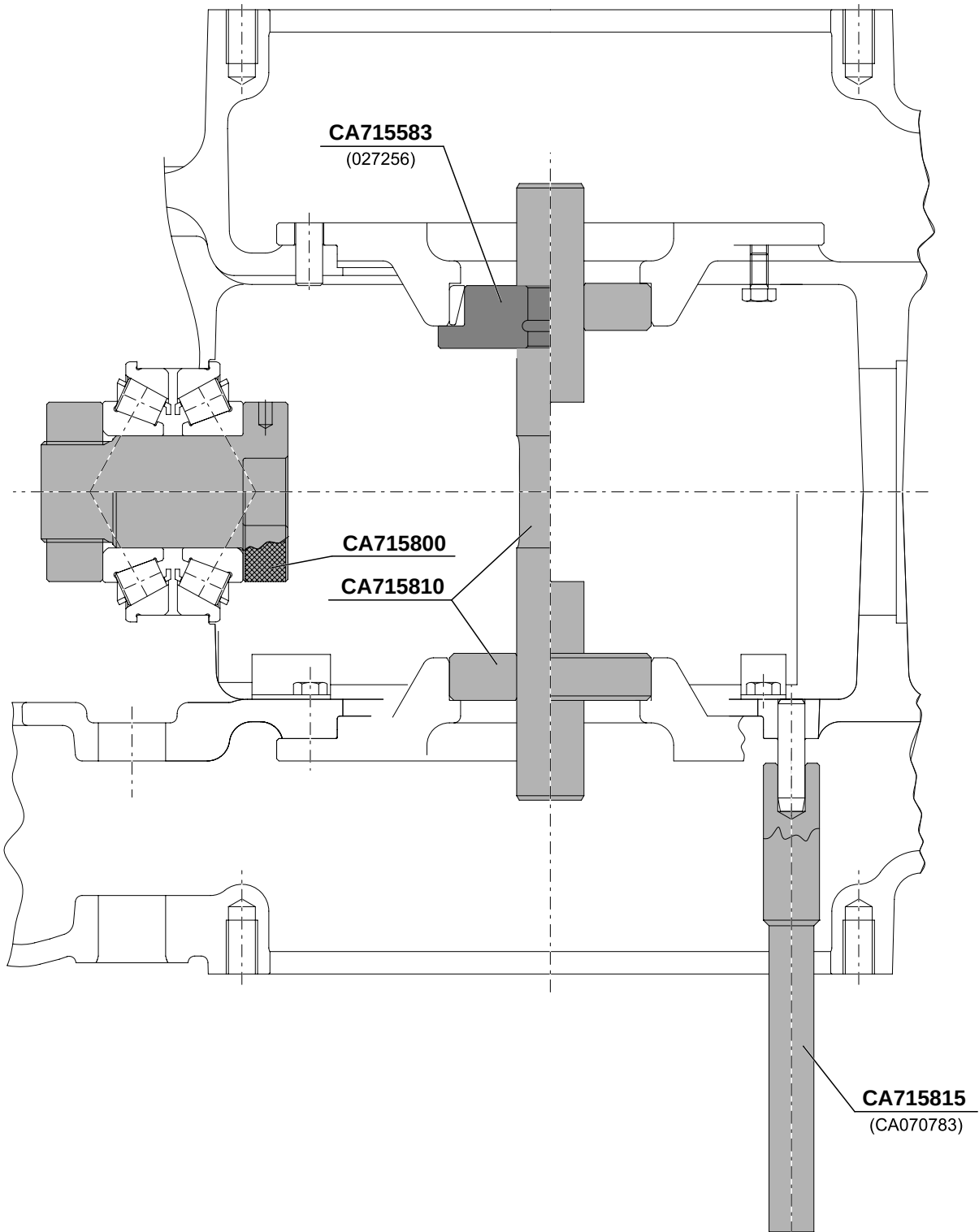




## Special Tools

CA716145

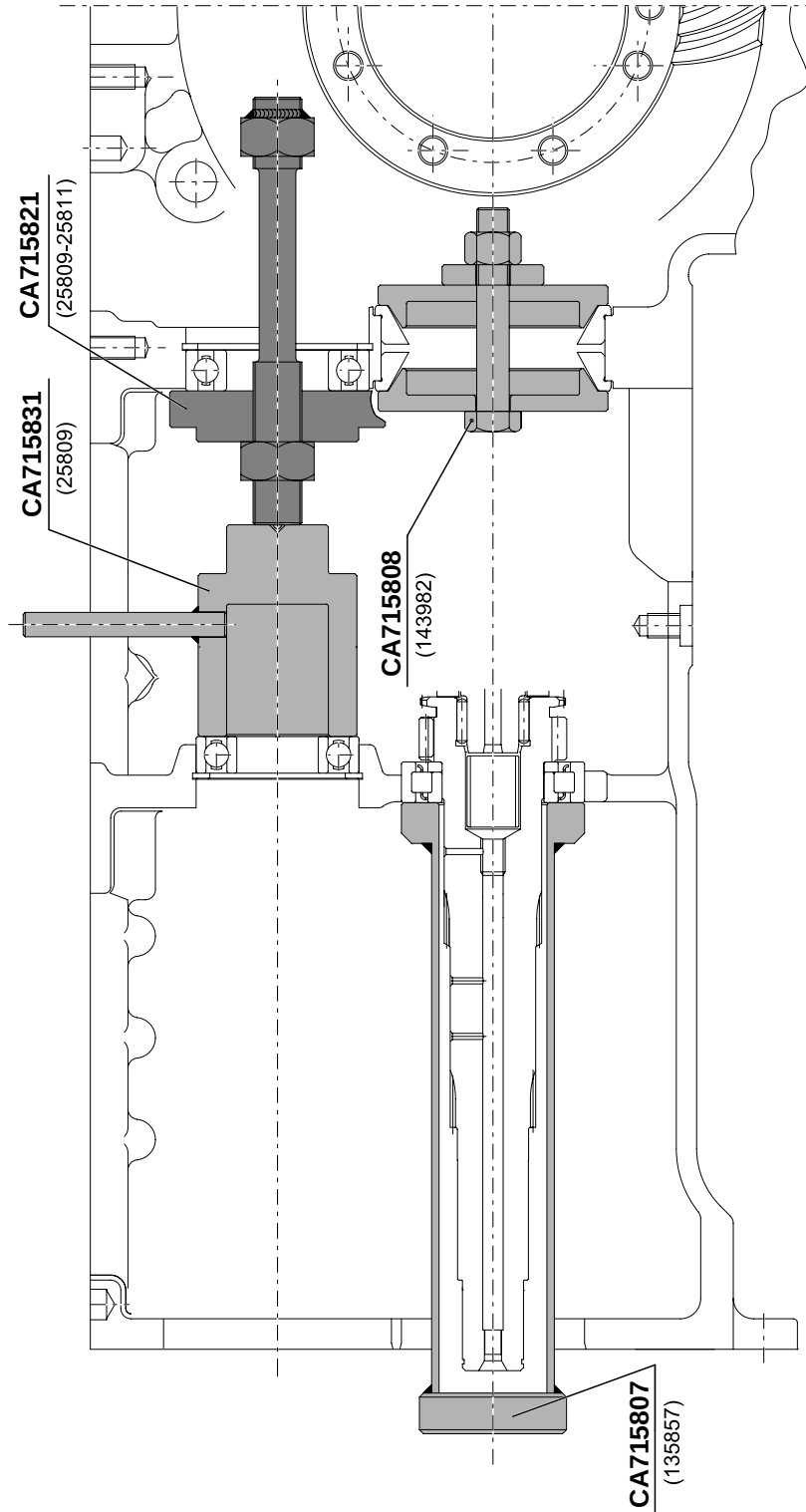
3.



## Special Tools

CA716145

4.

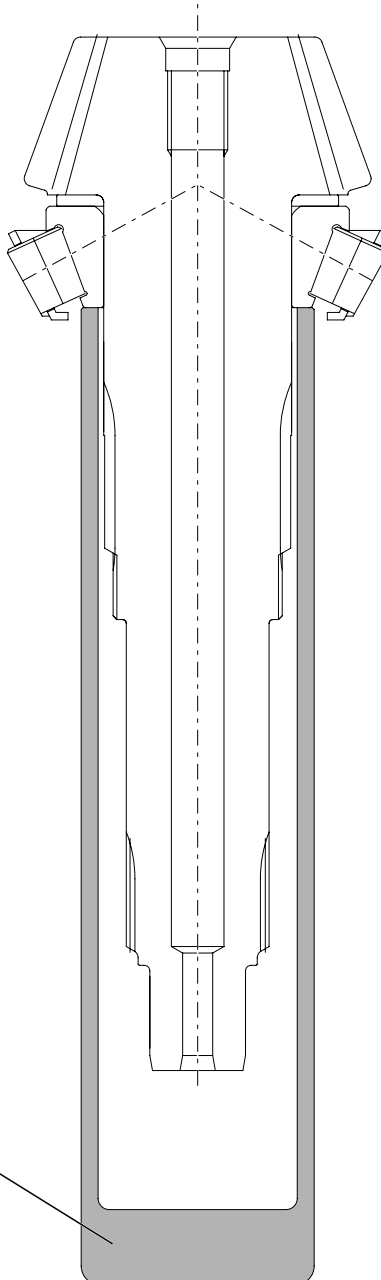


## Special Tools

CA716145

5.

**CA716171**  
(CA143982)



## Special Tools

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----|
| CA716145                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  | 6. |
| <p>The image contains five technical drawings of special tools, each with a label and a part number in parentheses:</p> <ul style="list-style-type: none"><li><b>CA715809</b> (CA025107): A long, thin, rectangular tool with a central slot and a small circular feature at one end.</li><li><b>CA715843</b> (025807): A tool with a central shaft and two large, rectangular, shaded blocks at each end.</li><li><b>CA715843</b> (025808): A similar tool to the previous one, but with a different internal structure and a small circular feature at one end.</li><li><b>CA715798</b> (CA109972): A tool with a central shaft and two large, rectangular, shaded blocks at each end, similar to CA715843 (025807).</li><li><b>CA715801</b> (CA138341): A tool with a central shaft and a large, rectangular, shaded block at one end.</li><li><b>CA715093</b> (CA027256): A tool with a central shaft and a large, rectangular, shaded block at one end, similar to CA715801.</li></ul> |  |    |

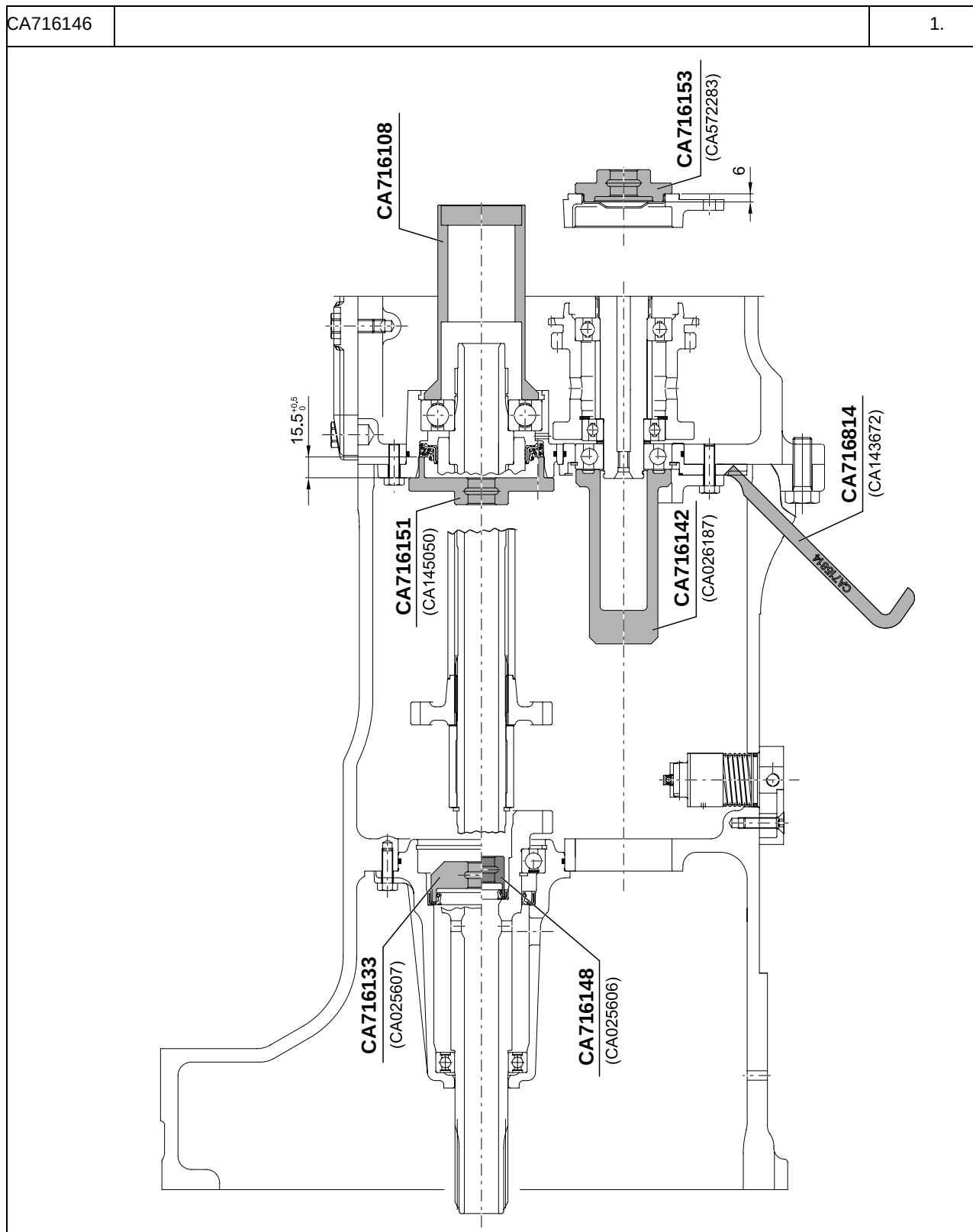
## Special Tools

---

### Clutch housing (12+12 Power shuttle)

|            | <b>8+8<br/>synchro<br/>shuttle</b> | <b>12+12<br/>synchro<br/>shuttle</b> | <b>24+24<br/>synchro shuttle<br/>and synchro<br/>splitter</b> | <b>24+24<br/>synchro shuttle<br/>and power<br/>splitter</b> | <b>12+12<br/>power<br/>shuttle</b> | <b>24+24<br/>power shuttle<br/>and synchro<br/>splitter</b> |
|------------|------------------------------------|--------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------|------------------------------------|-------------------------------------------------------------|
| For models | -                                  | -                                    | -                                                             | -                                                           |                                    | -                                                           |

# Special Tools



## Special Tools

Technical drawing of a mechanical assembly, showing a side view of a long, narrow component with a central shaft and a flange at the right end. The drawing includes several callouts to specific parts:

- CA715829** (CA122179): Points to the central shaft.
- CA716139** (CA026007): Points to the flange at the right end.
- CA716152** (CA025793): Points to a component on the flange.
- CA715801** (CA138341): Points to a component on the shaft.
- CA716154** (CA122187): Points to a component on the shaft, with a dimension of  $1 \frac{1}{8}$  indicated.
- CA119029** (CA027245): Points to a component on the shaft.
- CA715243** (CA027245): Points to a component on the shaft.
- CA119029** (CA027245): Points to a component on the shaft.
- CA715829** (CA122179): Points to the central shaft.



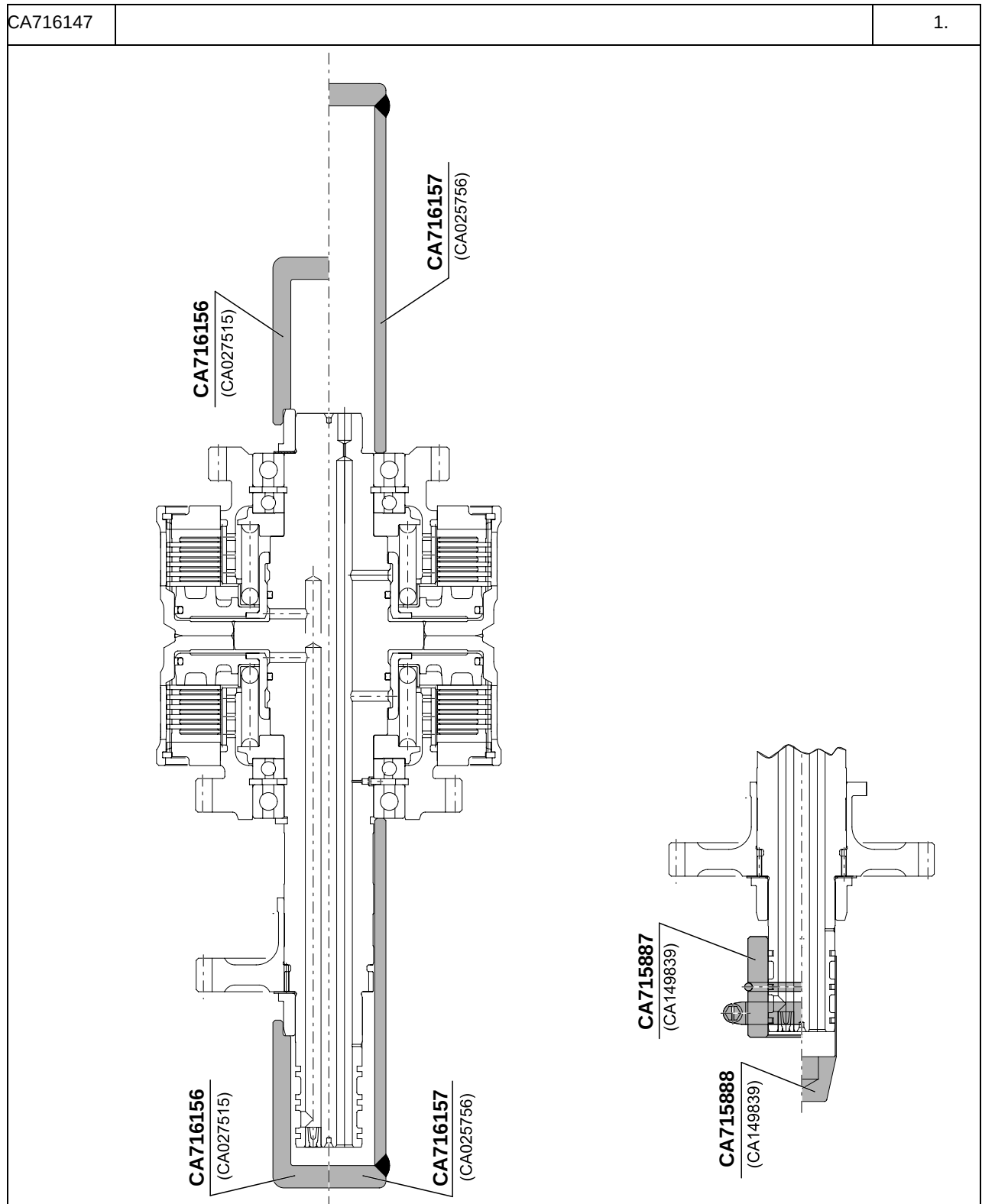
# Special Tools

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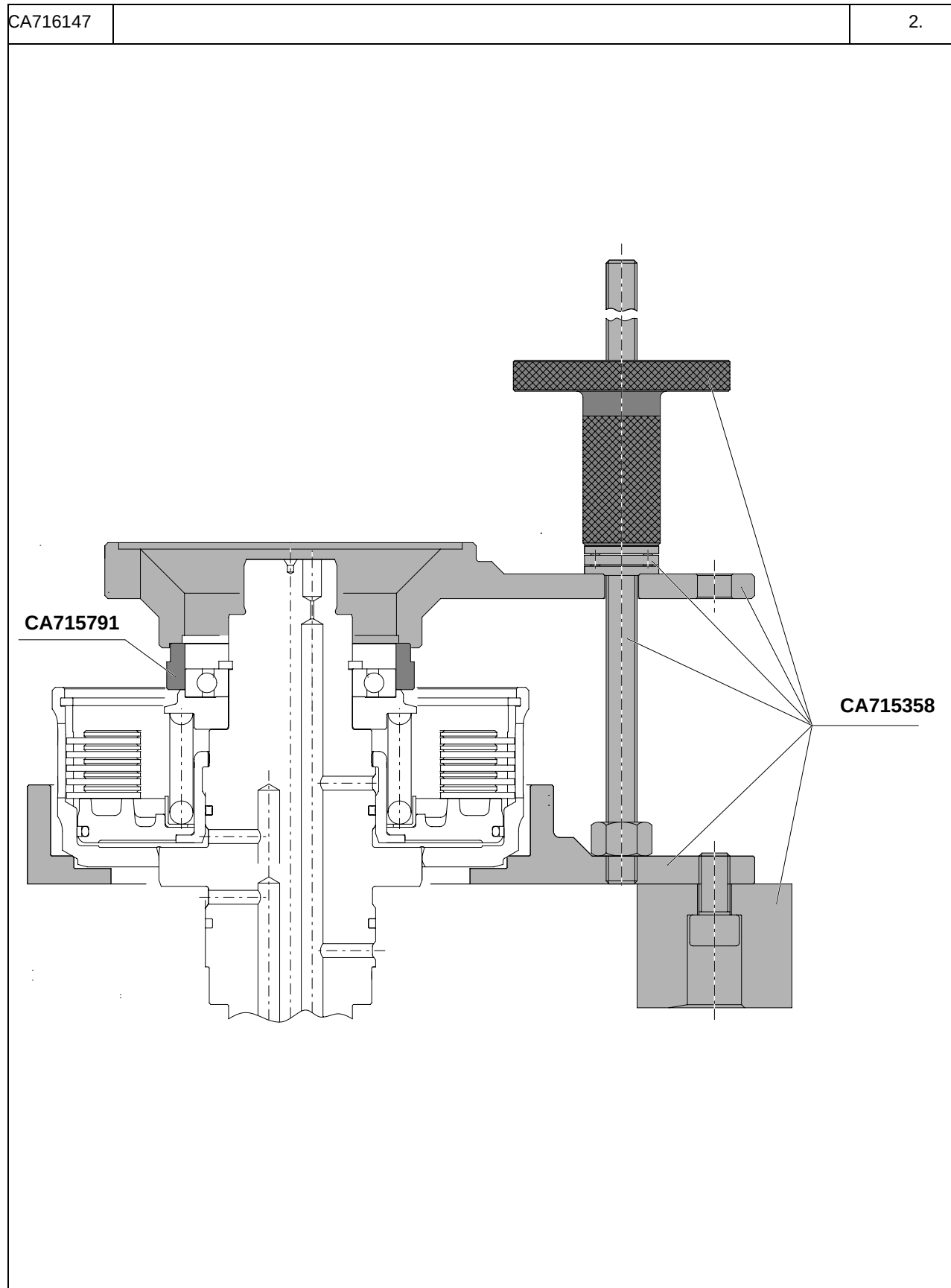
Wet clutch (Power shuttle)

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models | -                         | -                           | -                                                   | -                                                 |                           |                                                   |

# Special Tools



## Special Tools

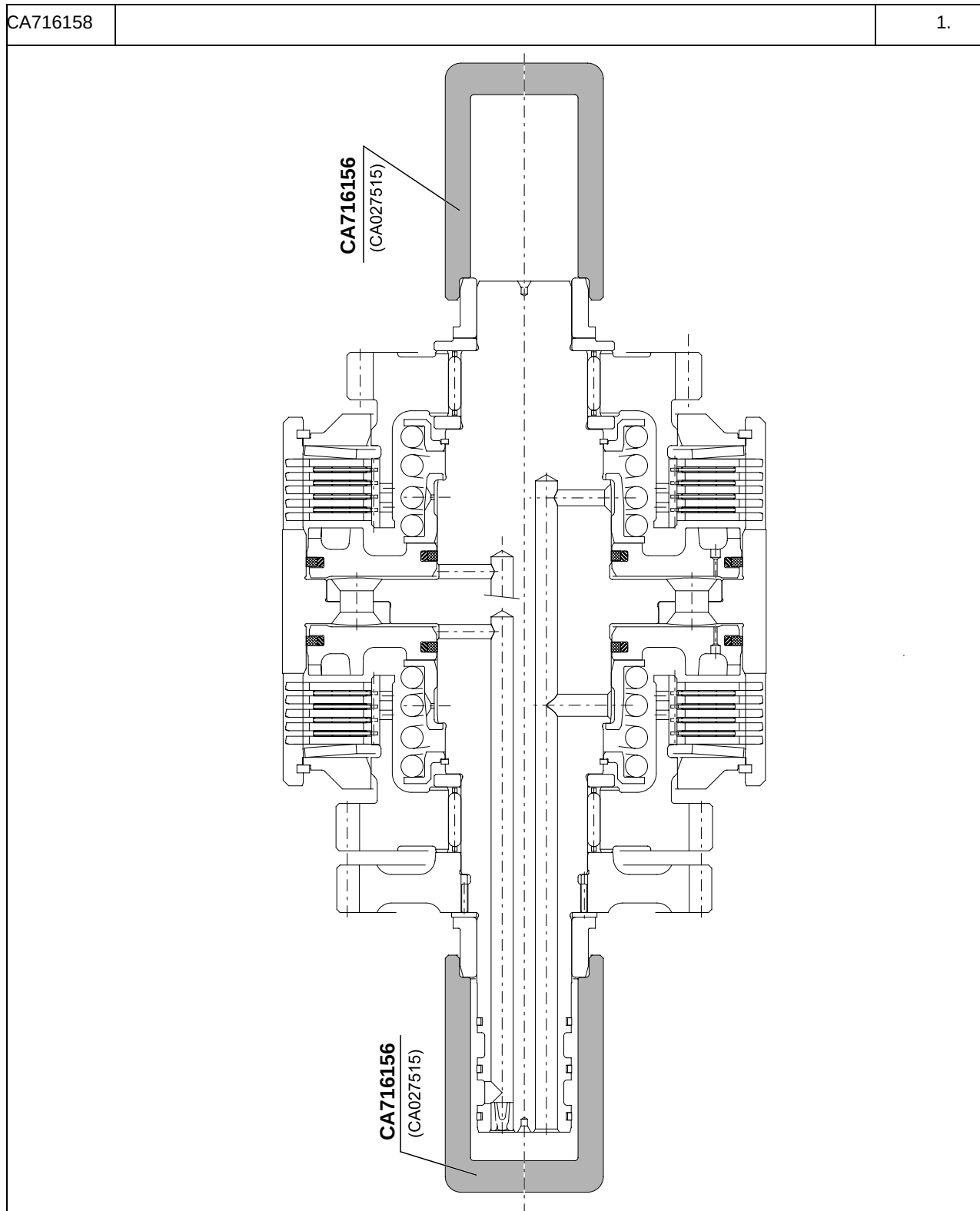


# Special Tools

Wet clutch (Power splitter)

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models | -                         | -                           | -                                                   |                                                   | -                         | -                                                 |

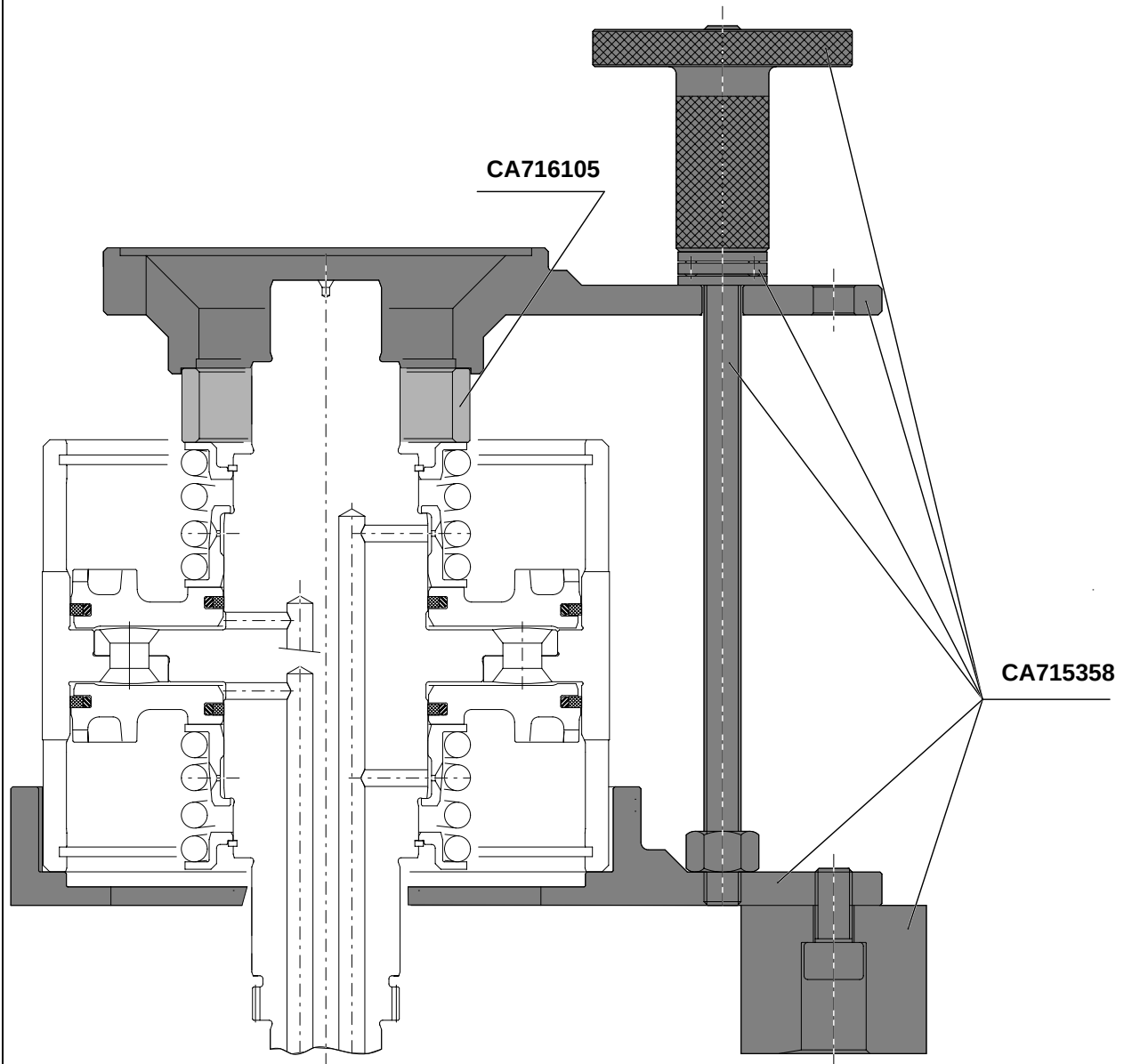
## Special Tools



## Special Tools

CA716158

2.



# Special Tools

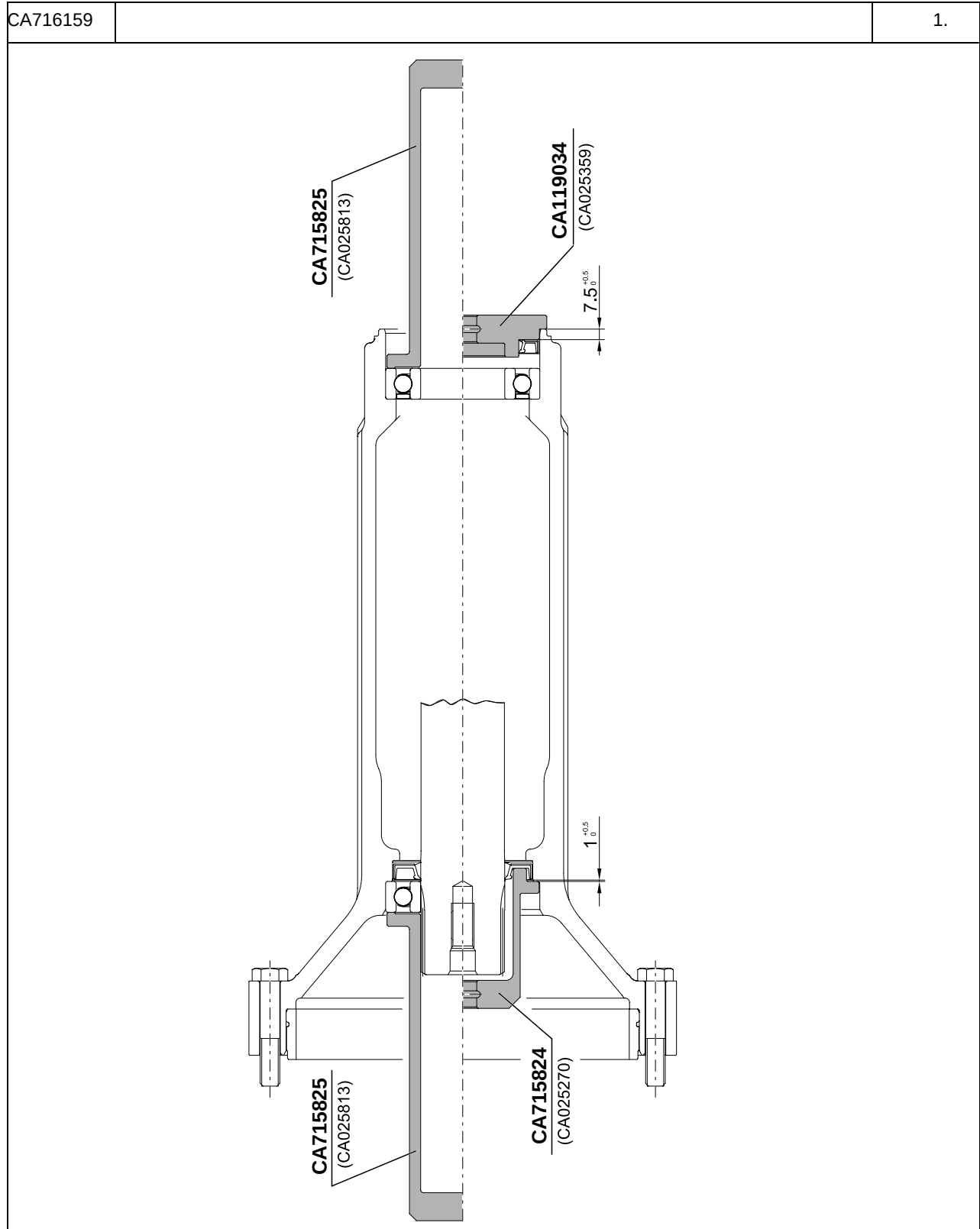
---

Final drive - from 55 to 75 HP

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models |                           |                             |                                                     |                                                   |                           |                                                   |



## Special Tools



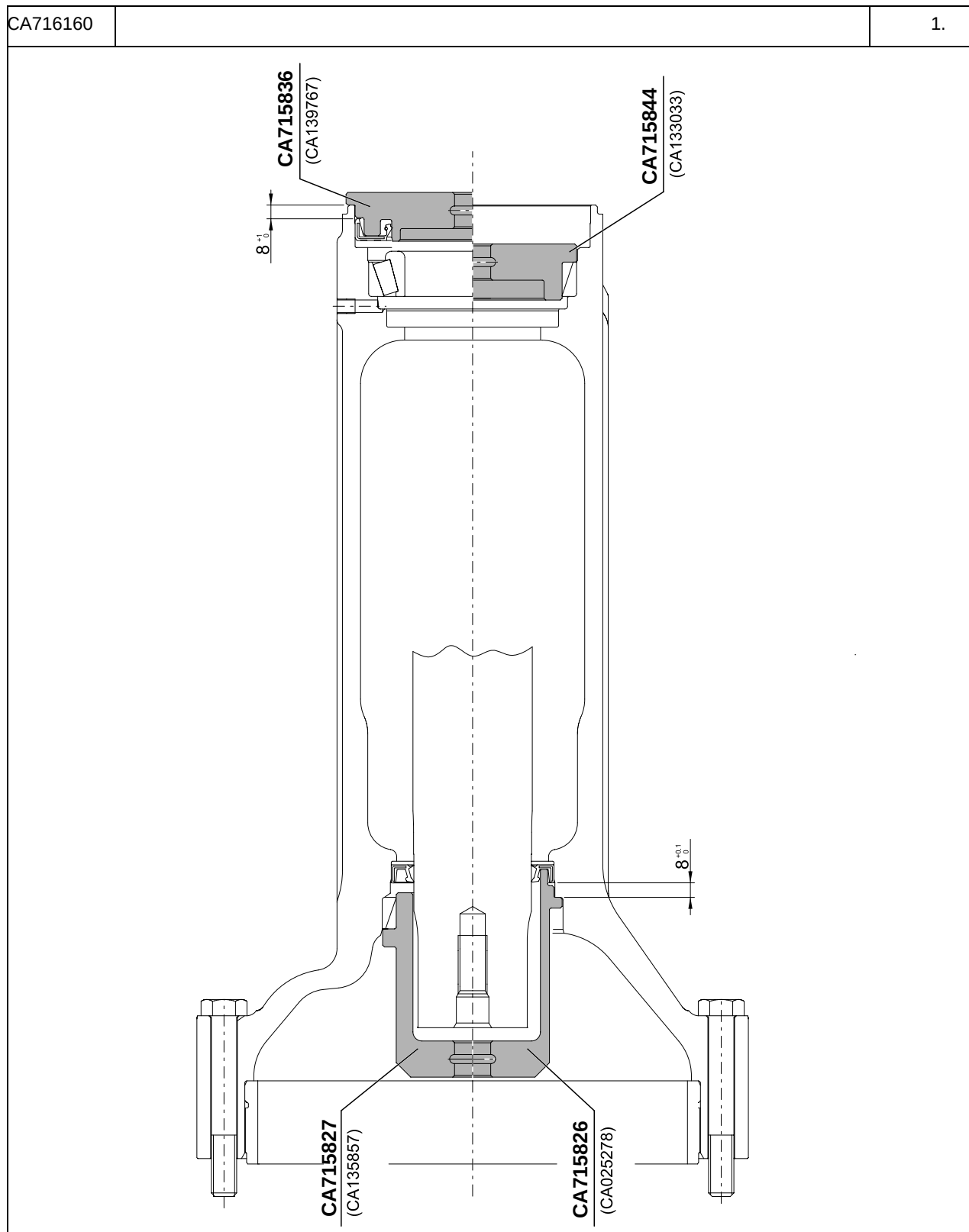
# Special Tools

---

Final drive - 85 HP

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models |                           |                             |                                                     |                                                   |                           |                                                   |

## Special Tools



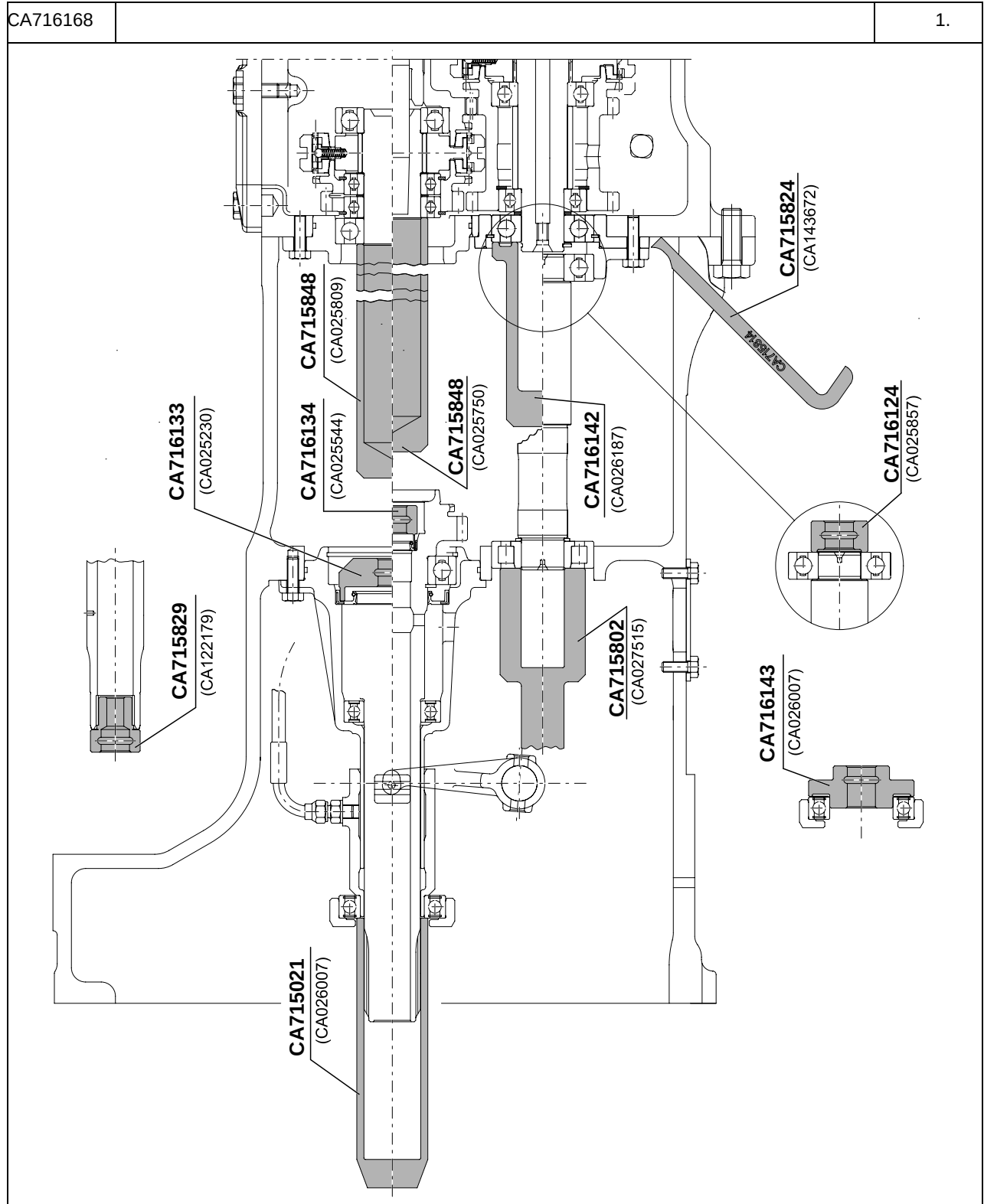
# Special Tools

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Clutch housing (synchro shuttle - synchro splitter

|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models | -                         | -                           |                                                     | -                                                 | -                         | -                                                 |

## Special Tools



Special Tools

|          |    |
|----------|----|
| CA716168 | 2. |
|          |    |

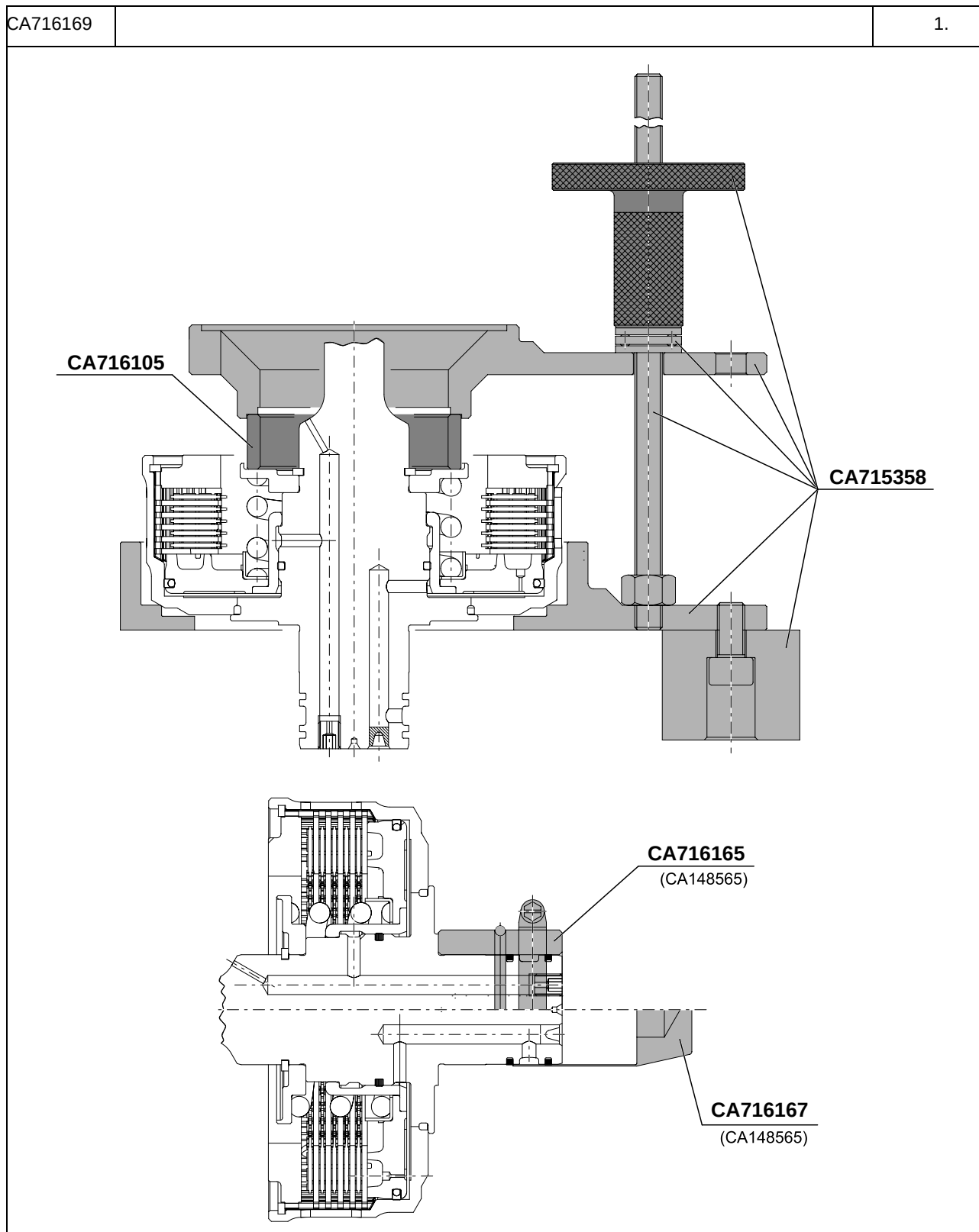
# Special Tools

Cover and PTO wet clutch

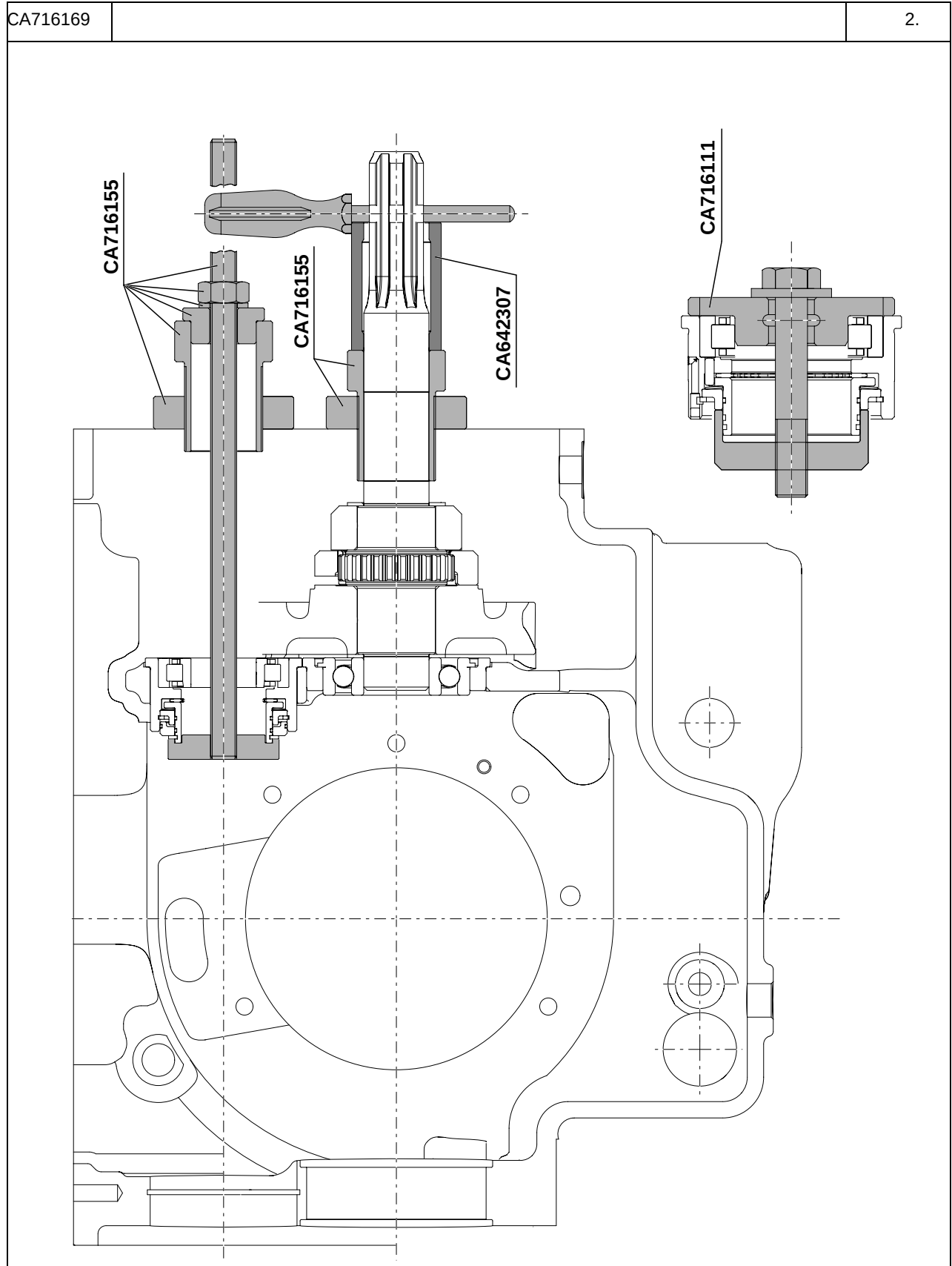
|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models |                           |                             |                                                     |                                                   |                           |                                                   |



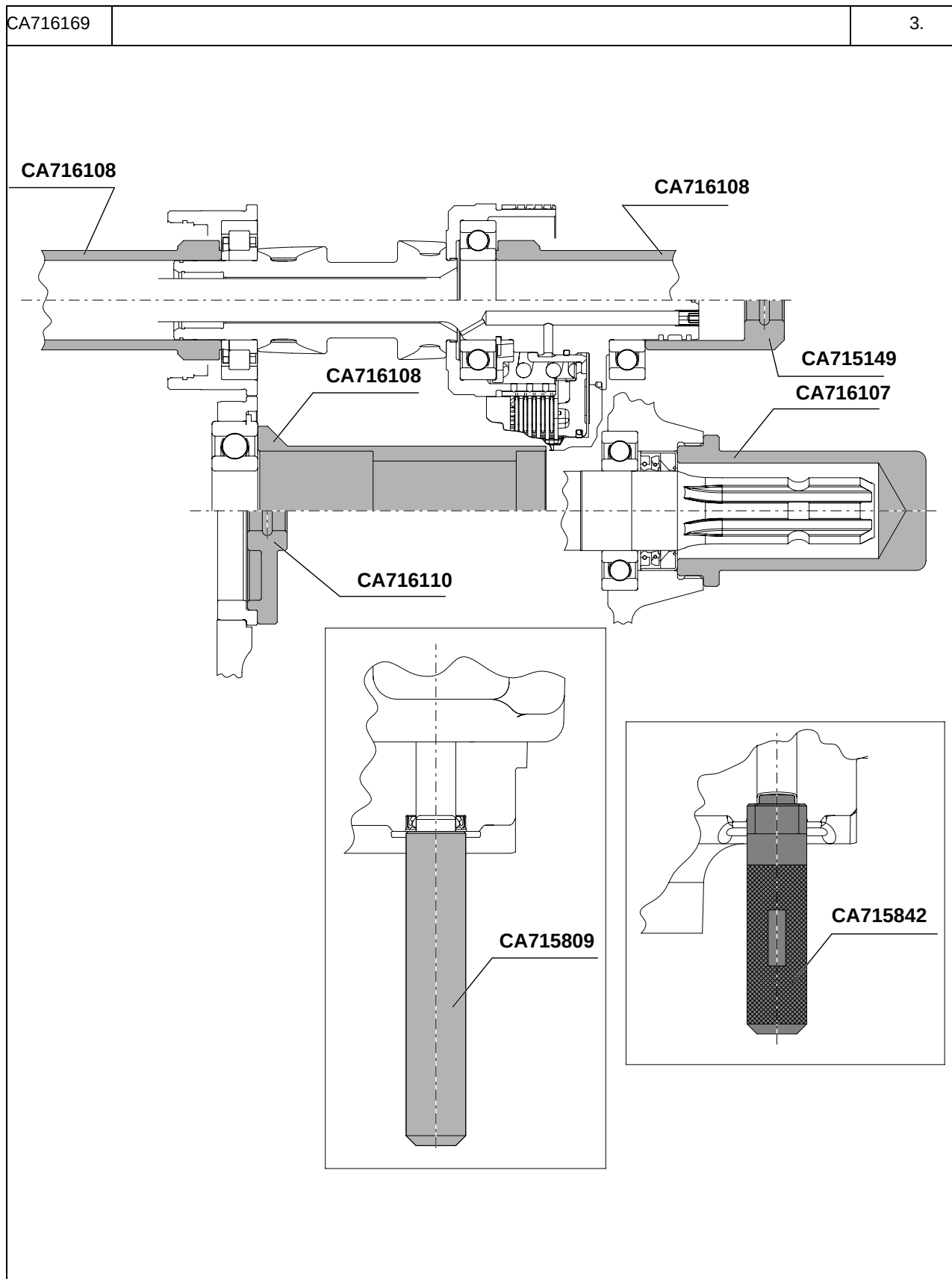
## Special Tools



## Special Tools



## Special Tools



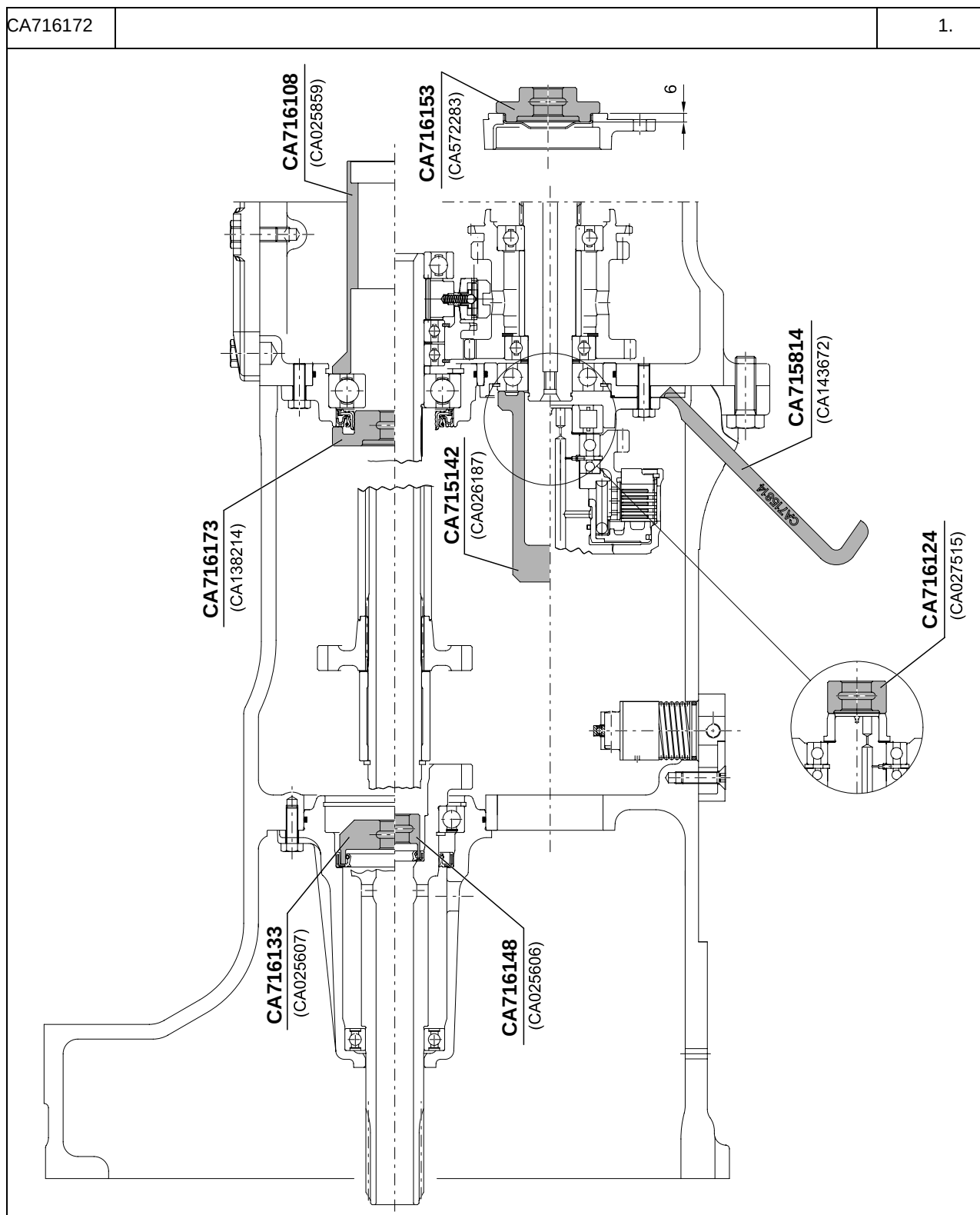
## Special Tools

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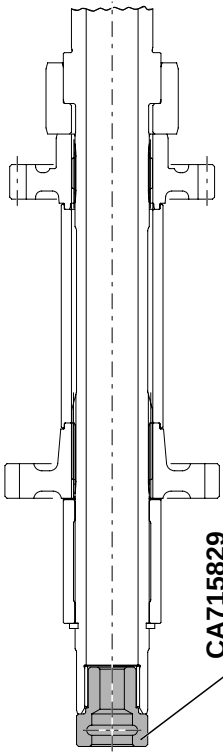
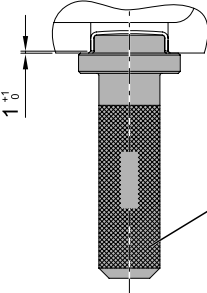
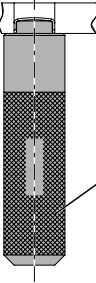
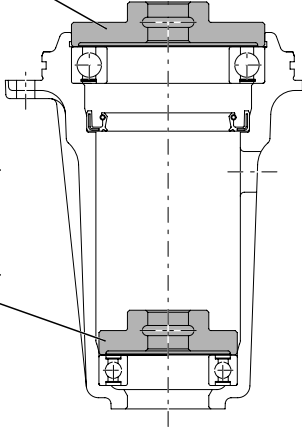
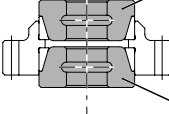
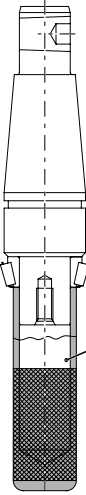
Clutch housing (Synchro shuttle - Synchro splitter

|            | <b>8+8<br/>synchro<br/>shuttle</b> | <b>12+12<br/>synchro<br/>shuttle</b> | <b>24+24<br/>synchro shuttle<br/>and synchro<br/>splitter</b> | <b>24+24<br/>synchro shuttle<br/>and power<br/>splitter</b> | <b>12+12<br/>power<br/>shuttle</b> | <b>24+24<br/>power shuttle<br/>and synchro<br/>splitter</b> |
|------------|------------------------------------|--------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------|------------------------------------|-------------------------------------------------------------|
| For models | -                                  | -                                    | -                                                             | -                                                           | -                                  |                                                             |

# Special Tools



# Special Tools

|                                                                                                                                                                  |  |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----|
| CA716172                                                                                                                                                         |  | 2. |
|  <p><b>CA715829</b><br/>(CA122179)</p>                                        |  |    |
|  <p><b>CA716154</b><br/>(CA122187)</p>                                         |  |    |
|  <p><b>CA715801</b><br/>(CA138341)</p>                                          |  |    |
|  <p><b>CA716139</b><br/>(CA026007)</p> <p><b>CA716152</b><br/>(CA025793)</p> |  |    |
|  <p><b>CA119029</b><br/>(CA027245)</p>                                       |  |    |
|  <p><b>CA119029</b><br/>(CA027245)</p> <p><b>CA715243</b><br/>(CA027245)</p> |  |    |

# Special Tools

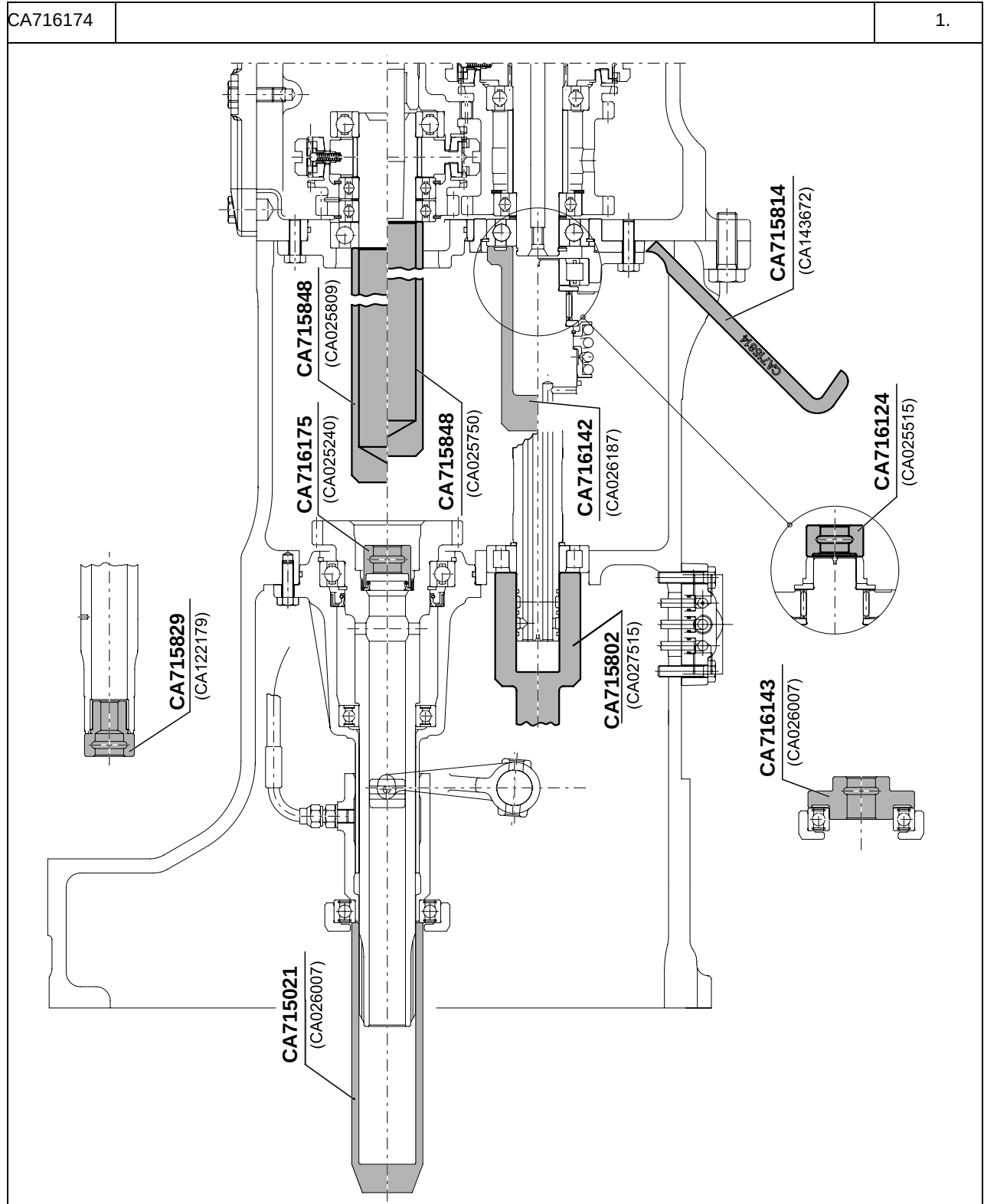
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Clutch housing (synchro shuttle and Power splitter)

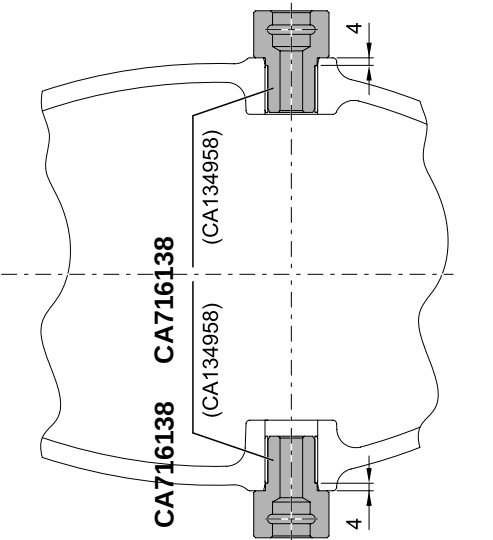
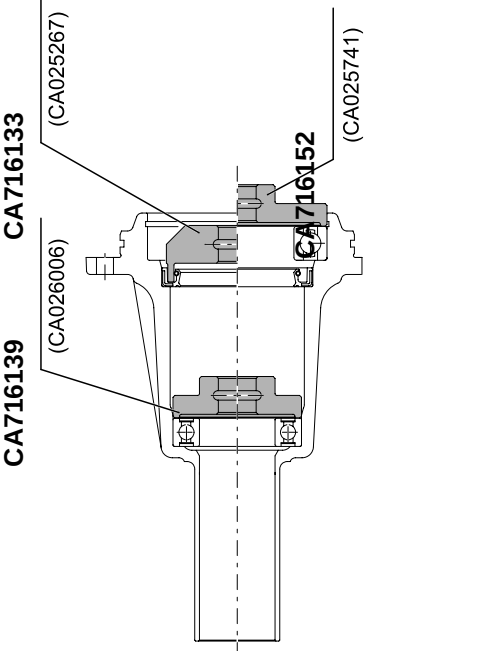
|            | 8+8<br>synchro<br>shuttle | 12+12<br>synchro<br>shuttle | 24+24<br>synchro shuttle<br>and synchro<br>splitter | 24+24<br>synchro shuttle<br>and power<br>splitter | 12+12<br>power<br>shuttle | 24+24<br>power shuttle<br>and synchro<br>splitter |
|------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------------------------------------------|---------------------------|---------------------------------------------------|
| For models | -                         | -                           | -                                                   |                                                   | -                         | -                                                 |



## Special Tools



## Special Tools

|                                                                                                                                                                                                                 |  |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----|
| CA716174                                                                                                                                                                                                        |  | 2. |
|  <p>CA715842<br/>(CA134209)</p> <p>CA716138 CA716139<br/>(CA134958) (CA134958)</p> <p>4 4</p>                                 |  |    |
|  <p>CA715842<br/>(CA134209)</p> <p>CA716133 CA716139<br/>(CA026006) (CA025267)</p> <p>CA716152<br/>(CA025741)</p> <p>4 4</p> |  |    |

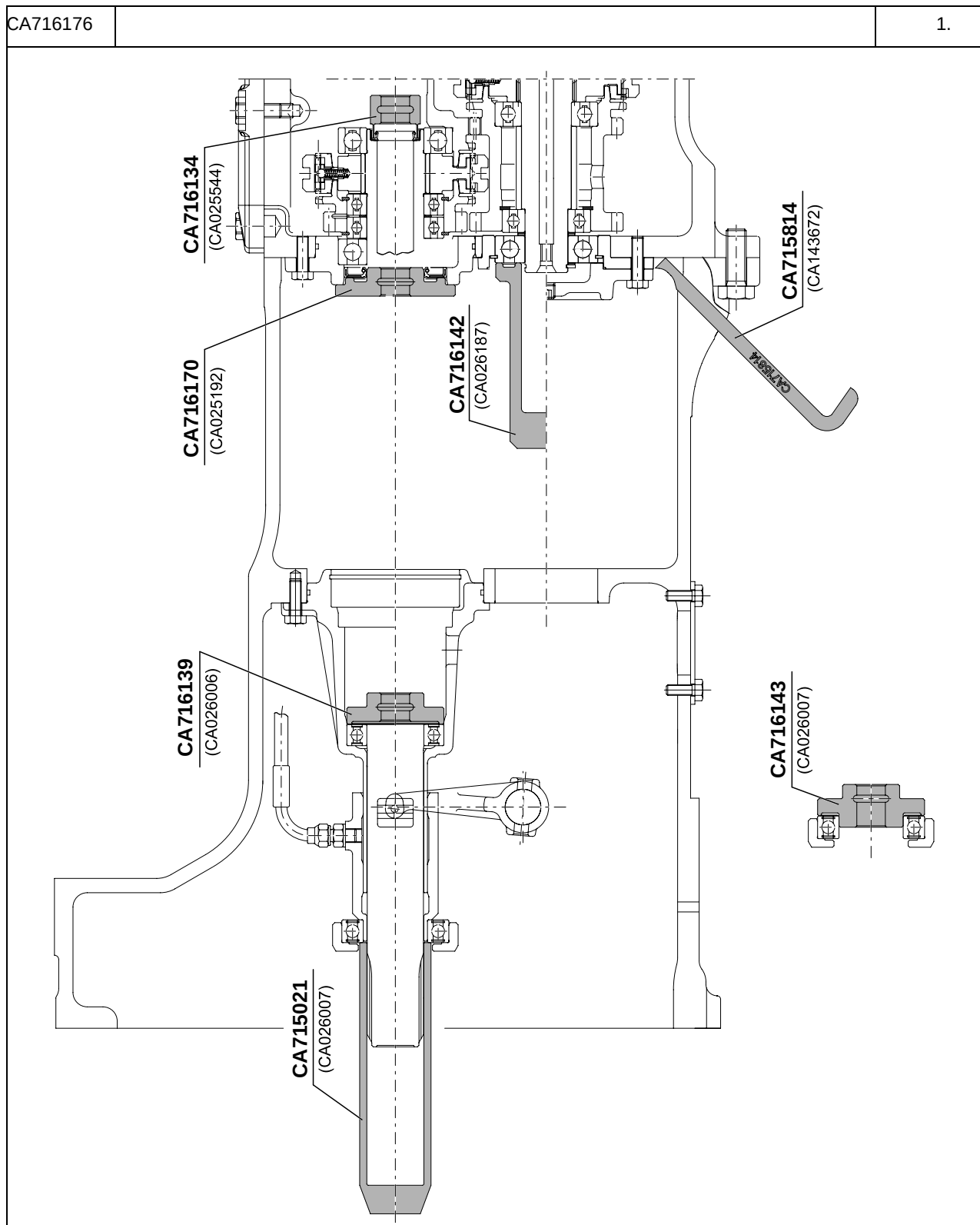
## Special Tools

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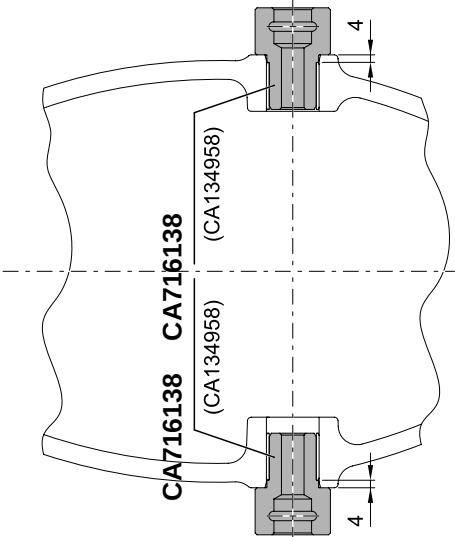
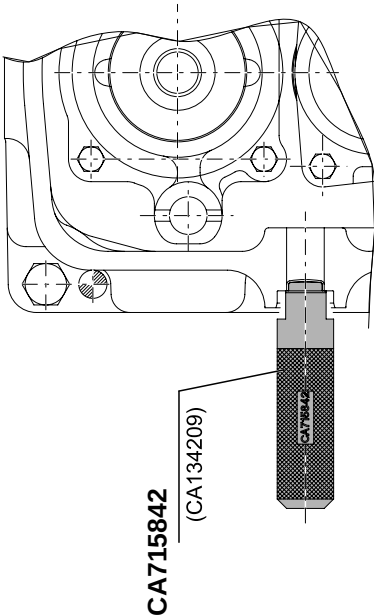
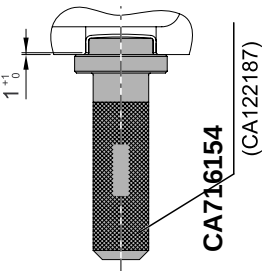
### Clutch housing (synchro shuttle)

|            | <b>8+8<br/>synchro<br/>shuttle</b> | <b>12+12<br/>synchro<br/>shuttle</b> | <b>24+24<br/>synchro shuttle<br/>and synchro<br/>splitter</b> | <b>24+24<br/>synchro shuttle<br/>and power<br/>splitter</b> | <b>12+12<br/>power<br/>shuttle</b> | <b>24+24<br/>power shuttle<br/>and synchro<br/>splitter</b> |
|------------|------------------------------------|--------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------|------------------------------------|-------------------------------------------------------------|
| For models |                                    |                                      | -                                                             | -                                                           | -                                  | -                                                           |

## Special Tools



## Special Tools

|                                                                                                                                                  |                                                                                                                    |                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| CA716176                                                                                                                                         |                                                                                                                    | 2.                                                                                                                |
|  <p>CA716138 CA716138<br/>(CA134958) (CA134958)</p> <p>4 4</p> |  <p>CA715842<br/>(CA134209)</p> |  <p>CA716154<br/>(CA122187)</p> |

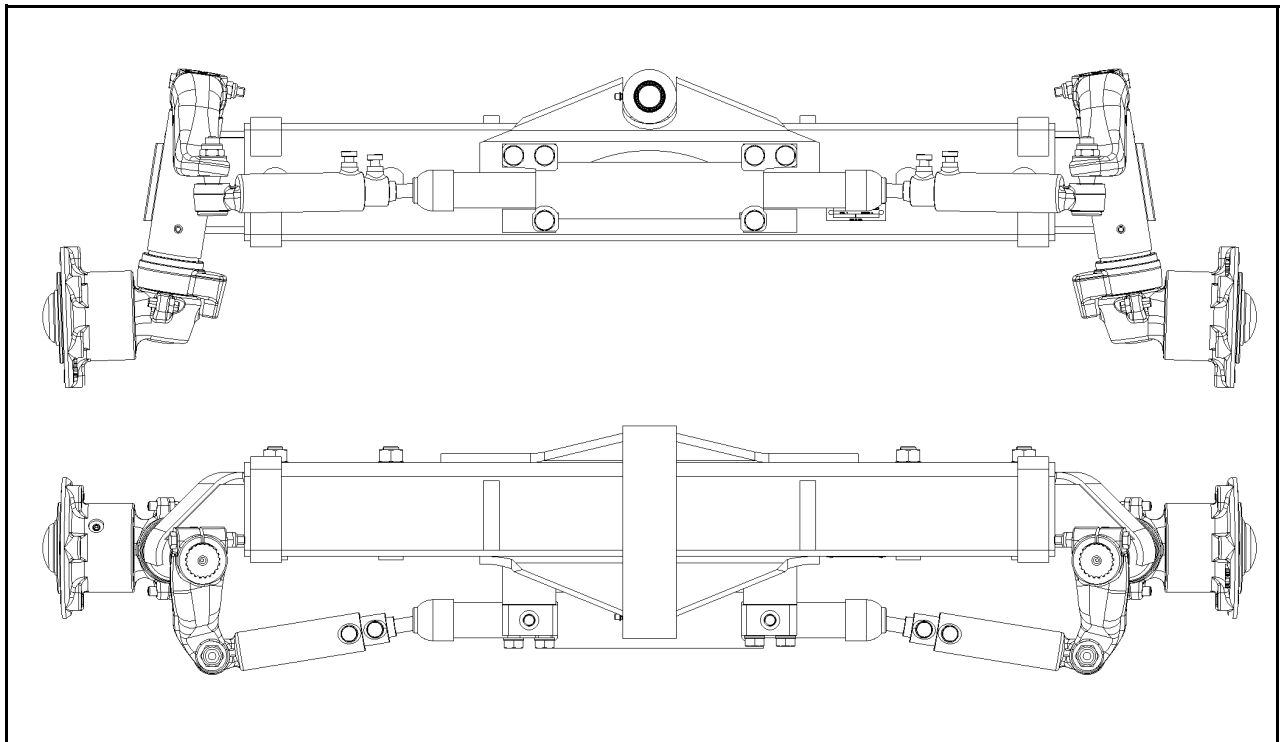
## Special Tools

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## 2WD Axle

### 2WD Axle Section 5A





## 2WD Axle

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## General Information

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# General Information

## Section 5A

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# General Information

---

## MANUAL USE

End users

- Installer
- User
- Maintenance operator

### Maintenance

CONSULT THIS MANUAL THOROUGHLY, as proper functioning and good efficiency of mechanical organs depends mostly on constant and correct routine maintenance ensuring product integrity and expected life duration.

In case of any damages or anomalies, quick intervention of specialized personnel can avoid future impairment and lengthen the working life.

### Repair

The disassembly/assembly procedures have been outlined for a total product overhauling. They have also been described in sequence through photographs with relevant explanation for specific interventions, thus obtaining a complete and safe guide for each and every phase of an operation.

Operation description presumes that the unit has already been removed from the vehicle. The manual supplied by the vehicle manufacturer should be consulted in case of a overhauling or maintenance intervention.

## INFORMATION PROPERTY

This manual should be considered as Massey Ferguson Limited confidential information. All rights reserved.

No part of this manual may be reproduced, in any form or by any means, without prior written permission of Massey Ferguson Limited. Only the customer, whom the manual, together with the product, has been issued to, is allowed to use this document, and only in order to use, maintain and repair the unit.

Massey Ferguson Limited declares that the subject of this manual consists with the technical and safety specifications of the machine that the manual is referred to. The manufacturer shall not be held liable for direct or indirect damages to persons, things or animals due to an improper use of this document or of the machine or to a different use of them, which does not comply with what is provided for in this manual.

Agco Limited  
Abbey Park  
Stoneleigh, Kenilworth, CV8 2TQ England  
Tel. +44 (0) 24 7669 4400  
[www.agcocorp.com](http://www.agcocorp.com)

## AGREEMENTS AND DEFINITIONS

### Agreements

Illustrations like pictures, drawings and components of this manual are NOT in scale, because of limited space and editing limits, therefore they are NOT reliable to obtain values about size or weight.

Illustrations are supposed to point out the correct methods to working on the machine and its components, therefore they could not display exactly the same elements.

### Definitions

Left side: it is the left side of the unit considering the vehicle running conditions.

Right side: it is the right side of the unit considering the vehicle running conditions.

### Typographic agreements

**NOTE:** The notes, pointed out externally to the text they refer, include important information.



### Warning

**Warning indications point out the procedures, whose partial or complete non-observance can damage the machine or the connected equipment.**



### Danger

**Danger indications point out the procedures, whose partial or complete non-observance can injure the operator.**

### Measurements

This manual indicates all measurements in International System (SI). Use the following conversion table to convert Imperial Measure.

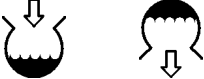
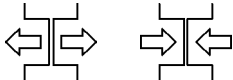
## General Information

### Conversion table

| S.I.                        |                       | GB/USA SYSTEM |             |
|-----------------------------|-----------------------|---------------|-------------|
| 1                           | (mm)                  | 0.03937       | (in)        |
| 10                          | (mm)                  | 0.3937        | (in)        |
| 25.4                        | (mm)                  | 1             | (in)        |
| 6.4516                      | (cm <sup>2</sup> )    | 1             | (sq. in)    |
| 1                           | (m <sup>2</sup> )     | 1550          | (sq. in)    |
| 16.378                      | (cm <sup>2</sup> )    | 1             | (cu. in)    |
| 0.473                       | (dm <sup>2</sup> )    | 1             | (U.S. pint) |
| 1                           | (l)                   | 6102          | (cu. in)    |
| 1                           | (l)                   | 0.2642        | (U.S. gal)  |
| 1.772                       | (g)                   | 1             | (oz)        |
| 0.4536                      | (kg)                  | 1             | (lb)        |
| 0.00070308                  | (kg/mm <sup>2</sup> ) | 1             | (lb/sq. in) |
| 1                           | (bar)                 | 14.51         | (psi)       |
| 1                           | (kg.m)                | 7.246         | (lb.ft)     |
| 1(daN)= 10 (N)= 1,02 (kg.f) |                       | 2.24          | (lb.f)      |

# General Information

## Symbology

| DESCRIPTION                                                      | SYMBOLS                                                                               |
|------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| WARNING/DANGER                                                   |    |
| REMOVE/INSTALL<br>seals-gaskets-filters                          |     |
| OIL FILLING OR OIL LEVEL/OIL DRAIN                               |     |
| LUBRICATION/GREASING                                             |    |
| ADJUSTMENTS/MEASUREMENTS<br>tightening torques-preloads-backlash |    |
| SPECIAL TOOLS                                                    |  |
| SEALING/LOCKING FLUIDS<br>APPLICATION                            |  |
| MARKING                                                          |  |
| DISASSEMBLY/ASSEMBLY OF BULKY PARTS OR<br>SUBASSEMBLIES          |   |
| WARNING:<br>respect assembly orientation                         |  |
| CLEANING CAREFULLY                                               |  |
| APPLY PRESSURIZED FLUID                                          |  |

# General Information

## GENERAL DESCRIPTION

The machine should be checked and/or repaired only by qualified technicians, acquainted with its peculiar features and well aware of all safety instructions.

Before performing any operation it is advisable to carry out unit cleaning accurately by removing oil/ grease encrustations and accumulation.

All disassembled mechanical parts must be cleaned accurately with suitable products to avoid possible damage. Parts should be replaced if damaged, worn out, cracked, seized, etc. as they could affect proper working.

Rotating parts (bearings, gears, shafts) and that of hardware/fasteners (O-Ring, oil seals) should be examined carefully, as they are subject to major stress, wearing and ageing.

We highly advise to replace tightening parts during every strippdown or repair.

Use appropriate spare parts, nuts and bolts to avoid any other problems. Moreover, use metric tools for metric nuts and bolts and Imperial tools for the others.

Some repairs are destructive for some axle components. Carefully reading and thorough understanding of these instructions will avoid damage to other components unnecessarily.

## RECOMMENDATIONS FOR REPAIR OPERATIONS

Before starting any disassembly and assembly operations, read carefully the following recommendations.

### Shafts seals

Respect the following recommendations during shaft seal assembly:

- Clean shaft very carefully and ensure that the part in contact with the shaft seal is not damaged, cut or out of roundness.
- Assemble the seals so that the lip is fitted towards the oil side.
- Lubricate seal lips (use oil) and fill 3/4 of seal cavity with grease.
- Use appropriate drivers. Do not use a hammer directly on the seals.
- Do not damage the seals while assembling the shaft.

### O-rings

Lubricate adequately before inserting them at the right place and avoid o-ring rolling while inserting the shaft.

### Bearings

Its advisable to heat up bearings to 80°C - 90°C before assembling them onto their respective shafts or to cool them (dry ice) before inserting them into corresponding bore.

Always use suitable extractors to remove the bearings. Before reassembling the bearings, clean, check and lubricate them.

### Sealing

Use sealing as advised by specifications. Ensure that parts to be sealed are clean, dry and completely grease free.

### Cleaning

Wash all moving parts (gears, bearings, etc.) accurately with diesel fuel or kerosene.

Avoid gasoline and watery alkaline solutions. Do not wash with steam or hot water, as it will be very difficult to eliminate surface humidity.

Dry all parts with a rag or air jet to avoid scratching from abrasive residues.

All surfaces should be covered with lubricant so as to protect it from future oxidation.

### Checks

Examine accurately all bearings, external rings which may be still stuck in their position and pivot pins on which rolls rotate. Replace those which are worn out or damaged.

Check all grooves: assure that they are not worn out or damaged.

Replace spoiled parts with original spare parts.

Replace seals on rotating shafts, before reassembly.

### Ends of flanges and tools

Be careful when hammering tool or flange ends, in order to avoid jeopardizing functionality and integrity of either the tools or the components on which you are operating.

### Assembly methods

In order to assemble the group, an appropriate fixture must be used.

In order to position the group a lifting system is needed.

To make disassembly and assembly operations easier, use a group assembly drawing.

## General Information

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# General Specifications

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## General Specifications

### Section 5A

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# General Specifications

## INTENDED USE

This axle has been designed and manufactured according to the customer's technical specifications to be mounted on agricultural tractors.

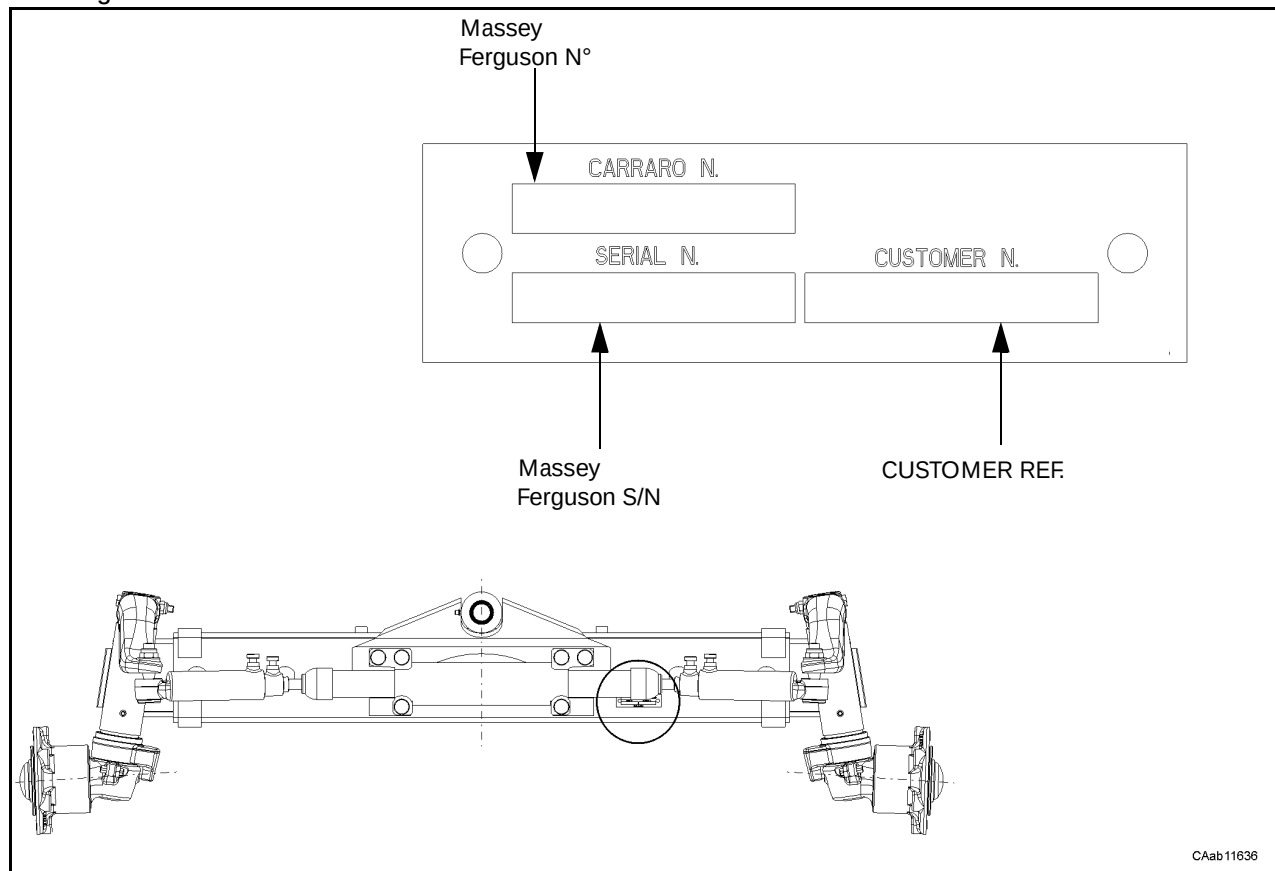
Never mount this axle on machines different from the ones for which it has been designed and manufactured

If the axle is used for any other purpose than the one foreseen, Massey Ferguson Limited declines any responsibility regarding damages or accidents caused by it. All consequences will be at the expense of the client.

However, when used as foreseen, operational formalities as well as regular maintenance repair specifications given by Massey Ferguson Limited are to be observed strictly.

## PRODUCT IDENTIFICATION

Axle tag

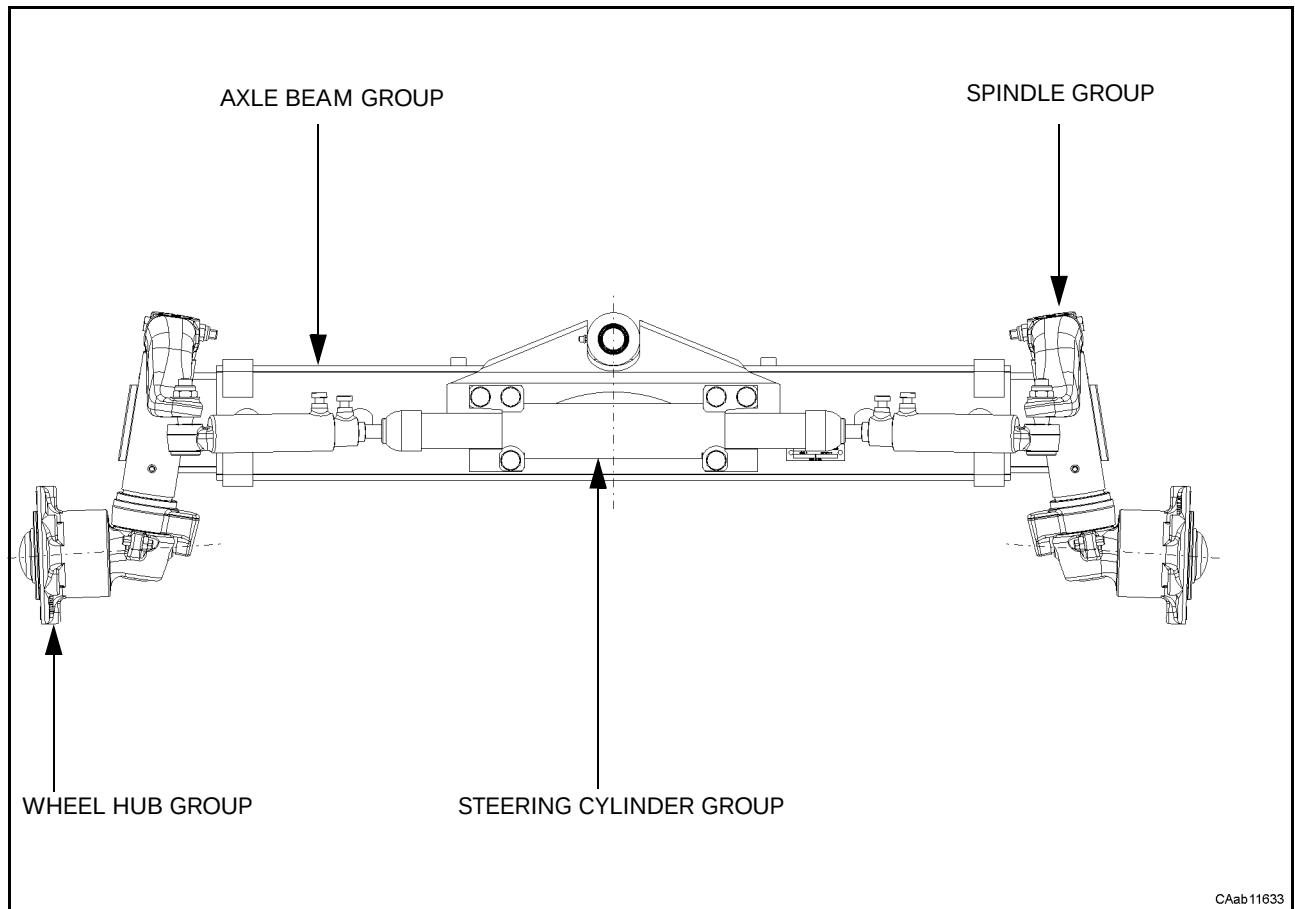


## GENERAL DESCRIPTION

The axle described in this manual consists mainly of following groups:

- AXLE BEAM: main part and load-bearing shell structure of the axle, with support parts to fix the axle to the vehicle
- WHEEL HUB: wheel support parts
- SPINDLE: wheel hub support parts with the steering knuckle
- STEERING CYLINDER: hydraulic cylinder and adjustable tie rods (steering arms) for toe-in setting

## General Specifications



CAab11633

### TECHNICAL FEATURES

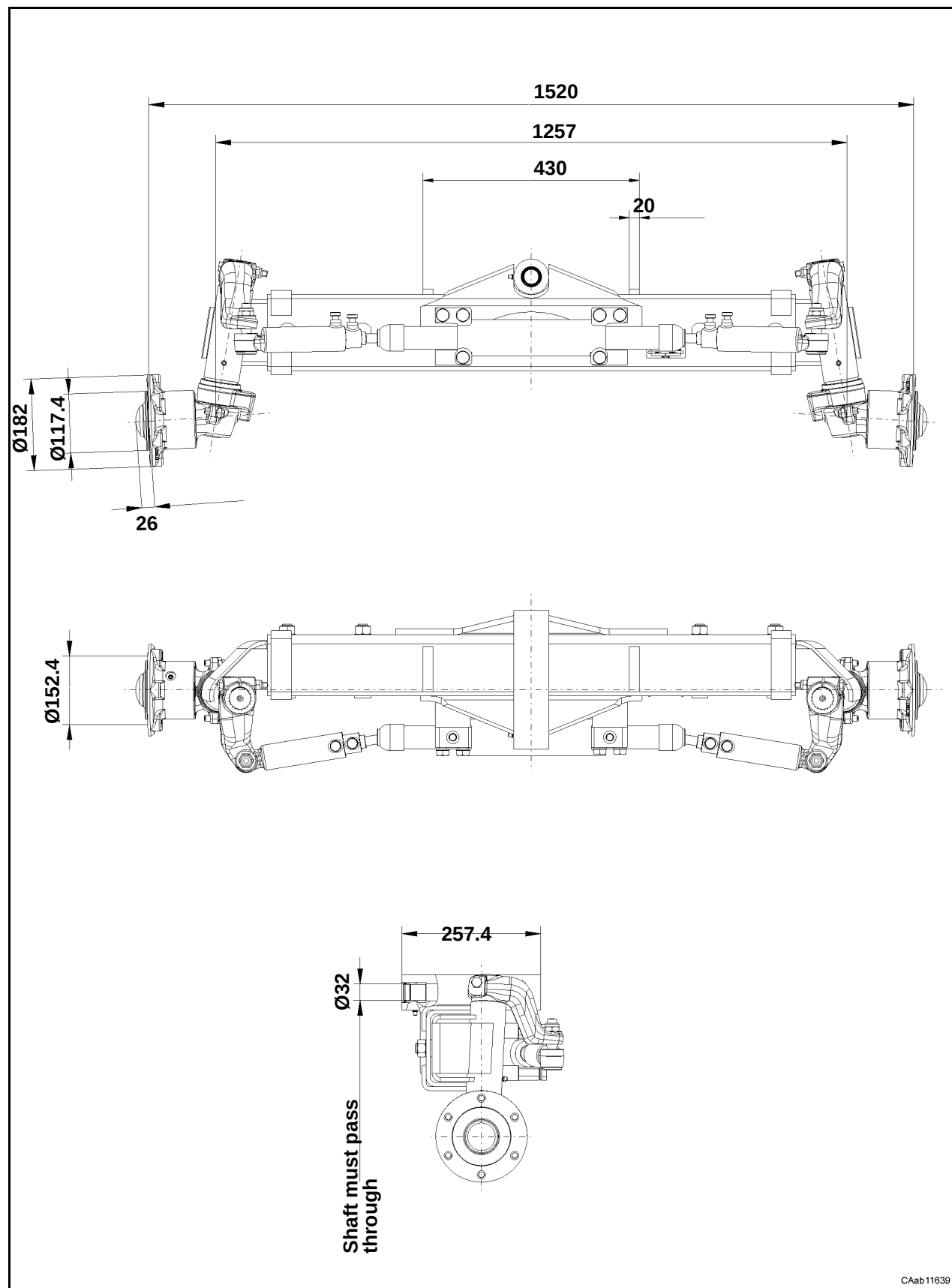
|                | MACHINE                                            | Axle     |
|----------------|----------------------------------------------------|----------|
| CODE           |                                                    | CA149967 |
| MODEL          |                                                    | 2RM/2WD  |
| DESCRIPTION    | VALUES                                             |          |
| Dry weight     | T.B.A.                                             |          |
| Steering angle | 55°                                                |          |
| Toe-in         | A $\begin{smallmatrix} -3 \\ -6 \end{smallmatrix}$ |          |

#### Assembly main data

|                                                               |             |
|---------------------------------------------------------------|-------------|
| Tapered bearings preloading                                   | 2.5 ÷ 3 daN |
| (increase the load until the first split hole is serviceable) |             |

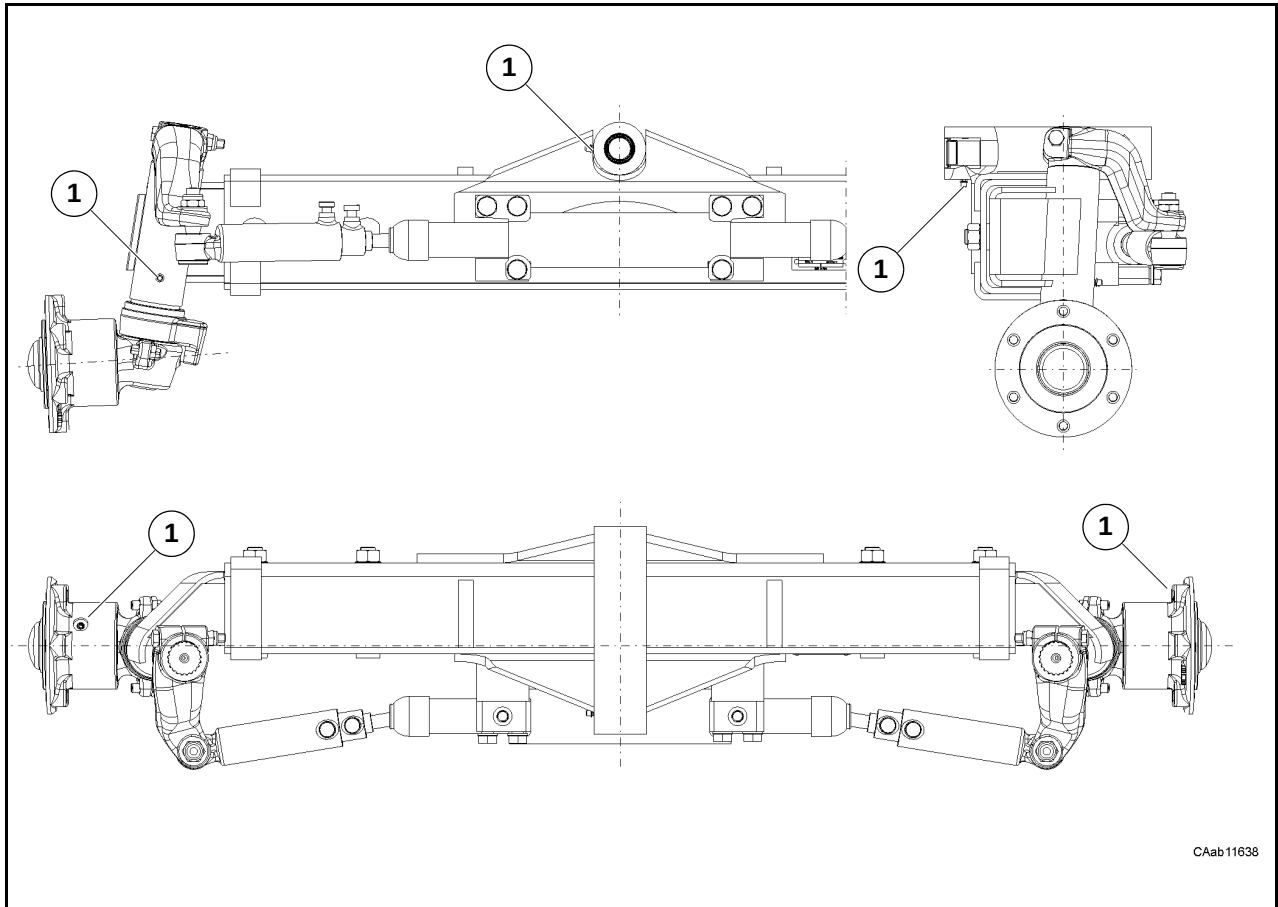
# General Specifications

## Main dimensions (mm)



## General Specifications

### MAINTENANCE



| DESCRIPTION    | POSITION |
|----------------|----------|
| Greasing point | 1        |

# General Specifications

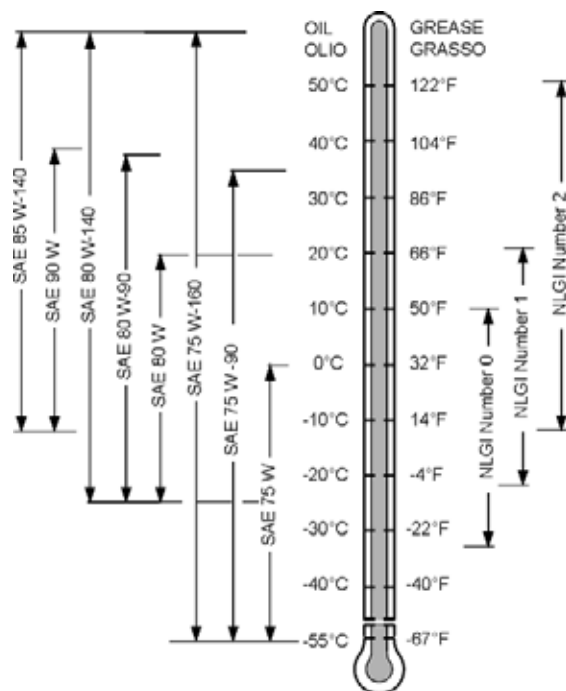
## Service schedule

Specified maintenance intervals are for standard-duty use.

Severe operating conditions may require more short intervals.

| Operation                                                                     | Recommended intervals |       |       |        |
|-------------------------------------------------------------------------------|-----------------------|-------|-------|--------|
|                                                                               | 50 h                  | 400 h | 800 h | 1200 h |
| CHECK WHEEL HUB/STEERING PIVOTS/<br>SUSPENSION CLEARANCE.                     |                       |       |       |        |
| LUBRICATE THE STEERING PIVOTS (king pin)                                      |                       |       |       |        |
| CHECK STEERING FOR CORRECT<br>OPERATION (WITH AND WITHOUT ENGINE<br>RUNNING). |                       |       |       |        |
| CHECK STEERING AND TOE-IN<br>ADJUSTMENT (INCLUDING TYRE WEAR<br>AND DAMAGE).  |                       |       |       |        |

## Lubricants application range



# General Specifications

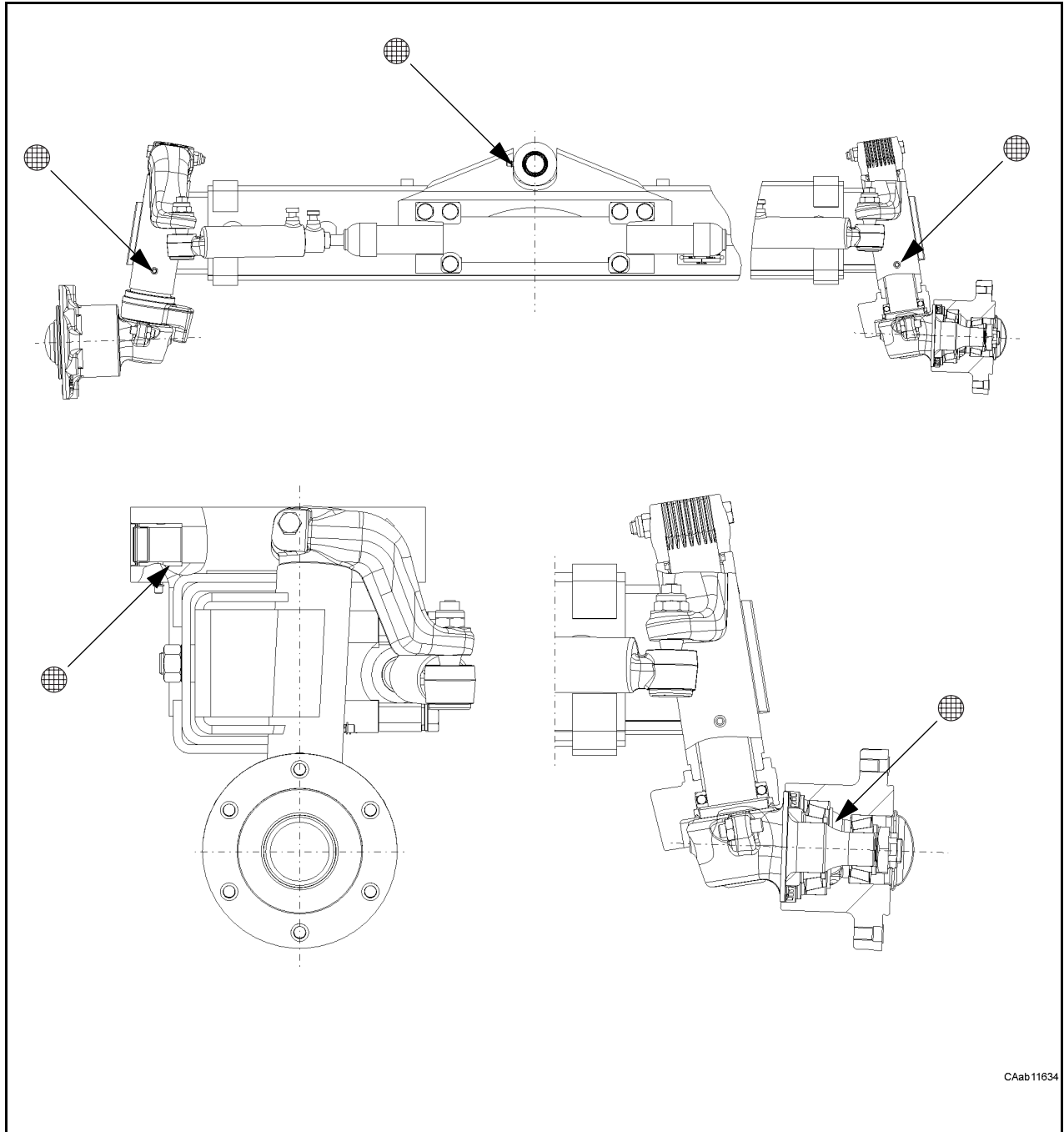
## GREASE IN ASSEMBLY

### Grease application in assembly

Fill / Apply in excess



AGIP®  
GR MU EP2



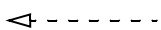
CAab11634



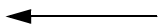
# General Specifications

## ADHESIVE AND SEALANT

### Adhesive/Sealant Application



Apply on the contact surfaces



Apply on bolts thread/on pins

### Gasket sealant

| Massey<br>Ferguson Ref. | Presence | Adhesive make and type         | Technical characteristics | Strength |
|-------------------------|----------|--------------------------------|---------------------------|----------|
| A1                      | ●        | Loctite® 510<br>Superbond® 529 | Flat surface sealing      | High     |
| A2                      | ○        | Loctite® 573<br>Superbond® 519 | Flat surface sealing      | Low      |
| A3                      | ○        | Loctite® 518<br>Superbond® 539 | Uneven surface sealing    | High     |

### Thread parts sealant

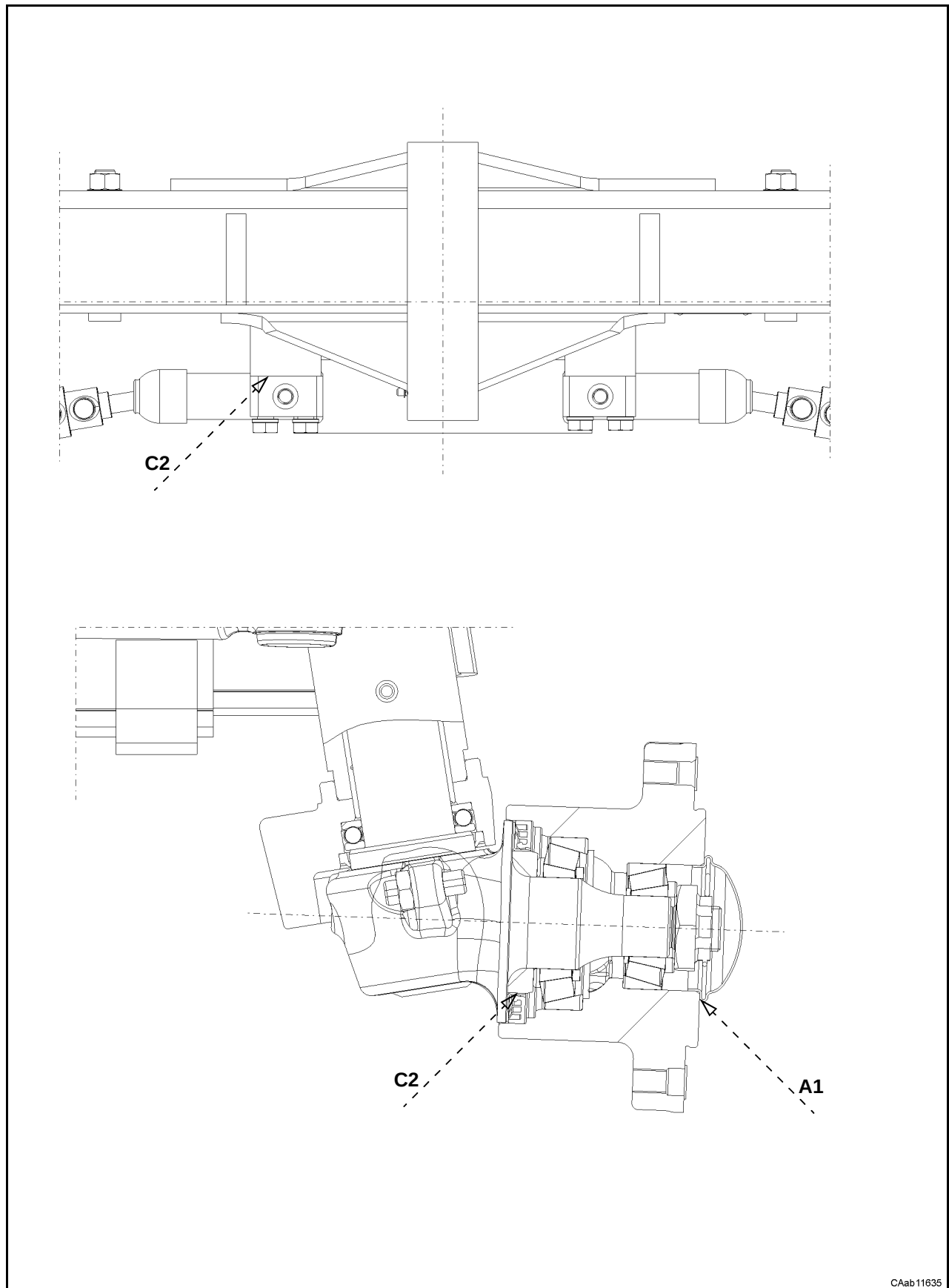
| Massey<br>Ferguson Ref. | Presence | Adhesive make and type             | Technical characteristics | Strength            |
|-------------------------|----------|------------------------------------|---------------------------|---------------------|
| B1                      | ○        | Loctite® 542<br>Superbond® 321     | Locking of threaded parts | Medium              |
| B2                      | ○        | Loctite® 270<br>Superbond® 331     | Locking of threaded parts | High                |
| B3                      | ○        | Loctite® 986/AVX<br>Superbond® 438 | Locking of threaded parts | High, special appl. |

### Fixing parts sealant

| Massey<br>Ferguson Ref. | Presence | Adhesive make and type                | Technical characteristics | Strength    |
|-------------------------|----------|---------------------------------------|---------------------------|-------------|
| C1                      | ○        | Loctite® 405<br>Superbond® instant 25 | Fixing adhesive           | Medium bond |
| C2                      | ●        | Loctite® 638<br>Superbond® 433        | Fixing adhesive           | Strong bond |
| C3                      | ○        | Loctite® 542<br>Superbond® 321        | Fixing adhesive           | Medium bond |
| C4                      | ○        | Loctite® 496<br>Superbond® SB14       | Rubber fixing adhesive    | Strong bond |

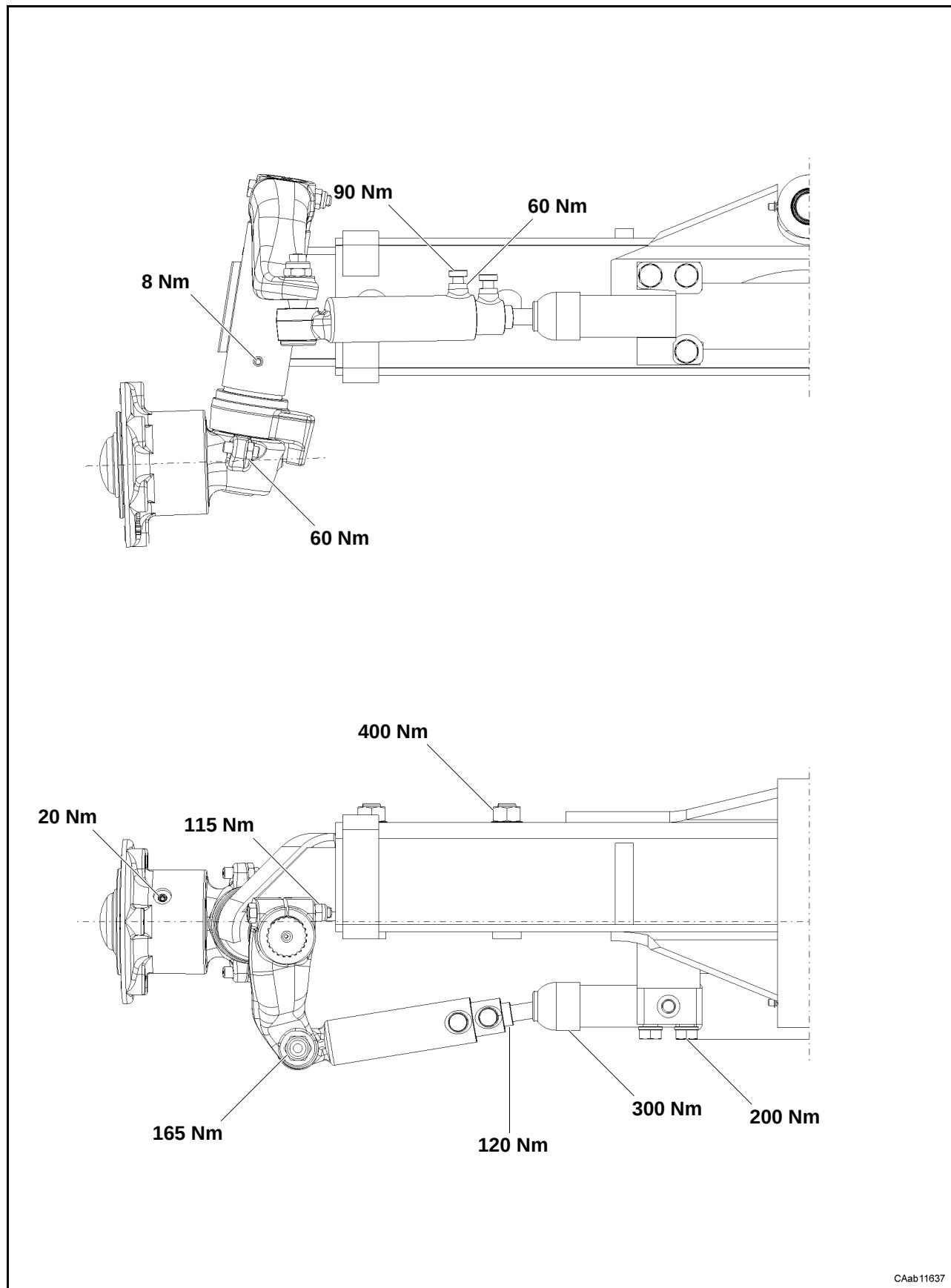
## General Specifications

### Sealing compounds and adhesives



# General Specifications

## TIGHTENING TORQUES



# Disassembly and Assembly Operations

---

## Disassembly and Assembly Operations

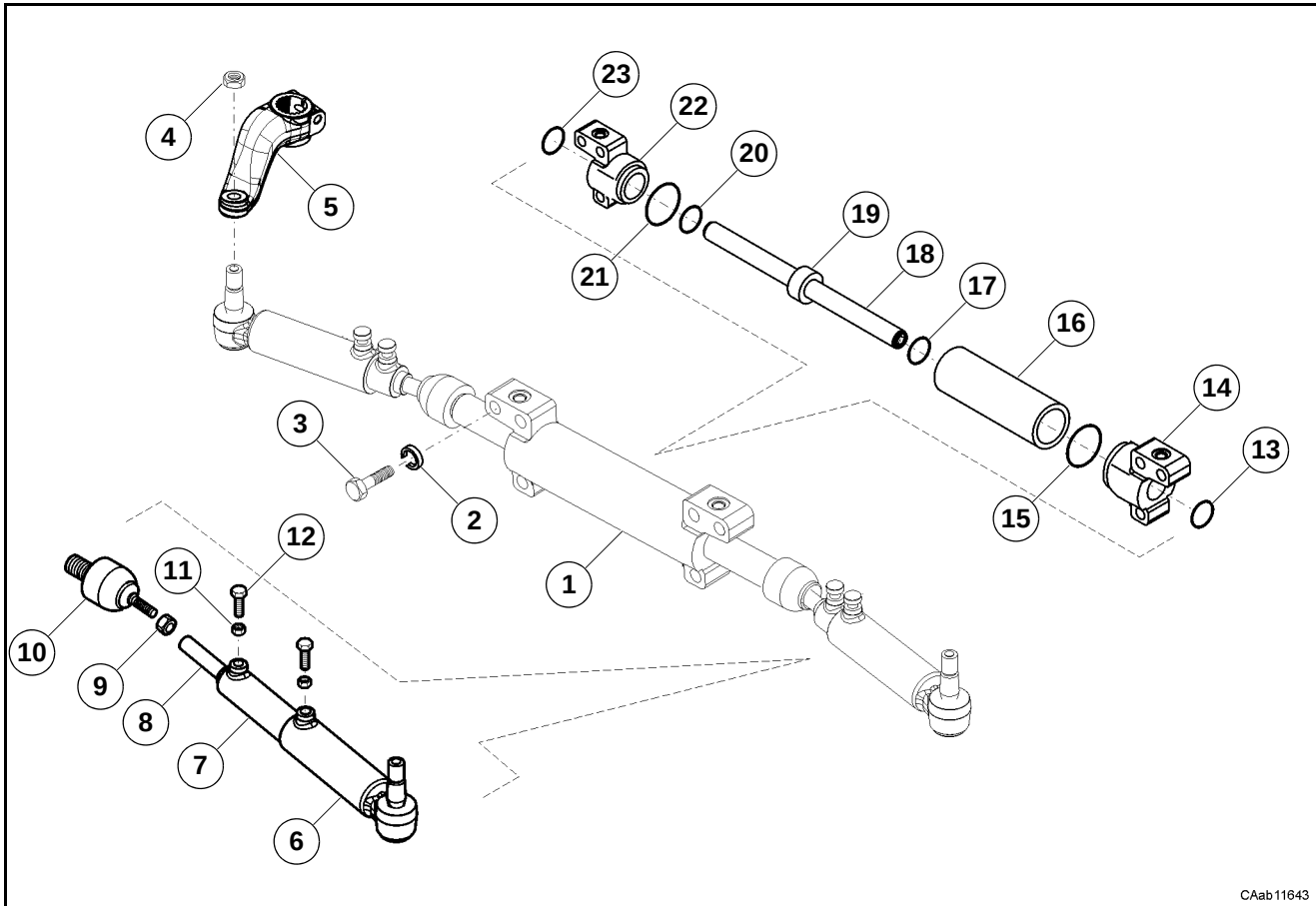
### Section 5A

#### Table of Contents

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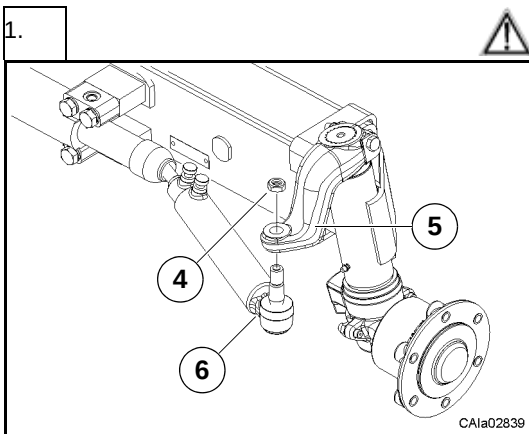
# Disassembly and Assembly Operations

## STEERING CYLINDER GROUP

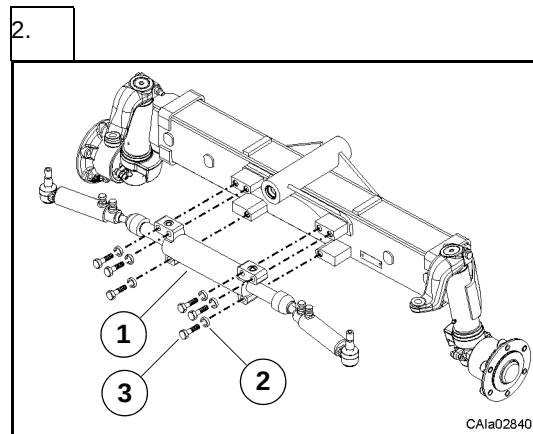


CAab11643

### Disassembly



Remove the nuts (4) and disjoin the tie rods (6) from the steering arms (5). Do not damage the threaded pin of the tie rod (6).



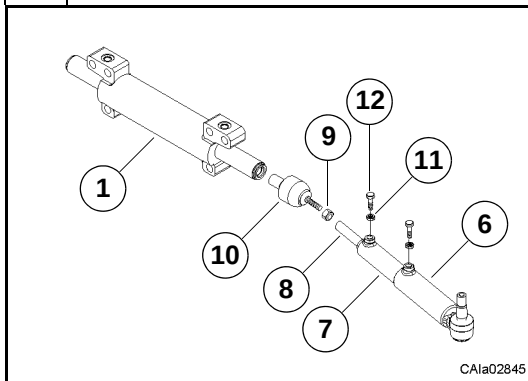
Remove the fastening bolts (3) and disassemble the steering cylinder (1).

Collect the washers (2).

CAIa02840

# Disassembly and Assembly Operations

3.

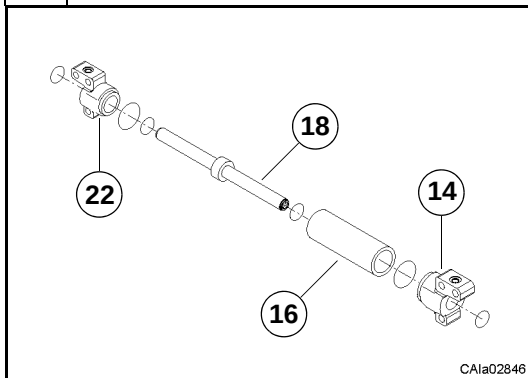


Remove the tie rods (6, 7, 8) by loosening the nuts (11) and screws (12), then check their conditions.

Loosen the nut (9) and unscrew the ball pin (10) from the cylinder (1) rod.

**NOTE:** Remove only parts that need to be overhauled and/or replaced.

4.



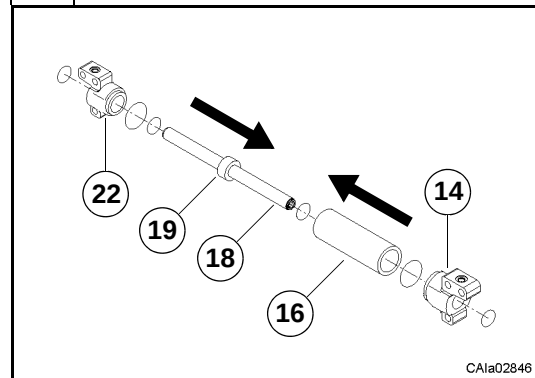
Detach the cylinder heads (14 and 22) from the cylinder case (16) and remove it from the rod (18).

Remove off the rod (18) from the cylinder case (16).

Remove all the seals from the cylinder heads (14 and 22), and the rod (18).

## Assembly

1.

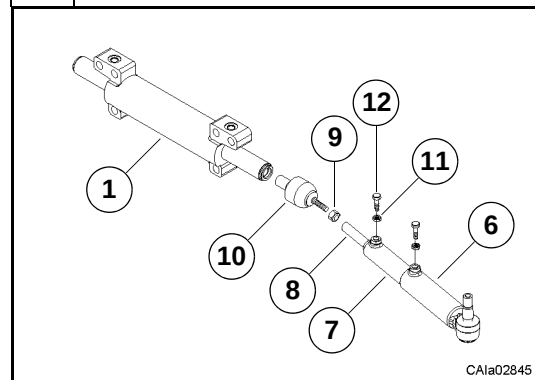


Assemble new seals on the cylinder heads (14 and 22) and on the rod piston (19).

Insert the rod (18) into the cylinder body (16).

Fit the cylinder heads (14 and 22) on the rod (18), then assemble the heads to the cylinder case (16).

2.



Assemble the tie rods (6, 7, 8) with the bolts (12) and related nuts (11).

Tighten the screws (12) and the nuts (11) to the requested torque

[Refer to: C.8](#)

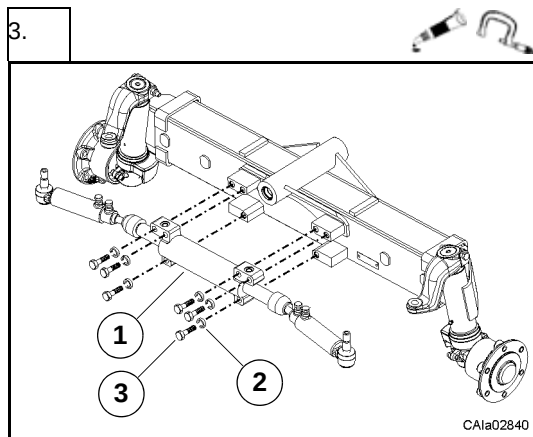
Screw the ball pin (10) to the cylinder rod (1) to the requested torque

[Refer to: C.8](#)

Screw the nut (9) on the ball pin (10) and assemble the tie rods (8) to the ball pin (10).

Do the same operations on the other cylinder side.

# Disassembly and Assembly Operations

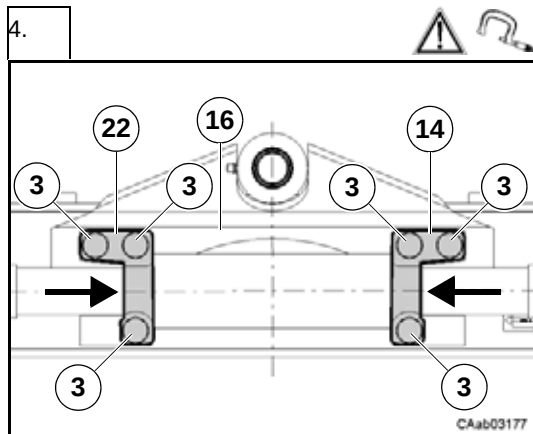


Spread a film of adhesive on the contact surfaces between the axle beam and the steering cylinder (1).

[Refer to: C.7.](#)

Install the assembled steering cylinder (1) on the central body.

Assemble the screws (3) and the related washers (2).

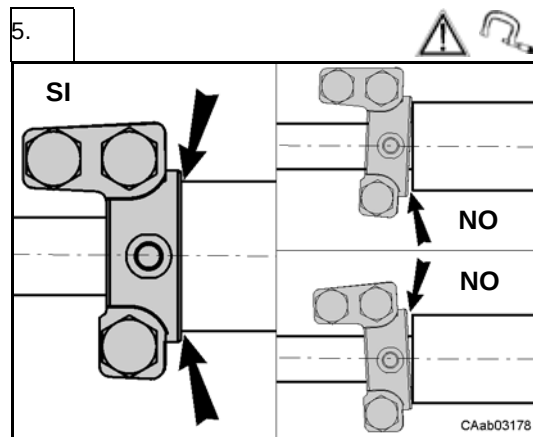


Press the cylinder heads (14) and (22) against the cylinder body (16) and tighten the fastening screws (3) to the prescribed torque

[Refer to: C.8](#)

## Warning

The heads (14) and (22) must be perfectly joined to the cylinder body (16).



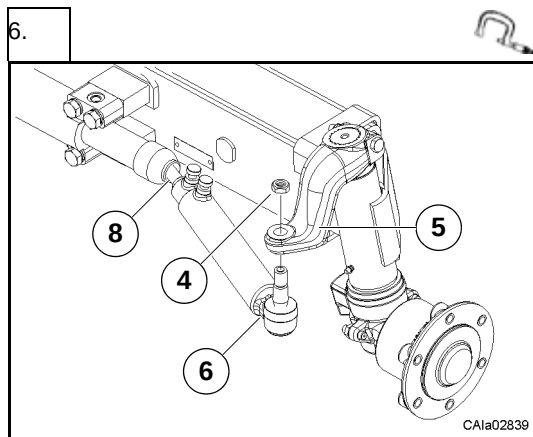
## Warning

Check that the maximum backlash between cylinder heads and cylinder body are less than 0.1 mm.

Use a 0.1 mm feeler and check that the feeler do not pass between cylinder heads and cylinder body.



# Disassembly and Assembly Operations



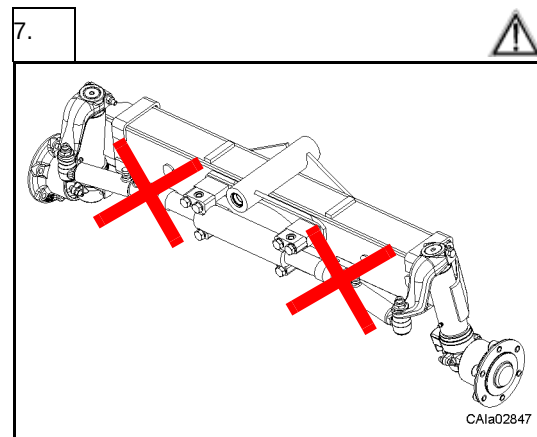
Align the wheel hubs with the axle.

Adjust the tie rods (8) so that the ball joints (6) can be inserted into the steering arms (5).

Assemble the ball joints of the tie rods (6) to the steering arms (5).

Assemble and tighten the lock nut (4) to the requested torque.

[Refer to: C.8](#)



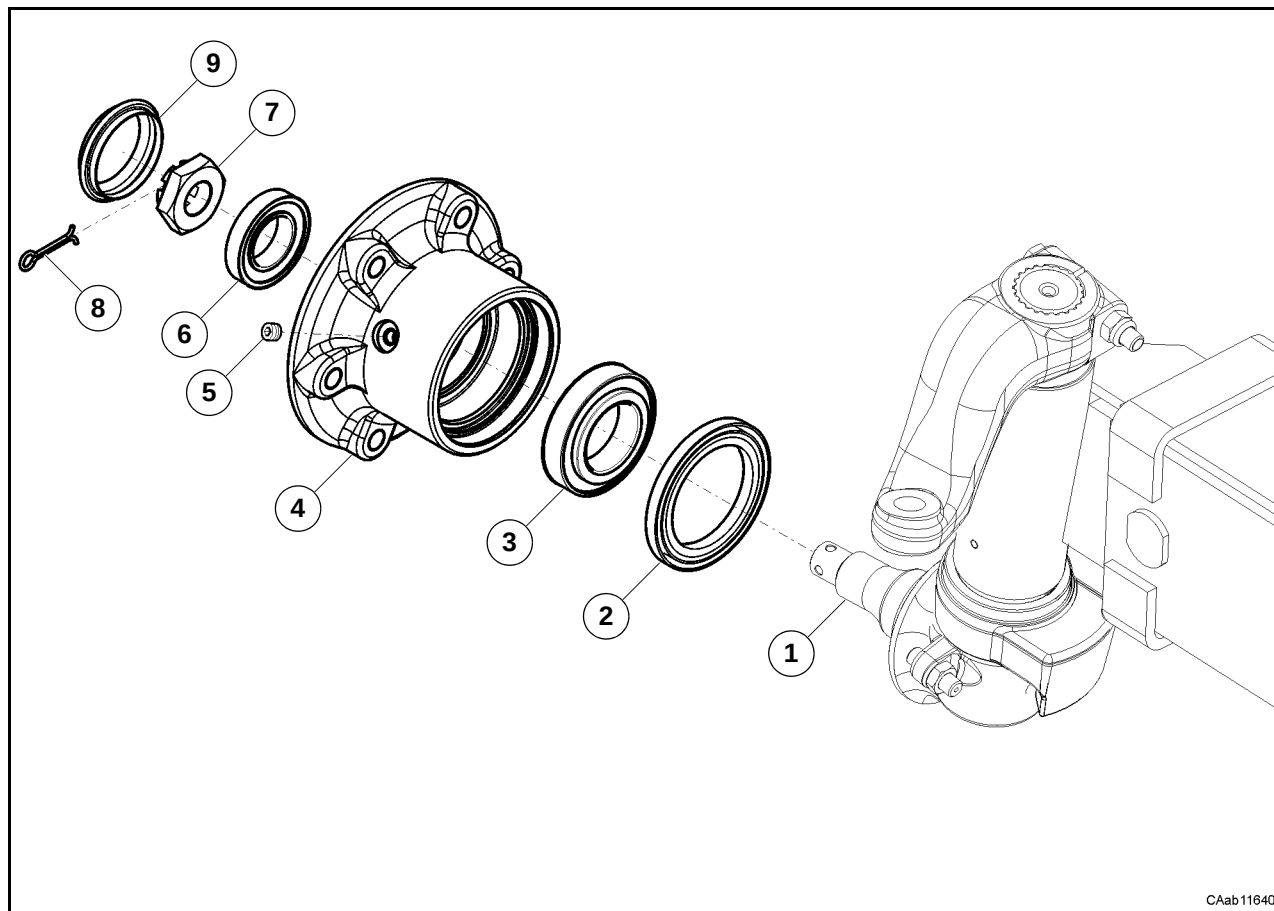
## Warning

**Screw in the lock nuts (9) of the tie rods (8) only when the toe-in adjustment has been carried out.**

[Refer to: D.5](#)

# Disassembly and Assembly Operations

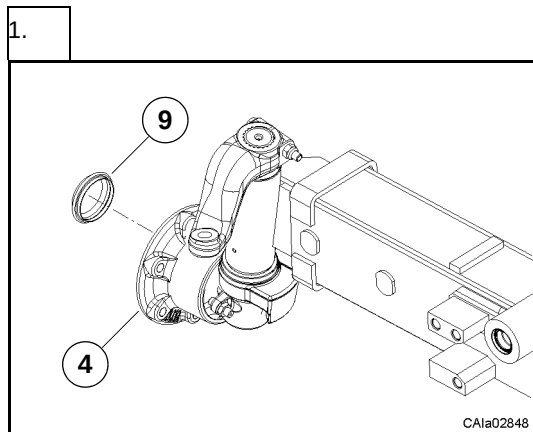
## WHEEL HUB GROUP



CAAb11640

### Disassembly

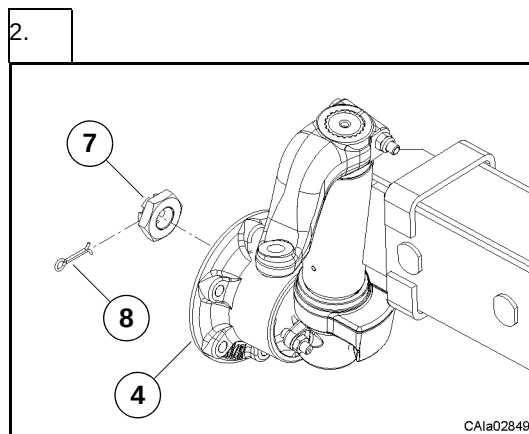
Refer to: D.1 before disassemble the wheel hub group.



CAIa02848

Using a chisel, remove the wheel hub cover (9).

**NOTE:** The cover has been glued on wheel hub with sealant.



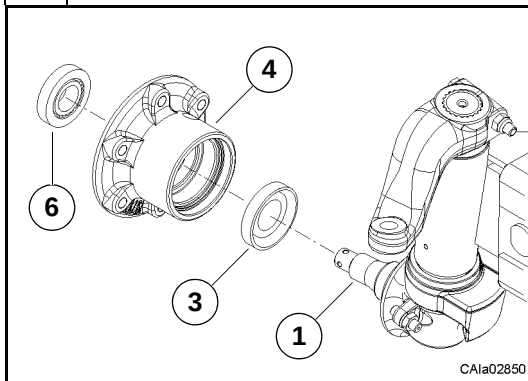
CAIa02849

Remove the safety split pin (8).

Unscrew and remove the nut (7).

# Disassembly and Assembly Operations

3.

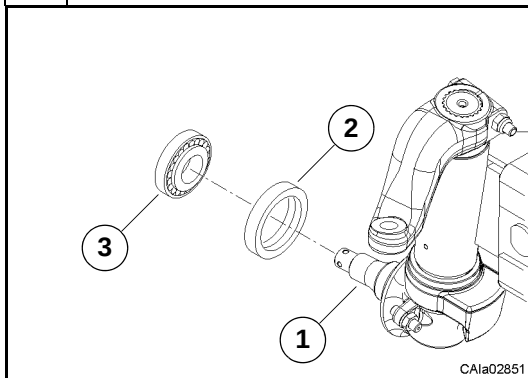


Remove the wheel hub (4) using a soft material hammer, if necessary.

**NOTE:** The bearing cone (6) is extracted together the wheel hub (4).

Remove the bearing cups (3) and (6) from both wheel hub sides with a hammer and a driver.

4.



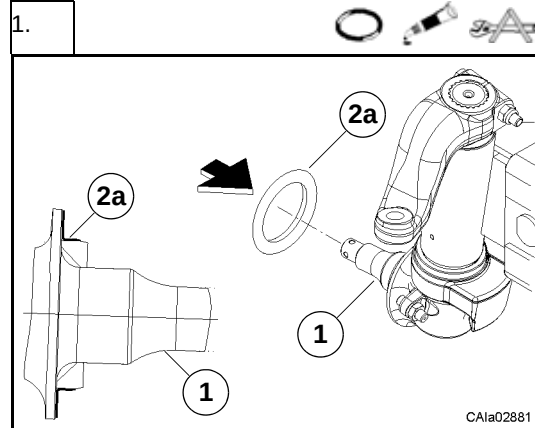
Remove the bearing cone (3) and seal ring (2) from the spindle (1) with a suitable extractor.

**NOTE:** Destructive operation for seal ring.

## Assembly

Refer to: D.3.2 before assemble the wheel hub group.

1.

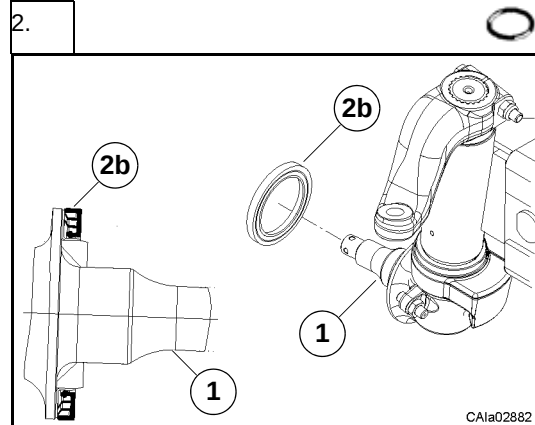


Apply indicated sealant on the contact surface of the new seal (2) inner ring (2a).

Refer to: C.7

Using the driver CA715673 and a hammer, fit on spindle (1) the seal (2) inner ring (2a).

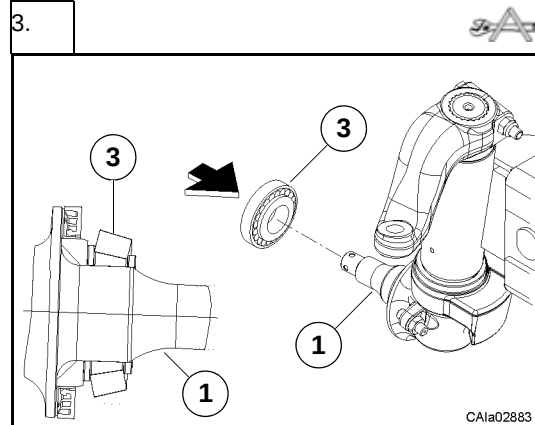
2.



Assemble the seal (2) outer ring (2b).

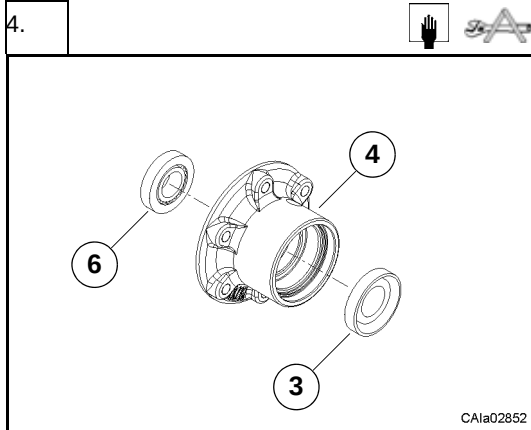
**NOTE:** Respect the shown orientation

3.



Using the driver CA715671 and a hammer, assemble the bearing cone (3) to the spindle (1).

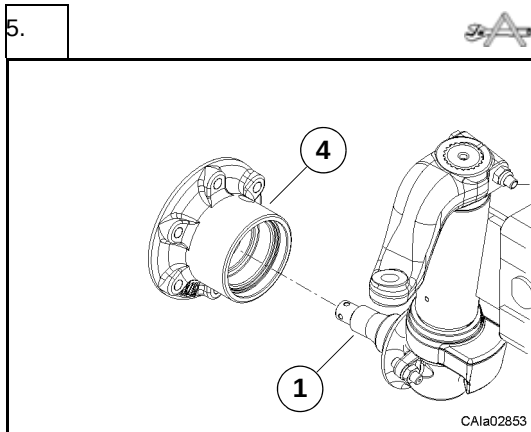
# Disassembly and Assembly Operations



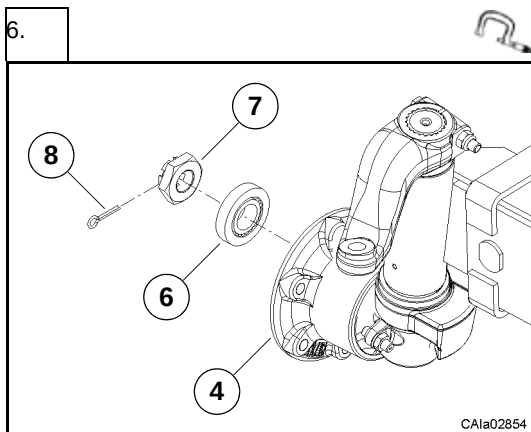
Carefully clean the seats of the bearings and of the seal ring.

Using the special tool CA715672 and a hammer, fit the bearing cup (3) in its seat on the wheel hub (4).

Using the special tool CA715669 and a hammer, fit the bearing cup (6) in its seat on the wheel hub (4).



Assemble the wheel hub (4) to the spindle (1).



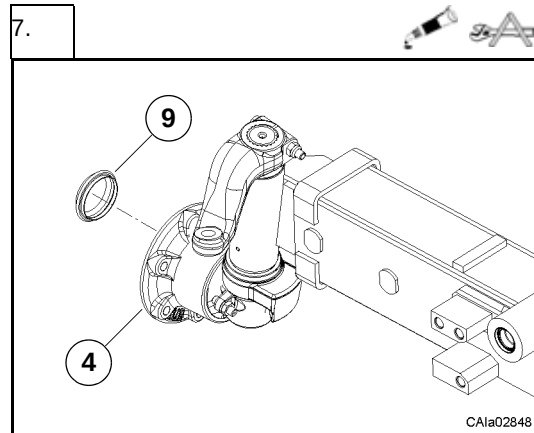
Assemble the bearing cone (6) to the wheel hub (4).

Screw and tighten the nut (7) to the prescribed torque (see C.8).

Screw the nut (7) further to align the notch with the hole in the wheel axis for the insertion of the safety split pin (8).

Insert the safety split pin (8) in the hole.

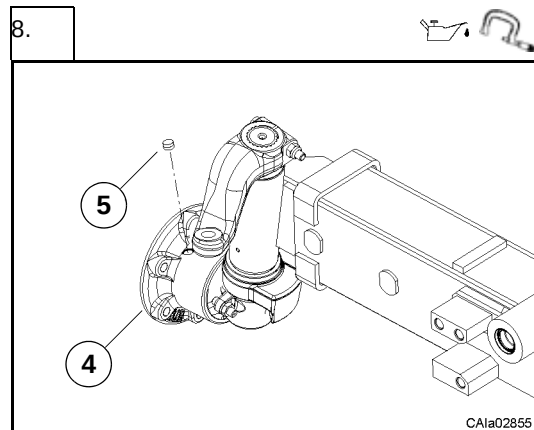
Twist the ends of the safety split pin (8) to lock it.



Apply indicated sealant on the contact surfaces of the wheel hub cover (9) and wheel hub (4).

[Refer to: C.7](#)

Using the special tool CA119183 and a hammer, assemble the cover (9) to the wheel hub (4).



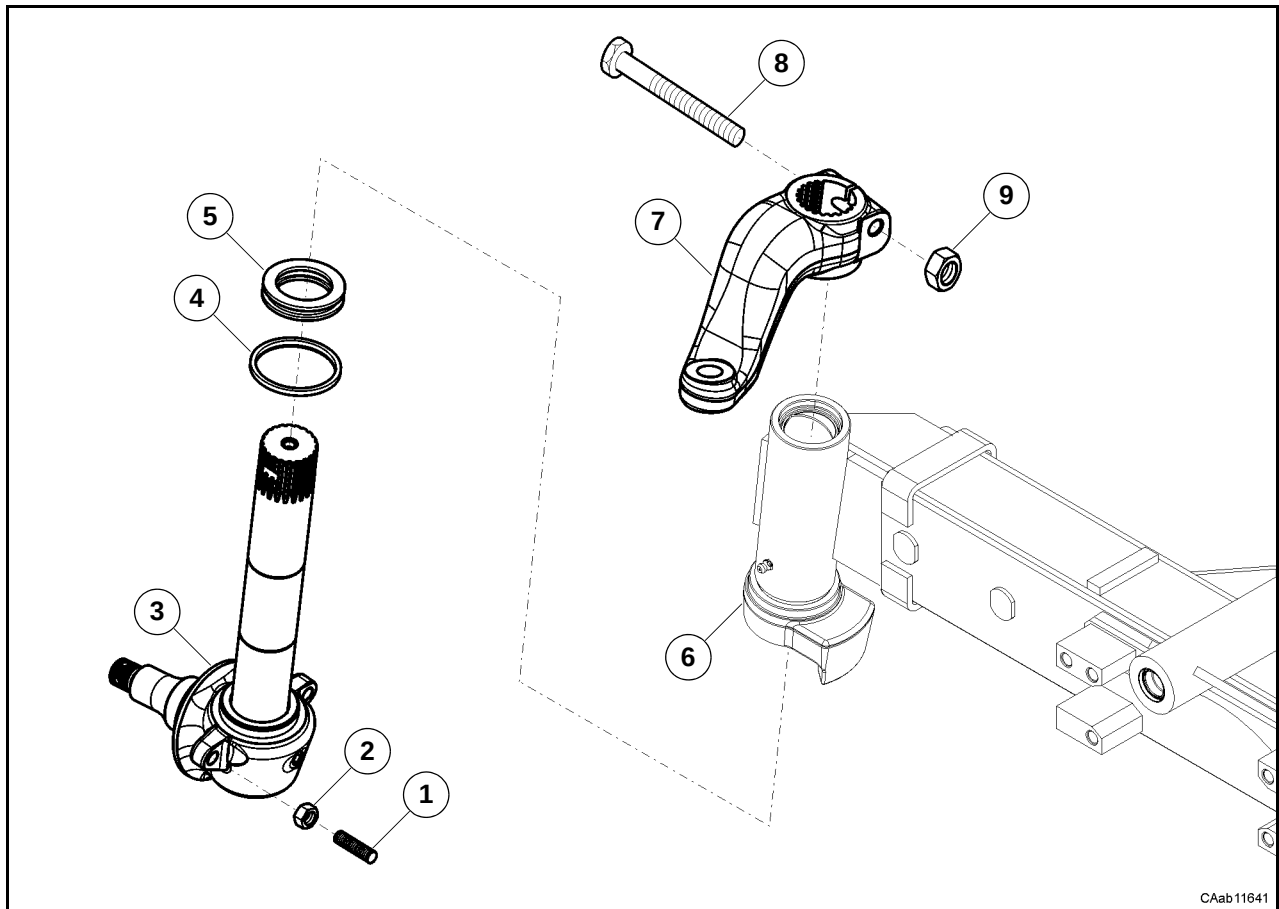
Inject grease in the greasing hole on the wheel hub (4) until the excess quantity starts coming out.

[Refer to: C.5 and C.6](#)

Screw the plug (5) to the prescribed torque (see C.8).

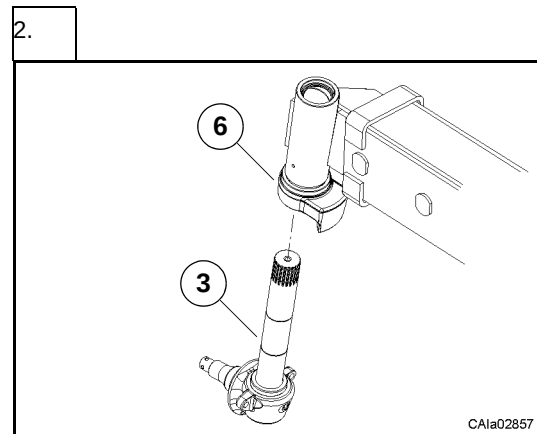
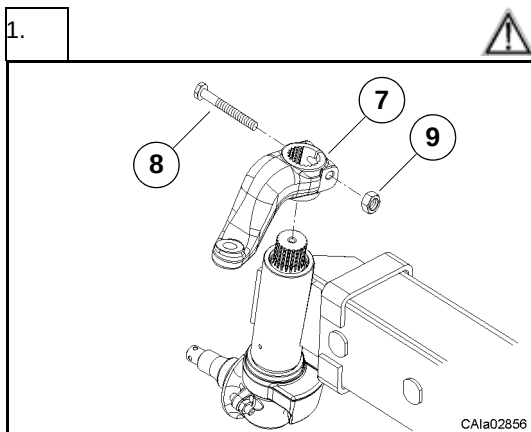
# Disassembly and Assembly Operations

## WHEEL HUB SUPPORT GROUP



### Disassembly

Refer to: previous sections before disassemble the wheel hub support group.



Remove the spindle (3) from the axle beam (6).



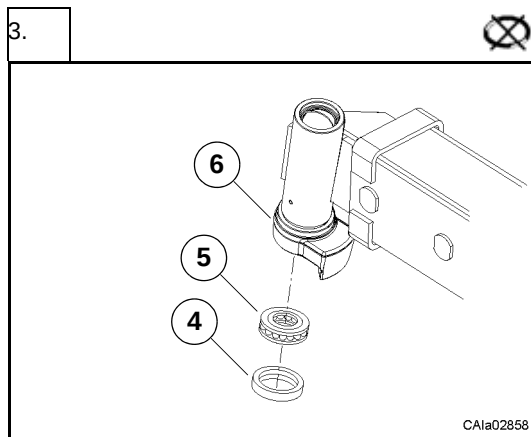
### Warning

**Support the axle beam with a suitable hoisting system.**

Remove the bolt (8) and the nut (9).

Remove the steering arm (7).

# Disassembly and Assembly Operations



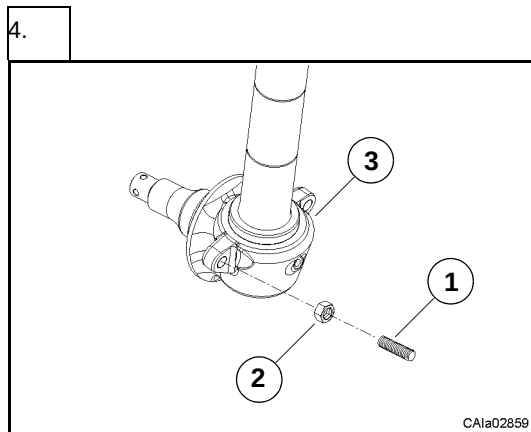
Remove the seal ring (4) from the axle beam (6).

**NOTE:** Destructive operation for the seal ring.

Extract the bearing (5) from the axle beam (6).

## Assembly

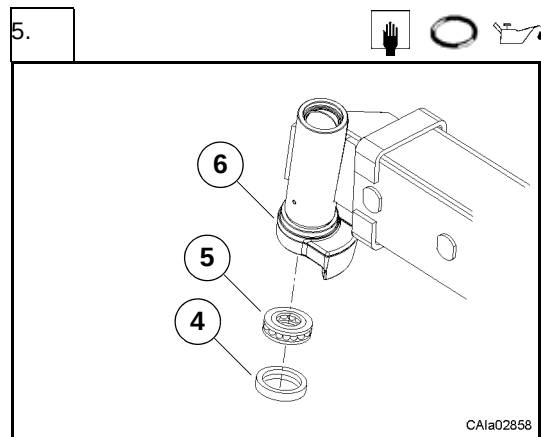
Refer to: D.4.2 before assemble the wheel hub support group.



If it has been previously removed, reassemble the steering stop composed by the grub screw (1) and nut (2).

**NOTE:** Do not tighten the nut (2) until the steering angle adjustment has been done.

Refer to: D.5.

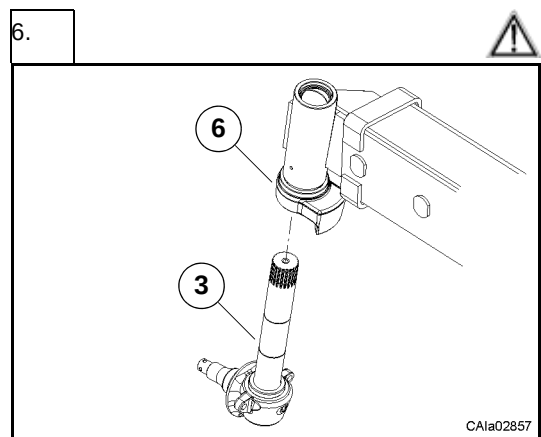


Carefully clean the seats of the bearing and of the seal ring.

Insert the bearing (5) into the axle beam (6).

Assemble a new seal ring (4) from the axle beam (6) with the special tool CA715674 and a hammer.

Lubricate the seal ring (4).

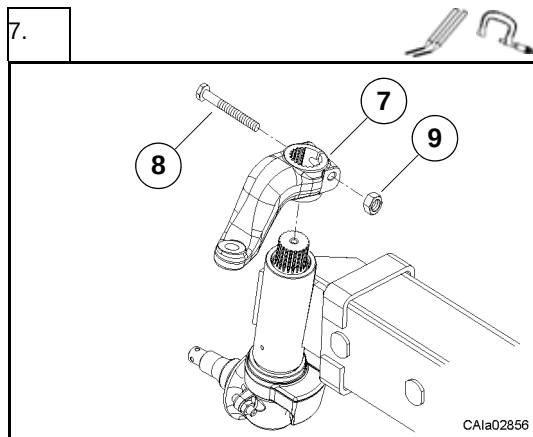


## Warning

**Support the axle beam with a suitable hoisting system.**

Assemble the wheel hub support (3) to the axle beam (6).

# Disassembly and Assembly Operations



Insert the steering arm (7) on the splined end.

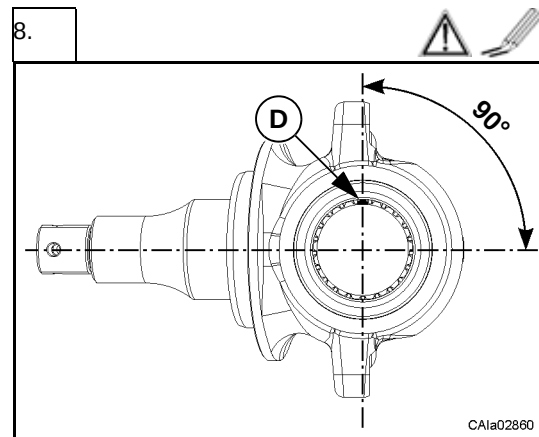
**NOTE:** Align the notch on the steering arm with the reference mark on the wheel hub support shaft (tooth D).

[Refer to: next figure](#)

Assemble the bolt (8) and the nut (9).

Tighten the nut to the prescribed torque

[Refer to: C.8](#)



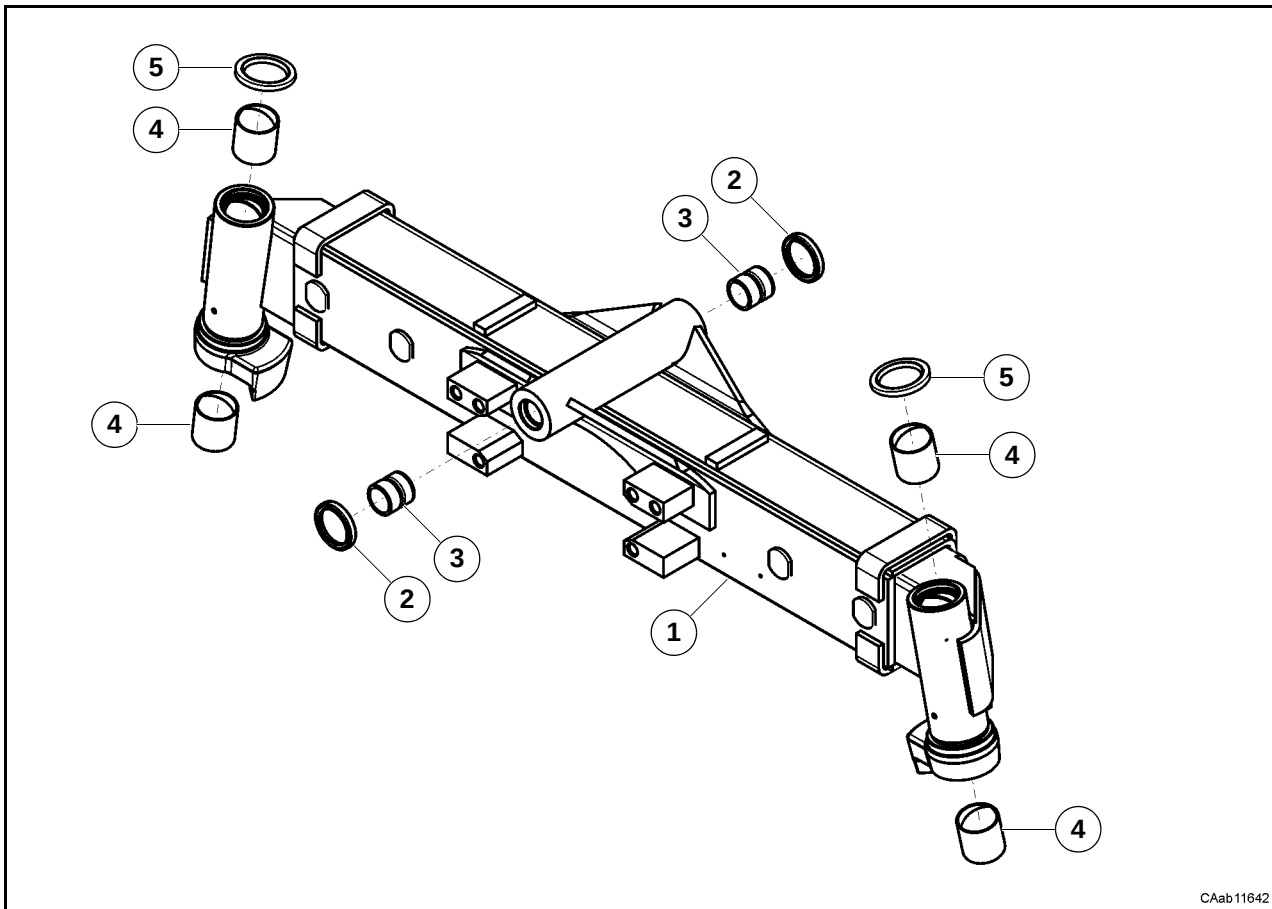
## Warning

**The notch on the steering arm must be aligned with the reference mark on the wheel hub support shaft (tooth D).**



# Disassembly and Assembly Operations

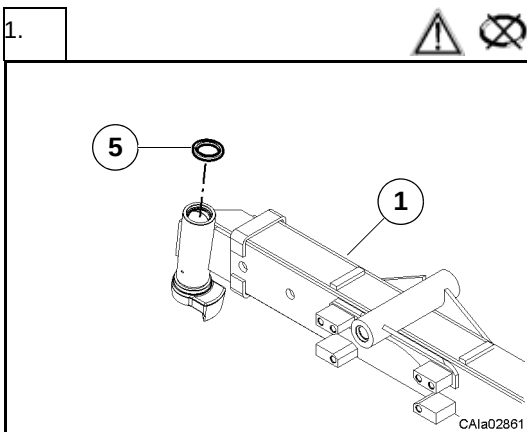
## AXLE BEAM GROUP



CAab11642

### Disassembly

Refer to: previous sections before disassemble the axle beam group.

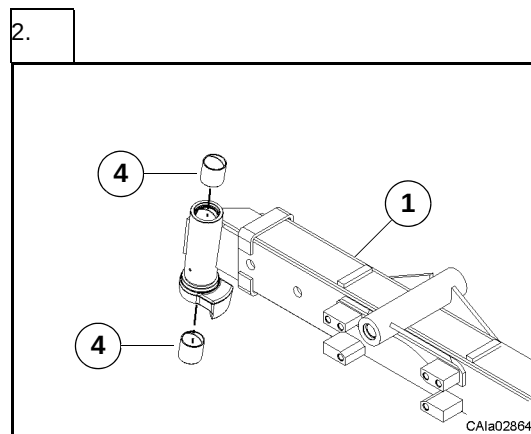


### Warning

**Support the axle beam with a suitable hoisting system.**

Remove the seal ring (5) from the axle beam (1).

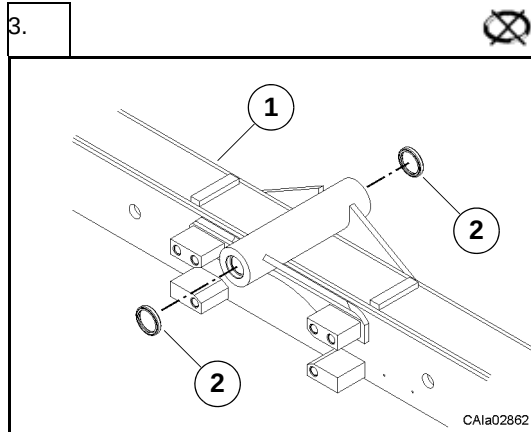
**NOTE:** Destructive operation for the seal ring.



Remove the bushes (4) from the axle beam (1) only if the wear condition make it necessary.

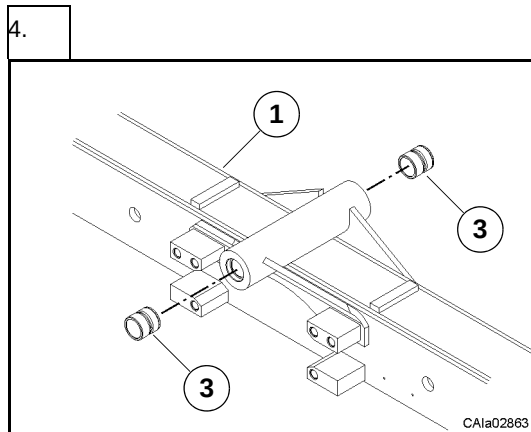
**NOTE:** Destructive operation for the bushes.

# Disassembly and Assembly Operations



Remove the seal rings (2) from the axle beam (1).

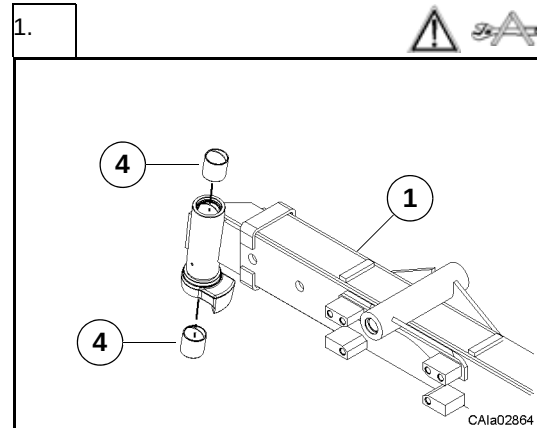
**NOTE:** Destructive operation for the seal rings.



Remove the bushes (3) from the axle beam (1) only if the wear condition make it necessary.

**NOTE:** Destructive operation for the bushes.

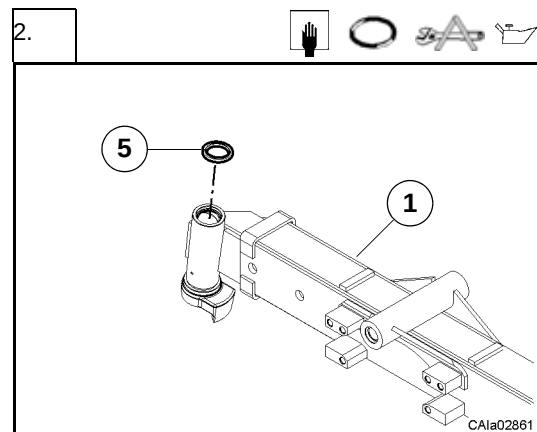
## Assembly



## Warning

**Support the axle beam with a suitable hoisting system.**

Assemble the bushes (4) to the axle beam (1) with the special tool CA715667 and a hammer.

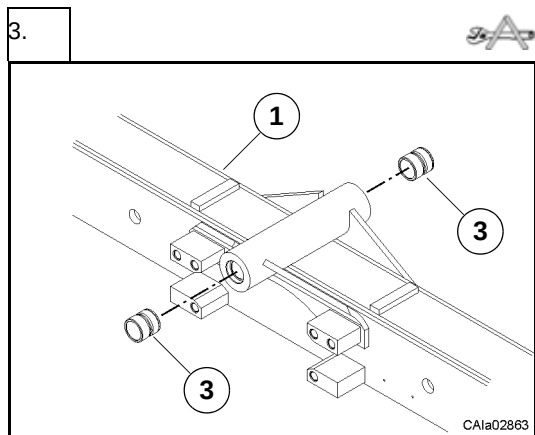


Carefully clean the seat of the seal ring.

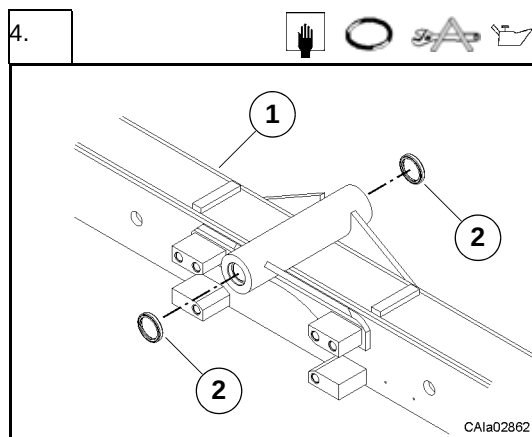
Assemble the seal ring (5) to the axle beam (1) with the special tool CA715668 and a hammer.

Lubricate the seal ring (5).

## Disassembly and Assembly Operations



Assemble the bushes (3) to the axle beam (1) with the special tool CA715665 and a hammer.



Carefully clean the seat of the seal ring.

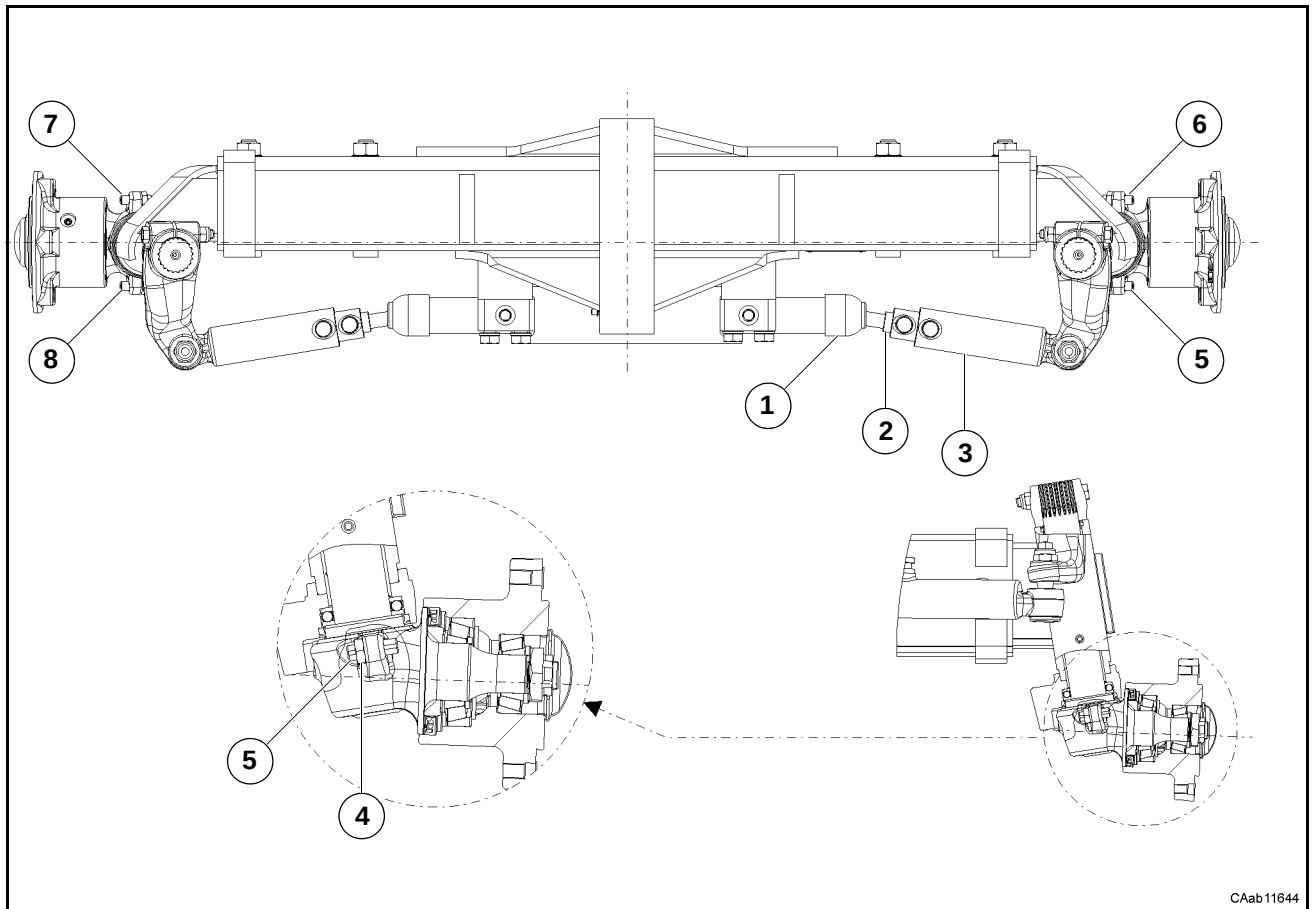
Assemble the seal rings (2) to the axle beam (1) with the special tool CA716106 and a hammer.

Lubricate the seal rings (2).

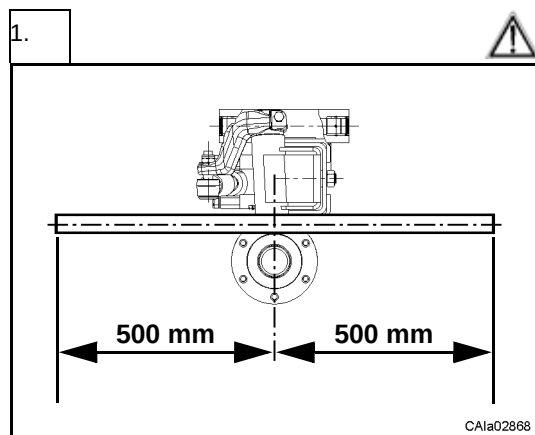
[Refer to: C.6](#)

# Disassembly and Assembly Operations

## TOE-IN/STEERING ANGLE



### Toe-in adjustment



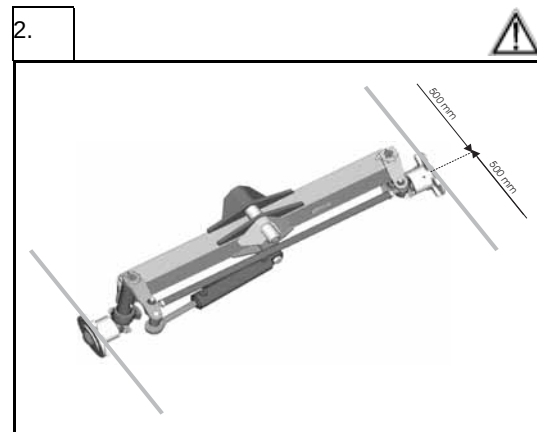
Put two equal one-meter-long linear bars on the wheel hubs and lock them with a clamp.



### Warning

The two bars must be fixed on their middle so that they are perpendicular to the wheel hub support axis.

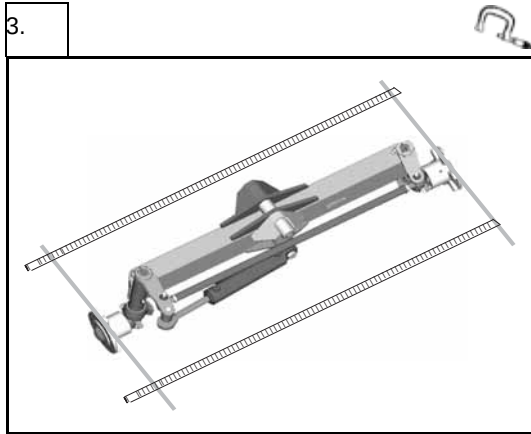
[Refer to: next point](#)



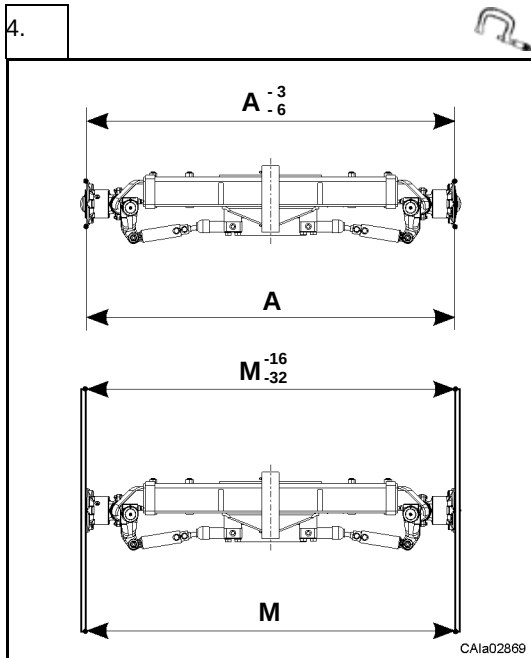
### Warning

The two bars must be fixed perpendicular to the wheel hub support axis and parallel to each other; align the two bars.

# Disassembly and Assembly Operations



Measure the distance in mm M between the bars ends with a tapeline.

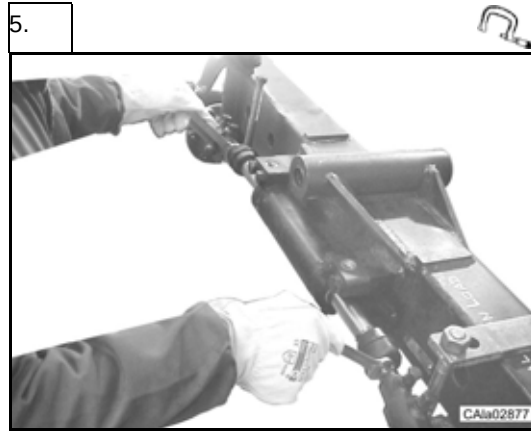


Check that the difference of the measurements between the wheel hubs diameters ends is within the requested tolerance range.

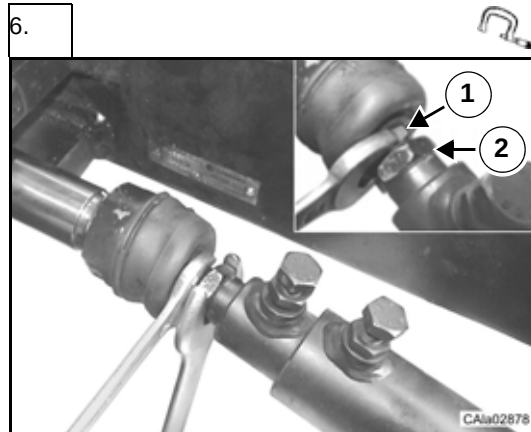
Refer to: "Toe-in" in sec.C.4.

The nominal toe-in value A is referred to the external diameter of the wheel hubs flange, therefore the measured value M at the bars ends must be related to the ratio between length of the bar and flange diameter

$$\text{nominal toe-in (C.4)} = A \begin{smallmatrix} -3 \\ -6 \end{smallmatrix} \longrightarrow \text{measured toe-in} = M \begin{smallmatrix} -16 \\ -32 \end{smallmatrix}$$



If toe-in is incorrect, operate with two wrenches on the guide rods (3) screwing in and out the two joint tie rods (1) equally till the toe-in is within the requested tolerance.

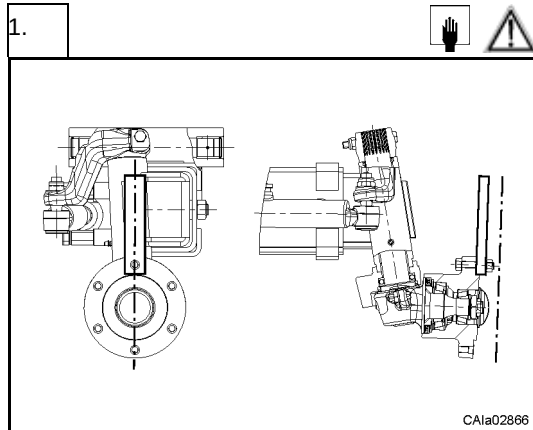


After adjusting, screw in the lock nuts (2) of the guide rods (3) to the requested tightening torque.

Refer to: C.8

# Disassembly and Assembly Operations

## Steering angle adjustment



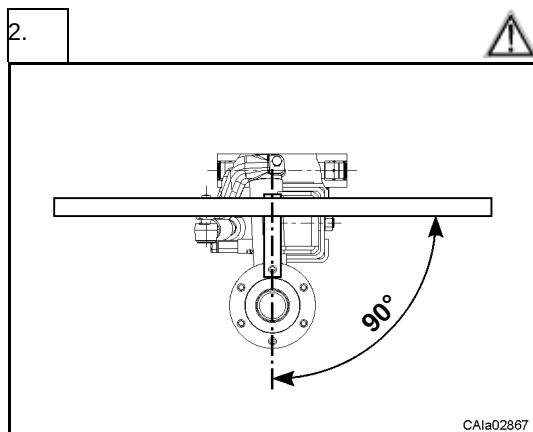
Carefully clean the surface of the wheel hub flange.

Put the CA715473 bar on the wheel hub and assemble it with bolt and nut to the wheel hub flange, as shown in figure.



### Warning

The bar must be parallel to the wheel hub surface and on the same axis.

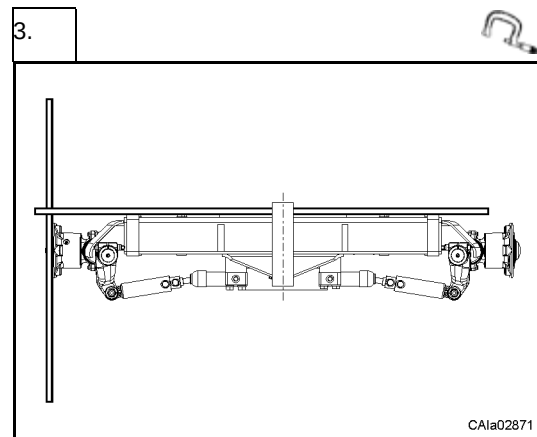


Put a one-meter-long linear bar on the CA715473 bar and lock it with a clamp.

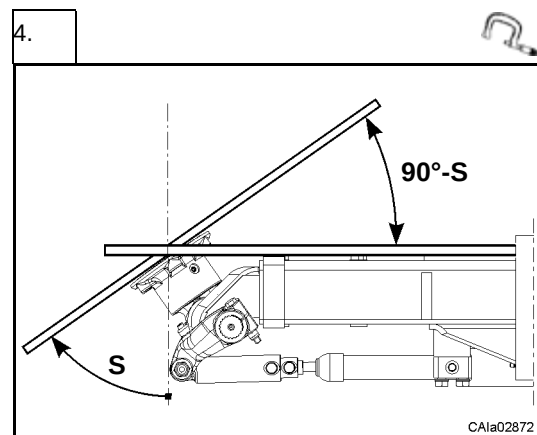


### Warning

The linear bar must be perpendicular to the CA715473 bar.

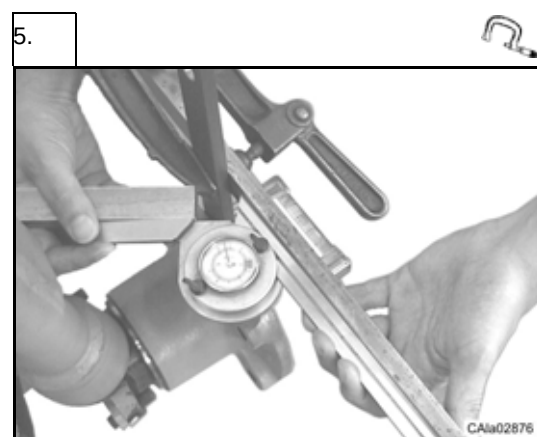


Use as reference a linear long bar perfectly leaned over the machined part of the central body.



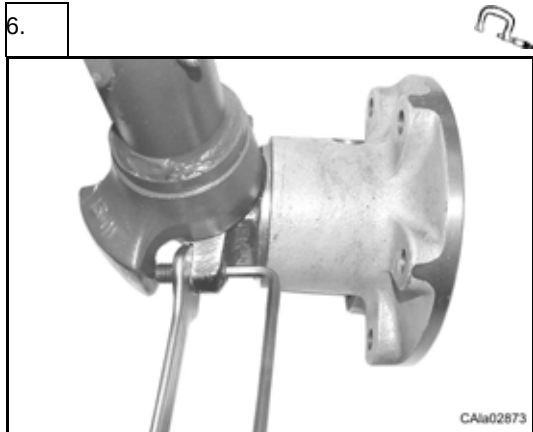
Steer until the end of the stroke has been reached (at the maximum steering) so that the two bars form an acute angle.

Adjust a protractor to the angle  $90^\circ - S$  where  $S$  is the requested angle (see C.4) and position it on the long bar.



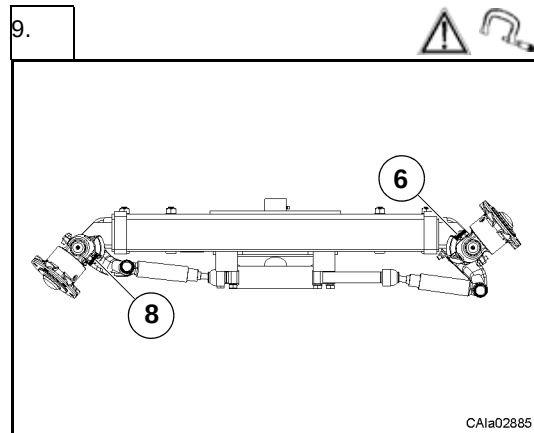
Move the wheel hub till it forms the angle fixed by the protractor, then screw in or out the grub screws (5) and (7) so as they touch the steering stop pads on the axle beam.

# Disassembly and Assembly Operations



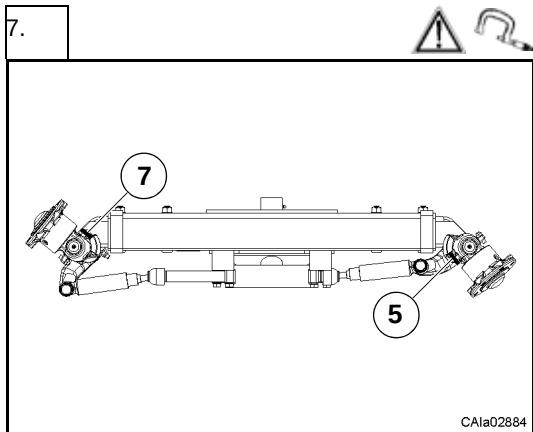
After the mechanical steering stops have been adjusted, locking them tightening the nuts (4) to the requested torque

Refer to: C.8



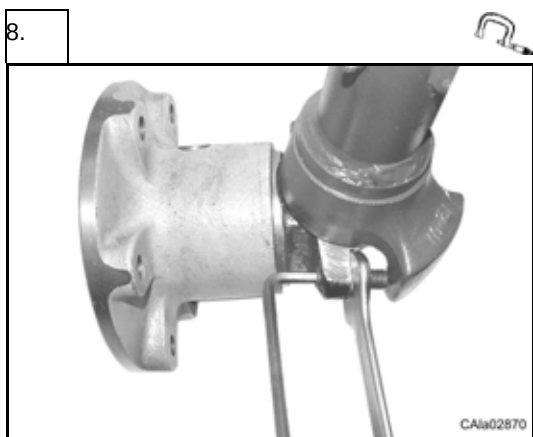
## Warning

Check the position of the stops (6) and (8) on the opposite side, both grub screws must touch the steering stop pads at the same time.



## Warning

Check the position of the stops (5) and (7) on the opposite side, both grub screws must touch the steering stop pads at the same time.



Steer on the other side and repeat the operations described at [4]÷[6] steps.



# Troubleshooting

---

## Troubleshooting

### Section 5A

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| AXLE PROBLEM AND DIAGNOSIS ..... | 39 |

# Troubleshooting

---

| PROBLEMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | POSSIBLE CAUSE |   |   |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---|---|---|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1              | 2 | 3 | 4 |
| Wheel vibration; front tyre resistance; halfshaft breakage.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1              |   |   | 1 |
| Steering is difficult; vehicle goes straight while its turning.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1              |   |   | 1 |
| Uneven wear of tyre.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1              | 1 |   | 1 |
| Friction noise.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                |   | 1 | 1 |
| Vibration during forward drive, intermittent noise.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                |   | 1 | 1 |
| <ol style="list-style-type: none"> <li>Overloading / incorrect weight distribution<br/>Remove excessive weight and redistribute load, following instructions related to the vehicle.</li> <li>Incorrect wheel adjustment<br/>Verify group integrity and wheel side bearings.<br/>Adjusting according.</li> <li>Spoiled or worn out axle parts<br/>Check the condition of ring gear, pinion gear, bearings etc. Replace when ever necessary.</li> <li>Incorrect use of the product<br/>See the vehicle producer's instructions once again.</li> </ol> |                |   |   |   |

# Troubleshooting

---

## TROUBLESHOOTING

This chapter is a descriptive and explanatory guide to common axle problems. This guide suggests the correct repair procedures to be followed.

| Problem                     | Cause                                                                 | Action                 |
|-----------------------------|-----------------------------------------------------------------------|------------------------|
| Axle beam body bent         | 1. Vehicle over loaded<br>2. Vehicle's accident<br>3. Load bump       | Replace axle beam body |
| Worn out or pitted bearings | 1. Insufficient lubrication<br>2. Excessive use<br>3. Normal wear out | Replace bearings.      |

## AXLE PROBLEM AND DIAGNOSIS

| Problem        | Cause                | Action     |
|----------------|----------------------|------------|
| Constant noise | 1. Worn out bearings | 1. Replace |

# Troubleshooting

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## Special Tools

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### Special Tools

#### Section 5A

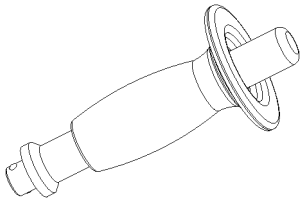
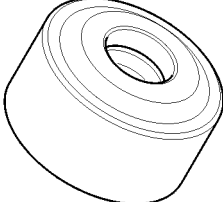
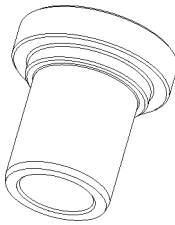
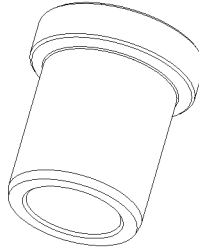
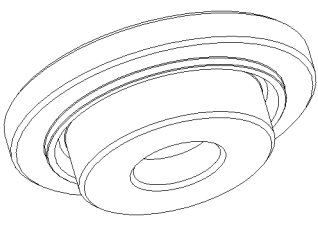
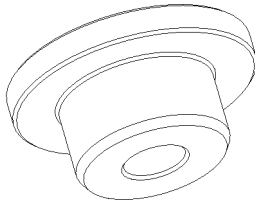
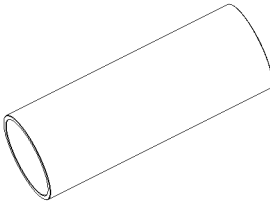
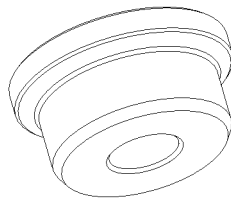
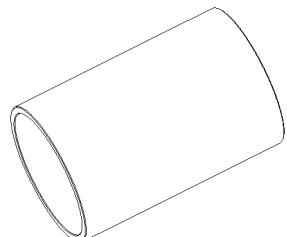
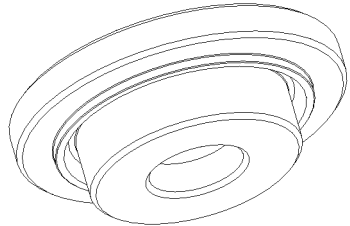
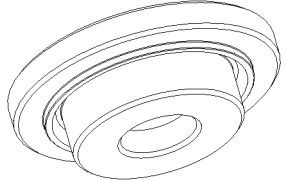
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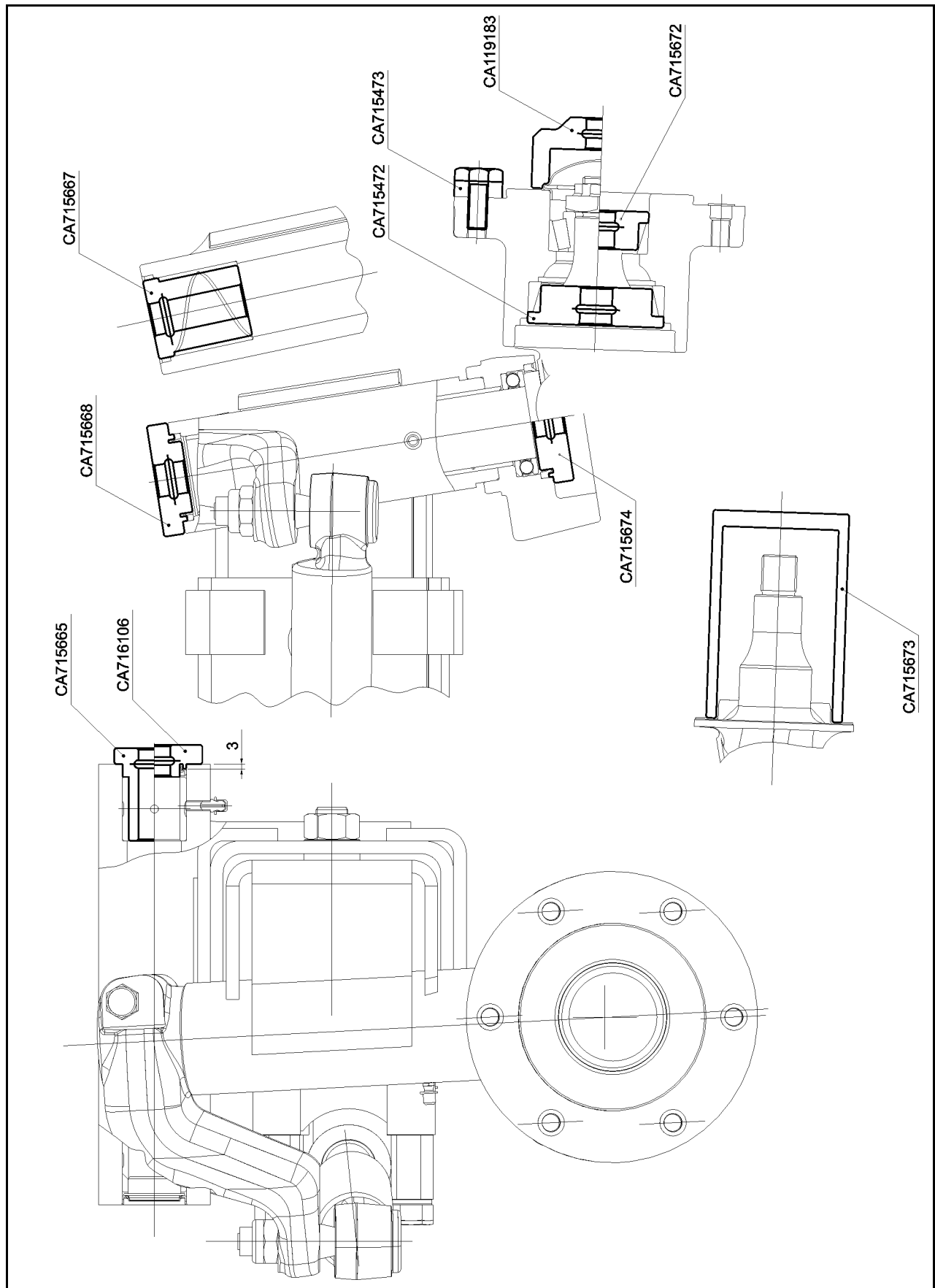
# Special Tools

## SPECIAL TOOLS

The special drifts/pads used to assemble the seals, bearings and bushes should always be used with the interchangeable handle CA119033; its use is recommended together with a suitable safety handle in order to protect the hands.

|                                                                                     |          |                                                                                     |          |                                                                                       |          |
|-------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------|----------|
| <b>CA119033</b>                                                                     | Handle   | <b>CA119183</b>                                                                     | Driver   | <b>CA715473</b>                                                                       | Bar      |
|    | CA119033 |    | CA119183 |    | CA715473 |
| <b>CA715665</b>                                                                     | Driver   | <b>CA715667</b>                                                                     | Driver   | <b>CA715668</b>                                                                       | Driver   |
|   | CA715665 |   | CA715667 |   | CA715668 |
| <b>CA715669</b>                                                                     | Driver   | <b>CA715671</b>                                                                     | Driver   | <b>CA715672</b>                                                                       | Driver   |
|  | CA715669 |  | CA715671 |  | CA715672 |
| <b>CA715673</b>                                                                     | Driver   | <b>CA715674</b>                                                                     | Driver   | <b>CA716106</b>                                                                       | Driver   |
|  | CA715673 |  | CA715674 |  | CA716106 |

## Special Tools





## Special Tools

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# Service Operations Time

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## Service Operations Time

### Section 5A

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# Service Operations Time

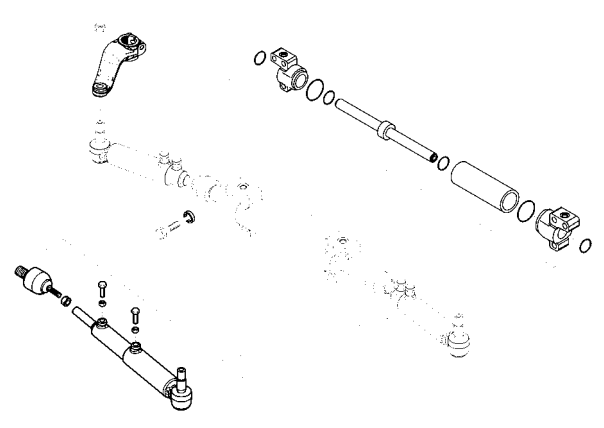
## SERVICE OPERATIONS TIME SCHEDULE

The times indicated are referred to medium values times of operations made by trained personnel in laboratory provided with all necessary tools for the good execution of the requested operations.

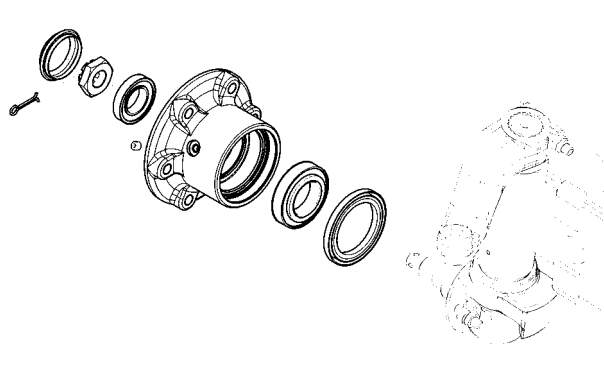
Reparation and/or substitution times are indicated in minutes.

This time schedule presumes that the axle has already been removed from the vehicle. To know the removal time of the axle from the vehicle refer to manual provided from vehicle manufacturer.

### Steering Cylinder Group

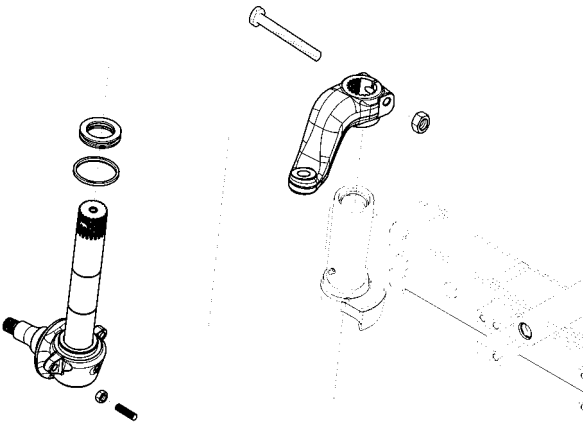
|  | Cod. | Operation                                 | Min. |
|-----------------------------------------------------------------------------------|------|-------------------------------------------|------|
|                                                                                   |      | Steering rod replacement (x 1)            | 35   |
|                                                                                   |      | Steering rod ball joint replacement (x 1) | 35   |
|                                                                                   |      | Steering rod tie rod replacement (x 1)    | 35   |
|                                                                                   |      | Steering cylinder replacement             | 75   |
|                                                                                   |      | Steering cylinder overhauling             | 90   |
|                                                                                   |      | Toe-in adjustment                         | 15   |

### Wheel Hub Group

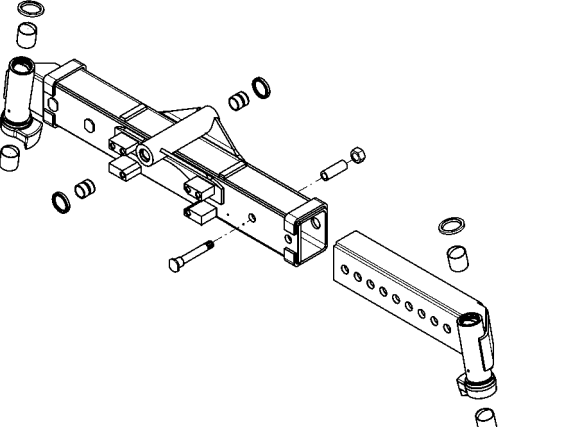
|  | Cod. | Operation                               | Min. |
|-------------------------------------------------------------------------------------|------|-----------------------------------------|------|
|                                                                                     |      | Wheel hub bearings and seal replacement | 60   |
|                                                                                     |      | Wheel hub replacement                   | 60   |
|                                                                                     |      |                                         |      |
|                                                                                     |      |                                         |      |

## Service Operations Time

### Spindle Group

|  | Cod. | Operation                      | Min. |
|-----------------------------------------------------------------------------------|------|--------------------------------|------|
|                                                                                   |      | Spindle replacement (x 1)      | 90   |
|                                                                                   |      | Steering arm replacement (x 1) | 25   |
|                                                                                   |      | Bearing and seal replacement   | 20   |
|                                                                                   |      |                                |      |
|                                                                                   |      |                                |      |

### Axle Beam Group

|  | Cod. | Operation                                    | Min. |
|------------------------------------------------------------------------------------|------|----------------------------------------------|------|
|                                                                                    |      | Axle beam replacement                        | 90   |
|                                                                                    |      | Knee replacement (x 1)                       | 40   |
|                                                                                    |      | Spindle bushes and seal replace. (each side) | 35   |
|                                                                                    |      | Pivot bushes and seals replace. (both sides) | 40   |
|                                                                                    |      |                                              |      |

## Service Operations Time

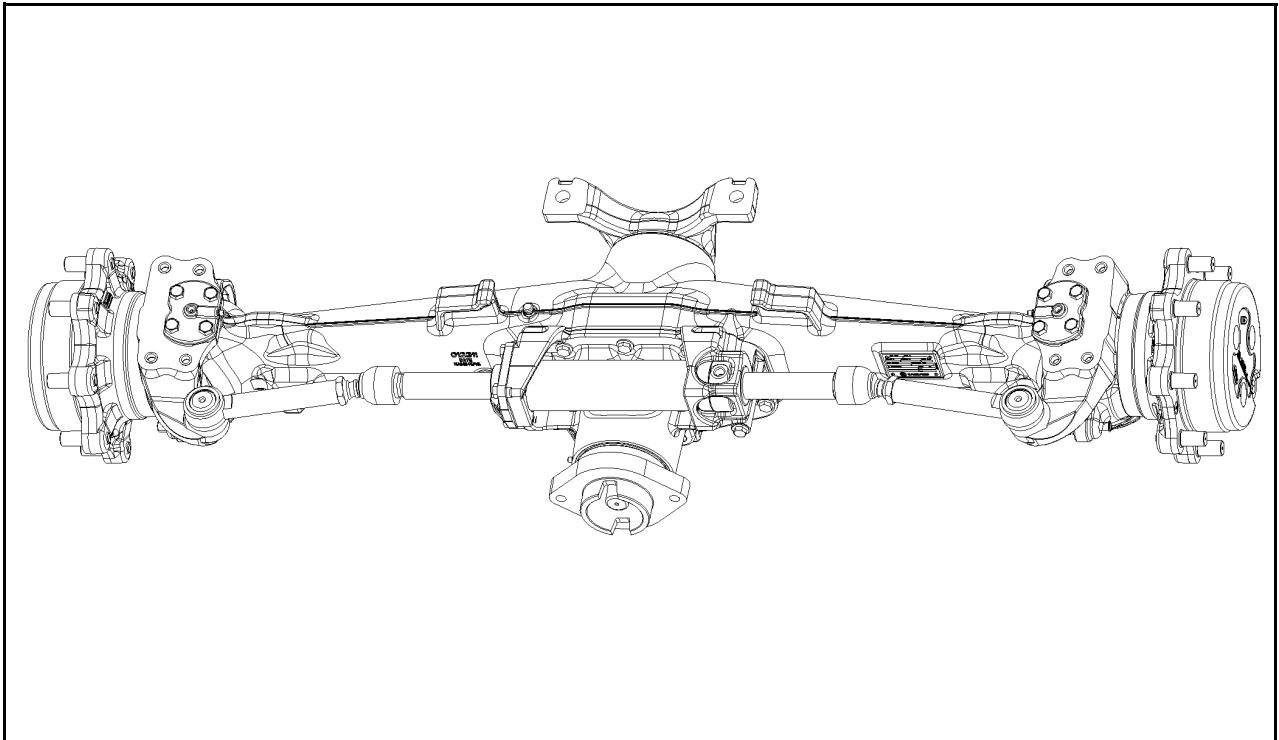
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## Front Axle

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### Front Axle Section 5B



## Front Axle

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## General Information

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### General Information

#### Section 5B

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# General Information

---

## MANUAL USE

End users

- Installer
- User
- Maintenance operator

### Maintenance

CONSULT THIS MANUAL THOROUGHLY, as proper functioning and good efficiency of mechanical organs depends mostly on constant and correct routine maintenance ensuring product integrity and expected life duration.

In case of any damages or anomalies, quick intervention of trained operators can avoid future impairment and lengthen the working life.

### Repair

The disassembly/assembly procedures have been outlined for a total product overhauling. They have also been described in sequence through photographs with relevant explanation for specific interventions, thus obtaining a complete and safe guide for each and every phase of an operation.

Operation description presumes that the axle has already been removed from the vehicle. To remove the axle from the vehicle refer to manual provided from vehicle manufacturer.

## INFORMATION PROPERTY

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Agco Limited  
Abbey Park  
Stoneleigh, Kenilworth, CV8 2TQ England  
Tel. +44 (0) 24 7669 4400  
[www.agcocorp.com](http://www.agcocorp.com)

## AGREEMENTS AND DEFINITIONS

### Agreements

Illustrations like pictures, drawings and components of this manual are NOT in scale, because of limited space and editing limits, therefore they are NOT reliable to obtain values about size or weight.

Illustrations are supposed to point out the correct methods to working on the machine and its components, therefore they could not display exactly the same elements.

### Definitions

Left side: it is the left side of the unit considering the vehicle running conditions.

Right side: it is the right side of the unit considering the vehicle running conditions.

### Typographic agreements

**NOTE:** The notes, pointed out externally to the text they refer, include important information.



### Warning

**Warning indications point out the procedures, whose partial or complete non-observance can damage the machine or the connected equipment.**



### Danger

**Danger indications point out the procedures, whose partial or complete non-observance can injure the operator.**

### Measurements

This manual indicates all measurements in International System (SI). Use the following conversion table to convert Imperial Measure.

## General Information

### Conversion table

| S.I.                        |                       | GB/USA SYSTEM |             |
|-----------------------------|-----------------------|---------------|-------------|
| 1                           | (mm)                  | 0.03937       | (in)        |
| 10                          | (mm)                  | 0.3937        | (in)        |
| 25.4                        | (mm)                  | 1             | (in)        |
| 6.4516                      | (cm <sup>2</sup> )    | 1             | (sq. in)    |
| 1                           | (m <sup>2</sup> )     | 1550          | (sq. in)    |
| 16.378                      | (cm <sup>2</sup> )    | 1             | (cu. in)    |
| 0.473                       | (dm <sup>2</sup> )    | 1             | (U.S. pint) |
| 1                           | (l)                   | 6102          | (cu. in)    |
| 1                           | (l)                   | 0.2642        | (U.S. gal)  |
| 1.772                       | (g)                   | 1             | (oz.)       |
| 0.4536                      | (kg)                  | 1             | (lb)        |
| 0.00070308                  | (kg/mm <sup>2</sup> ) | 1             | (lb/sq. in) |
| 1                           | (bar)                 | 14.51         | (psi)       |
| 1                           | (kg.m)                | 7.246         | (lb.ft)     |
| 1(daN)= 10 (N)= 1,02 (kg.f) |                       | 2.24          | (lb.f)      |

# General Information

---

## Symbology

| DESCRIPTION                                                      | SYMBOLS                                                                                                                                                                    |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| WARNING/DANGER                                                   |                                                                                         |
| REMOVE/INSTALL<br>seals-gaskets-filters                          |       |
| OIL FILLING OR OIL LEVEL/OIL DRAIN                               |       |
| LUBRICATION/GREASING                                             |                                                                                         |
| ADJUSTMENTS/MEASUREMENTS<br>tightening torques-preloads-backlash |                                                                                         |
| SPECIAL TOOLS                                                    |                                                                                       |
| SEALING/LOCKING FLUIDS<br>APPLICATION                            |                                                                                       |
| MARKING                                                          |                                                                                       |
| DISASSEMBLY/ASSEMBLY OF BULKY PARTS OR<br>SUBASSEMBLIES          |   |
| WARNING:<br>respect assembly orientation                         |                                                                                       |
| CLEANING CAREFULLY                                               |                                                                                       |
| APPLY PRESSURIZED FLUID                                          |                                                                                       |

# General Information

## GENERAL DESCRIPTION

The machine should be checked and/or repaired only by qualified technicians, acquainted with its peculiar features and well aware of all safety instructions.

Before performing any operation it is advisable to carry out unit cleaning accurately by removing oil/ grease encrustations and accumulation.

All disassembled mechanical parts must be cleaned accurately with suitable products to avoid possible damage. Parts should be replaced if damaged, worn out, cracked, seized, etc. as they could affect proper working.

Rotating parts (bearings, gears, shafts) and that of hardware/fasteners (O-Ring, oil seals) should be examined carefully, as they are subject to major stress, wearing and ageing.

We highly advise to replace tightening parts during every stripdown or repair.

In case of replacement of one part of the bevel gear set this operation requires the replacement of the other part too.

Use appropriate spare parts, nuts and bolts to avoid any other problems. Moreover, use metric tools for metric nuts and bolts and Imperial tools for the others.

Some operations are destructive for removed components.

Carefully reading and through understanding of these instructions will avoid damage to other components.

## RECOMMENDATIONS FOR REPAIR OPERATIONS

Before starting any disassembly and assembly operations, read carefully the following recommendations.

### Shafts seals

Respect the following recommendations during shaft seal assembly:

- Clean shaft very carefully and ensure that the part in contact with the shaft seal is not damaged, cut or out of roundness.
- Assemble the seals so that the lip is fitted towards the oil side.
- Lubricate seal lips (use oil) and fill 3/4 of seal cavity with grease.
- Use appropriate drivers. Do not use a hammer directly on the seals.
- Do not damage the seals while assembling the shaft.

### O-rings

Lubricate adequately before inserting them at the right place and avoid o-ring rolling while inserting the shaft.

### Adjusting shims

Use appropriate adjusting shims and measure each one separately.

Complete group measurement or stampings on the shims are not always reliable: check.

### Bearings

Its advisable to heat up bearings to 80°C - 90°C before assembling them onto their respective shafts or to cool them (dry ice) before inserting them into corresponding bore.

Always use suitable extractors to remove the bearings. Before reassembling the bearings, clean, check and lubricate them.

### Split pins

Before assembling elastic pins, make sure that the notch is oriented towards the stressing force.

Spiral elastic pins do not need orientation.

### Sealing

Use sealing as advised by specifications. Ensure that parts to be sealed are clean, dry and completely grease free.

### Oil drain

Before disassembly, oil should be drained out.



## Warning

**Disposal of used oil must be done according to laws.**

# General Information

---

## Cleaning

Wash all moving parts (gears, bearings, etc.) accurately with diesel fuel or kerosene.

Avoid gasoline and watery alkaline solutions. Do not wash with steam or hot water, as it will be very difficult to eliminate surface humidity.

Dry all parts with a rag or air jet to avoid scratching from abrasive residues.

All surfaces should be covered with lubricant so as to protect it from future oxidation.

## Checks

Examine accurately all bearings, external rings which may be still stuck in their position and pivot pins on which rolls rotate. Replace those which are worn out or damaged.

Gears should not be spoiled and teething should not be excessively worn out. Teeth smoothing should not be deteriorated.

Check all grooves: assure that they are not worn out or damaged.

Replace spoiled parts with original spare parts.

Replace seals on rotating shafts, before reassembly.

## Ends of flanges and tools

Be careful when hammering tool or flange ends, in order to avoid jeopardizing functionality and integrity of either the tools or the components on which you are operating.

## Lubricant use

In order to lubricate the Massey Ferguson axles correctly and to reach the exact operation temperature, it is important to use the recommended lubricants, keeping their level constant as indicated in this manual.

# General Specifications

---

## General Specifications

### Section 5B

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# General Specifications

## INTENDED USE

This axle has been designed and manufactured to be mounted on agricultural machines to transmit the power from the engine to the wheels and to allow:

- increasing of tractive force of the vehicle
- adjusting of inner wheels' speed with outer wheels' speed during steering of the vehicle.

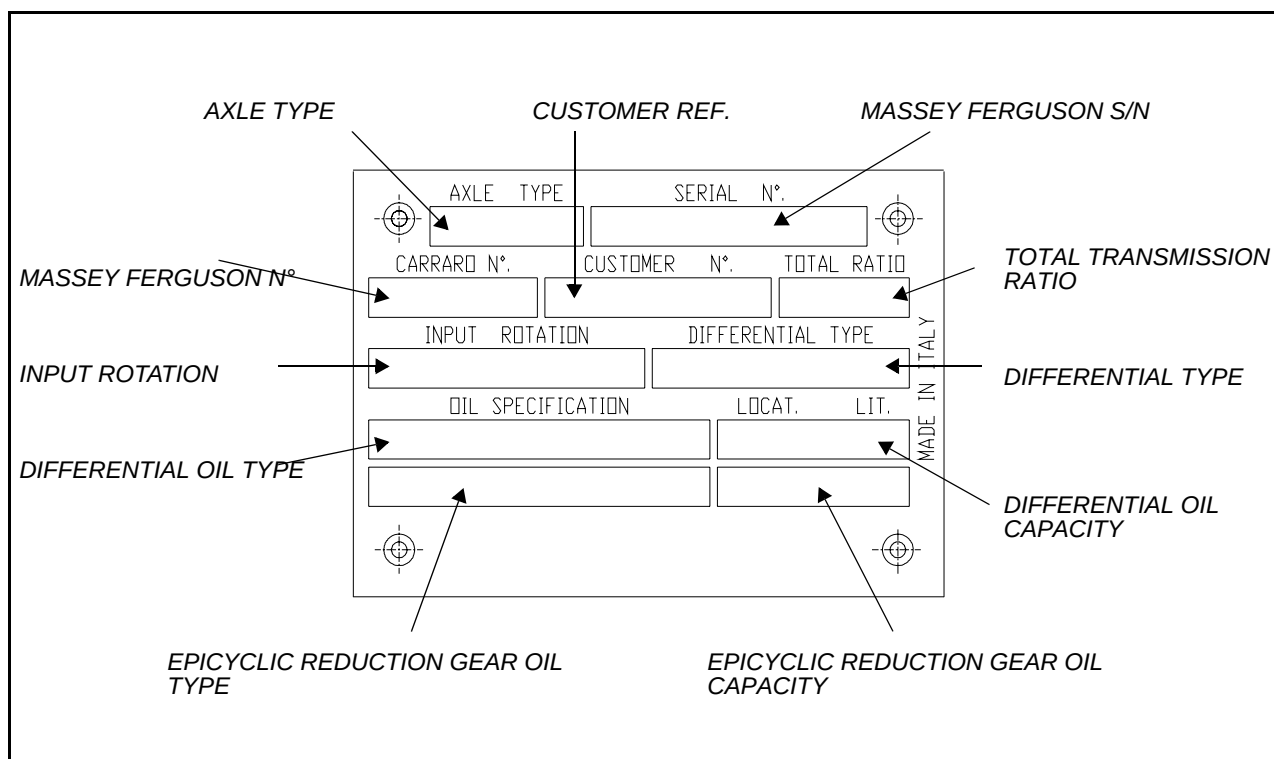
Never mount this axle on machines different from the ones for which it has been designed and manufactured.

If the axle is used for any other purpose than the one foreseen, Massey Ferguson Limited declines any responsibility regarding damages or accidents caused by it. All consequences will be at the expense of the client.

However, when used as foreseen, operational formalities as well as regular maintenance repair specifications given by Massey Ferguson Limited are to be observed strictly.

## PRODUCT IDENTIFICATION

Axle serial plate

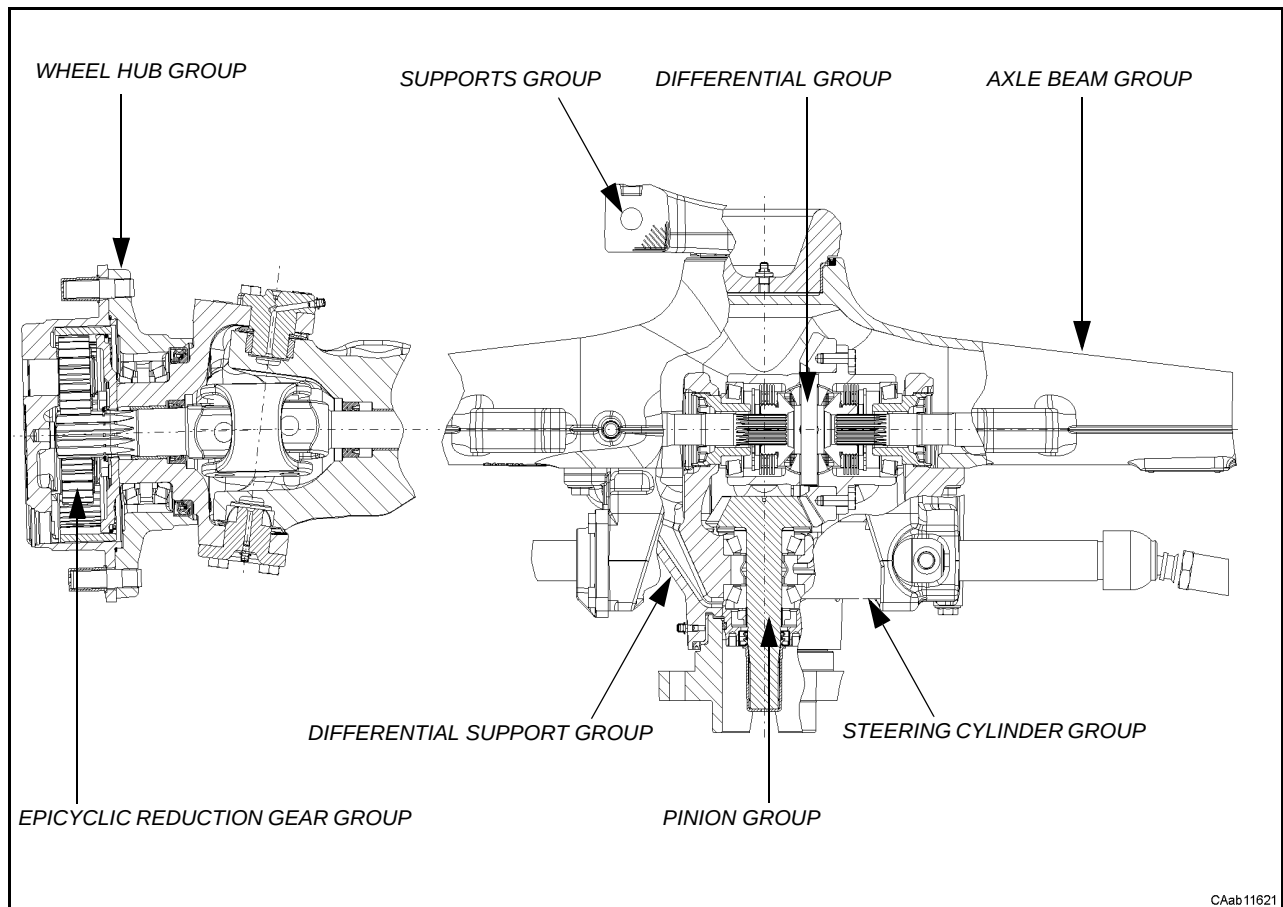


# General Specifications

## GENERAL DESCRIPTION

The axle described in this manual consists mainly of following groups:

- WHEEL HUB: wheel support parts containing the epicyclic reduction gears
- EPICYCLIC REDUCTION GEAR: planetary carrier with reduction/transmission parts
- AXLE BEAM: load-bearing shell structure of the axle
- SUPPORTS: axle's trunnion parts to secure the vehicle
- STEERING CYLINDER: steering cylinder parts with adjusting system components
- DIFFERENTIAL SUPPORT: differential housing with ring bevel gear adjusting system
- DIFFERENTIAL: differential parts with ring bevel gear
- PINION: pinion with adjusting and support parts



# General Specifications

## TECHNICAL FEATURES

|                   |              |
|-------------------|--------------|
| MACHINE           | Front axle   |
| CODE              | CA642064     |
| MODEL             | 20.16        |
| DIFFERENTIAL TYPE | Limited slip |

| DESCRIPTION                    | VALUES                                                                             |
|--------------------------------|------------------------------------------------------------------------------------|
| Dry weight                     | 250 Kg                                                                             |
| Steering angle                 | $55^{\circ} \begin{smallmatrix} 0 \\ -0,2 \end{smallmatrix}$                       |
| Toe-in                         | $A \begin{smallmatrix} 0 \\ -0,2 \end{smallmatrix}$                                |
| Bevel gear ratio               | 1.765/1                                                                            |
| Epicyclic reduction gear ratio | 6.000/1                                                                            |
| Total ratio                    | 10.588/1                                                                           |
| Input rotation                 |                                                                                    |
| CLOCK WISE (C.W.)              |  |
| COUNTER CLOCK WISE (C.C.W.)    |  |

### Assembly main data

|                                                                                       |                                            |
|---------------------------------------------------------------------------------------|--------------------------------------------|
| Bevel gear set backlash                                                               | 0.17÷0.23 mm                               |
| Pinion bearings preloading<br>(measured D=29.75 mm without seal rings)                | $P = 10.8 \div 16.1 \text{ daN}$           |
| Total pinion-ring gear bearing preloading<br>(measured D=29.75 mm without seal rings) | $T = (P + 4.0) \div (P + 6.0) \text{ daN}$ |

|                   |              |
|-------------------|--------------|
| MACHINE           | Front axle   |
| CODE              | CA642094     |
| MODEL             | 20.16        |
| DIFFERENTIAL TYPE | Limited slip |

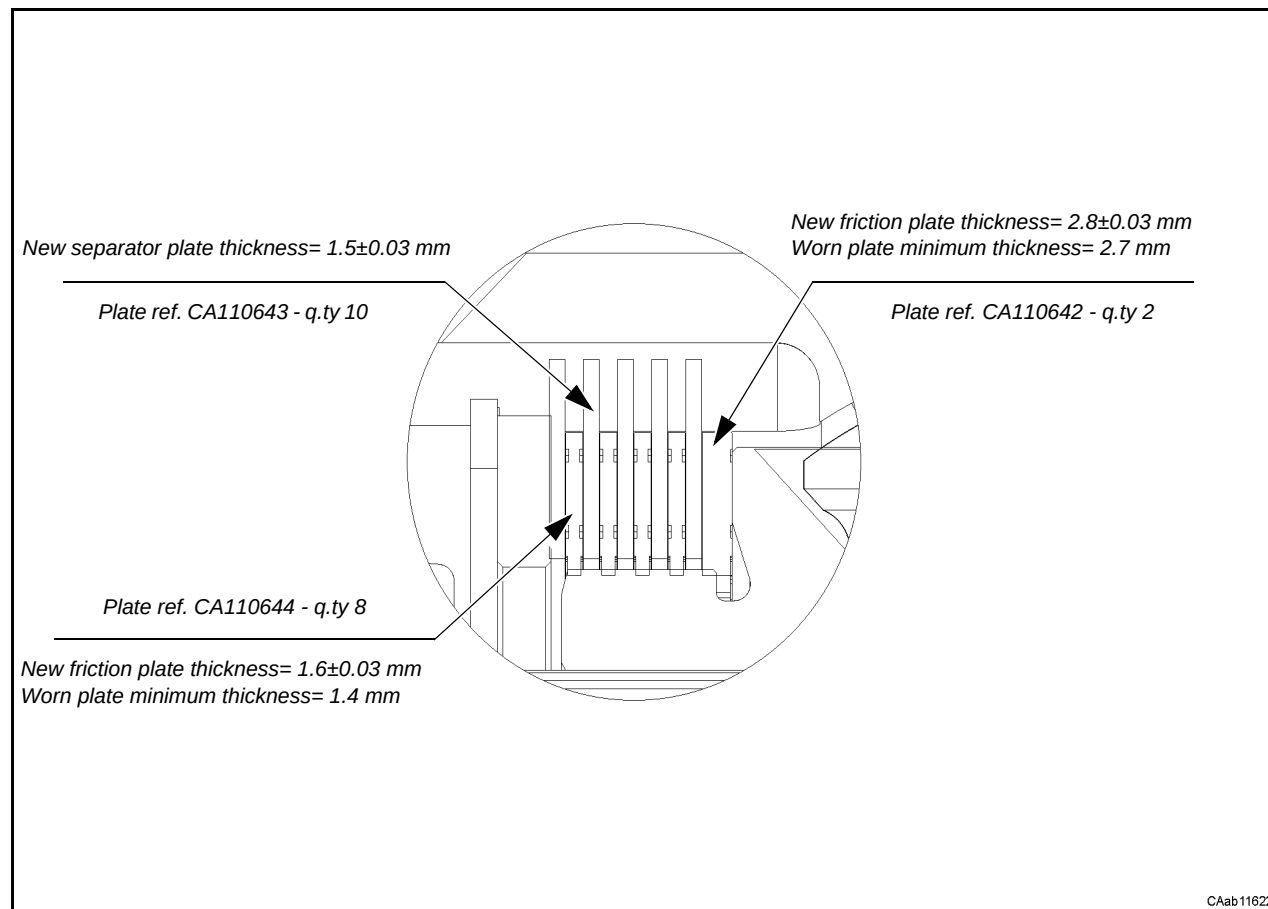
| DESCRIPTION                    | VALUES                                                                               |
|--------------------------------|--------------------------------------------------------------------------------------|
| Dry weight                     | 250 Kg                                                                               |
| Steering angle                 | $55^{\circ} \begin{smallmatrix} 0 \\ -0,2 \end{smallmatrix}$                         |
| Toe-in                         | $A \begin{smallmatrix} 0 \\ -0,2 \end{smallmatrix}$                                  |
| Bevel gear ratio               | 2.214/1                                                                              |
| Epicyclic reduction gear ratio | 6.000/1                                                                              |
| Total ratio                    | 13.284/1                                                                             |
| Input rotation                 |                                                                                      |
| CLOCK WISE (C.W.)              |  |
| COUNTER CLOCK WISE (C.C.W.)    |  |

### Assembly main data

|                                                                                       |                                            |
|---------------------------------------------------------------------------------------|--------------------------------------------|
| Bevel gear set backlash                                                               | 0.24÷0.32 mm                               |
| Pinion bearings preloading<br>(measured D=29.75 mm without seal rings)                | $P = 10.7 \div 16.0 \text{ daN}$           |
| Total pinion-ring gear bearing preloading<br>(measured D=29.75 mm without seal rings) | $T = (P + 4.8) \div (P + 7.2) \text{ daN}$ |

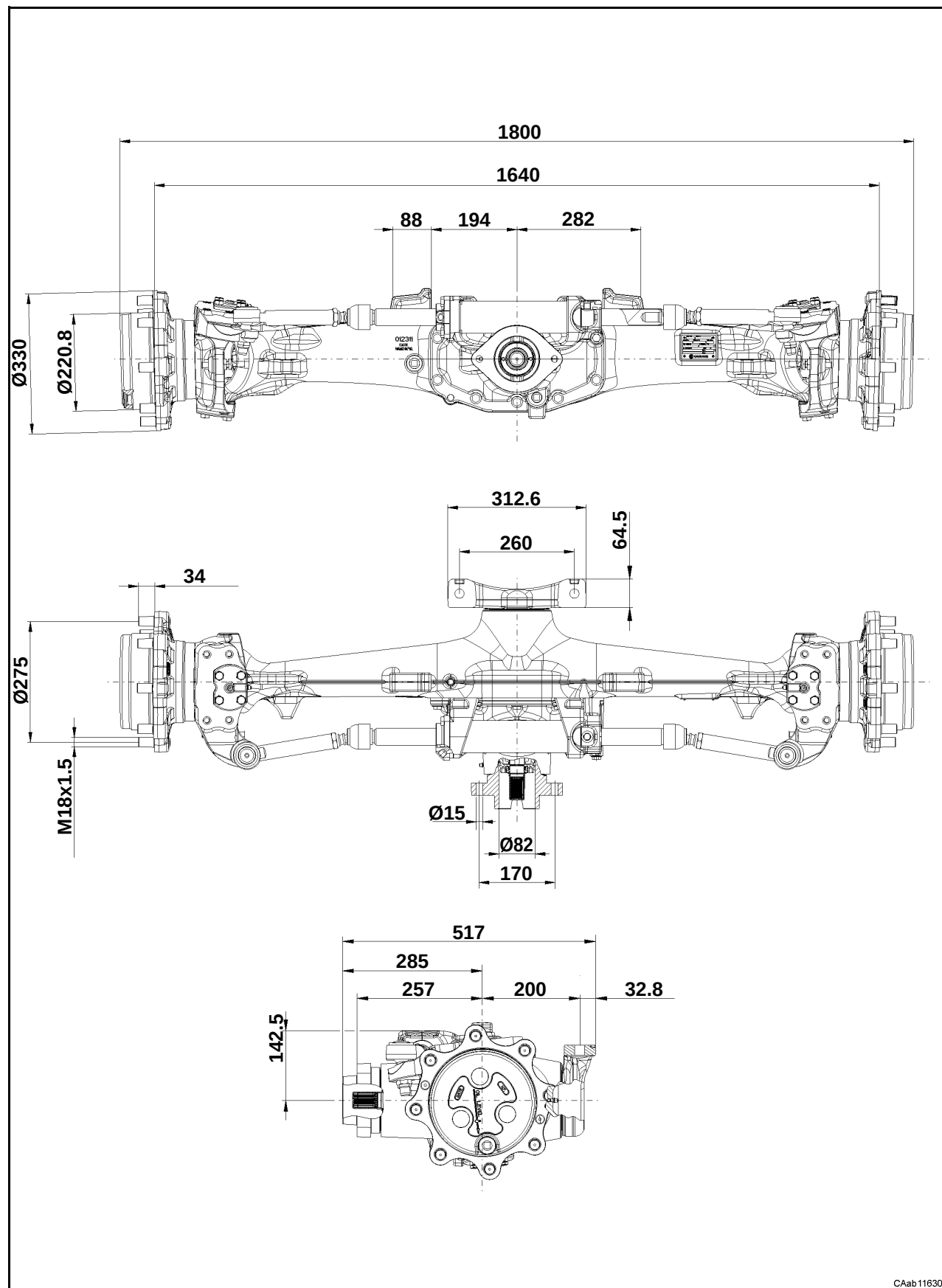
## General Specifications

### Limited slip differential disks specifications



# General Specifications

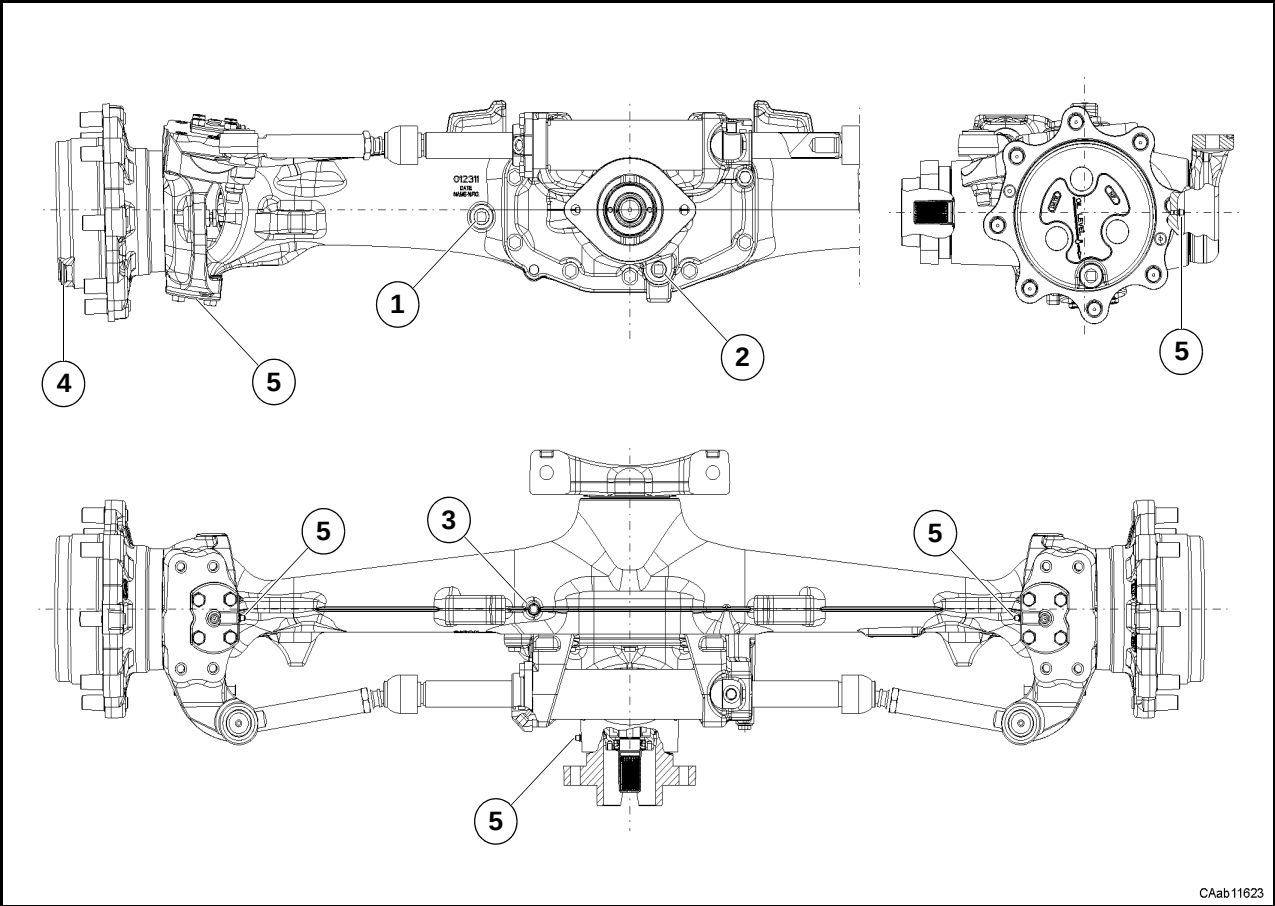
## Principal Dimensions (mm)



# General Specifications

## MAINTENANCE AND OIL CHANGE

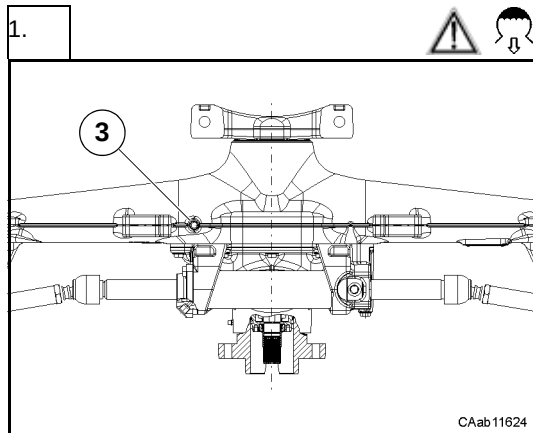
| DESCRIPTION                                                                                                                                        | VALUES     |
|----------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Oil specification:<br>USE RECOMMENDED OIL ENRICHED IN ADDITIVES.<br>do not use synthetic or vegetable oil without consent of the axle manufacturer | API GL4    |
| Differential oil capacity                                                                                                                          | 5.5 litres |
| Epicyclic red. gear oil capacity (each side)                                                                                                       | 0.6 litres |



| DESCRIPTION                                                | POSITION |
|------------------------------------------------------------|----------|
| Differential oil filling and level plug                    | 1        |
| Differential oil drain plug                                | 2        |
| Oil breather                                               | 3        |
| Fill, level and drain plug of epicyclic reduction gear oil | 4        |
| Greasing point                                             | 5        |

# General Specifications

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.



## Warning

To drain and fill the oil and to check the oil level the axle must be horizontal.

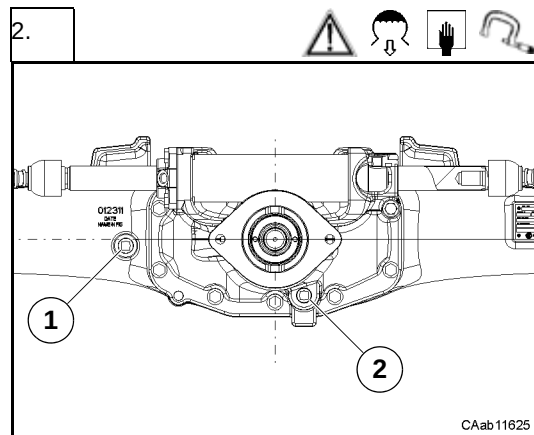


## Danger

Risk of violent oil ejection, follow carefully all the safety procedures indicated in this manual and in the vehicle manual.

Refer to: [section B - SAFETY INSTRUCTIONS](#)

Clean the breather (3) and the surrounding area.



To drain the oil remove the level plug (1) and the drain plug (2).



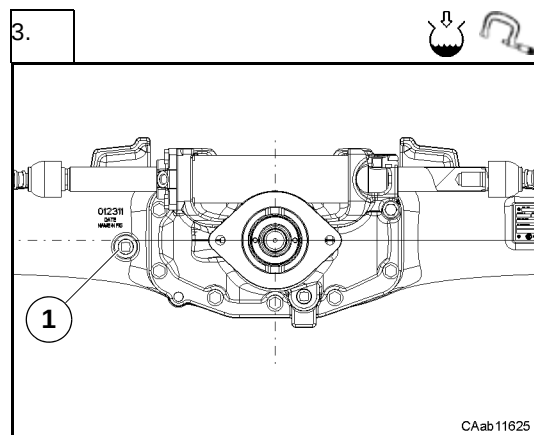
## Danger

**Risk of violent oil ejection.**

Refer to: [previous step](#)

Drain all oil.

Clean the plug (2) and tighten it to the prescribed torque (see C.8).



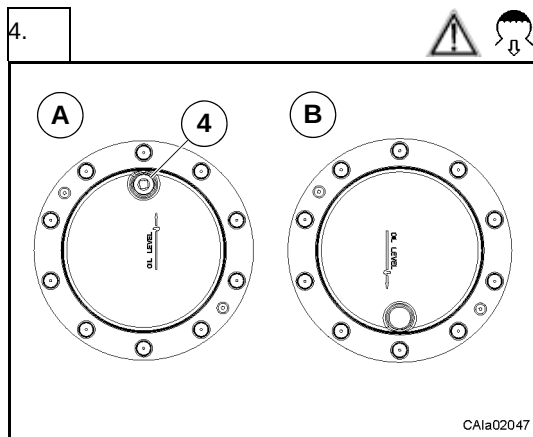
Unscrew the oil fill plug (1) and fill to the bottom of the level plug hole with the specified oil.

Wait to allow the oil to flow through the axle. Check oil level and fill to the specified level if necessary.

Screw the plug (1) to the prescribed torque (see C.8).



## General Specifications



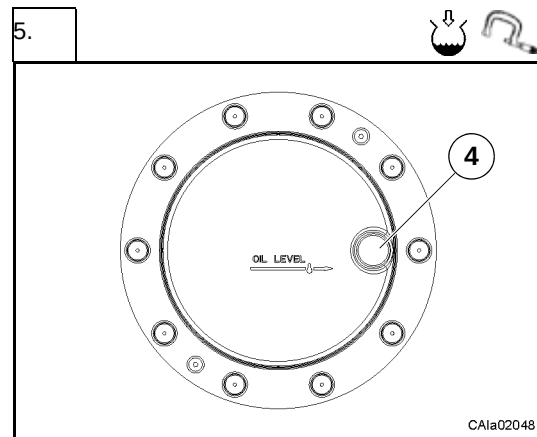
### Warning

**To drain and fill the oil and to check the oil level the axle must be horizontal.**

Before draining the oil from wheel end rotate the wheel end so that the plug (4) is at the highest position [pos.A] and partially unscrew to release possible pressure.

Rotate the wheel end so that the plug (4) is toward the ground [pos.B].

Remove the plug and drain the oil.



Rotate the wheel end so that the hole (4) is in the position shown in figure.

Fill to the bottom of the fill plug hole with specified oil (see C.4).

Tighten the plug to the prescribed torque (see C.8).

# General Specifications

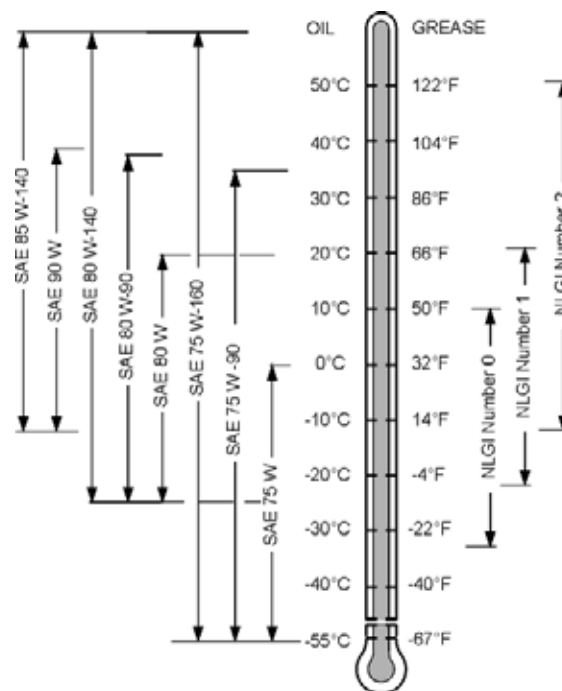
## Service schedule

Specified maintenance intervals are for standard-duty use.

Severe operating conditions may require more short intervals.

| Operation                                                                  | Recommended intervals |       |       |        |
|----------------------------------------------------------------------------|-----------------------|-------|-------|--------|
|                                                                            | 50 h                  | 400 h | 800 h | 1200 h |
| CHECK OIL LEVEL IN AXLE AND EPICYCLIC DRIVE UNITS (4WD).                   |                       | 1     |       | 1      |
| CHANGE OIL IN AXLE AND EPICYCLIC DRIVE UNITS (4WD).                        | 1                     |       | 1     |        |
| CHECK WHEEL HUB/STEERING PIVOTS/<br>SUSPENSION CLEARANCE.                  |                       | 1     | 1     | 1      |
| LUBRICATE THE STEERING PIVOTS (king pin)                                   | 1                     | 1     | 1     | 1      |
| CHECK STEERING FOR CORRECT OPERATION<br>(WITH AND WITHOUT ENGINE RUNNING). |                       | 1     | 1     | 1      |
| CHECK STEERING AND TOE-IN ADJUSTMENT<br>(INCLUDING TYRE WEAR AND DAMAGE).  |                       |       |       | 1      |

## Lubricants application range



## General Specifications

### GREASE IN ASSEMBLY

#### Grease application in assembly



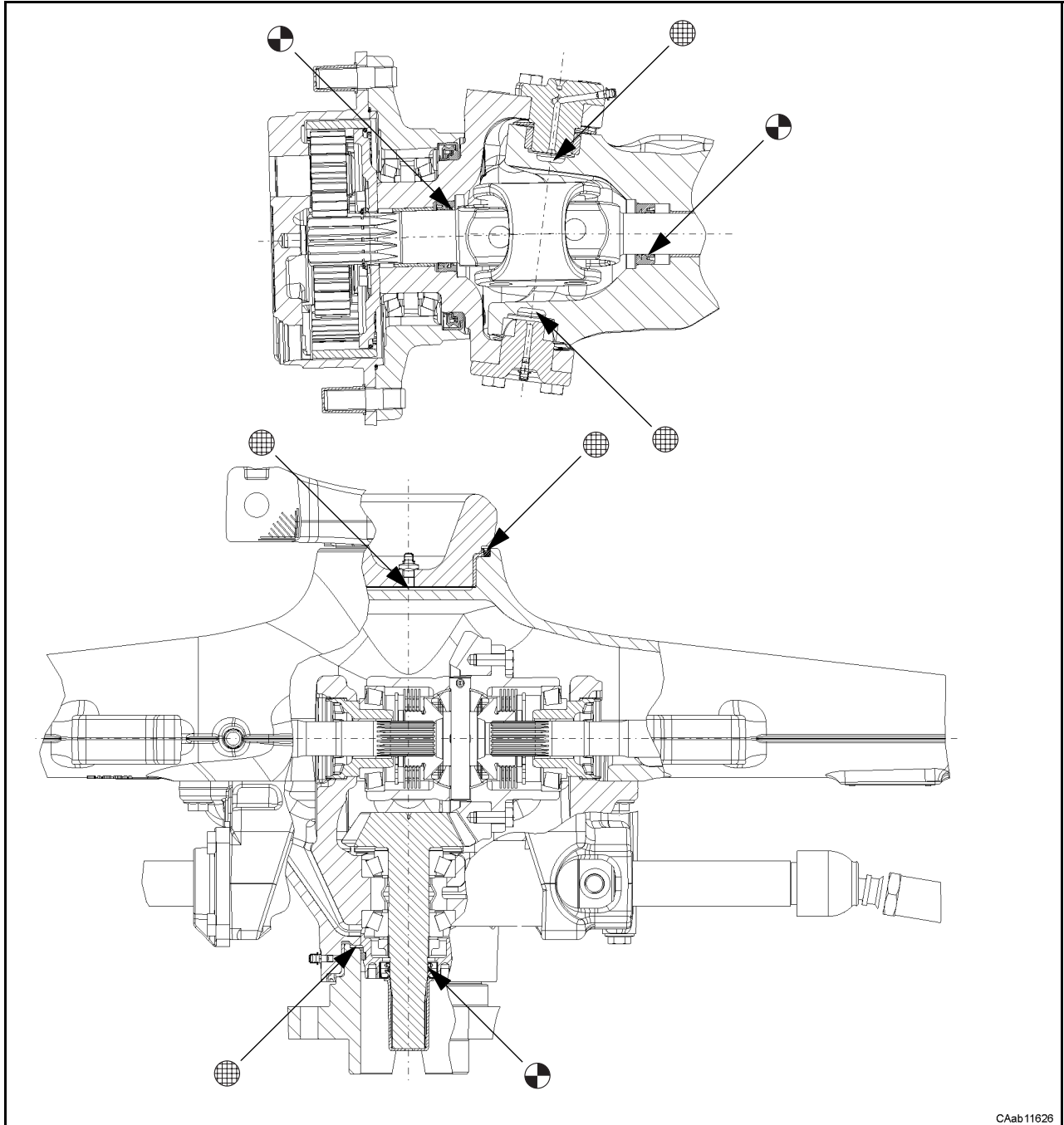
Tecnolube® POLYMER 400

Apply on the indicated surfaces



AGIP® GR MU EP2

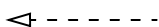
Fill/Apply in excess



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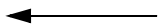
# General Specifications

## ADHESIVE AND SEALANT



### Sealant Application

Apply on the contact surfaces



Apply on bolts thread/on pins

### Gasket sealant

| Massey<br>Ferguson Ref. | Presence | Adhesive make and type         | Technical characteristics | Strength |
|-------------------------|----------|--------------------------------|---------------------------|----------|
| A1                      | ●        | Loctite® 510<br>Superbond® 529 | Flat surface sealing      | High     |
| A2                      | ○        | Loctite® 573<br>Superbond® 519 | Flat surface sealing      | Low      |
| A3                      | ○        | Loctite® 518<br>Superbond® 539 | Uneven surface sealing    | High     |

### Thread parts sealant

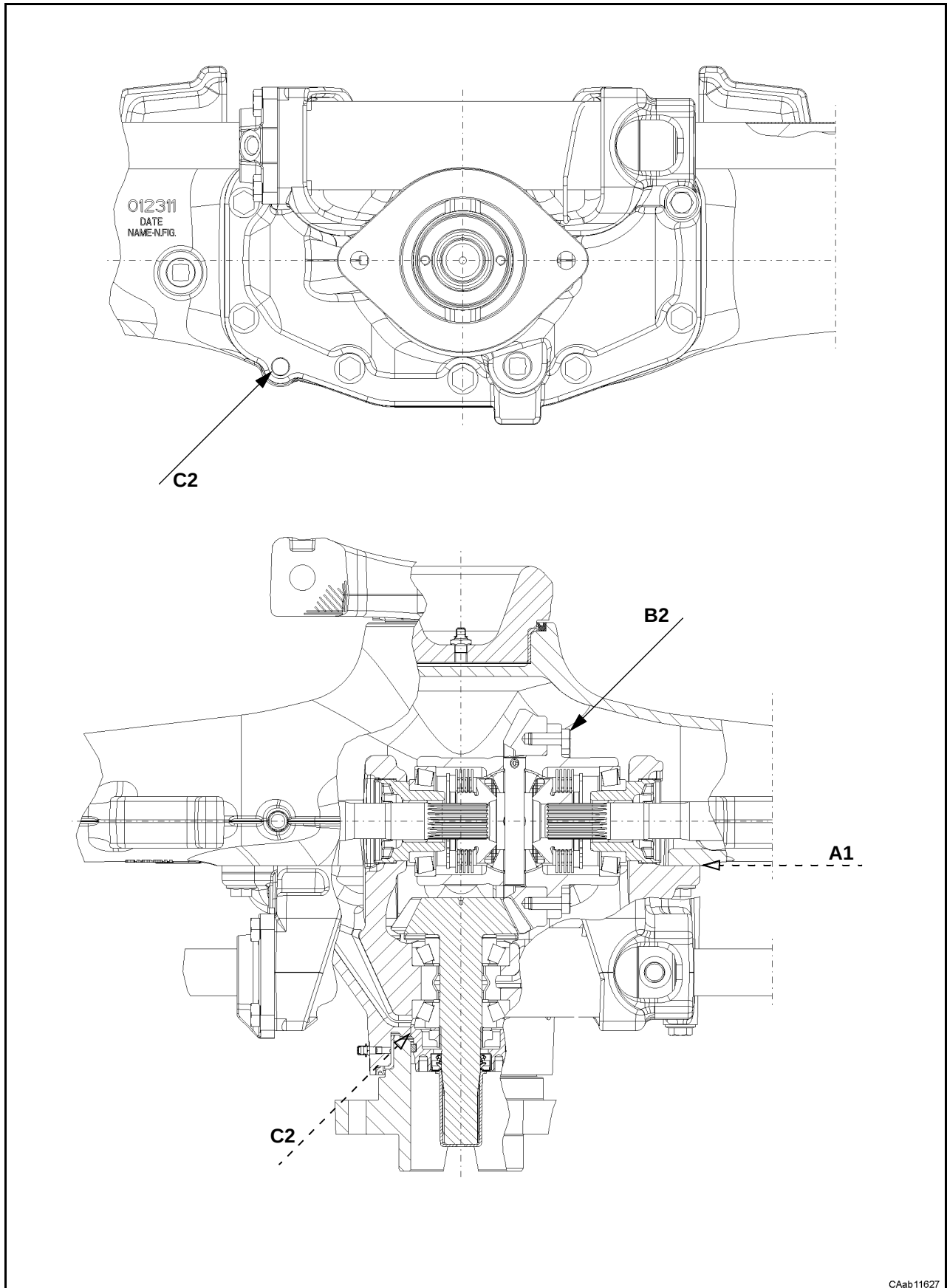
| Massey<br>Ferguson Ref. | Presence | Adhesive make and type             | Technical characteristics | Strength            |
|-------------------------|----------|------------------------------------|---------------------------|---------------------|
| B1                      | ○        | Loctite® 542<br>Superbond® 321     | Locking of threaded parts | Medium              |
| B2                      | ●        | Loctite® 270<br>Superbond® 331     | Locking of threaded parts | High                |
| B3                      | ○        | Loctite® 986/AVX<br>Superbond® 438 | Locking of threaded parts | High, special appl. |

### Fixing parts sealant

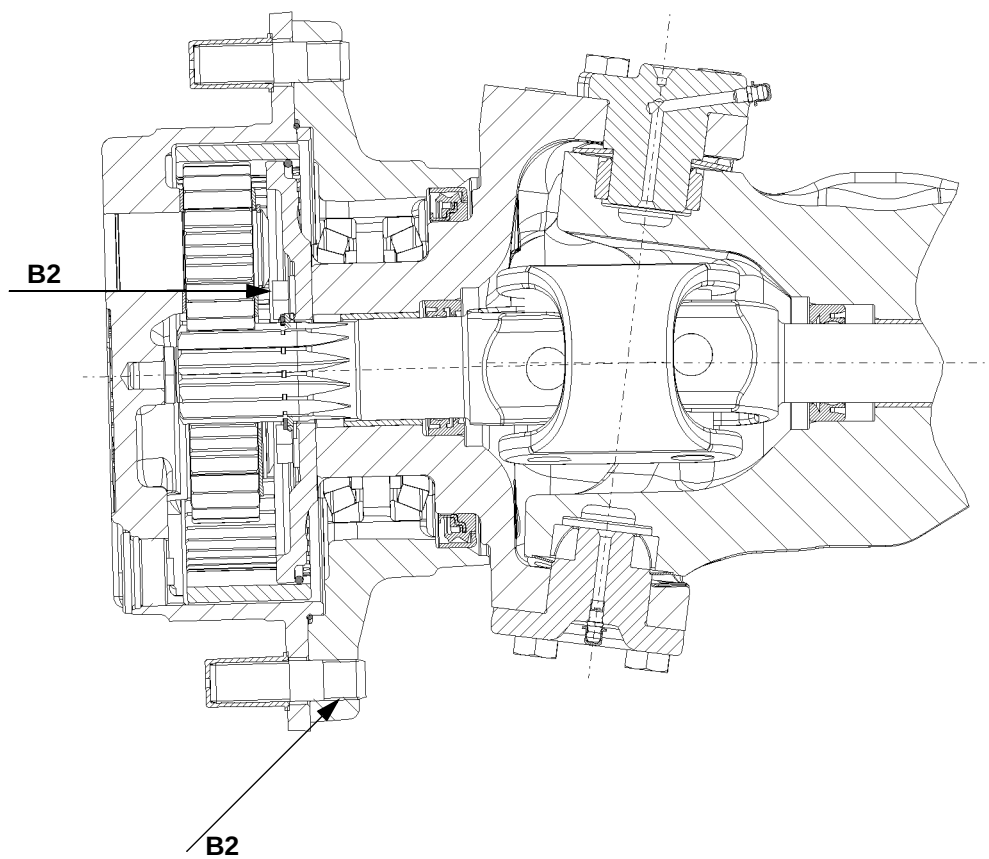
| Massey<br>Ferguson Ref. | Presence | Adhesive make and type                | Technical characteristics | Strength    |
|-------------------------|----------|---------------------------------------|---------------------------|-------------|
| C1                      | ○        | Loctite® 405<br>Superbond® instant 25 | Fixing adhesive           | Medium bond |
| C2                      | ●        | Loctite® 638<br>Superbond® 433        | Fixing adhesive           | Strong bond |
| C3                      | ○        | Loctite® 542<br>Superbond® 321        | Fixing adhesive           | Medium bond |
| C4                      | ○        | Loctite® 496<br>Superbond® SB14       | Rubber fixing adhesive    | Strong bond |

## General Specifications

### Sealing compounds and adhesives



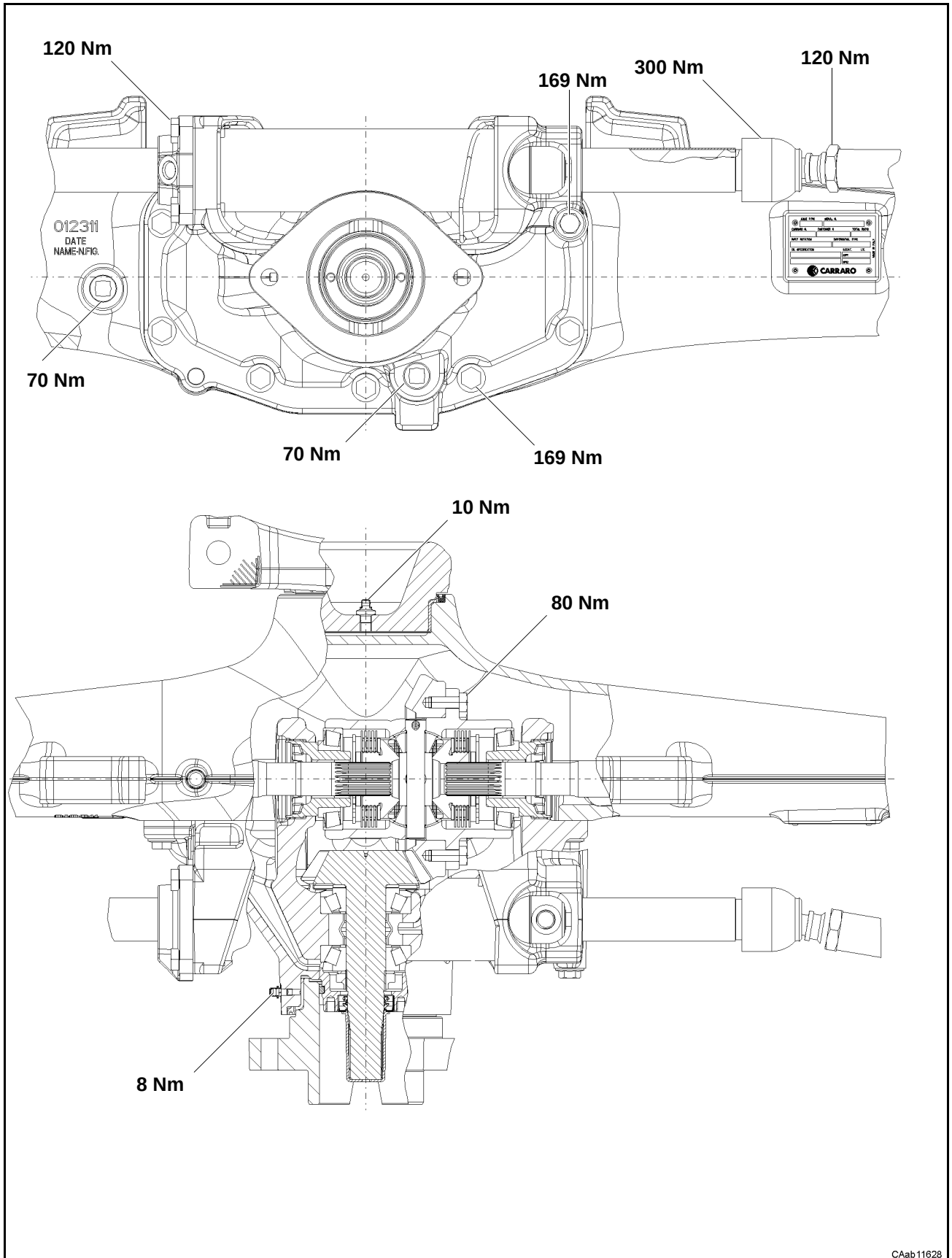
# General Specifications



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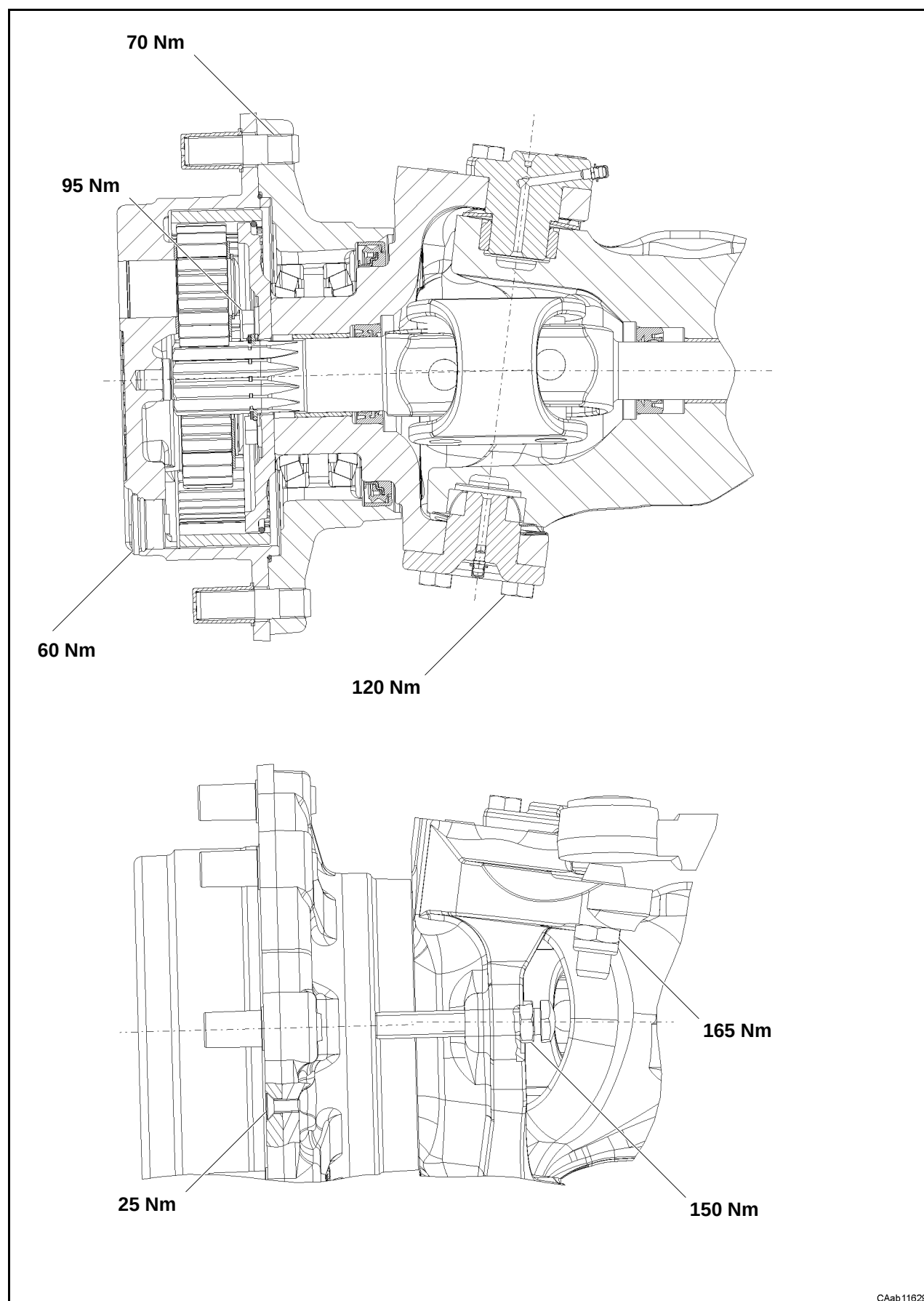
## General Specifications

### TIGHTENING TORQUES





# General Specifications



**D i s a s s e m b l y   a n d   A s s e m b l y   O p e r a t i o n s**

# Disassembly and Assembly Operations

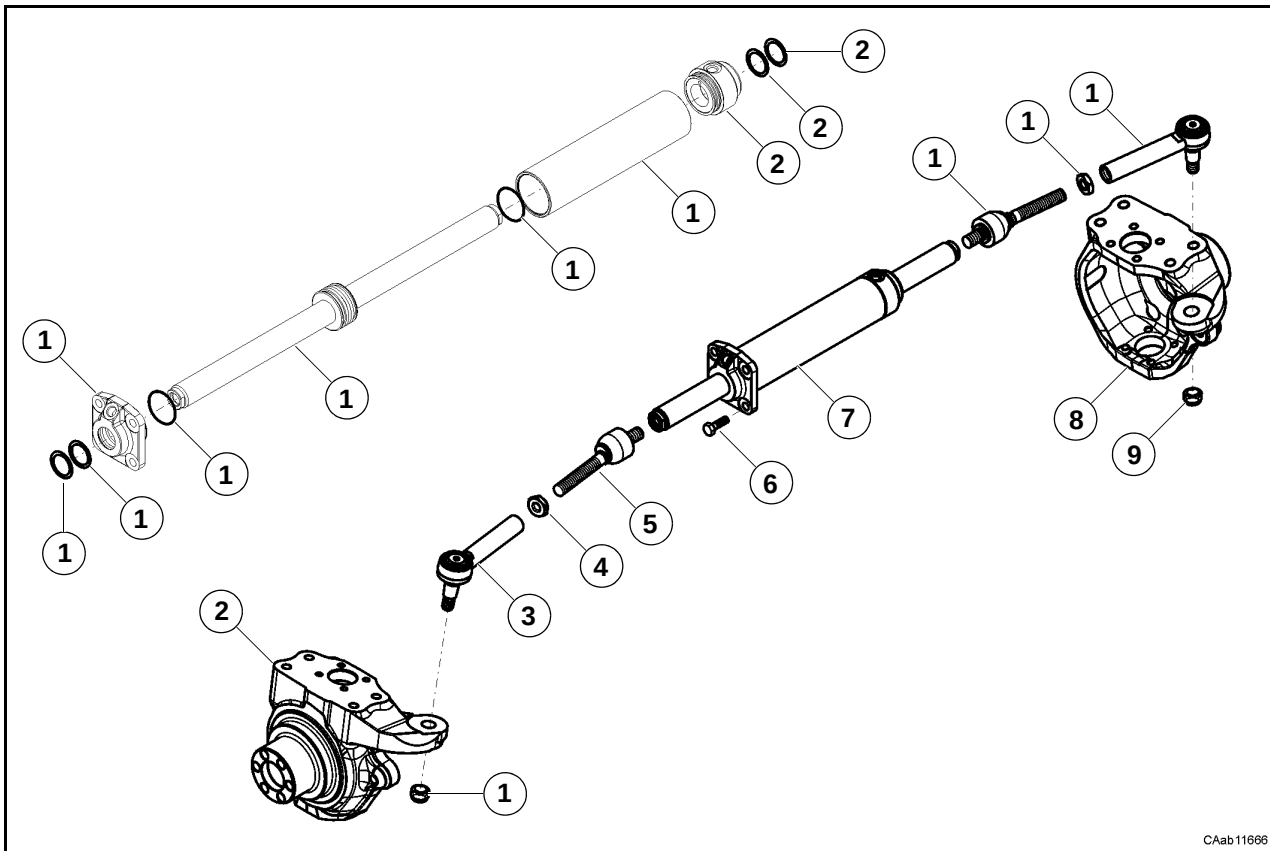
## Section 5B

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# Disassembly and Assembly Operations

## STEERING CYLINDER GROUP

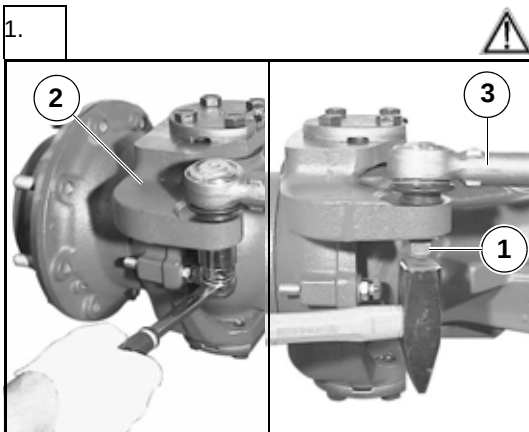


### Disassembly

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.

**NOTE:** This is a destructive operation for the nut (1).

Repeat the whole sequence at the other side.



Loosen the nut (1) with enough turns till it is protruding over the threaded pin end of the tie rod (3).

Beat on the nut (1) with an appropriate hammer in order to disconnect the tie rod (3) from the swivel housing (2).

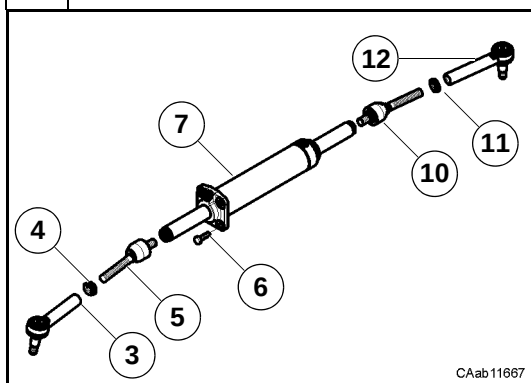


### Warning

**Do not beat on the threaded pin end of the tie rod (3).**

# Disassembly and Assembly Operations

2.

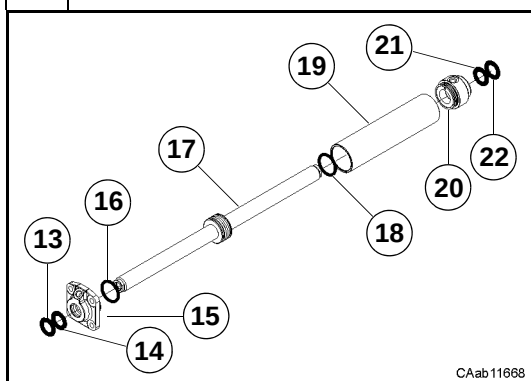


Remove the tie rods (3) and (12) by loosening the nuts (4) and (11) with a suitable wrench, then check their conditions.

Unscrew the fastening screws (6) and take the steering cylinder (7) out of its housing, if necessary use a rubber hammer.

Remove only parts that need to be overhauled and/or replaced.

3.



Detach the cylinder head (15) from the cylinder case (19) and remove it from the rod (17).

Remove the rod (17) from the cylinder case (19).

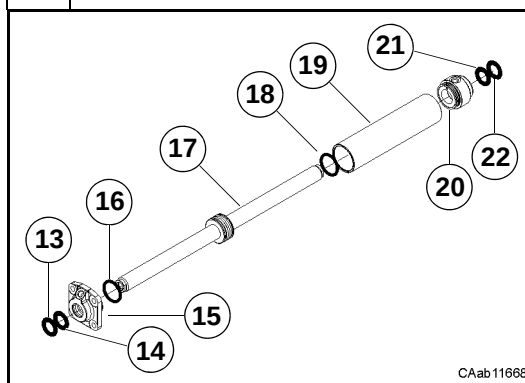
Remove the cylinder head (20) from the cylinder case (19).

Remove all the seals and O-Rings (13, 14, 16, 18, 21 and 22) from the cylinder case (19), the cylinder heads (15, 20), and the rod (17).

## Assembly

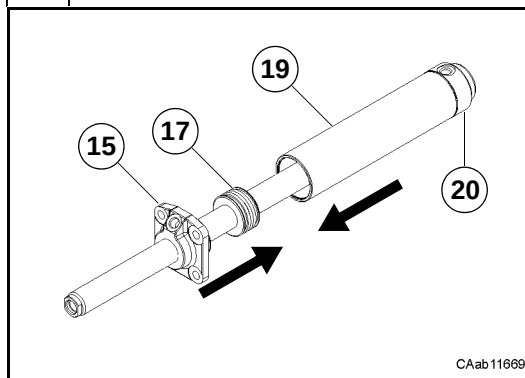
Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.

1.



Assemble new seals and O-Rings (13, 14, 16, 18, 21 and 22) on the cylinder heads (15, 20), on the rod piston (17) and on the cylinder body (19).

2.

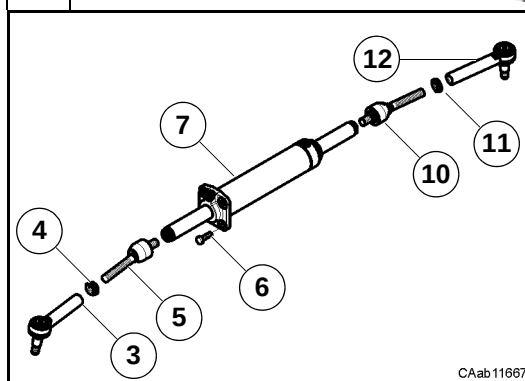


Assemble the cylinder head (20) to the cylinder body (19).

Fit the cylinder head (15) on the rod (17).

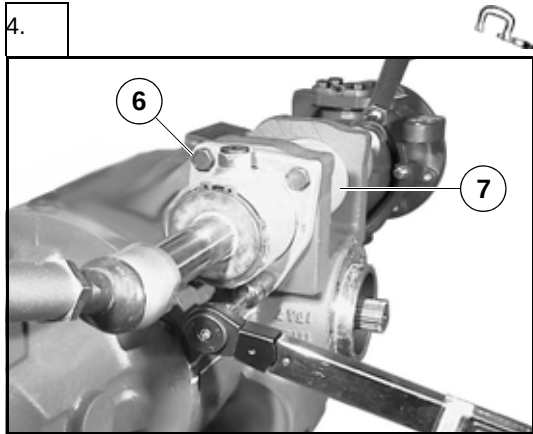
Slide the pre-assembled rod (17) into the cylinder body (19).

3.



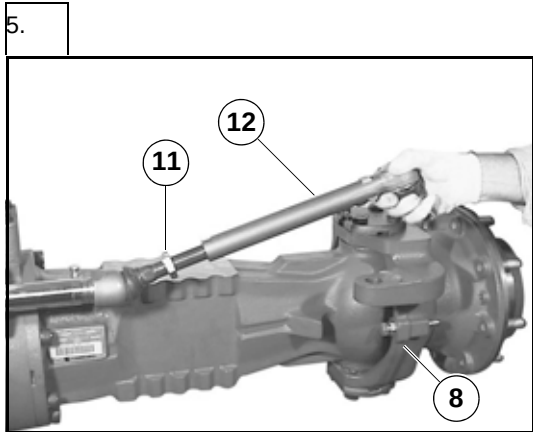
Fit the tie rods (3) and (12), the ball joints (5) and (10), the nuts (4) and (11) to the ends of the rod (17), then tighten with a torque wrench to the requested torque (Sec. C.8).

# Disassembly and Assembly Operations



Install the steering cylinder (7) already assembled on the central body.

Assemble and tighten the screws (6) with torque wrench to the requested torque (Sec. C.8).

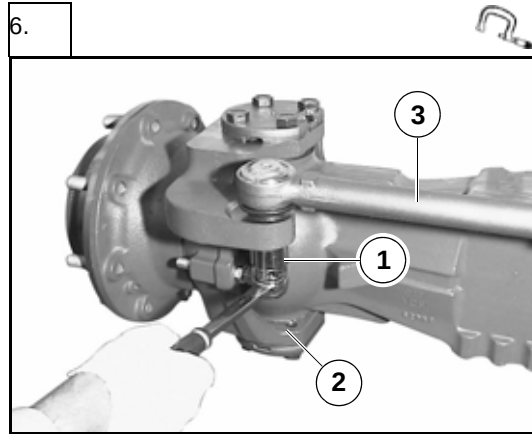


Align the swivel housing (8) with the axle.

Screw the tie rod (12) so that its ball joint can be inserted into the swivel housing (8) arm.

**NOTE:** It is important to unscrew the lock nut (11) to carry out this operation.

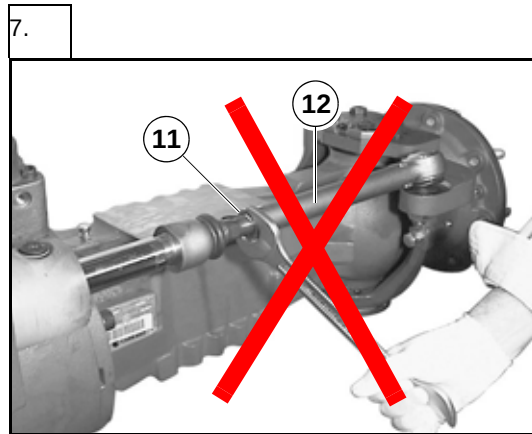
Repeat the whole sequence of the mentioned operations to the other side.



Insert the ball joint of the tie rod (3) into its housing on the swivel housing (2).

Assemble and tighten the lock nut (1) with a torque wrench to the requested torque (Sec. C.8).

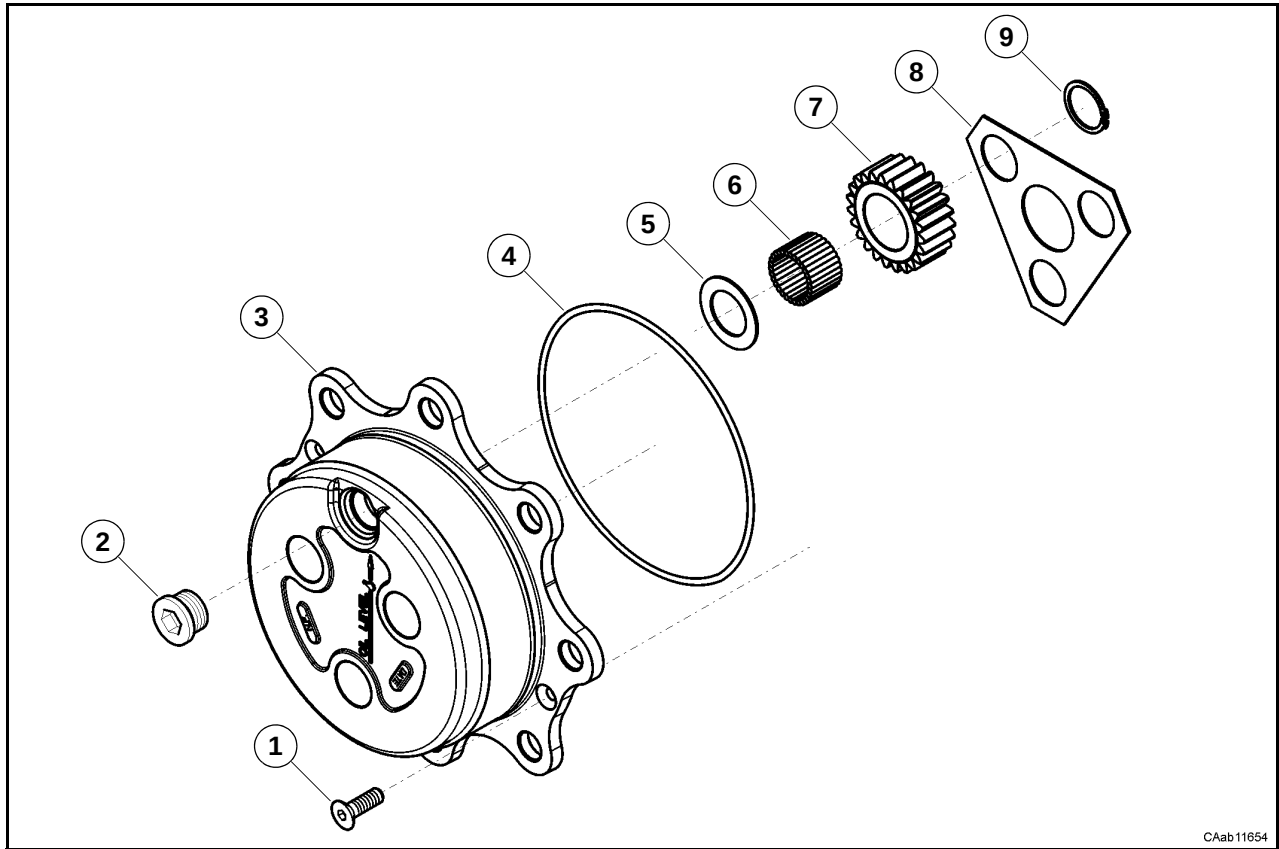
Repeat the whole sequence of the mentioned operations to the other side.



Screw the lock nuts (4) and (11) of the tie rods (3) and (12) only when the toe-in adjustment has been carried out (Sec.D.9).

# Disassembly and Assembly Operations

## EPICYCLIC REDUCTION GEAR GROUP



CAab 11654

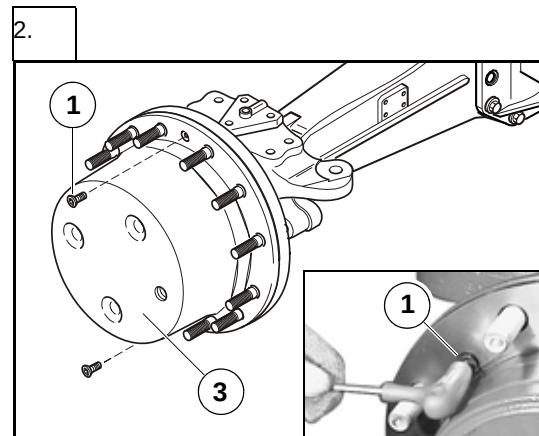
### Disassembly

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.



Drain the oil completely from the planetary carrier.

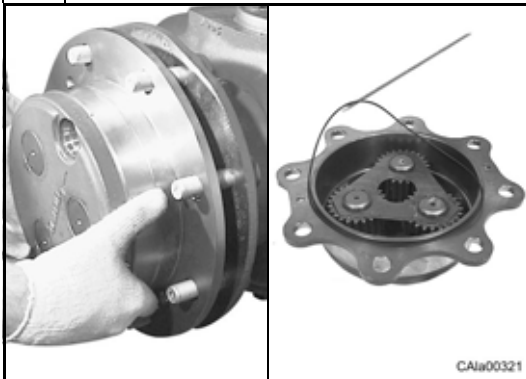
Refer to: C.5.



Unscrew and remove both fastening screws (1) of the planetary carrier (3) with a wrench.

# Disassembly and Assembly Operations

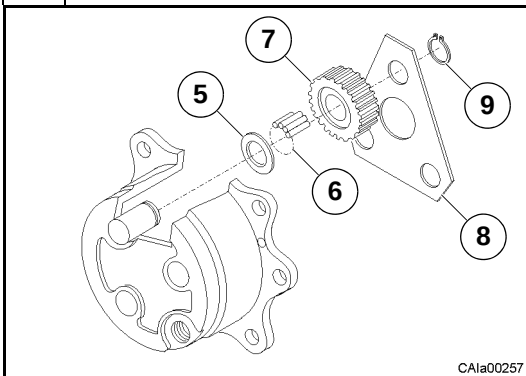
3.



Remove the planetary carrier (3) from the wheel hub and collect the relative O-Ring (4).

Position the planetary carrier (3) on a workbench and check its wear conditions.

4.



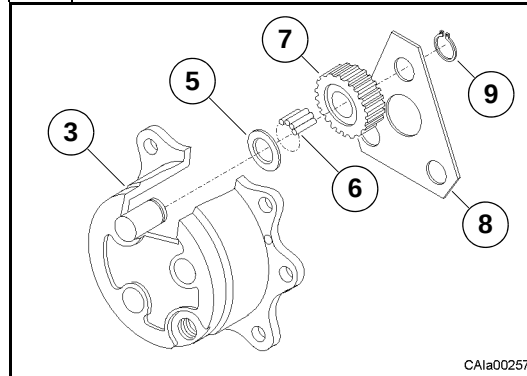
If required replace the planetary gears as follows:

- remove the Seeger rings (9) on every pin;
- remove the triangular plate (8);
- remove the planetary gears (7) from the pins;
- collect the needle bearings (6), checking their conditions;
- collect the washer (5).

## Assembly

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.

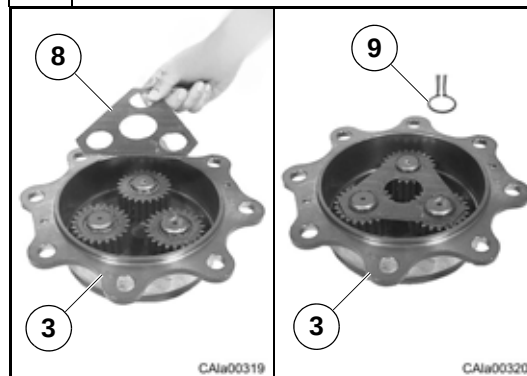
1.



Collect all epicyclic reduction gear parts: the planetary carrier (3), the thrust washers (5), the needle bearings (6), the planetary gears (7), the triangular plate (8) and the snap rings (9) of every pin.

**NOTE:** With new planetary gears is advisable to assemble new roller bearings.

2.



Position the planetary carrier on a workbench.

Insert the thrust washers (5) and the epicyclic gears (7) in the planetary carrier pins.

Insert the needle bearings (6) in the epicyclic gears (7).

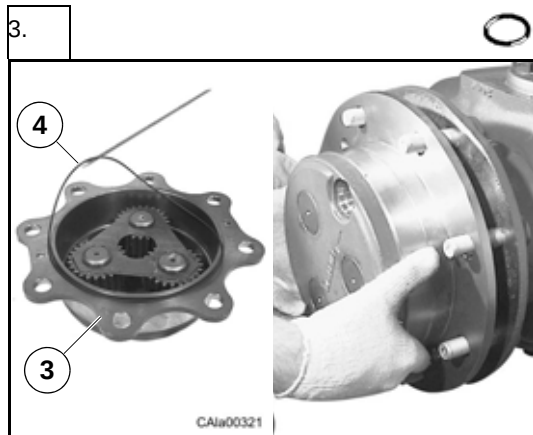
**NOTE:** Grease well the needles.

Refer to: C.6.

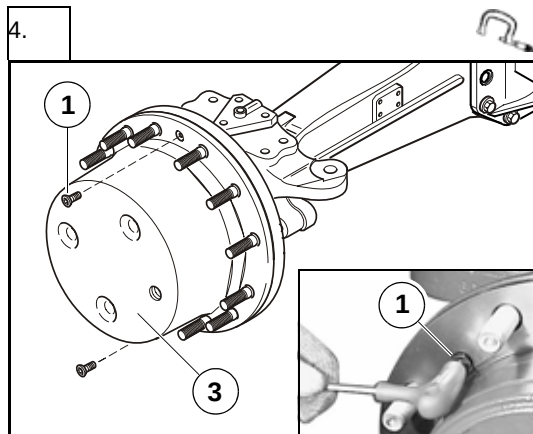
Assemble the triangular plate (8) and the related snap rings (9).



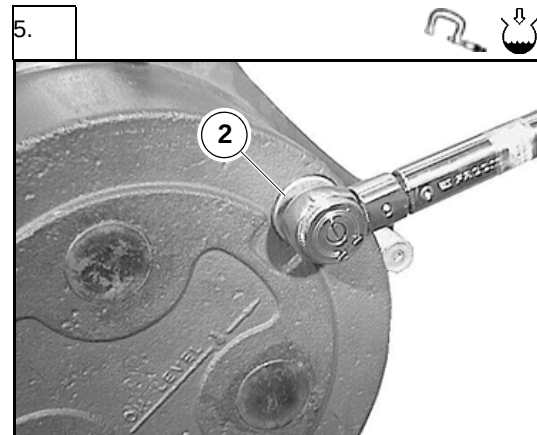
# Disassembly and Assembly Operations



Assemble a new O-ring (4) on the planetary carrier (3).  
Assemble the epicyclic reduction gear on the wheel hub.



Assemble the screws (1) and tighten them to the prescribed torque (see C.8).



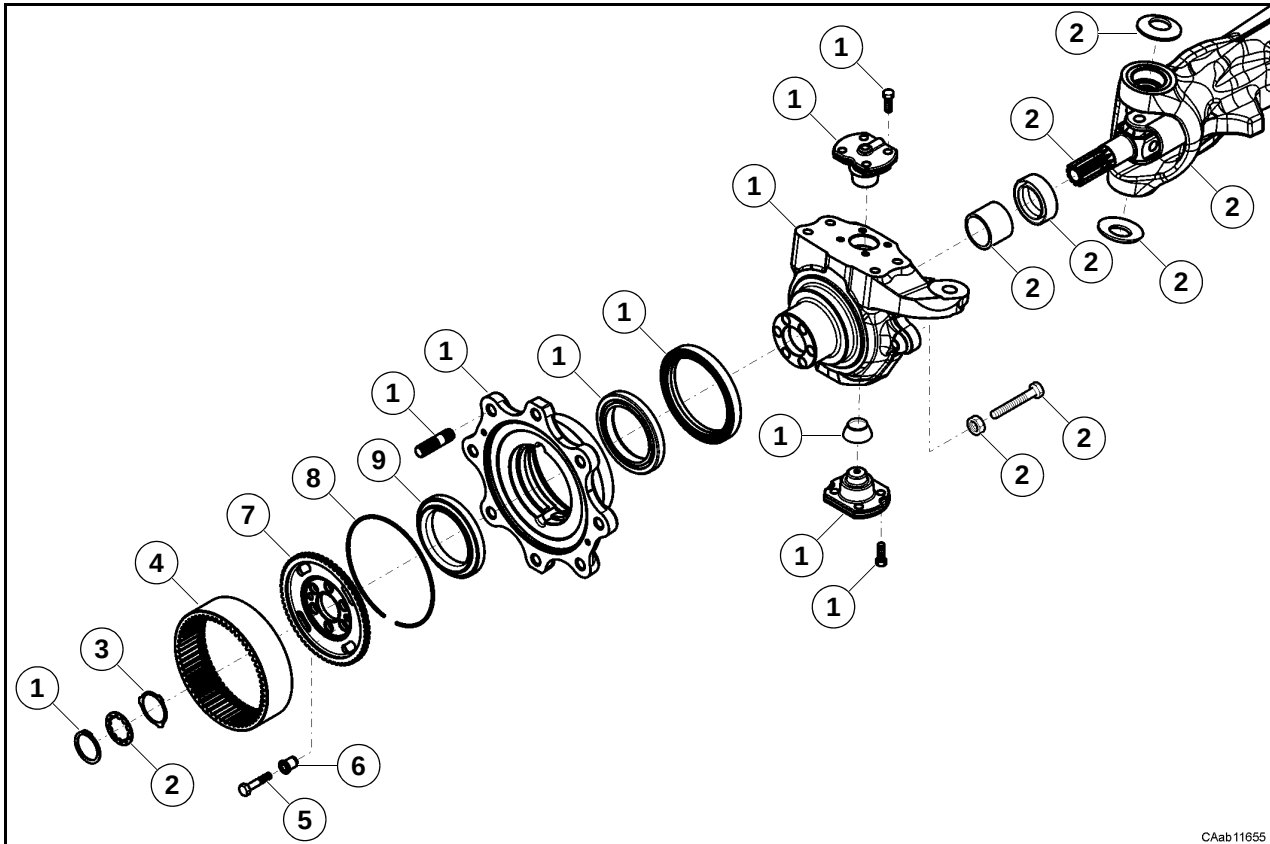
Top up the oil on the wheel hub.

[Refer to: C.5 to top up the oil.](#)

Fit the filling/drain and level oil plug (2) on the planetary carrier (3) and tighten to the prescribed torque (see C.8).

# Disassembly and Assembly Operations

## WHEEL HUB GROUP

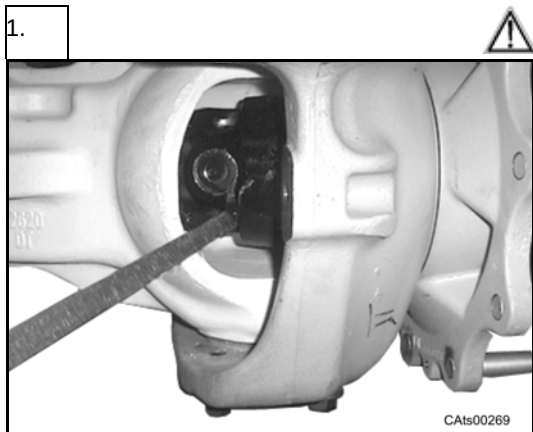


CAab11655

### Disassembly

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.

Refer to: D.1 and D.2 before disassemble the wheel hub group.

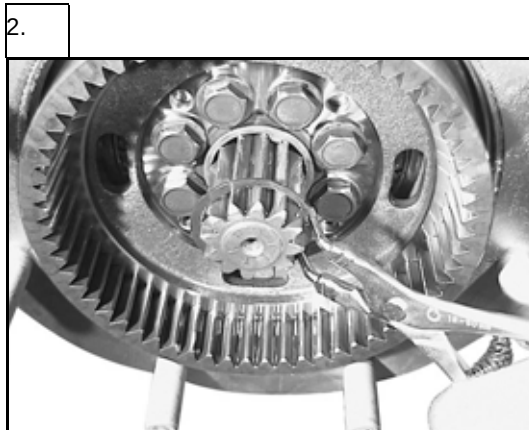


Insert a lever between the swivel housing (14) and the axle beam and fit it into the double U-Joint.

With the lever push the double U-Joint in the direction of the wheel hub to allow the lock ring (1) removal.

### Warning

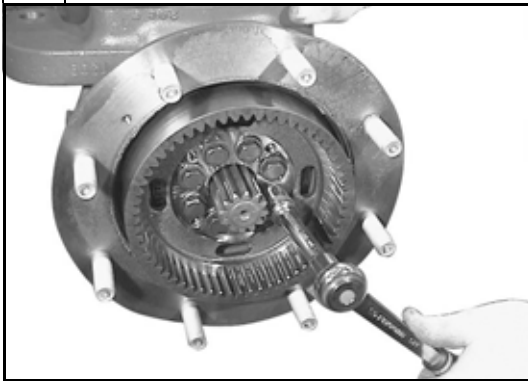
**Do not damage the double U-Joint.**



Remove the lock ring (1) from the double U-Joint shaft.  
Collect the double U-Joint shaft washers (2, 3).

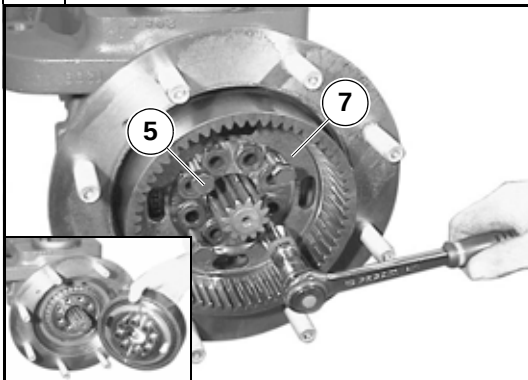
# Disassembly and Assembly Operations

3.



Unscrew and remove the fastening bolts (5) from the wheel carrier (7).

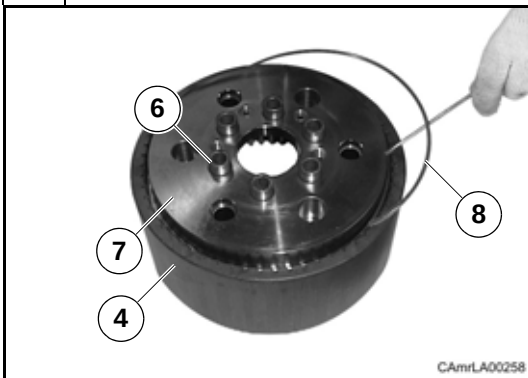
4.



To extract the wheel carrier screw two of the just removed bolts (5) in the threaded holes.

Remove the wheel carrier (7) with the epicyclic ring gear (4).

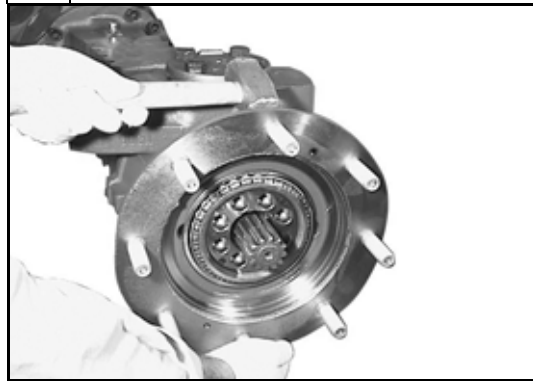
5.



Remove the steel lock ring (8) and disconnect the wheel carrier (7) from the epicyclic ring gear (4).

Only if necessary, remove the centring bushes (6) from the wheel carrier with a hammer and the special tool CA715086.

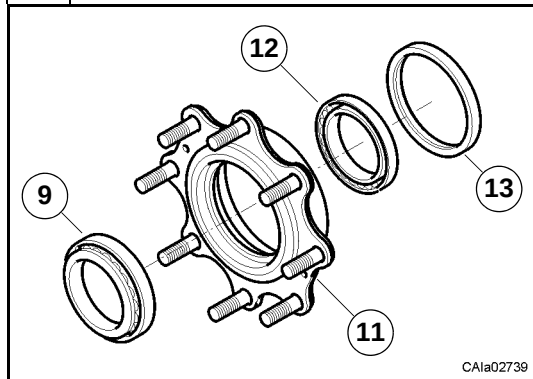
6.



Remove the wheel hub (11) using levers and a hammer to facilitate the operation.

**NOTE:** Collect the bearing cone (9).

7.



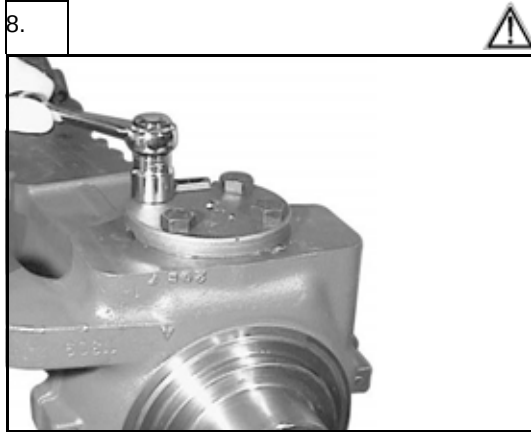
Position the wheel hub (11) on a flat surface and remove the seal ring (13) with a lever.

**NOTE:** Destructive operation for the seal ring (13).

Remove the bearing cups (9) and (12) using a hammer and a suitable drift.

Remove the bearing cone (12) from the swivel housing end (14), using a suitable extractor.

# Disassembly and Assembly Operations



Unscrew and remove the fastening bolts (19) and (17) from the upper (18) and lower (16) king pin.

## Danger

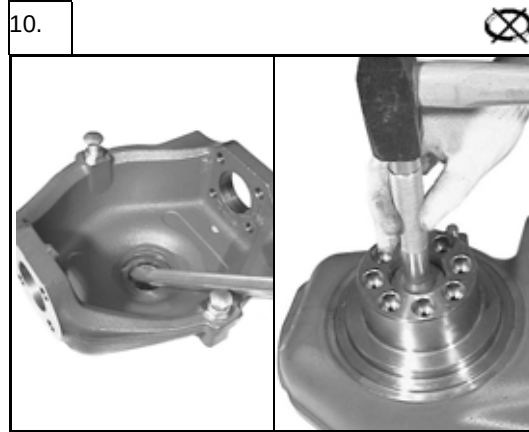
**Before removing the king pins (16) and (18), secure the swivel housing (14) with a belt or a rope to a hoist or any other supporting device; observe all current safety regulations to guarantee operator's safety.**

Remove the king pins (16) and (18).



Remove the swivel housing (14) from the axle beam and from the short shaft of the double U-Joint.

Collect the belleville washers (25) and (27).



Position the swivel housing (14) on a flat surface and take the seal ring (23) out with a lever.

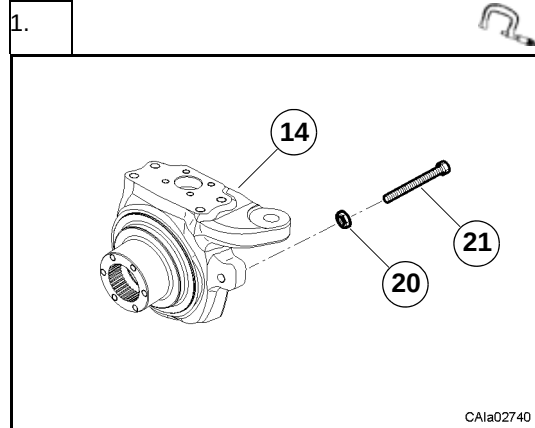
**NOTE:** *This is a destructive operation for the seal ring.*

Turn the swivel housing and take the bush (22) out, using a suitable drift and a hammer.

# Disassembly and Assembly Operations

## Assembly

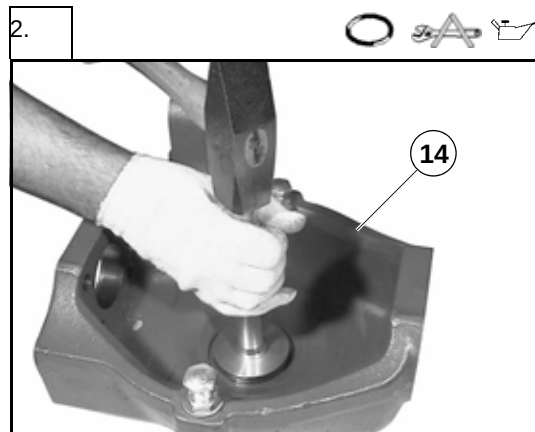
Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.



If it has been previously removed, reassemble the steering stop composed by the screw (21) and nut (20).

**NOTE:** Do not tighten the nut (20) until the steering angle adjustment has been done.

Refer to: D.9.

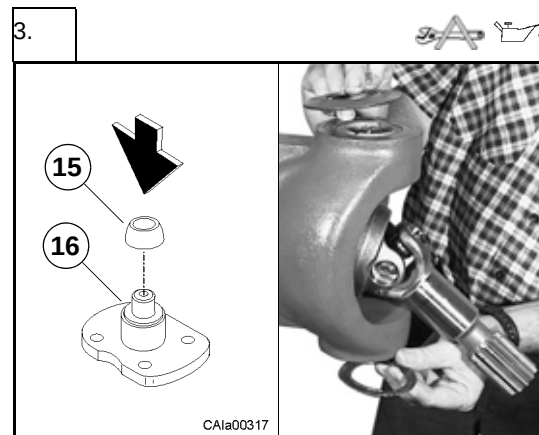


Force the bush (22) into the swivel housing (14) with the special tool CA119097 and a hammer or a press.

Assemble the seal ring (23) on the swivel housing (14) with the special tool CA715360 and a hammer.

Grease carefully the seal ring (23).

Refer to: C.6.

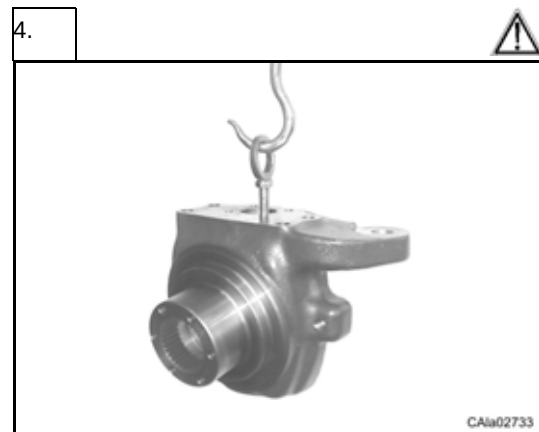


If the cone (15) of the spherical joint has been previously removed, reassemble it to the lower king pin (16) using the special tool CA715451 under a press.

Grease carefully the seats of king pin (16) and (18) with specific grease.

Refer to: C.6.

Position the belleville washers (25) and (28) on the king pin (16) and (18) housings.



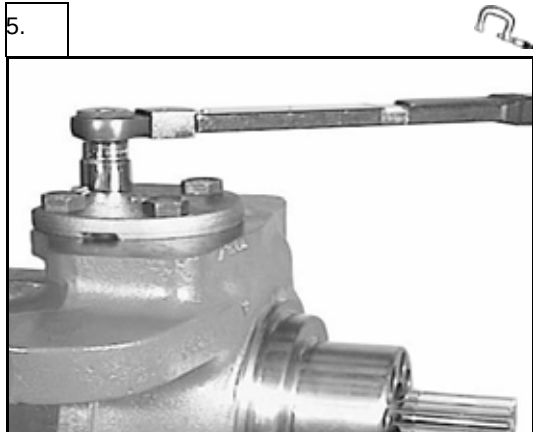
## Danger

**Secure the swivel housing (14) with a belt or a rope to a hoist or any other supporting device.**

Protect the splined end of the axle shaft by winding it with an adhesive tape to avoid damage to the seal ring (23).

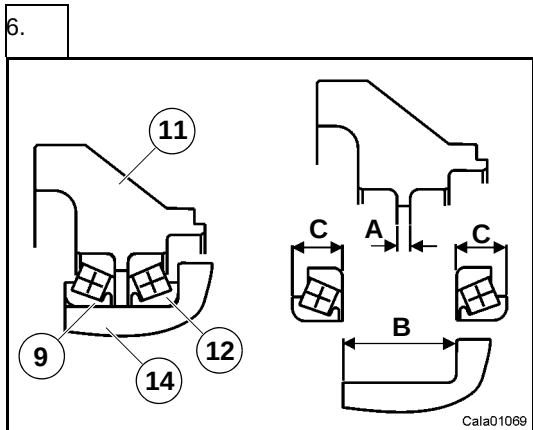
Assemble the swivel housing (14) on the axle beam and after assembly, remove completely the adhesive tape.

# Disassembly and Assembly Operations



Assemble the king pins, the lower (16) and the upper (18), and tighten the retaining screws (17) and (19) to the requested torque (see C.6).

**NOTE:** Make sure that the belleville washers (25) and (27) remain in their position.

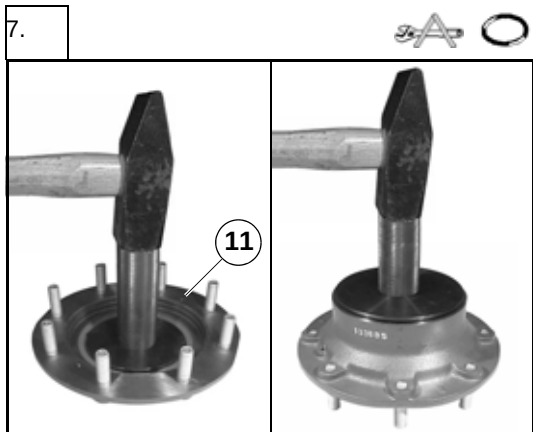


The special operation "Set Right" of the bearings (9) and (12) does not require preload or backlash adjustment. Anyway, before assembling new components check the indicated dimensions.

A= 11.975 ÷ 12.025 mm

B= 52.229 ÷ 52.279 mm

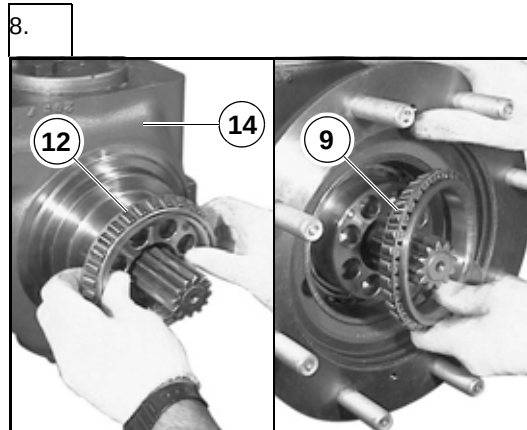
C= 20.000 ÷ 20.100 mm



Force both bearing cups (9) and (12) to their wheel hub (11) housings using the special tool CA715026 under a press or with a hammer.

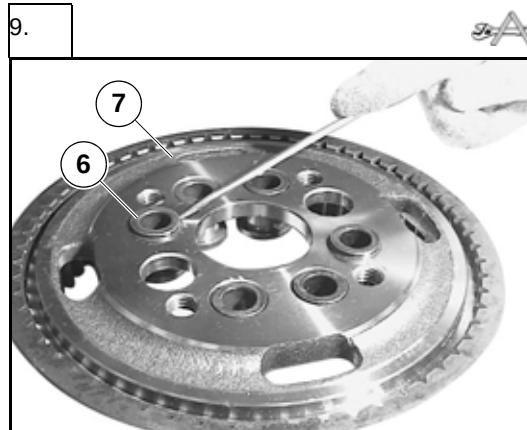
Insert the seal ring (13) into the wheel hub (11) with the special tool CA715509 and a hammer.

**NOTE:** Do not lubricate the seal ring (13).



Assemble the bearing cone (12) on the swivel housing (14) end.

Assemble the wheel hub (11) on the swivel housing (14) and fit the bearing cone (9).



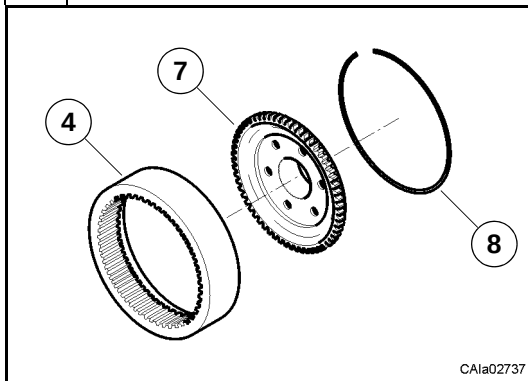
Position the wheel carrier (7) on a workbench and force the bushes (6) to the carrier surface level with the special tool CA715086.

At least two bushes (diametrically-opposed) should be set slightly higher than the carrier surface level to be used as dowel pins.



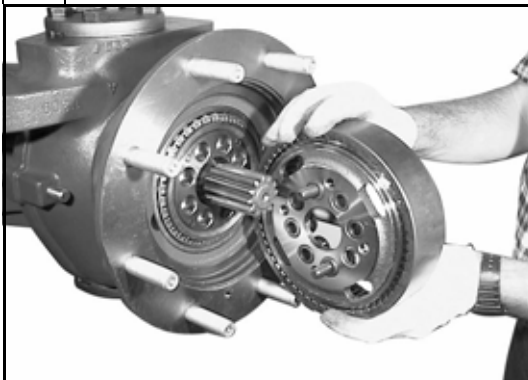
# Disassembly and Assembly Operations

10.



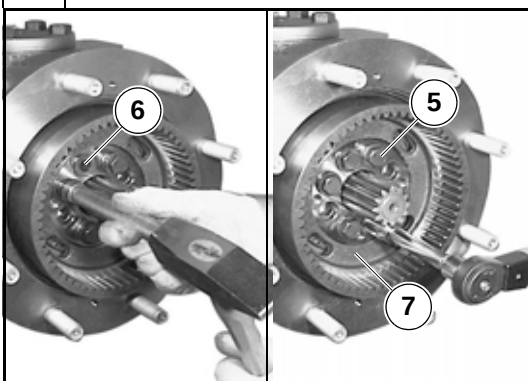
Pre-assemble the wheel carrier (7) and the epicyclic ring gear (4) with the lock ring (8) shown in figure.

11.



Assemble the wheel carrier group on the wheel hub using the two projecting bushes as dowel pins and screw the relative screws (5) in order to put in contact the ring bevel gear with the wheel hub.

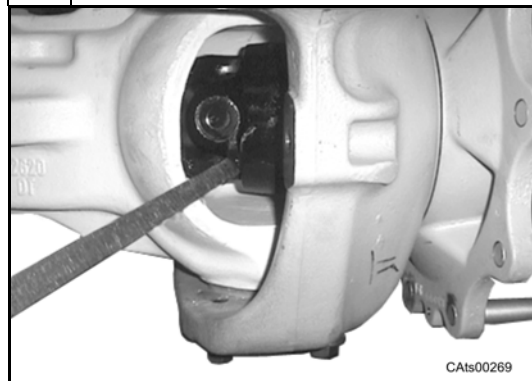
12.



Force all the hub dowel bushes (6) completely with the special tool CA715086 and a hammer.

Assemble the wheel carrier (7) fastening bolts (5) and tighten to the requested torque (see C.8).

13.



Insert a lever between the swivel housing (14) and the axle beam and fit it into the double U-Joint.

With the lever push the double U-Joint in the direction of the wheel hub to make easier the lock ring (1) insertion.

14.



Slide the thrust washers (2) and (3) onto the double U-Joint shaft end (24).

Insert the lock ring (1) at the end of the splined hub and push it into its seat.

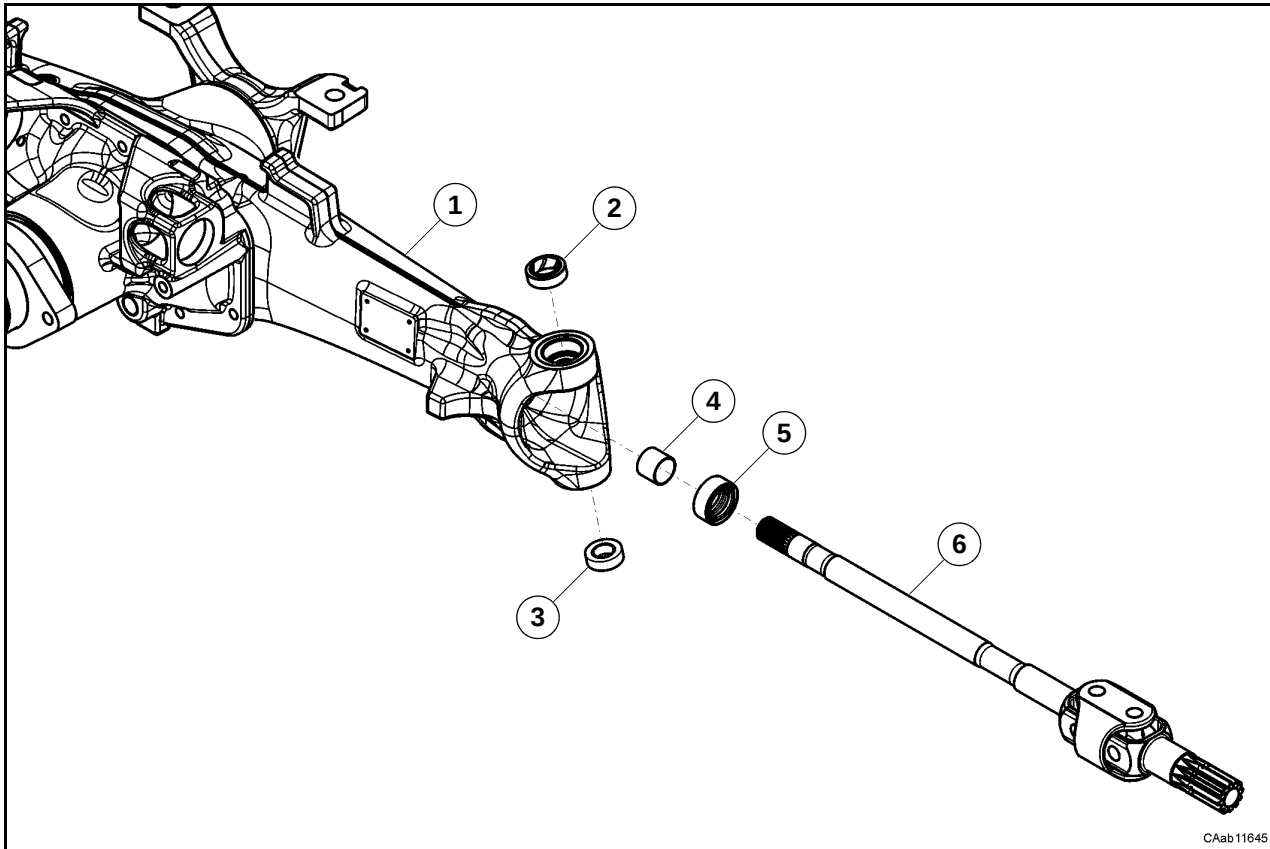
**NOTE:** Check that the lock ring (1) is correctly fitted in its seat.

Push the double U-Joint thoroughly.



# Disassembly and Assembly Operations

## AXLE BEAM GROUP

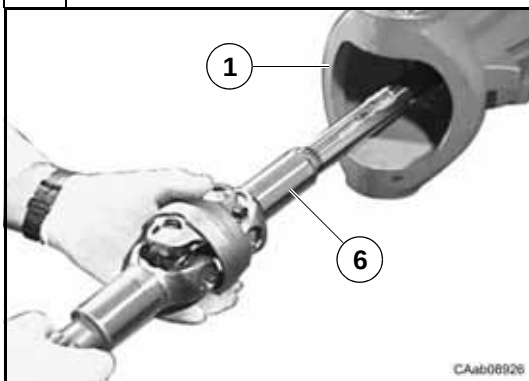


### Disassembly

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.

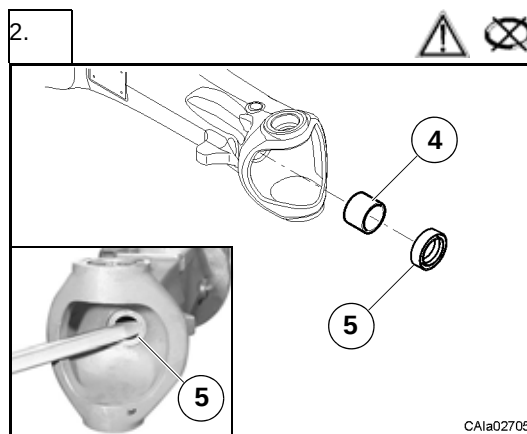
Refer to: [previous sections](#) before disassemble this group.

1.



Remove the two double U-Joints (6) from the axle beam (1).

2.



Remove the seal rings (5) from the axle beam (1).

**NOTE:** Destructive operation for the seal rings.

Remove the bush (4) from the axle beam (1) only if the wear conditions require this.

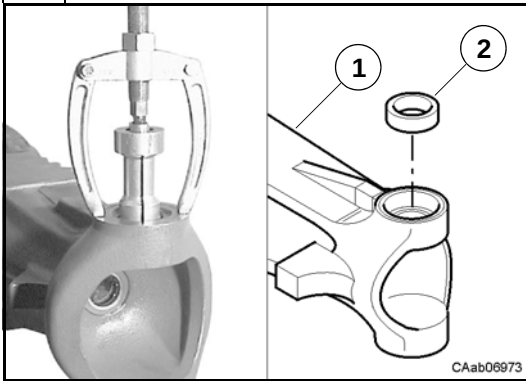


### Warning

Be careful not to damage the bush seat.

# Disassembly and Assembly Operations

3.

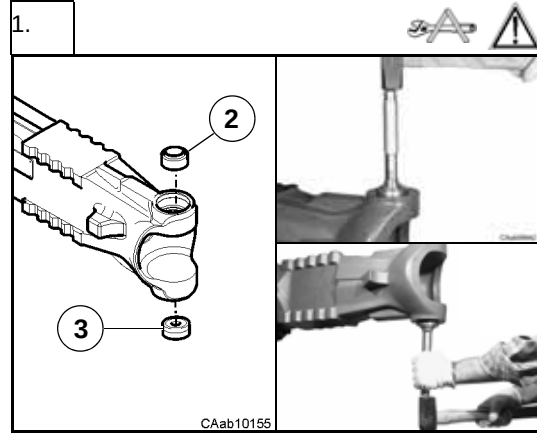


Remove the upper king pin bush (2) and the ball bearing cup (3) from the king pin seats using a suitable extractor only if the wear conditions require this.

## Assembly

Some of the following pictures may not show exactly your axle, but the process is the same.

1.



Cool the upper king pin bush (2) and the ball bearing cup (3) at a temperature lower than  $-100^{\circ}\text{C}$  with liquid nitrogen.



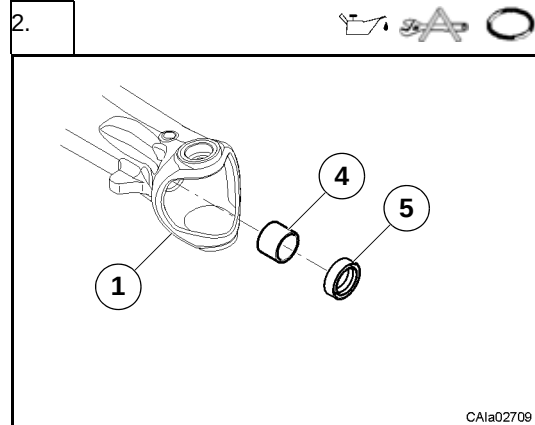
## Warning

**Wear safety gloves.**

Assemble the upper bush (2) on the upper king pin seat with the special tool CA119220 and a hammer.

Assemble the ball bearing cup (3) on the lower king pin seat with the special tool CA715451 and a hammer.

2.



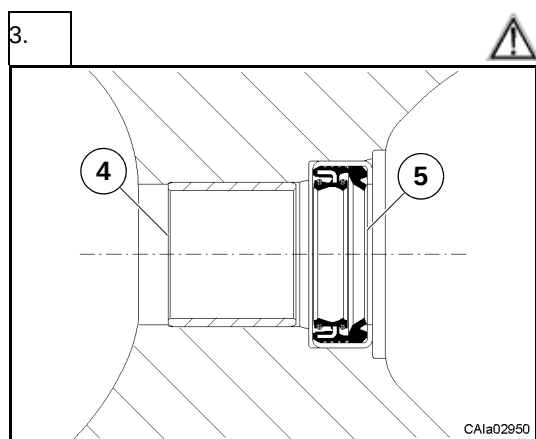
Assemble the bush (4) on the axle beam (1) with the special tool CA715649 and a hammer.

Assemble the seal ring (5) on the axle beam with the special tool CA715087 and a hammer.

[Refer to: next point.](#)

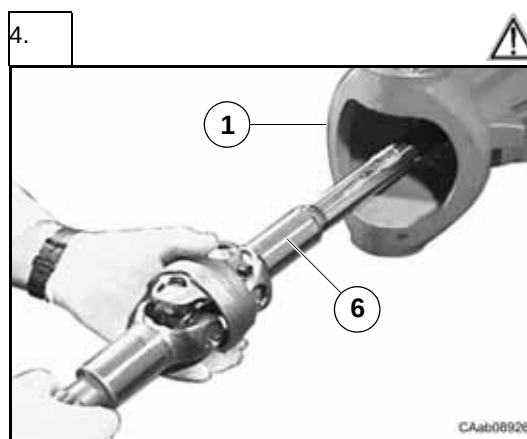
**NOTE:** Grease carefully the seal rings (see C.6).

## Disassembly and Assembly Operations



### Warning

Assemble the seal ring (5) as in figure.

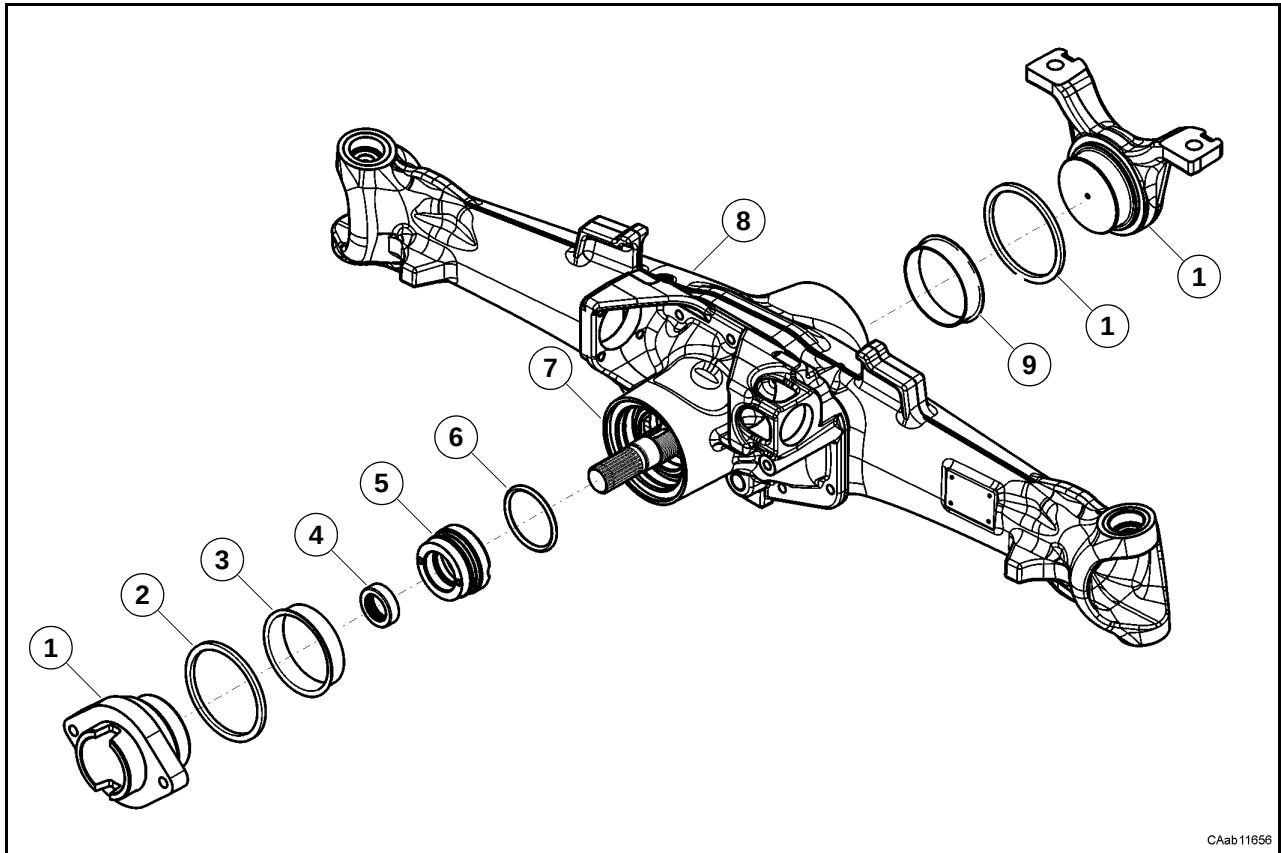


### Warning

Be careful not to damage the seal ring (5).

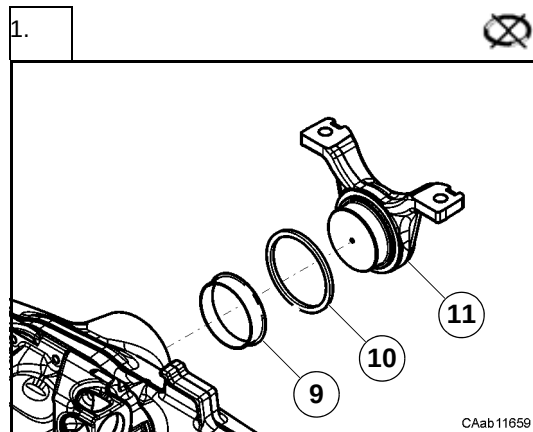
# Disassembly and Assembly Operations

## TRUNNIONS GROUP



### Disassembly

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.

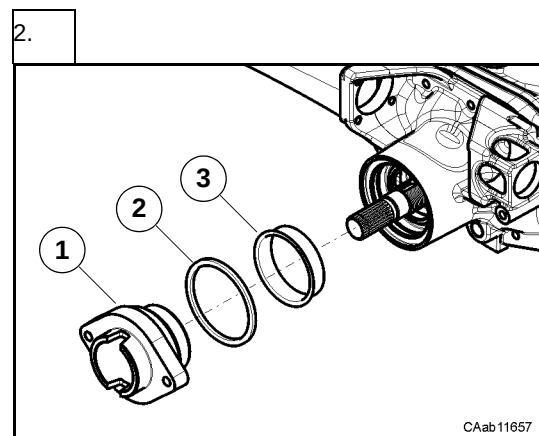


Remove the front support (11) from the axle housing (8).  
Remove the V-ring (10) from the axle.

**NOTE:** Destructive operation for the V-ring.

Remove the bush (9).

**NOTE:** Destructive operation for the bush.



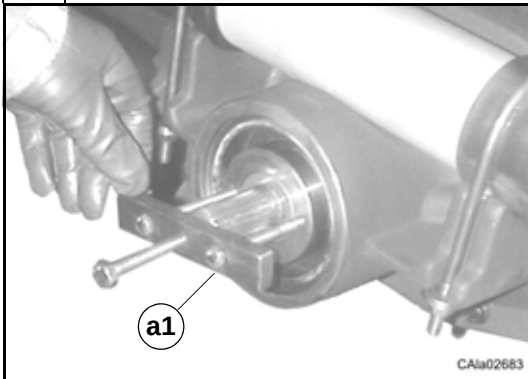
Remove the rear support (1).

Remove the V-ring (2) and the bush (3) from the differential support (7).

**NOTE:** Destructive operation for the V-ring.

# Disassembly and Assembly Operations

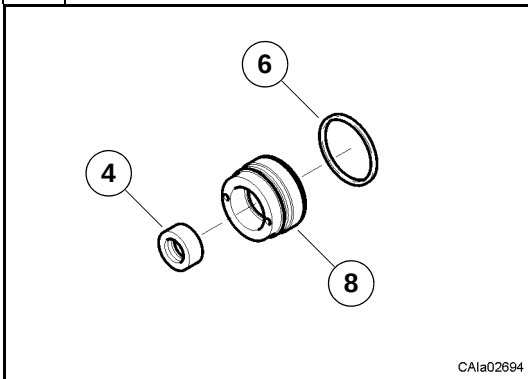
3.



Remove the sleeve (5) from differential support with an extractor (a1).

**NOTE:** Use the M8 threaded extraction holes.

4.



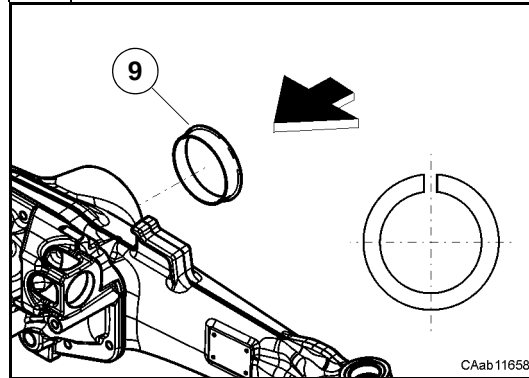
Remove the seal rings (4) and (6) from the sleeve (8).

**NOTE:** Destructive operation for the seal rings.

## Assembly

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.

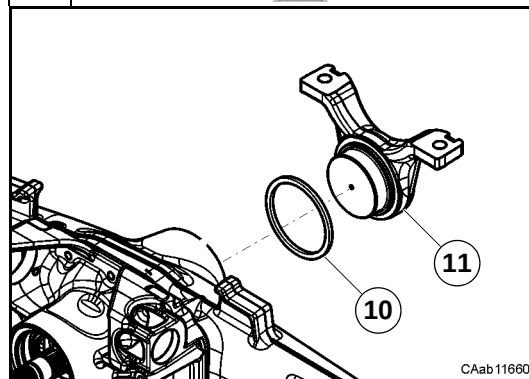
1.



Insert the bush (9) into the axle beam (8) with the special tool CA715643 and a hammer.

**NOTE:** Position the bush with the cut upward as shown.

2.



Insert the V-ring (10) in the axle beam (8) with the special tool CA715656 and a hammer.



## Warning

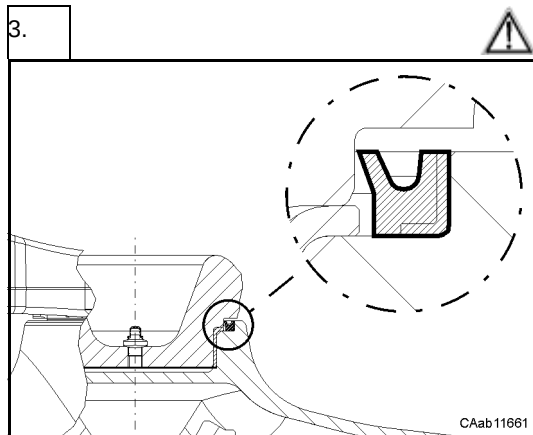
**The seal lip must be positioned on the external side.**

[Refer to: next point.](#)

Lubricate the seal ring (10) (see C.6).

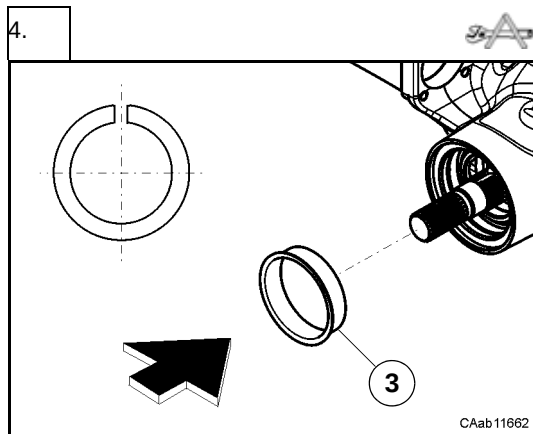
Assemble the front support (11) to the axle beam (8).

# Disassembly and Assembly Operations



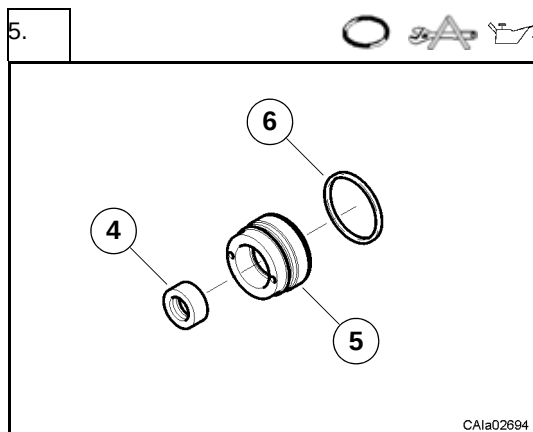
## Warning

The seal lip of the V-ring (10) must be positioned on the external side.



Insert the bush (3) into the differential support with the special tool CA715643 and a hammer.

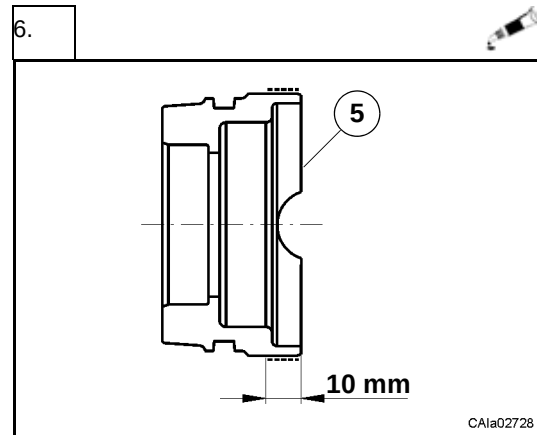
**NOTE:** Position the bush as shown.



Assemble the seal ring (4) to the sleeve (5) with the special tool CA715644 and a hammer.

Assemble the O-ring (6) to the sleeve (5).

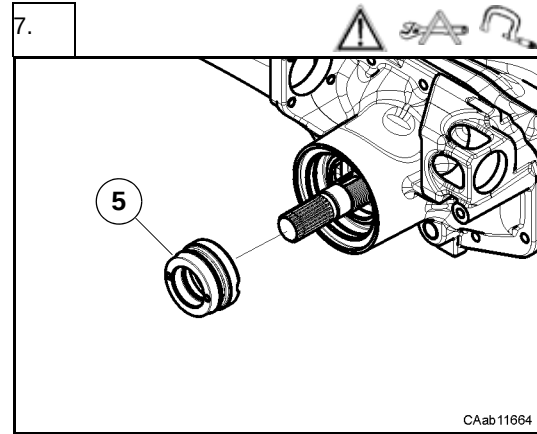
Lubricate the O-ring (6).



Apply sealant on the sleeve (5).

**NOTE:** Apply sealant on indicated surface only.

Refer to: C.7



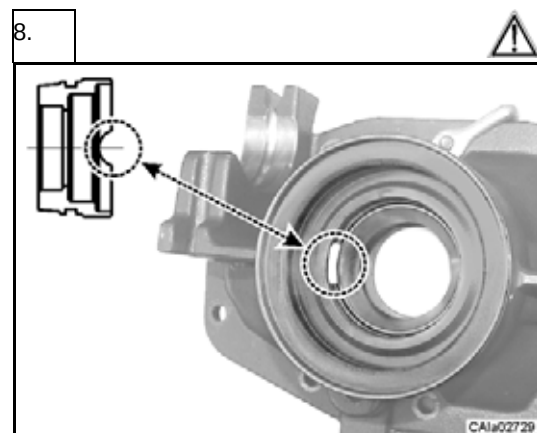
Assemble the sleeve (5) to differential support.



## Warning

Align bushing slots and lube oil holes.

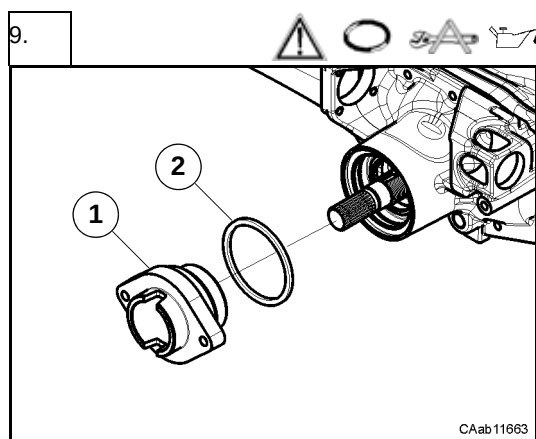
Refer to: next point.



## Warning

Bushing slot must be positioned on lube oil holes.

# Disassembly and Assembly Operations



Insert the V-ring (2) in the differential support with the special tool CA715656 and a hammer.



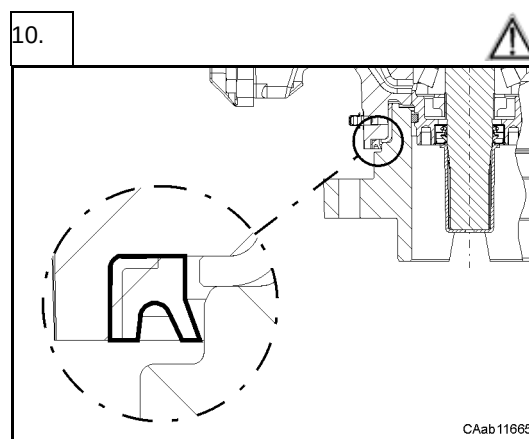
## Warning

**The seal lip must be positioned on the external side.**

[Refer to: next point.](#)

Lubricate the V-ring (2).

Assemble the rear support (1) to differential support.



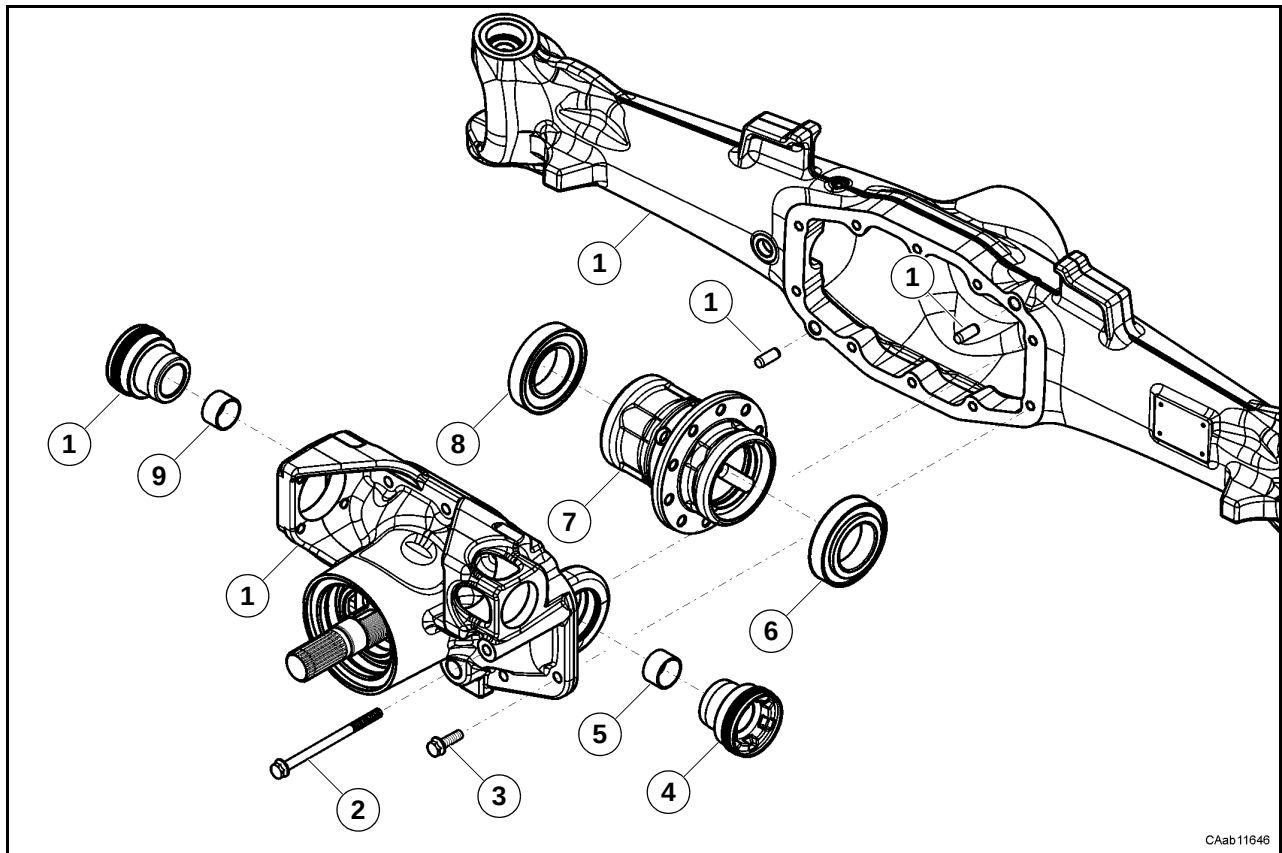
## Warning

**The seal lip of the V-ring (2) must be positioned on the external side.**



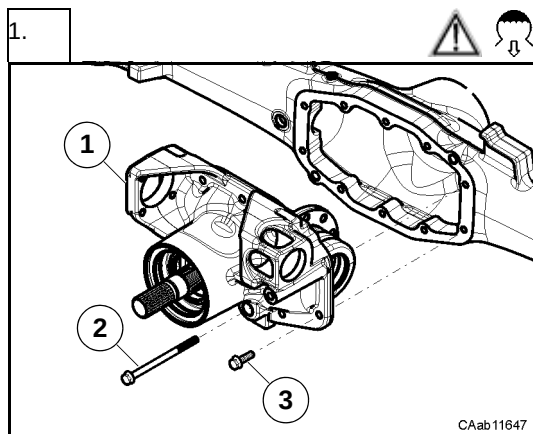
# Disassembly and Assembly Operations

## DIFFERENTIAL SUPPORT GROUP



### Disassembly

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.



Drain the oil completely from the differential.

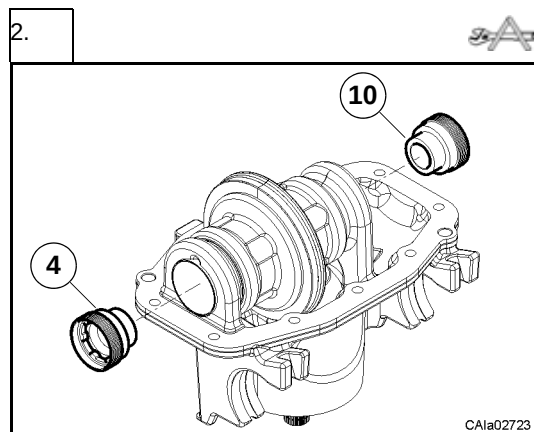
**NOTE:** See C.5 to drain the oil.

Screw out the screw (2) and the screws (3) and remove the differential support (1).



### Warning

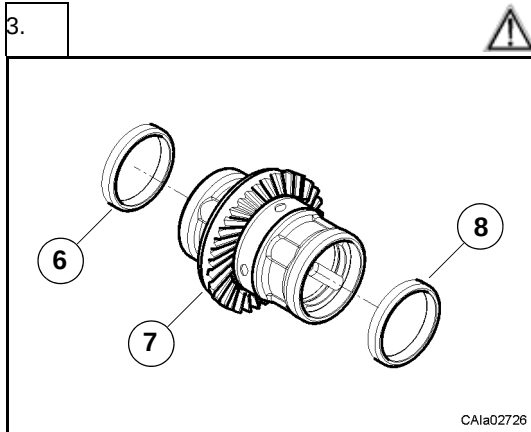
Support the differential support (1) with a rope or other appropriate means.



Unscrew the adjuster ring nuts (4) and (10) using the special tool CA715651.

**NOTE:** Destructive operation for the ring nuts (4) and (10).

# Disassembly and Assembly Operations



Remove the differential housing (7).

The bearing cones (6, 8) are removed together with the differential housing.

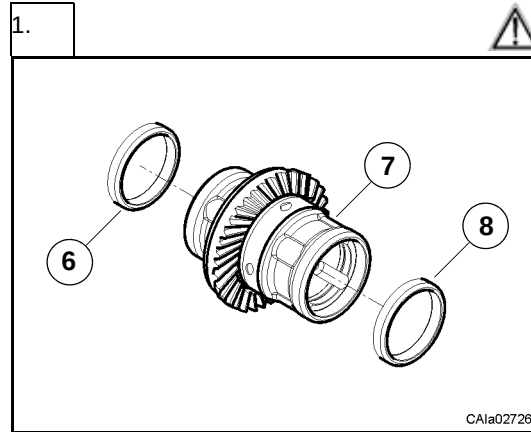


## Warning

**Do not invert the bearing cone if the bearings are not replaced.**

## Assembly

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.

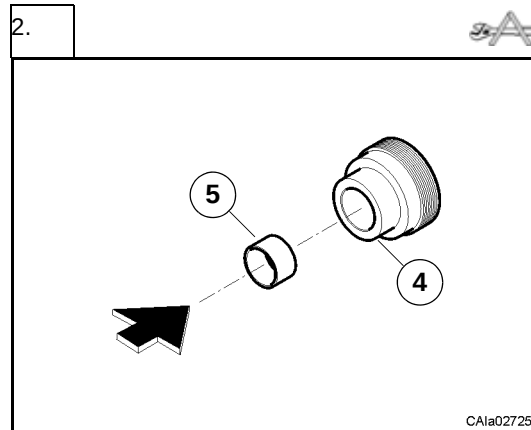


Assemble the bearings cone (6, 8) on the differential housing (7).



## Warning

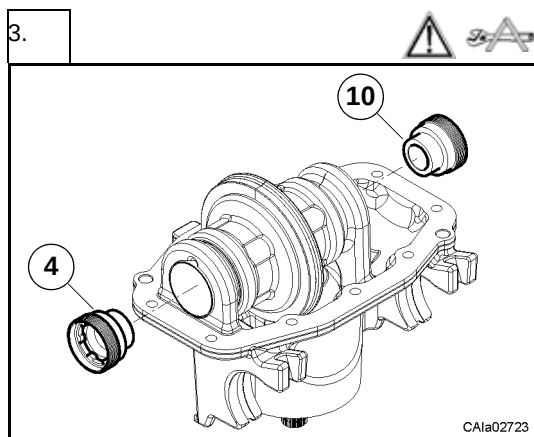
**Do not invert the bearing cones if the bearings are not replaced.**



Assemble the bushes (5) and (9) to the new ring nuts (4) and (10) with the special tool CA715652 and a hammer.

**NOTE:** Use new bushes only.

# Disassembly and Assembly Operations



Position the complete differential box with bearings on the differential carrier (1).



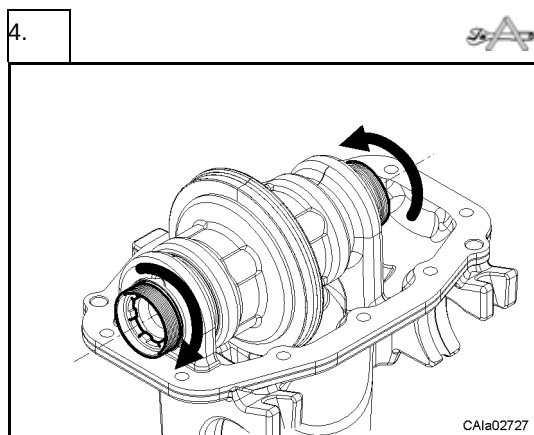
## Warning

**Check the right side of the bevel crown assembly.**

Move the differential group so to place the bevel crown gear on the pinion.

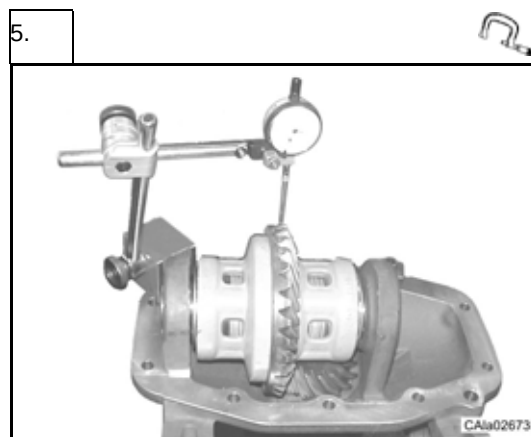
Insert the adjuster ring nuts (4) and (10).

**NOTE:** Use new ring nuts only.

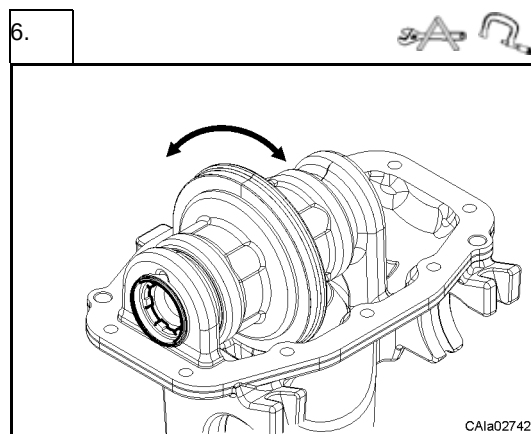


Assemble and tighten both adjuster ring nuts (4) and (10) in the differential support with special tool CA715651, till the backlash is eliminated and the differential bearings are slightly preloaded.

**NOTE:** Check that the differential bearings are well settled; if necessary, knock slightly with a soft hammer, in order to properly set the bearings in position.



Position a magnetic-base dial gauge on the differential support, so that the feeler stylus touches the surface of one tooth of the crown gear with a 90° angle.



Lock the pinion and move the crown gear alternatively and note the pinion-ring gear backlash, measured with the comparator.

Repeat the operation on two or more points (teeth), rotating the crown gear, so that to obtain an average value.

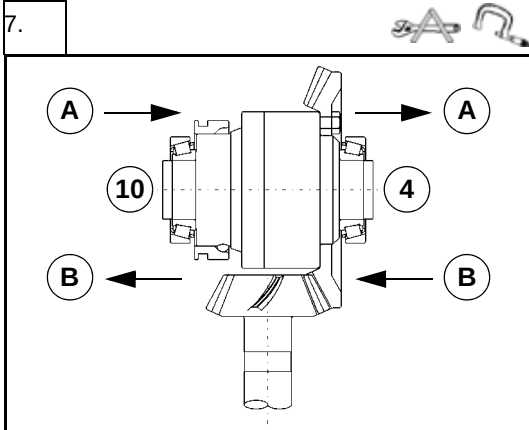
Check if the measured backlash value is within the requested range:

0.17÷0.23 mm axle CA642064

0.24÷0.32 mm axle CA642094

Carry out the adjustment by operating on the adjuster ring nuts (4) and (10) with the appropriate tool CA715651.

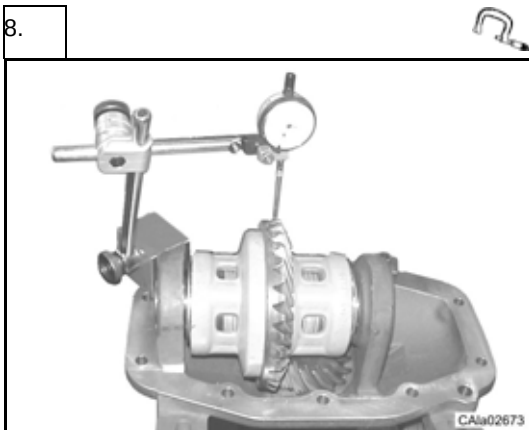
# Disassembly and Assembly Operations



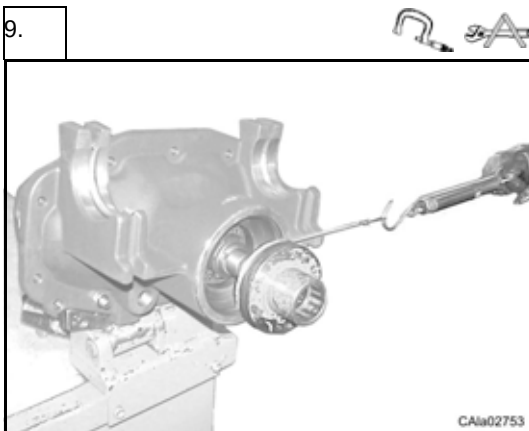
Adjust the ring nuts (4) and (10), remembering that:

(A)- if the measured backlash is greater than the given tolerance range, unscrew the adjuster ring nut (10) and screw in the adjuster ring nut (4) by the same measure;

(B)- if the measured backlash is less than the given tolerance range, unscrew the adjuster ring nut (4) and screw in the adjuster ring nut (10) by the same measure.

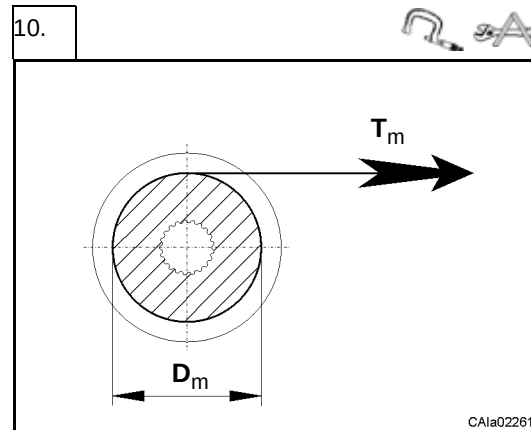


Repeat the whole sequence of the above mentioned operations till the indicated conditions are reached.



Once the pinion-ring gear backlash has been established, measure the total preloading  $T_m$  of the bearings (pinion-crown bevel gear system), using a dynamometer whose

cord is wound on the special tool CA715657 inserted on the pinion splined end.



The total preloading  $T_m$  is measured on the special tool CA715657 (gauge diameter  $D_m = 91.5$  mm).

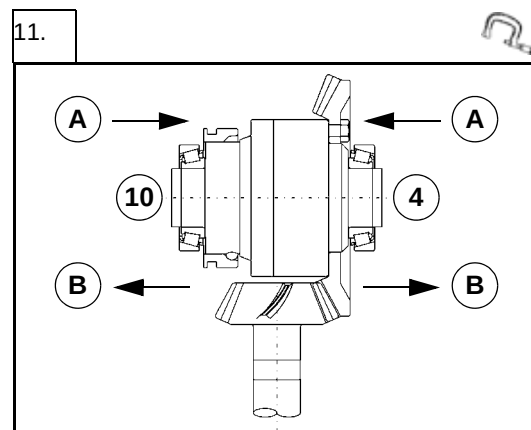
The measured value should be within the following range:

$$T_m = (P_m + 13.0) \div (P_m + 19.5) \text{ N axle CA642064}$$

$$T_m = (P_m + 15.6) \div (P_m + 23.4) \text{ N axle CA642094}$$

where  $P_m$  is the effectively preloading measured on the special tool CA715624 (gauge diameter  $D_m = 91.5$  mm).

Refer to: See: D.8.

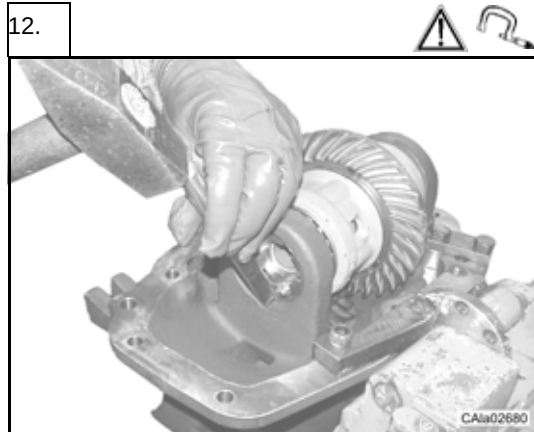


If the measurement is not within the requested range, check well the assembly of each component and operate on the adjuster ring nuts (4) and (10) of the differential support:

(A)- if the total preloading is less than the given range, screw in both adjuster ring nuts (4) and (10) by the same measure, keeping the pinion-ring gear backlash value unchanged;

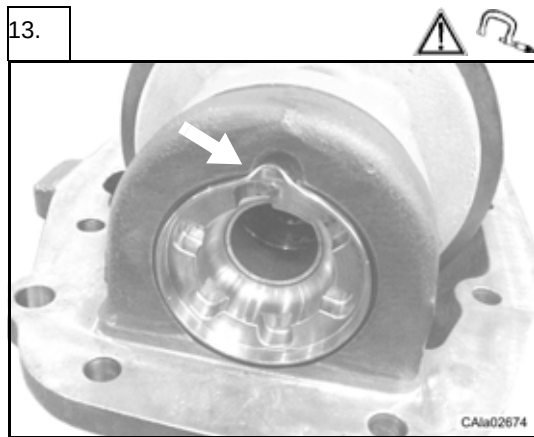
(B)- if the total preloading is greater than the given range, unscrew both adjuster ring nuts (4) and (10) by the same measure, keeping the pinion-ring gear backlash value unchanged.

# Disassembly and Assembly Operations



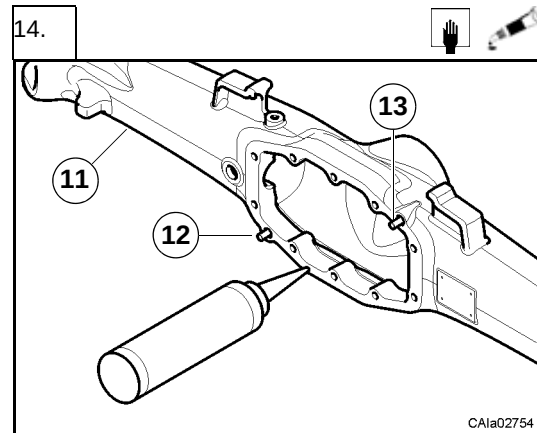
Once all the adjustment operations have been completed, chalk the adjuster ring nuts (4) and (10).

[Refer to: next point](#)



## Warning

Chalk with care the adjuster ring nuts (4) and (10).

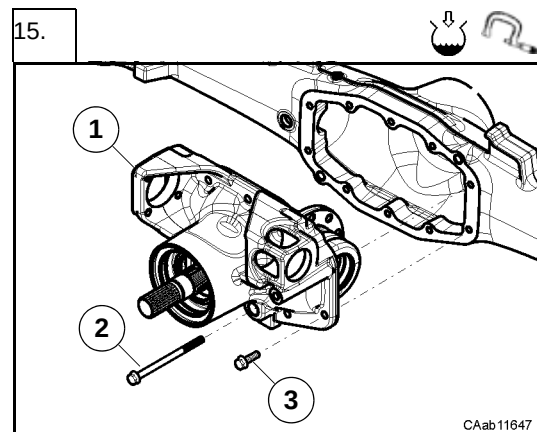


Before matching surfaces, make sure that they are perfectly clean, de-grease and clean them with appropriate detergents.

Spread a film of adhesive on the contact surface between the axle beam (11) and the differential carrier (1).

[Refer to: C.7](#)

**NOTE:** Check that two dowel pins (12, 13) are in their housing.



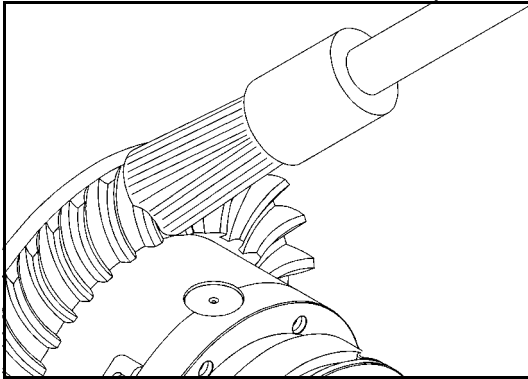
Assembly the differential carrier (1) to the axle housing (11), and tighten the fastening screw (2) and the fastening screws (3) to the requested torque (see C.8).

[Refer to: C.5 to top up the oil.](#)

# Disassembly and Assembly Operations

## Bevel gear marking test

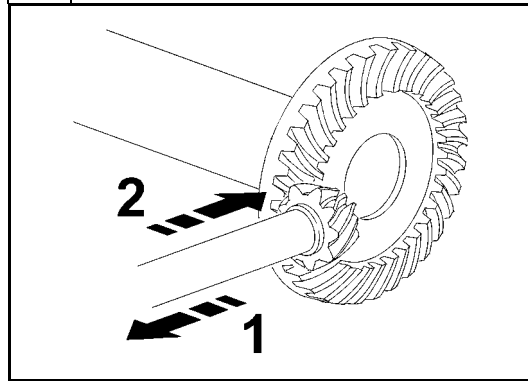
1.



**NOTE:** To test the marks of the bevel gear teeth, paint the ring gear with red lead paint.

**NOTE:** The marking test should be always carried out on the ring bevel gear teeth and on both sides.

3.

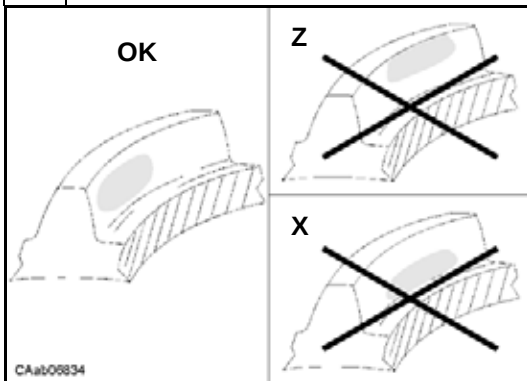


*Movements to correct:*

1 -> move the pinion for type X contact adjustment

2 -> move the pinion for type Z contact adjustment.

2.



*OK -> Correct contact:*

If the bevel gear is well adjusted, the mark on the teeth surfaces will be regular.

*Z -> Excessive contact on the tooth tip:*

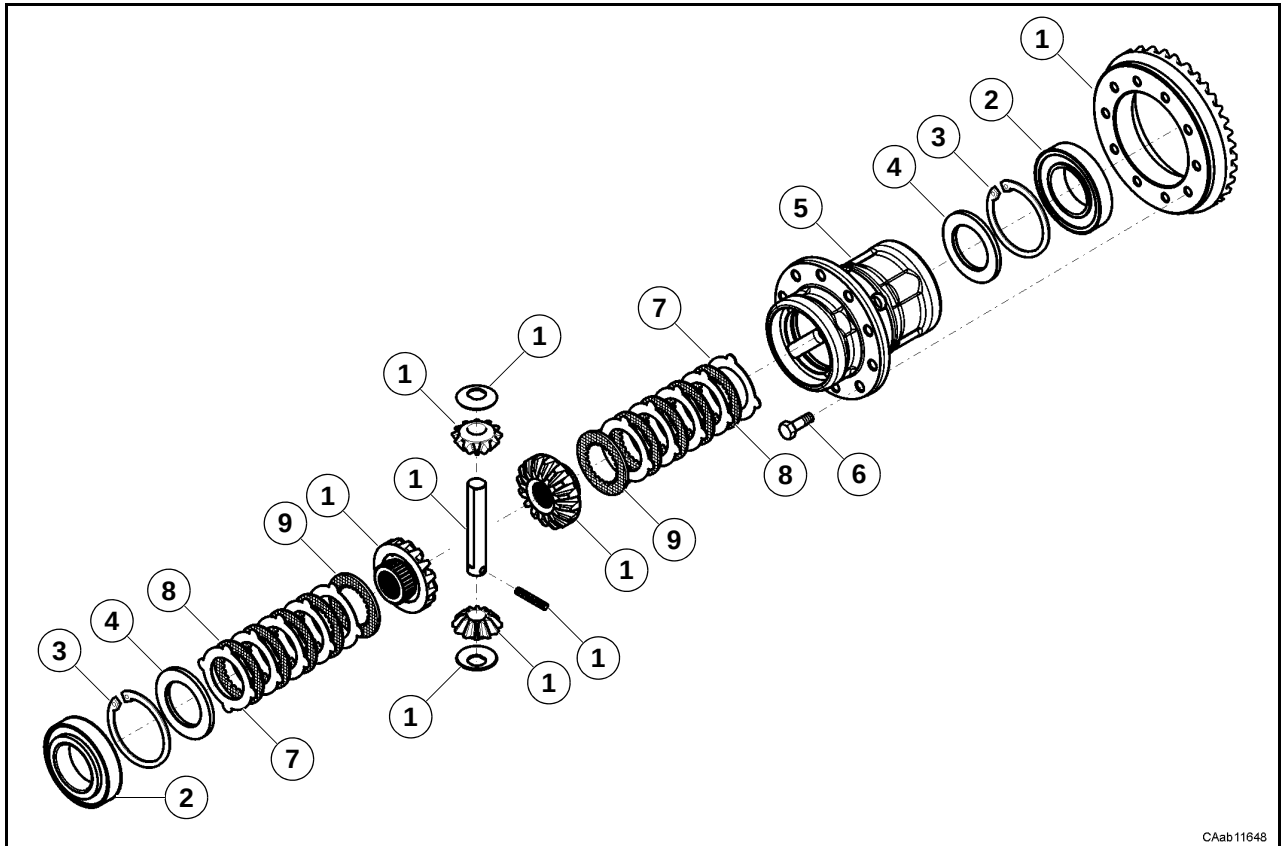
Approach the pinion to the ring bevel gear and then move the ring bevel gear away from the pinion in order to adjust the backlash.

*X -> Excessive contact at the tooth base:*

Move the pinion away from the ring bevel gear and then approach the ring bevel gear to the pinion in order to adjust the backlash.

# Disassembly and Assembly Operations

## DIFFERENTIAL GROUP

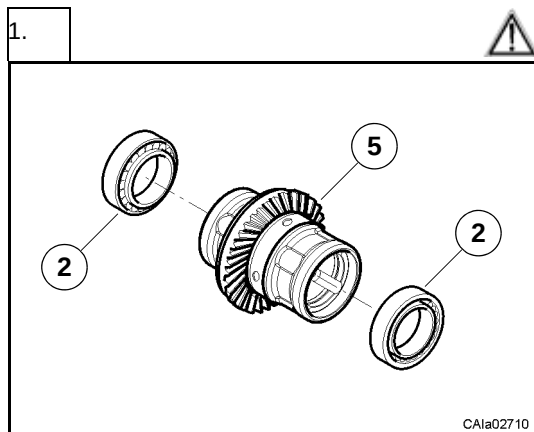


CAab 11648

### Disassembly

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.

Refer to: [section D.6 before disassemble the differential group.](#)



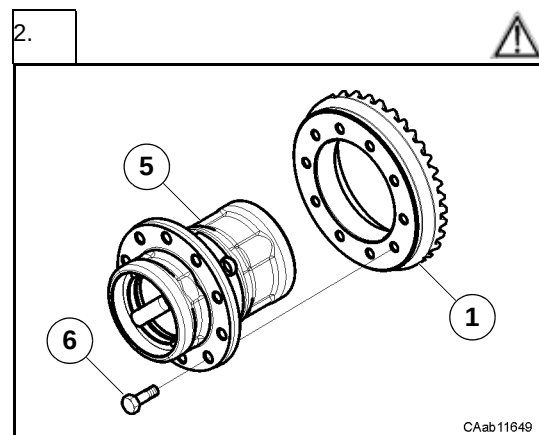
CAIa02710

Remove the bearing cups (2) from differential housing (5).



### Warning

**Do not invert the bearing cups if the bearings are not replaced.**



CAab 11649

Remove the screws (6) and remove the bevel gear crown (1).



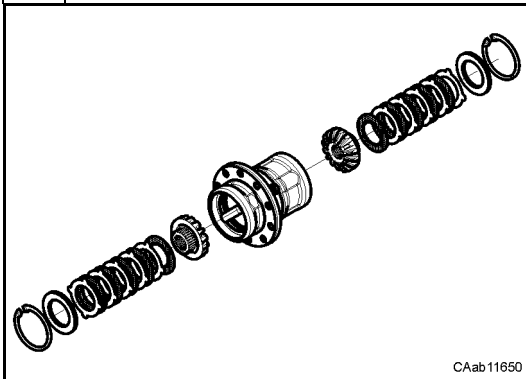
### Warning

**This operation make free the spider (11).**



# Disassembly and Assembly Operations

3.

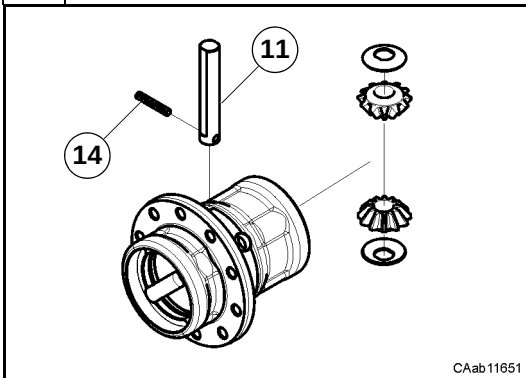


CAab 11650

Remove the snap rings (3).

Extract washers (4), counterdisks (7), disks (8, 9) and sun gear (10).

4.



CAab 11651

Extract pin (14).

Extract the spider (11).

Collect all the components.

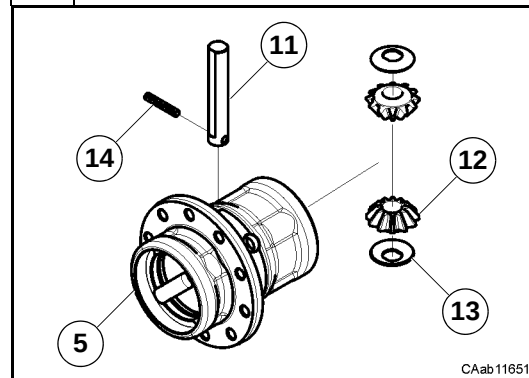
Check the operating and wear conditions of the components.

## Assembly

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.

**NOTE:** Assemble the pinion group before proceeding with differential group assembly.

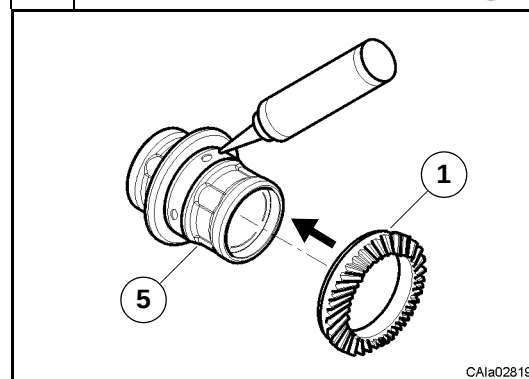
1.



CAab 11651

Position the differential box (5) on a workbench and assemble: spider (11), planetary gears (12), thrust washers (13), pin (14) as shown in figure.

2.

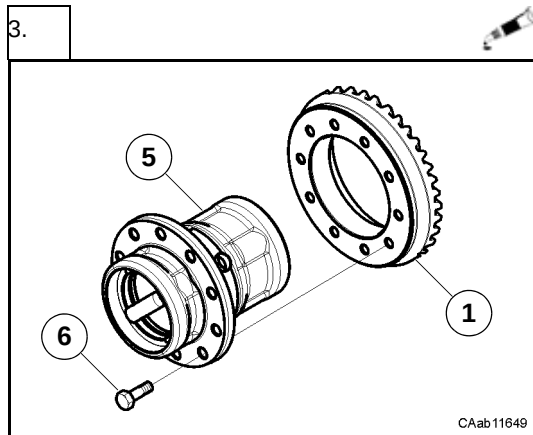


CAIa02819

Before assembling the crown gear (1), spread a film of adhesive on the differential box (5) on the contact surface box/crown gear.

[Refer to: C.7](#)

# Disassembly and Assembly Operations

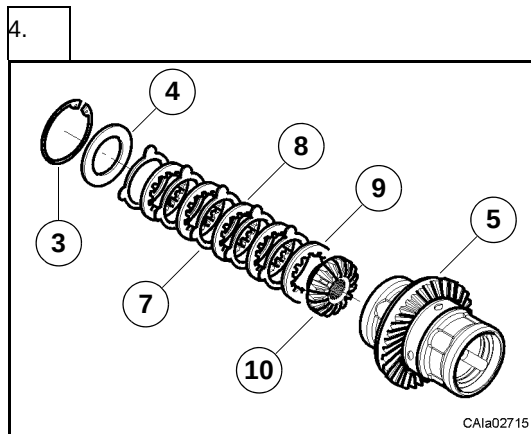


Assemble the crown gear (1) to the differential box (5).

Apply the prescribed sealant (see C.7) on fastening bolts (6).

Assemble the bolts (6) and tighten them to the requested torque

Refer to: C.8

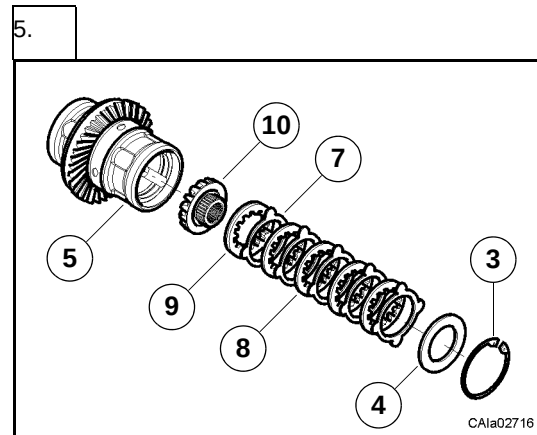


Position the differential box (5) on a workbench and assemble these inner components: sun gear (10), locking differential disks (8) and (9), locking differential counterplate (7) and washer (4), as shown in figure.

**NOTE:** The first disk (9) must be assembled with friction material on the disks side and the flat surface on the sun gear (10) side.

Refer to: C.4.

Assemble the snap ring (3).

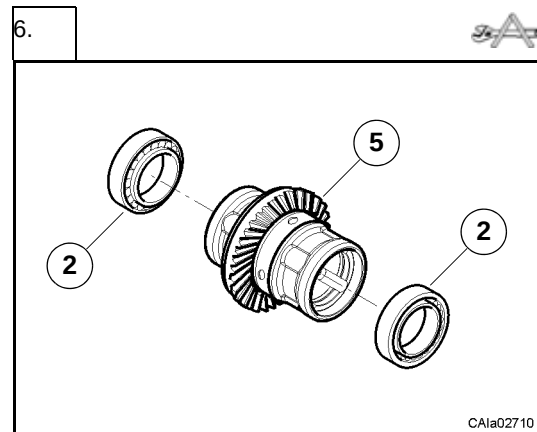


Assemble the inner components on the other side of the box (5): sun gear (10), disks (8) and (9), counterplate (7) and washer (4), as shown in figure.

**NOTE:** The first disk (9) must be assembled with friction material on the disks side and the flat surface on the sun gear (10) side.

Refer to: C.4.

Assemble the snap ring (3).



Assemble the bearing cups (2) to the differential housing (5) with the special tool CA715299 and a hammer.

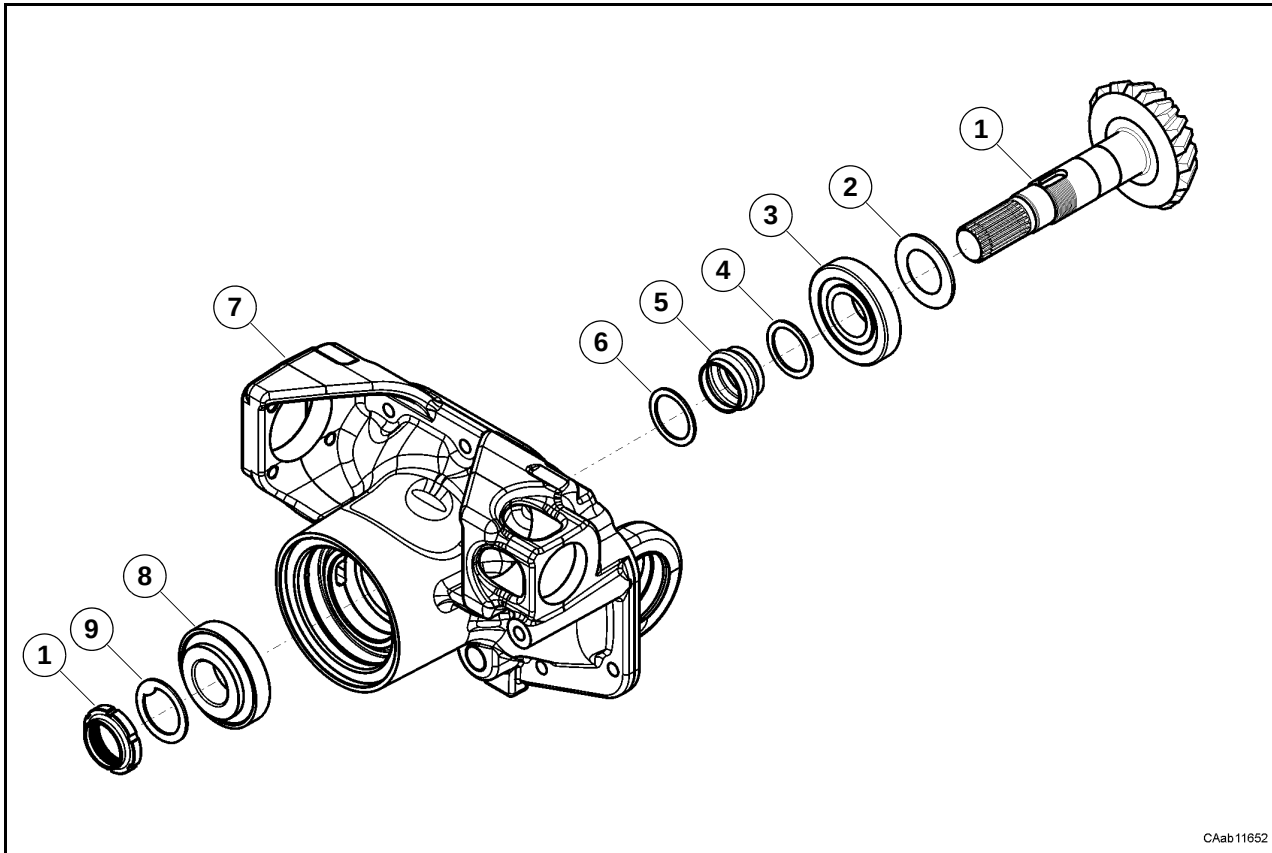


## Warning

**Do not invert the bearing cups if the bearings are not replaced.**

## Disassembly and Assembly Operations

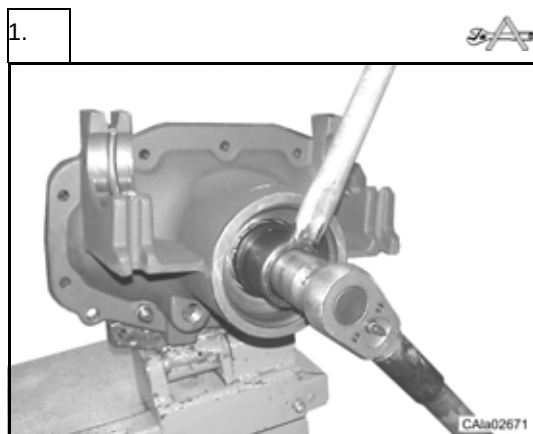
## PINION GROUP



## Disassembly

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.

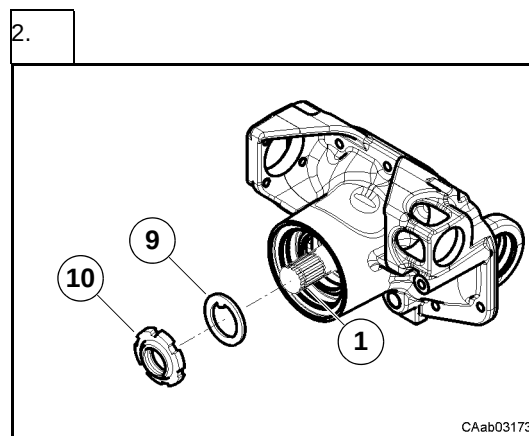
**NOTE:** Remove the differential group before proceeding with the pinion group disassembly.



Lock the differential carrier with a vice.

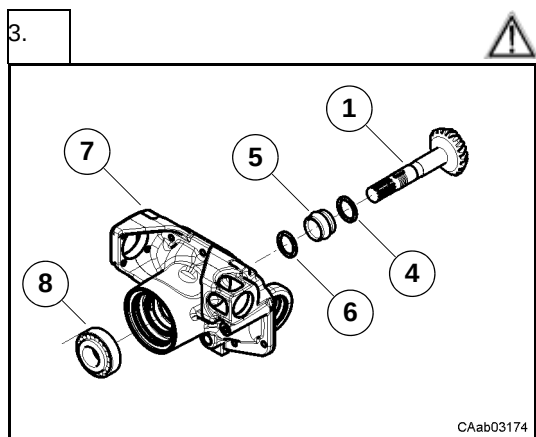
Unscrew the lock nut (10) using special tools CA715080 and CA715107.

**NOTE:** This operation will irretrievably damage the lock nut (10).



Remove the ring nut (10) and collect its retaining washer (9).

# Disassembly and Assembly Operations



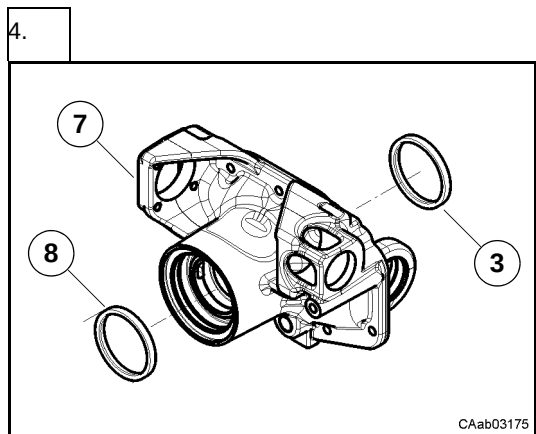
Tap the shaft with a soft hammer to remove the bevel pinion (1).



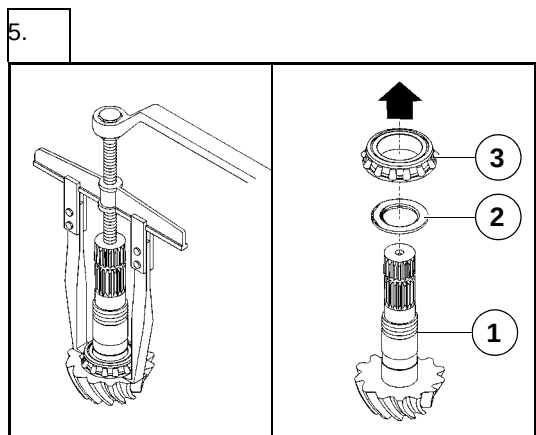
## Warning

**Take care not to drop the bevel pinion (1).**

Collect the washers (4) and (6), the collapsible spacer (5) and the bearing cone (8).

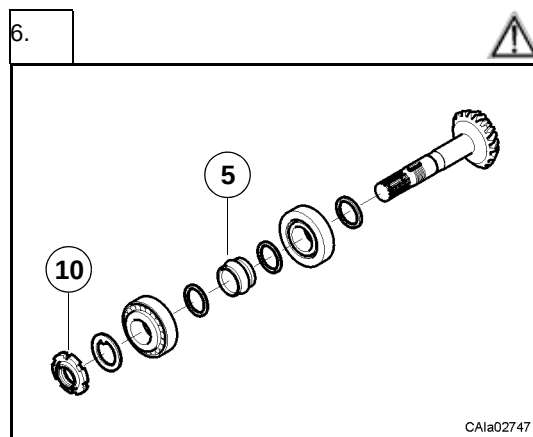


Remove the bearing cups (3) and (8) from the differential carrier (7) using a drift and a hammer.



To remove the cone of the tapered roller bearing (3) of the bevel pinion (1), use a standard extractor.

Collect the bearing cone (3) and the underlying shim (2).



Check all pinion components for wear.

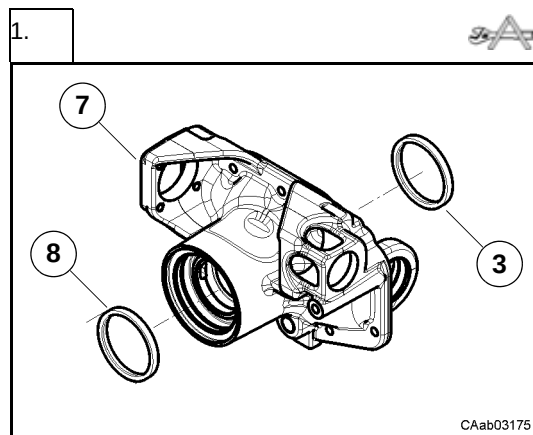


## Warning

**The ring nut (10) and the collapsible spacer (5) must be replaced when reassembling the unit.**

## Assembly

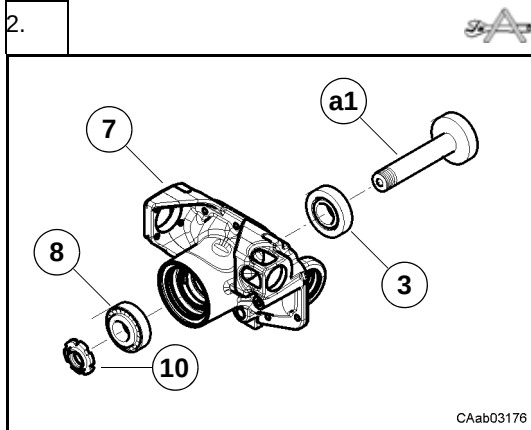
Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.



Place the differential support (7) on a workbench.

Fit the bearing cups (3) and (8) using the special drift CA715654 and a hammer.

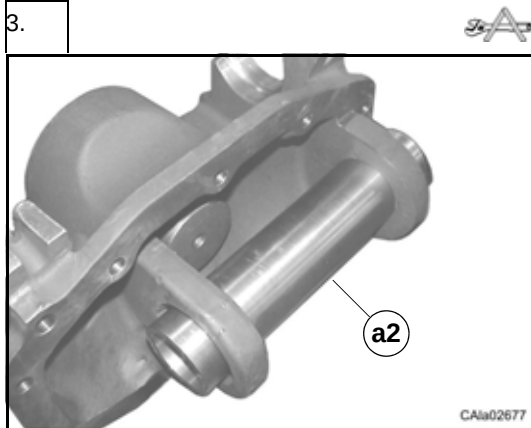
# Disassembly and Assembly Operations



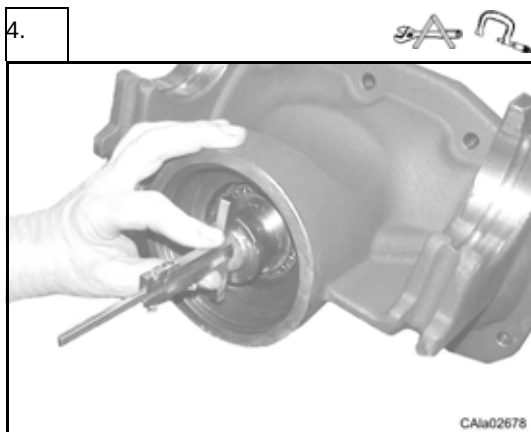
Insert bearing cones (3) and (8) in their housings.

Assemble the false pinion CA715653 (a1) and its ring nut (10).

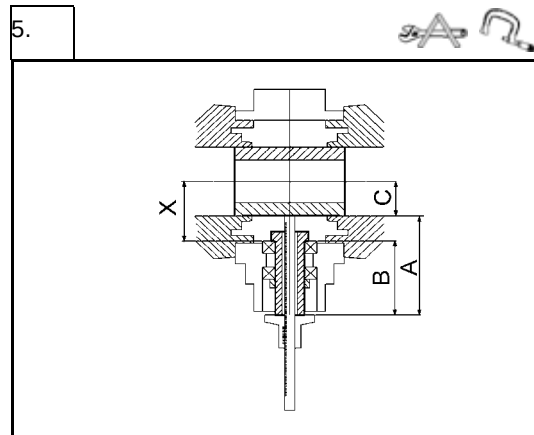
Tighten without exceeding the ring nut, till the backlash is eliminated.



Install special tool CA715654 (a2) to the differential group supports (7).



Use a depth gauge to measure distance "X" (distance between the axis of the differential bearings and the point at which the pinion head is supported, or base of the bearing).

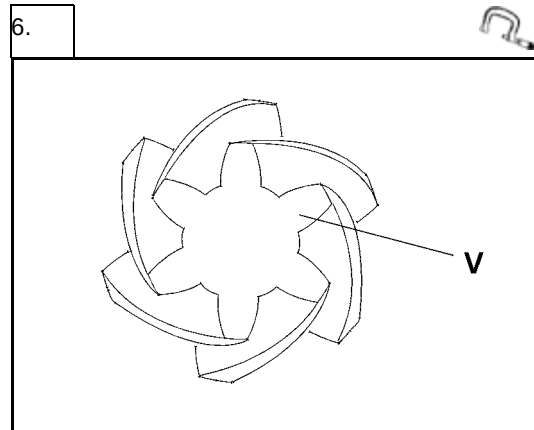


To adjust bevel gear/pinion measure the distance "A" with a depth gauge.

Calculate the value "X" as follows:

$$X = (A + C) - B \text{ mm}$$

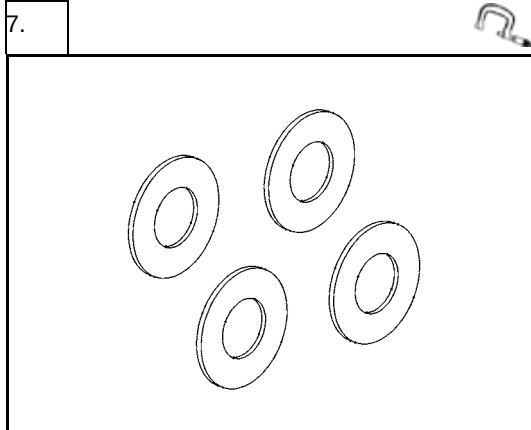
where "B" and "C" are known.



In order to determine the necessary thickness value (S) between the pinion and the bearing, subtract the value (V), stamped on the pinion head (V=requested distance), from the measured value (X).

$$S = X - V \text{ mm}$$

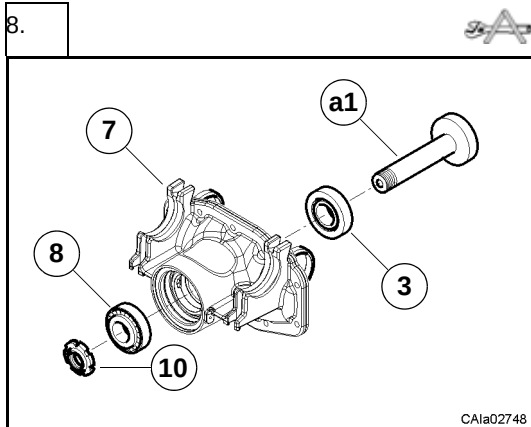
# Disassembly and Assembly Operations



Select the shim (2) of thickness value (S) among the range of available shims.

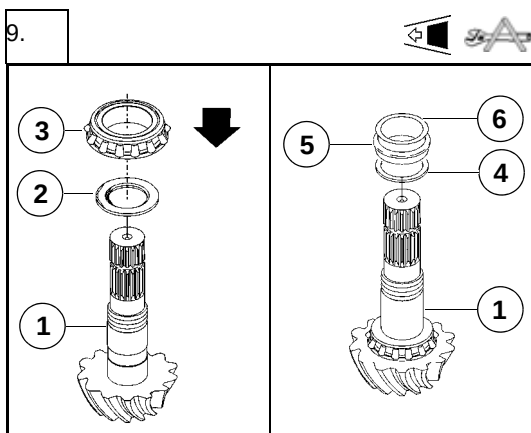
## SHIMS RANGE

| Thickness - mm | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Q.ty           | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |



Remove the special tool CA715654 to the differential group supports (7).

Remove the ring nut (10), the false pinion CA715653 (a1) and the bearing cones (3) and (8).

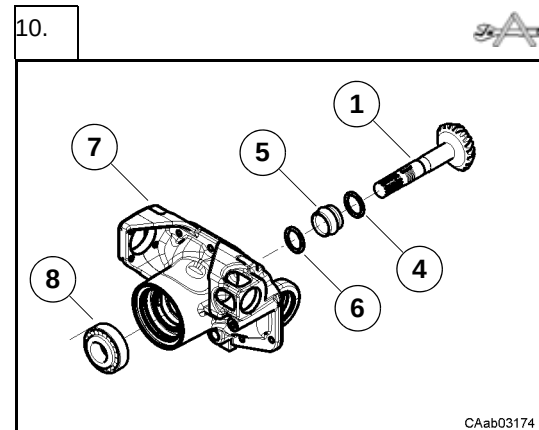


Insert the chosen shim (2), with the chamfer against the gear, into the pinion shaft (1).

Force the bearing (3) into the pinion shaft (1) with the special tool CA715082 under a press, making sure that it is well set.

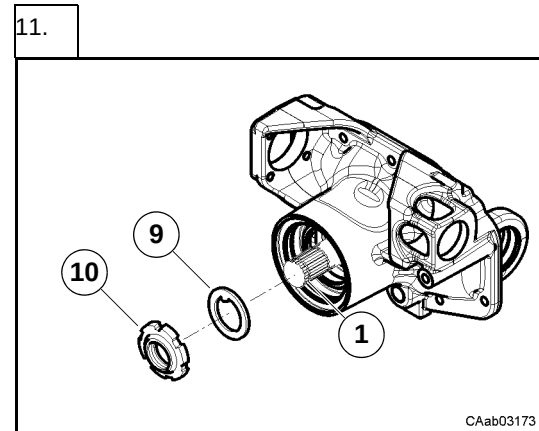
Insert the shims (4) and (6) and a new collapsible spacer (5).

**NOTE:** Use always a new collapsible spacer (5).



Insert the bevel pinion (1) unit into the differential support housing (7) and the bearing cone (8) on the pinion shaft, as shown in figure.

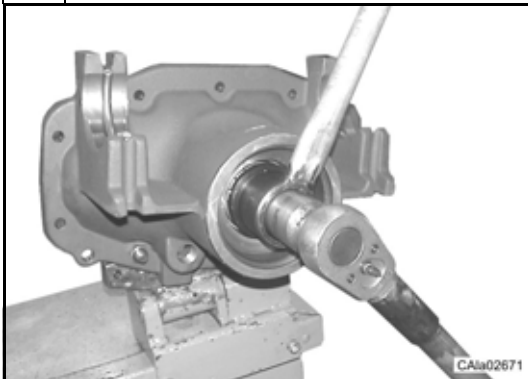
Use the special tool CA715082 and a hammer to drive the bearing (8).



Insert the ring nut washer (9) and screw a new lock ring nut (10) on the pinion end.

# Disassembly and Assembly Operations

12.



Screw the ring nut (10) in, using the wrench for ring nut CA715080 and for pinion retainer CA715107.

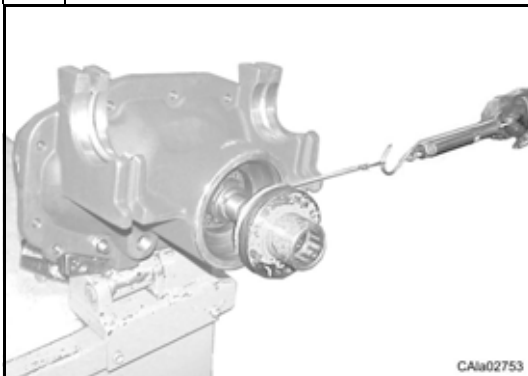


## Warning

The torque setting is given by the preloading measurement on bearings (3) and (8); tighten the ring nut (10) gradually.

**NOTE:** If the tightening is excessive, the elastic spacer (5) must be replaced and the procedure repeated. When you check the preloading, it is advisable to beat slightly both pinion ends (1) with a soft hammer, so as to help setting the bearings (3) and (8).

13.



To measure the preloading  $P_m$  of the pinion taper roller bearings (3) and (8), use a dynamometer whose cord is wound on the special tool CA715657 inserted on the end of pinion shaft (1).

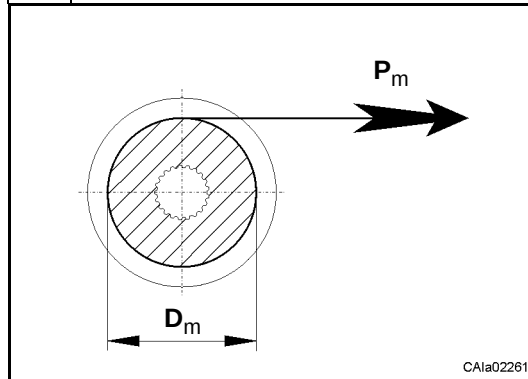
The adjustment is carried out by increasing the ring nut (10) torque gradually, being careful not to exceed.



## Warning

All preloadings must be measured without the seal rings.

14.



The effectively preloading  $P_m$  is measured on the special tool CA715657 (gauge diameter  $D_m = 91.5$  mm)

The measured value should be within the following range:

$$P_m = 35.5 \div 51.0 \text{ N}$$

15.

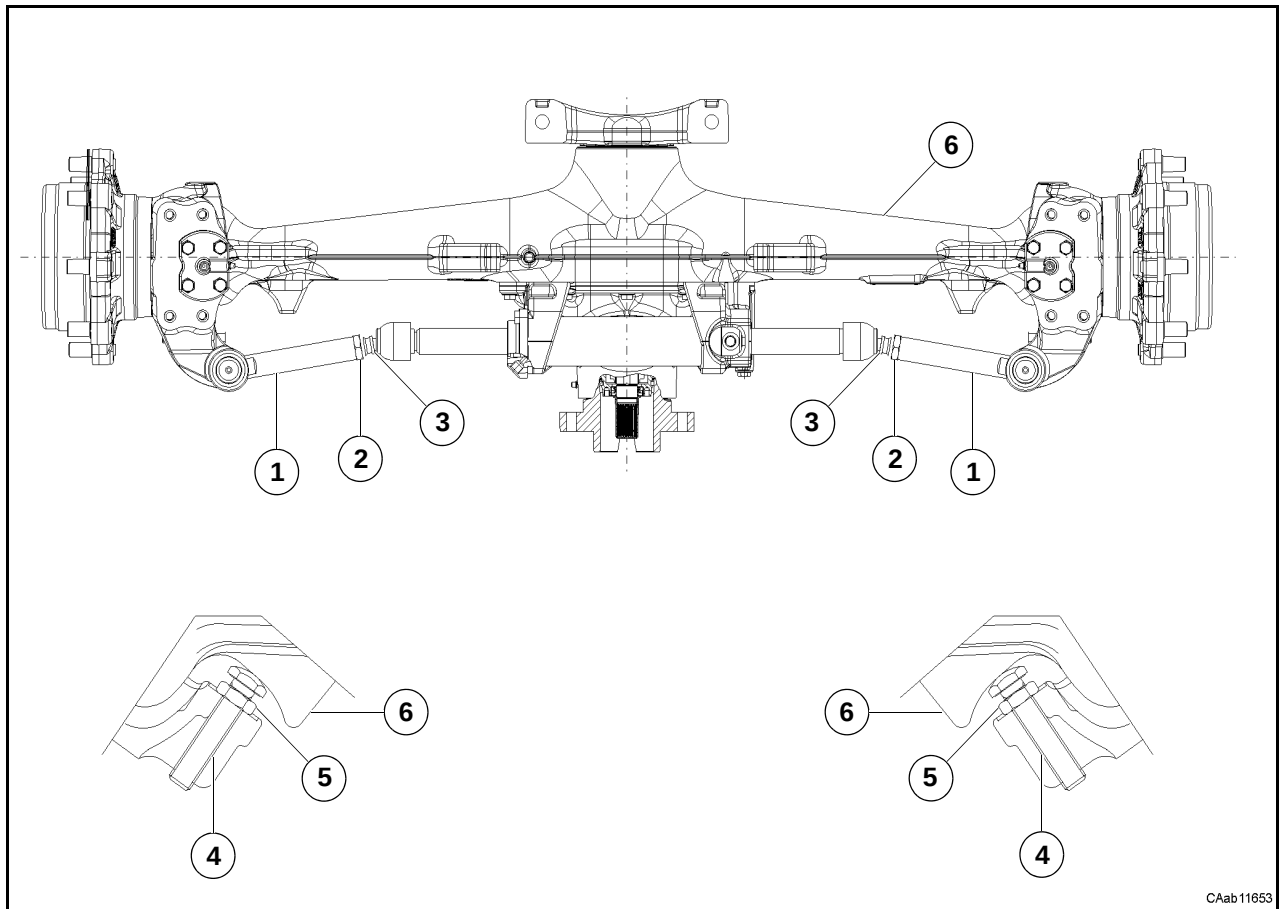


Once the requested preloading value is achieved, caulk the ring nut (10), using a hammer and a chisel.



# Disassembly and Assembly Operations

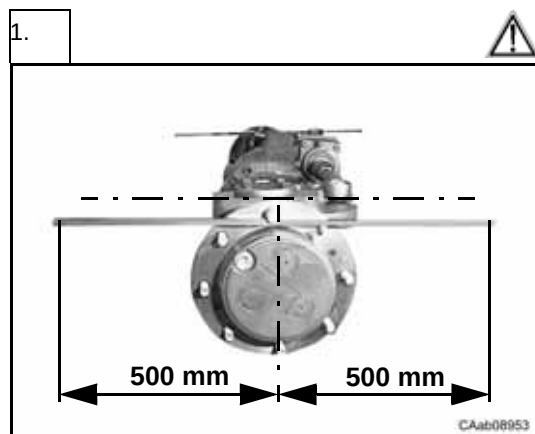
## TOE-IN/STEERING ANGLE



CAab11653

### Toe-in adjustment

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.

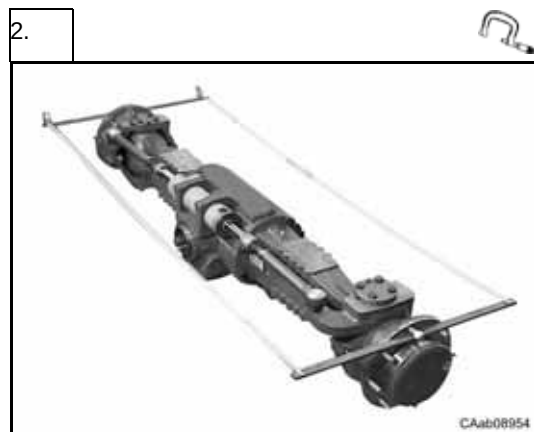


Put two equal one-meter-long linear bars on the wheel sides and lock them with two nuts on the wheel hub stud bolt.



### Warning

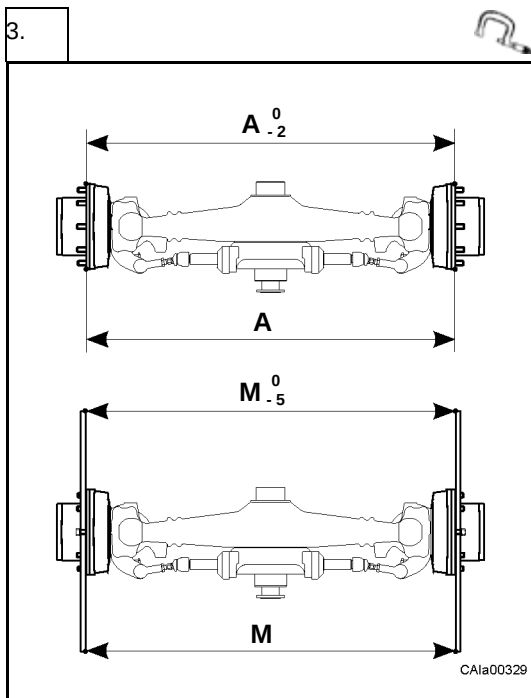
**The two bars should be fixed on their middle so that they are perpendicular to the supporting surface and parallel to the pinion shaft axis; align the two bars.**



Measure the distance in mm M between the bars ends with a tapeline.

**NOTE:** Keep the minimum value, swinging the measurement point.

# Disassembly and Assembly Operations

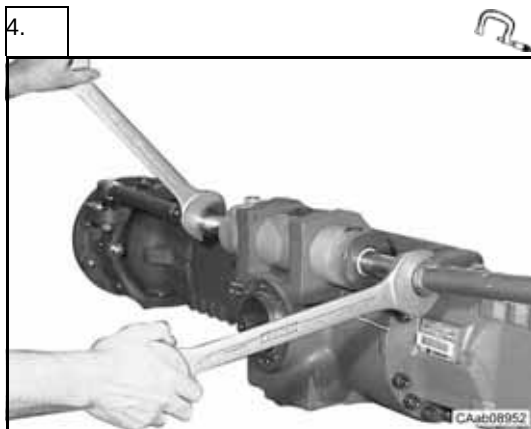


Check that the difference of the measurements between the wheel hubs diameters ends is within the requested tolerance range.

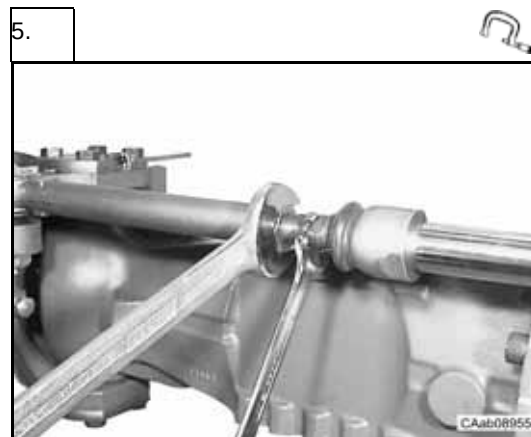
Refer to: "Toe-in" in C.4.

The nominal toe-in value (A) is referred to the external diameter of the wheel hubs flange, therefore the measured value (M) at the bars ends must be related to the ratio between length of the bar and flange diameter

$$\text{nominal toe-in (C.4)} = A - 0.2 \rightarrow \text{measured toe-in} = M - 0.5$$



If toe-in is incorrect, operate with two wrenches on the guide rods (1) screwing in and out the two joint tie rods (3) equally till the toe-in is within the requested tolerance.

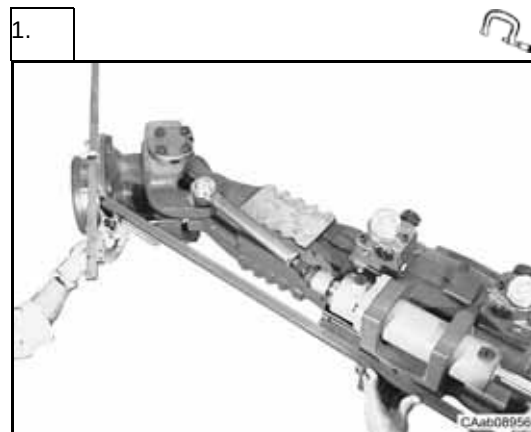


After adjusting, screw in the lock nuts (2) of the guide rods (1) to the requested tightening torque

Refer to: C.8

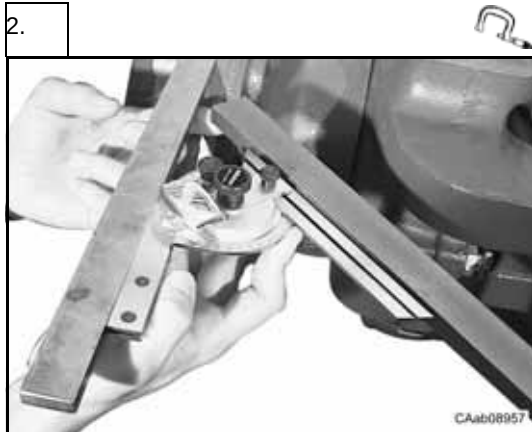
## Steering angle adjustment

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.



Use the same bars assembled for the toe-in adjustment and a long bar perfectly leaned over the machined part of the central body (pinion side), so that the two bars form an acute angle at the maximum steering.

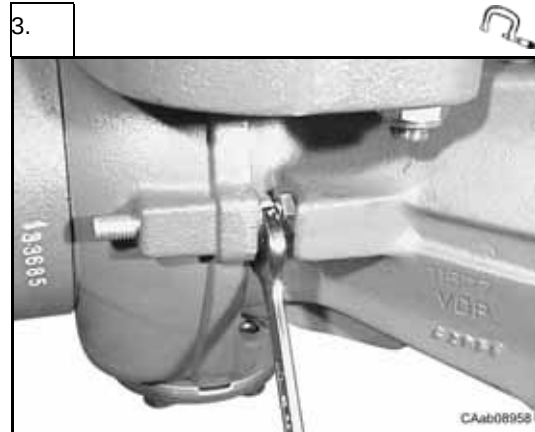
## Disassembly and Assembly Operations



Adjust a protractor to the requested angle and position it on the long bar.

[Refer to: C.4](#)

Move a wheel side till it forms, with the two bars, the angle fixed by the protractor.



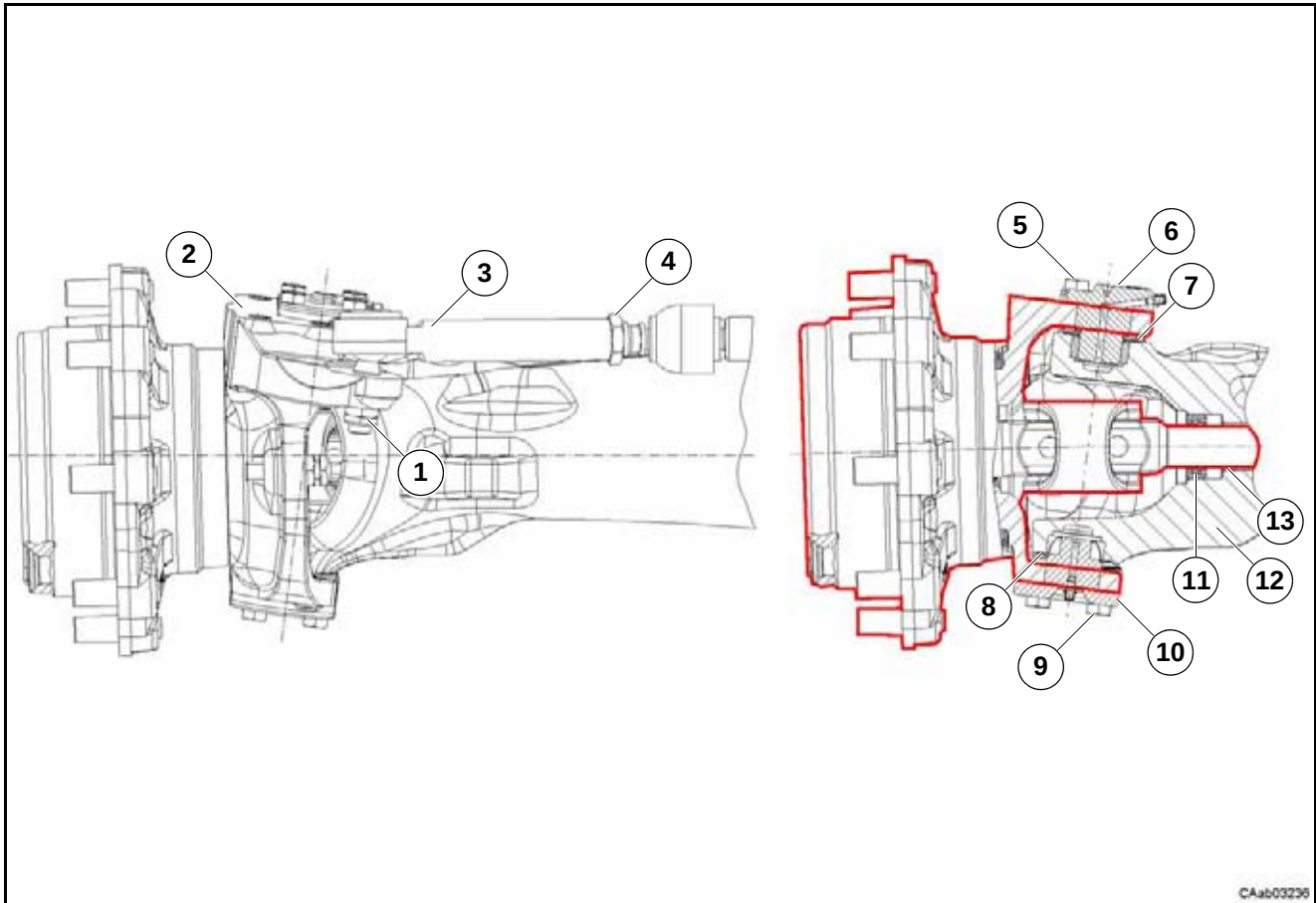
Adjust the mechanical steering stop, screwing in or out the stop bolts (4), locking them with the nuts (5) to the requested tightening torque

[Refer to: C.8](#)

Steer completely towards the other side and repeat the same operations.

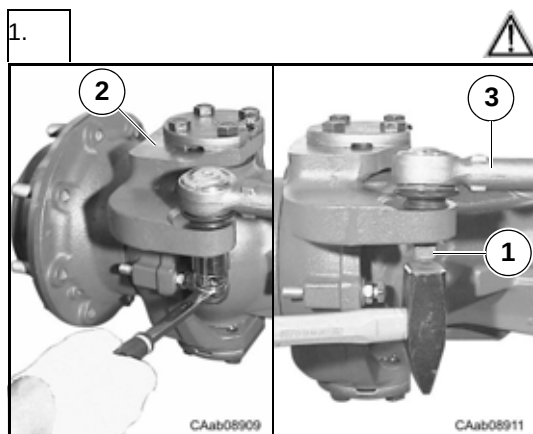
# Disassembly and Assembly Operations

## SPECIAL REPAIR OPERATIONS



### Wheel and double U-joint group disassembly

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.

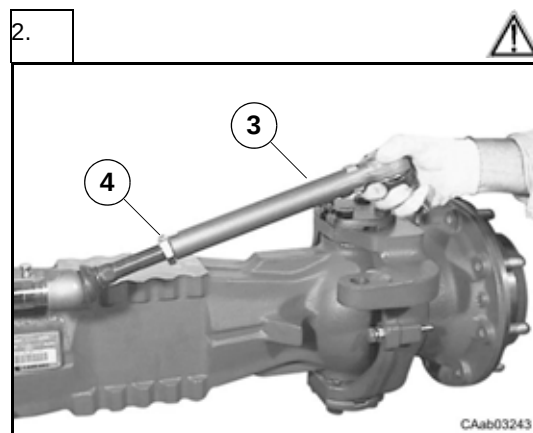


Remove the nut (1) and detach the tie rod (3) from the swivel housing (2) as described in "Steering cylinder group, Disassembly".

### Warning

Do not beat on the threaded pin end of the tie rod (3).

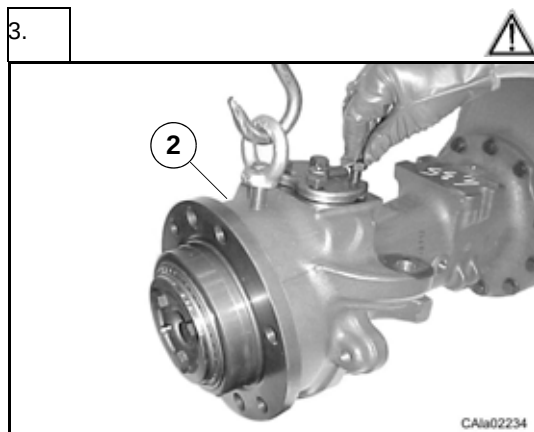
**NOTE:** This is a destructive operation for the nut (1); use a new nut in the reassembly.



### Warning

Do not unscrew the tie rod (3) nor the nut (4) to preserve the correct toe-in adjustment.

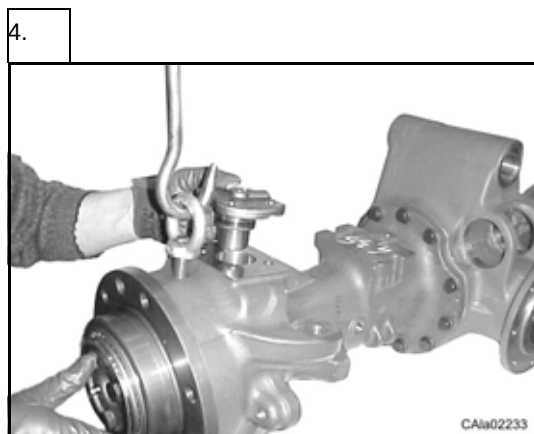
# Disassembly and Assembly Operations



## Danger

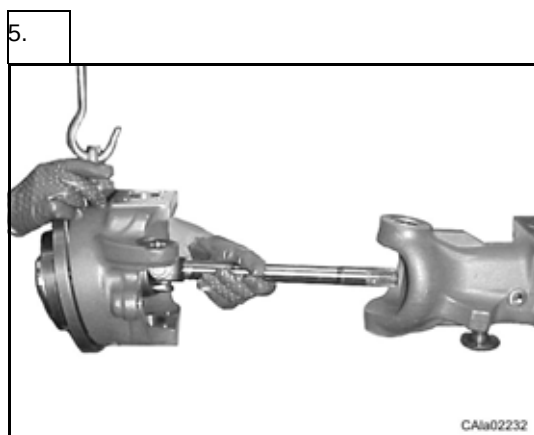
**Secure the swivel housing (2) with a belt or a rope to a hoist or any other suitable supporting device.**

Unscrew and remove the fastening screws (5) and (9) from the upper (6) and lower (10) king pin.



Remove the king pins (6) and (10).

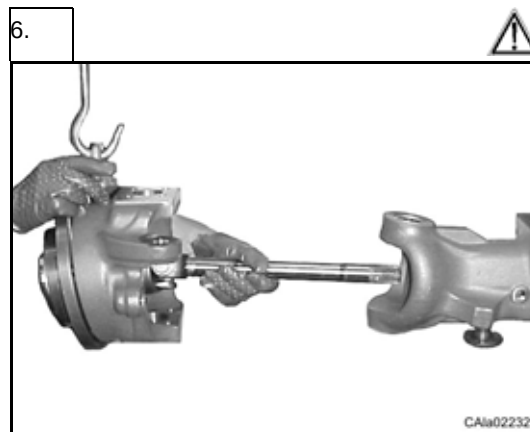
**NOTE:** Collect the belleville washers (7) and (8).



Remove the wheel/double U-joint group from the axle.

## Wheel and double U-joint group assembly

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.



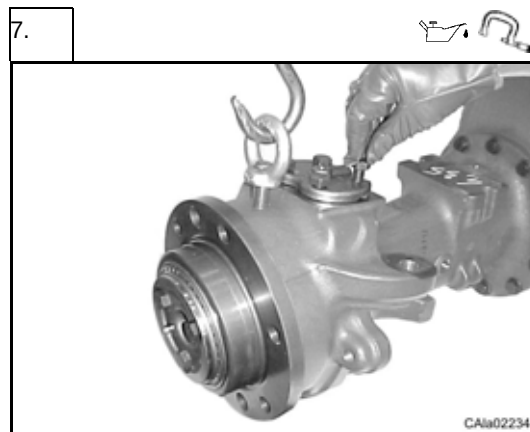
Assemble the wheel/double U-joint group to the axle beam.

**NOTE:** The differential support group must be assembled to the axle (see relative section in this document).



## Warning

**Be careful not to damage the seal ring (11); couple with care the double U-joint splined end to the differential.**



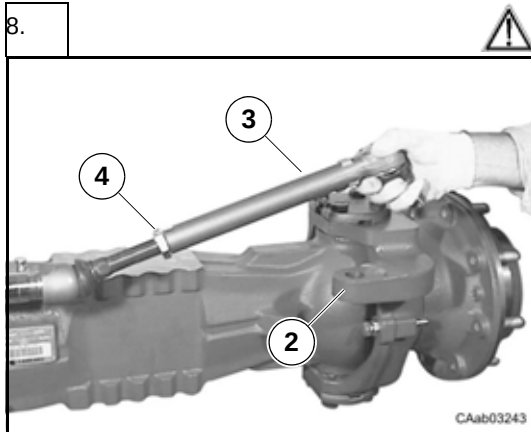
Grease carefully the seats of king pin (16) and (18) with specific grease.

[Refer to: C.6.](#)

Position the belleville washers (7) and (8) on the king pin seats.

Assemble the king pins, the lower (10) and the upper (6), and tighten the retaining screws (9) and (5) to the requested torque (see C.8).

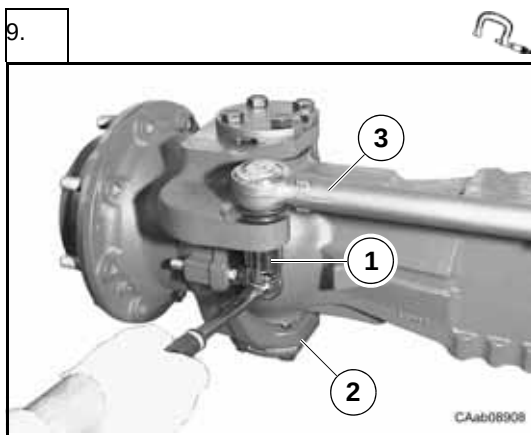
# Disassembly and Assembly Operations



Insert the ball joint of the tie rod (3) into its housing on the swivel housing (2).

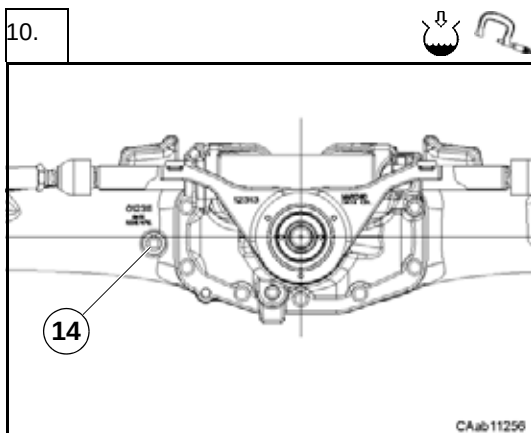
## Warning

**Do not unscrew the tie rod (3) nor the nut (4) to preserve the correct toe-in adjustment.**



Assemble and tighten the lock nut (1) with a dynamometric wrench to the requested torque

[Refer to: C.8.](#)



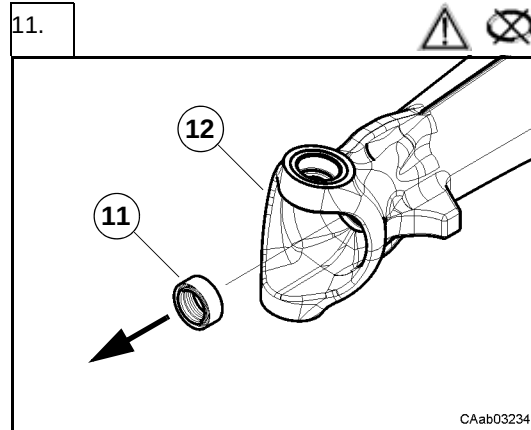
Check the differential oil level from the oil fill plug (14) and top up if necessary.

[Refer to: C.5.2.](#)

Reassemble the plug (14) to the prescribed torque (see C.8).

## Double U-joint seal ring replacement on axle beam side

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.

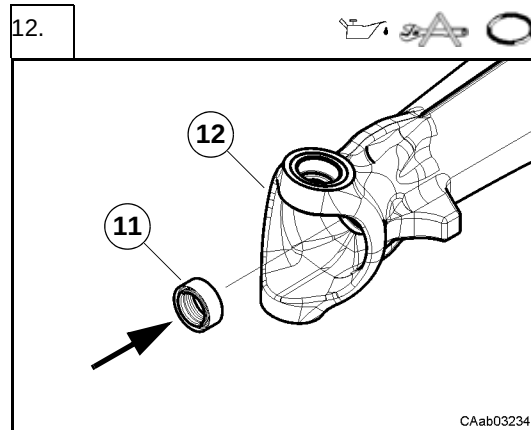


Disassemble the wheel/double U-joint group from the axle beam as described in D.10.1.

Remove the seal ring (11) from the axle beam (12).

## Warning

**Be careful not to damage the seal ring seat.**

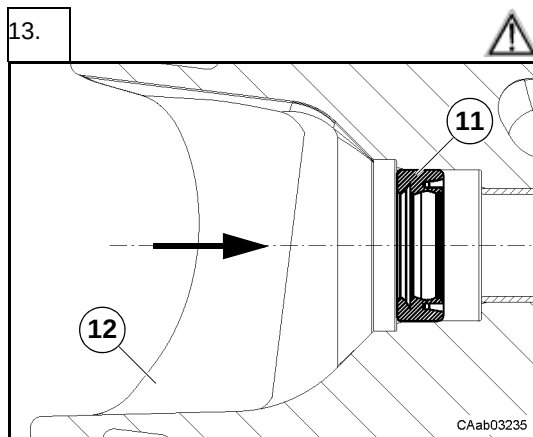


Assemble the seal ring (11) on the axle beam (12) with the special tool CA715087 and a hammer.

[Refer to: next point.](#)

**NOTE:** Grease carefully the seal ring (see C.6).

# Disassembly and Assembly Operations



## Warning

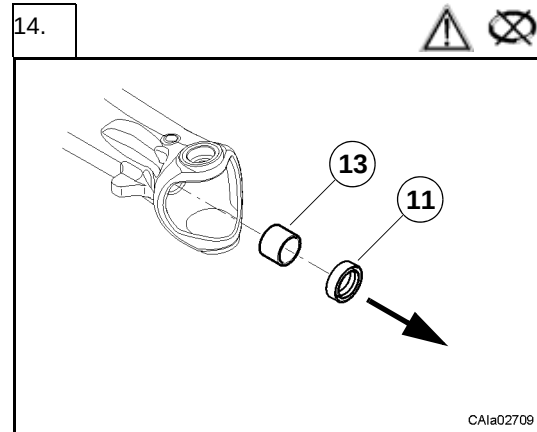
**Assemble the seal ring (11) as in figure.**

Check the correct position of the seal ring after the assembly.

Assemble the wheel/double U-joint group to the axle beam as described in D.10.2.

## Double U-joint bushing replacement on axle beam side

Some of the following pictures may not show exactly your axle, but the indicated operations are correct anyway.



Disassemble the wheel/double U-joint group from the axle beam as described in D.10.1.

Remove the seal rings (11) from the axle beam (12).

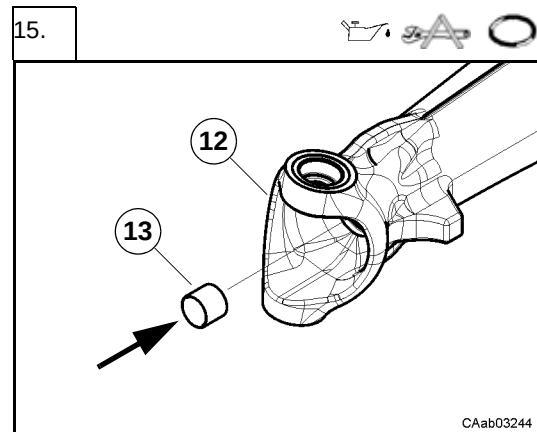
**NOTE:** Destructive operation for the seal ring; the seal ring must be replaced in the assembly.

Use an extractor to remove the bush (13) from the axle beam (12).



## Warning

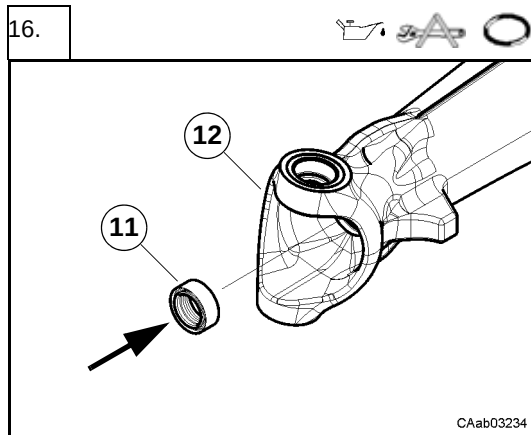
**Be careful not to damage the bush seat.**



Assemble the new bush (13) on the axle beam (12) with the special tool CA715649 and a hammer.



# Disassembly and Assembly Operations



Assemble the seal ring (11) to the axle beam (12) as described in D.10.3.

**NOTE:** Grease carefully the seal rings (see C.6).

Check the correct position of the seal ring after the assembly.

Assemble the wheel/double U-joint group to the axle beam as described in D.10.2.

## TESTING AFTER ASSEMBLY

### Testing methods

#### Step 1

With engine off, lift the axle so that the tyres get away from the ground.

#### Step 2

Engage the gear so that the pinion gets locked.

#### Step 3

With the help of another person standing on the opposite side, begin the assembly testing by rotating as much as possible both the wheels forward. (Both the wheels should get blocked after a while.)

#### Step 4

Keeping the pinion blocked, free the right wheel and rotate the left one in the line of march. Rotate the right wheels in the opposite direction.

The wheel will move freely without difficulty and the right wheel will move in the opposite direction if the assembly has been carried out correctly.

Repeat the same operation in the opposite direction (reverse gear).

IF ONE WHEEL DOES NOT ROTATE FREELY IN BOTH DIRECTIONS, then check step by step all assembly operations.

Check and see that the brakes are regulated correctly and functioning properly.

# Troubleshooting

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## Troubleshooting

### Section 5B

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| AXLE PROBLEM AND DIAGNOSIS ..... | 71 |

# Troubleshooting

| PROBLEMS                                                                                                                                                                                                                                                                                                                                                               | POSSIBLE CAUSES                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|----|----|
|                                                                                                                                                                                                                                                                                                                                                                        | 1                                                                                                                                                                                                                                                                                                                                                 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Wheel vibration; front tyre resistance; halfshaft breakage.                                                                                                                                                                                                                                                                                                            | 1                                                                                                                                                                                                                                                                                                                                                 | 1 | 1 |   | 1 |   |   |   |   |    | 1  |
| Steering is difficult; vehicle goes straight while its turning.                                                                                                                                                                                                                                                                                                        | 1                                                                                                                                                                                                                                                                                                                                                 | 1 | 1 | 1 |   |   |   |   |   |    | 1  |
| No differential action; jamming while steering.                                                                                                                                                                                                                                                                                                                        | 1                                                                                                                                                                                                                                                                                                                                                 |   |   | 1 | 1 |   |   |   |   |    | 1  |
| No differential action; jamming while steering.                                                                                                                                                                                                                                                                                                                        | 1                                                                                                                                                                                                                                                                                                                                                 | 1 | 1 | 1 | 1 |   | 1 |   | 1 |    | 1  |
| Uneven wear of tyre.                                                                                                                                                                                                                                                                                                                                                   | 1                                                                                                                                                                                                                                                                                                                                                 | 1 | 1 | 1 | 1 | 1 | 1 |   |   |    | 1  |
| Friction noise.                                                                                                                                                                                                                                                                                                                                                        | 1                                                                                                                                                                                                                                                                                                                                                 |   |   | 1 | 1 |   |   | 1 | 1 | 1  | 1  |
| Vibration during forward drive, intermittent noise.                                                                                                                                                                                                                                                                                                                    | 1                                                                                                                                                                                                                                                                                                                                                 | 1 | 1 |   | 1 |   |   |   |   |    | 1  |
| 1. Incorrect installation / defective axle<br>Correct installation or repair or replace the differential in case it does not survive any one of the test phases.                                                                                                                                                                                                       | <p>Look for foreign particles. Check assembly of the various parts of the axle.</p> <p>10. Incorrect adjustment of bevel gear set: Parts of the transmission worn out (transmission gears, U joints, etc.)<br/>Replace or adjust as required.</p> <p>11. Incorrect use of the product<br/>See the vehicle producer's instructions once again.</p> |   |   |   |   |   |   |   |   |    |    |
| 2. Overloading / incorrect weight distribution<br>Remove excessive weight and redistribute load, following instructions related to the vehicle.                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |
| 3. Different rotation radius of the tyres<br>If one tyre has a smaller radius, it will cause partial wheel slipping when force is applied. The other tyre with bigger radius will have to support all the work. Replace the tyre or adjust pressure to have same radius on both tyre.                                                                                  |                                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |
| 4. Broken halfshaft<br>It is not advisable to operate the vehicle with a broken halfshaft. It is acceptable to move the vehicle (engine off unloaded) a few meters away only.                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |
| 5. Bent halfshaft<br>Replace halfshaft.                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |
| 6. Blocked differential<br>Abnormal functioning of the differential or breakage/ blockage of command device. Verify assembly and all components.<br>Vehicles with wide steering angle may proceed with kicks, have steering difficulty or cause pneumatic wearing at sharp turns. Reduce the steering angle to minimum and decelerate when the vehicle begins to kick. |                                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |
| 7. Incorrect wheel adjustment<br>Verify group integrity and wheel side bearings. Adjusting according.                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |
| 8. Spoiled or worn out axle parts<br>Check the condition of ring gear, pinion gear, bearings etc. Replace when ever necessary.                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |
| 9. Contamination in the axle box or incorrect assembly of parts                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |    |    |

# Troubleshooting

## TROUBLESHOOTING

This chapter is a descriptive and explanatory guide to common axle problems. This guide suggests the repair correct procedures to be followed.

| Problem                                                                                                  | Cause                                                                                                                                                                                                                                                                                           | Action                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ring gear tooth broken at the outer side                                                                 | <ol style="list-style-type: none"> <li>1. Excessive gear load compared to the one foreseen</li> <li>2. Incorrect gear adjustment (excessive backlash)</li> <li>3. Pinion nut loose</li> </ol>                                                                                                   | <p>Replace bevel gear set</p> <p>Follow carefully the recommended operations for the adjustment of bevel gear set backlash</p>                                                                                                                |
| Ring gear tooth broken side                                                                              | <ol style="list-style-type: none"> <li>1. Load bump</li> <li>2. Incorrect gear adjustment (insufficient backlash)</li> <li>3. Pinion nut loose</li> </ol>                                                                                                                                       | <p>Replace bevel gear set</p> <p>Follow carefully the recommended operations for the adjustment of bevel gear set backlash.</p>                                                                                                               |
| Pinion or ring gear teeth pitted or worn                                                                 | <ol style="list-style-type: none"> <li>1. Insufficient lubrication</li> <li>2. Contaminated oil</li> <li>3. Incorrect lubrication or depleted additives</li> <li>4. Worn out pinion bearings that cause an incorrect pinion axle backlash and wrong contact between pinion and ring.</li> </ol> | <p>Replace bevel gear set.</p> <p>Follow carefully the recommended operations for the adjustment of bevel gear set backlash.</p> <p>Use correct lubricants, fill up to the right levels and replace according to the recommended program.</p> |
| Overheated ring and pinion teeth. See if gear teeth have faded                                           | <ol style="list-style-type: none"> <li>1. Prolonged functioning at high temperatures</li> <li>2. Incorrect lubrication</li> <li>3. Low oil level</li> <li>4. Contaminated oil</li> </ol>                                                                                                        | <p>Replace bevel gear set.</p> <p>Use proper lubrication, fill up to right level and replace at recommended program.</p>                                                                                                                      |
| Pinion teeth pitting                                                                                     | <ol style="list-style-type: none"> <li>1. Excessive use</li> <li>2. Insufficient lubrication</li> </ol>                                                                                                                                                                                         | <p>Replace bevel gear set.</p> <p>Use correct lubrication, fill up to the right level and substitute at recommended intervals</p>                                                                                                             |
| Axle beam body bent                                                                                      | <ol style="list-style-type: none"> <li>1. Vehicle over loaded</li> <li>2. Vehicle's accident</li> <li>3. Load bump</li> </ol>                                                                                                                                                                   | <p>Replace axle beam body</p>                                                                                                                                                                                                                 |
| Worn out or pitted bearings                                                                              | <ol style="list-style-type: none"> <li>1. Insufficient lubrication</li> <li>2. Contaminated oil</li> <li>3. Excessive use</li> <li>4. Normal wear out</li> <li>5. Pinion nut loose</li> </ol>                                                                                                   | <p>Replace bearings.</p> <p>Use correct lubrication fill up, to the right level and replace at recommended intervals</p>                                                                                                                      |
| Oil leakage form gaskets and seals                                                                       | <ol style="list-style-type: none"> <li>1. Prolonged functioning at high temperature of the oil</li> <li>2. Oil gasket assembled incorrectly</li> <li>3. Seal lip damaged</li> <li>4. Contaminated oil</li> </ol>                                                                                | <p>Replace the gasket or seal and matching surface if damaged.</p> <p>Use correct lubrication and replace at recommended intervals.</p>                                                                                                       |
| Excessive wearing out of input flange spline                                                             | <ol style="list-style-type: none"> <li>1. Exhaustive use</li> <li>2. Pinion nut loose</li> <li>3. Pinion axle backlash</li> </ol>                                                                                                                                                               | <p>Replace the flange.</p> <p>Check that the pinion spline is not excessively worn out.</p> <p>Replace bevel gear set if required.</p>                                                                                                        |
| Fatigue failure of pinion teeth<br>See if the fracture line is well defined<br>(wave lines, beach lines) | <ol style="list-style-type: none"> <li>1. Exhaustive use</li> <li>2. Continuous overload</li> </ol>                                                                                                                                                                                             | <p>Replace bevel gear set</p>                                                                                                                                                                                                                 |
| Pinion and ring teeth breakage                                                                           | <ol style="list-style-type: none"> <li>1. Crash load of differential components</li> </ol>                                                                                                                                                                                                      | <p>Check and/or replace other differential components.</p>                                                                                                                                                                                    |

# Troubleshooting

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| Problem                                                                             | Cause                                                                                                        | Action                                                                                                                                   |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Side gear spline worn out.<br>Replace all scratched washers<br>(Excessive backlash) | Excessive use                                                                                                | Replace differential gear group.<br>Replace halfshaft if required<br><br>Use correct lubrication and fill up to right level.             |
| Thrust washer surface worn out or scratched.                                        | 1. Insufficient lubrication<br>2. Incorrect lubrication<br>3. Contaminated oil                               | Replace at intervals recommended.<br>Replace all scratched washers and those with 0,1mm thickness lower than the new ones.               |
| Inner diameter of tapered roller bearing worn out.                                  | 1. Excessive use<br>2. Excessive pinion axial backlash<br>3. Insufficient lubrication<br>4. Contaminated oil | Replace bearing.<br>Check pinion axial backlash.<br>Use proper lubrication, fill up to right level and replace at recommended intervals. |
| Bent or broken halfshaft                                                            | Vehicle intensively operated or overloaded                                                                   | Replace                                                                                                                                  |
| Halfshaft broken at wheel side                                                      | 1. Wheel support loose<br>2. Beam body bent                                                                  | Replace<br>Check that wheel support is not worn out or wrongly adjusted.                                                                 |

# Troubleshooting

## AXLE PROBLEM AND DIAGNOSIS

| Problem                        | Cause                                                                                                                | Action                           |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Noise while driving            | 1. Excessive backlash between pinion and ring gear                                                                   | 1. Adjust                        |
|                                | 2. Worn out pinion and gear ring                                                                                     | 2. Replace                       |
|                                | 3. Worn out pinion bearings                                                                                          | 3. Replace                       |
|                                | 4. Pinion bearings loose                                                                                             | 4. Adjust                        |
|                                | 5. Excessive axial pinion backlash                                                                                   | 5. Adjust                        |
|                                | 6. Worn out differential bearings                                                                                    | 6. Replace                       |
|                                | 7. Differential bearings loose                                                                                       | 7. Adjust                        |
|                                | 8. Ring gear out of roundness                                                                                        | 8. Replace                       |
|                                | 9. Low lubricant level                                                                                               | 9. Oil level                     |
|                                | 10. Poor or wrong lubricant                                                                                          | 10. Replace                      |
|                                | 11. Bent halfshaft                                                                                                   | 11. Replace                      |
| Noise while driving in neutral | 1. Noise coming from axle are usually heard when vehicle moves in neutral gear but are not loud.                     | 1. Replace or adjust (see above) |
|                                | 2. Incorrect backlash between pinion and ring (sound heard while decelerating disappears while increasing the speed) | 2. Replace                       |
|                                | 3. Pinion or input flange worn out                                                                                   | 3. Adjust                        |
| Intermittent noise             | 1. Ring gear damaged                                                                                                 | 1. Replace bevel gear set        |
|                                | 2. Differential box bolts loose                                                                                      | 2. Tighten to torque             |
| Constant noise                 | 1. Ring gear teeth or pinion damaged                                                                                 | 1. Replace bevel gear set        |
|                                | 2. Worn out bearings                                                                                                 | 2. Replace                       |
|                                | 3. Pinion spline worn out                                                                                            | 3. Replace                       |
|                                | 4. Bent halfshaft                                                                                                    | 4. Replace                       |
| Noise while steering           | 1. Worn out differential gears                                                                                       | 1. Replace                       |
|                                | 2. Worn out differential box or spider                                                                               | 2. Replace                       |
|                                | 3. Differential thrust washers worn out                                                                              | 3. Replace                       |
|                                | 4. Half shaft spline worn out                                                                                        | 4. Replace                       |

# Troubleshooting

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## Special Tools

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### Special Tools

#### Section 5B

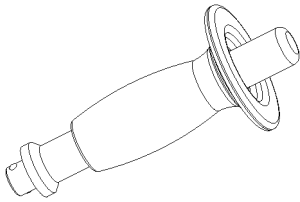
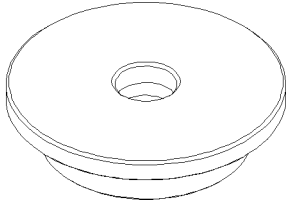
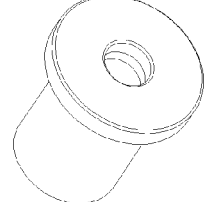
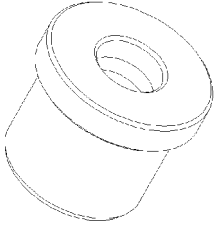
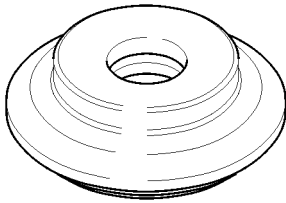
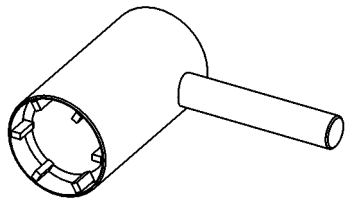
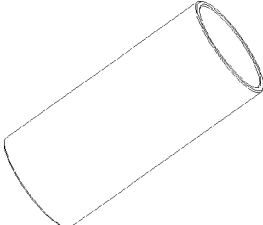
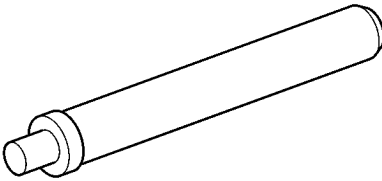
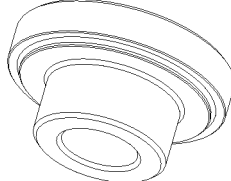
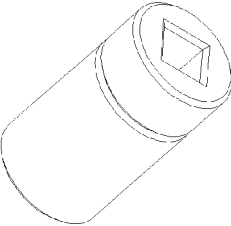
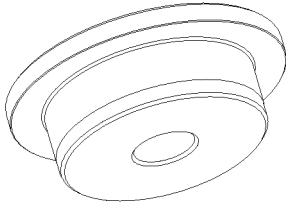
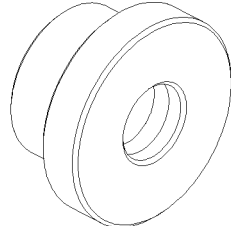
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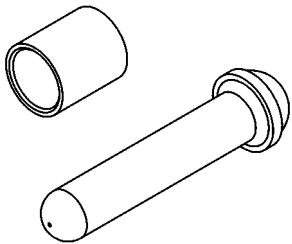
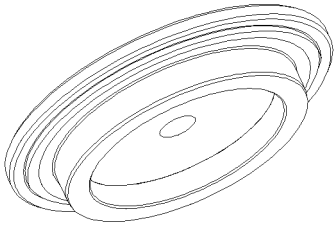
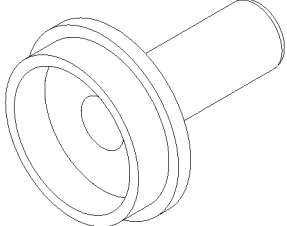
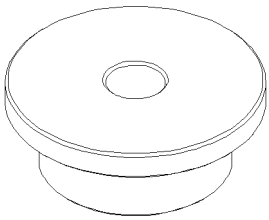
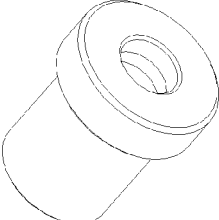
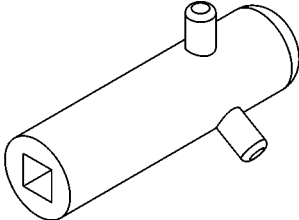
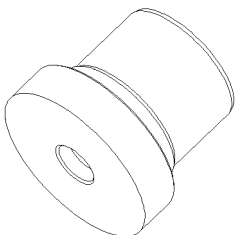
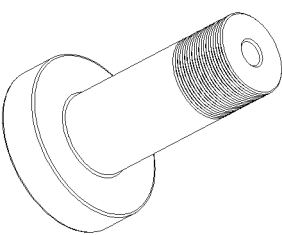
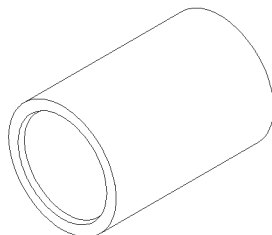
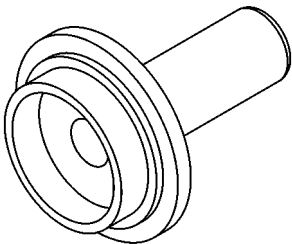
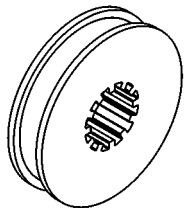
# Special Tools

## SPECIAL TOOLS

The special drifts/pad used to assembly the seals, bearings and bushes should always be used with the interchangeable handle CA119033; its use is recommended together with a suitable safety handle in order to protect the hands.

|                                                                                     |          |                                                                                     |          |                                                                                       |          |
|-------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------|----------|
| <b>CA119033</b>                                                                     | Handle   | <b>CA119068</b>                                                                     | Driver   | <b>CA119097</b>                                                                       | Driver   |
|    | CA119033 |    | CA119068 |    | CA119097 |
| <b>CA119220</b>                                                                     | Driver   | <b>CA715026</b>                                                                     | Driver   | <b>CA715080</b>                                                                       | Wrench   |
|   | CA119220 |   | CA715026 |   | CA715080 |
| <b>CA715082</b>                                                                     | Driver   | <b>CA715086</b>                                                                     | Driver   | <b>CA715087</b>                                                                       | Driver   |
|  | CA715082 |  | CA715086 |  | CA715087 |
| <b>CA715107</b>                                                                     | Wrench   | <b>CA715299</b>                                                                     | Driver   | <b>CA715360</b>                                                                       | Driver   |
|  | CA715107 |  | CA715299 |  | CA715360 |

# Special Tools

|                                                                                     |          |                                                                                     |                          |                                                                                       |                        |
|-------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------|------------------------|
| <b>CA715451</b>                                                                     | Driver   | <b>CA715509</b>                                                                     | Driver                   | <b>CA715643</b>                                                                       | Driver                 |
|    | CA715451 |    | CA715509                 |    | CA715643               |
| <b>CA715644</b>                                                                     | Driver   | <b>CA715649</b>                                                                     | Driver                   | <b>CA715651</b>                                                                       | Handle                 |
|    | CA715644 |    | CA715649                 |    | CA715651               |
| <b>CA715652</b>                                                                     | Driver   | <b>CA715653</b>                                                                     | False pinion             | <b>CA715654</b>                                                                       | False differential box |
|  | CA715652 |  | CA715653                 |  | CA715654               |
| <b>CA715656</b>                                                                     | Driver   | <b>CA715657</b>                                                                     | Tool for preload measur. |                                                                                       |                        |
|  | CA715656 |  | CA715657                 |                                                                                       |                        |

## Special Tools

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# Service Operations Time

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## Service Operations Time

### Section 5B

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# Service Operations Time

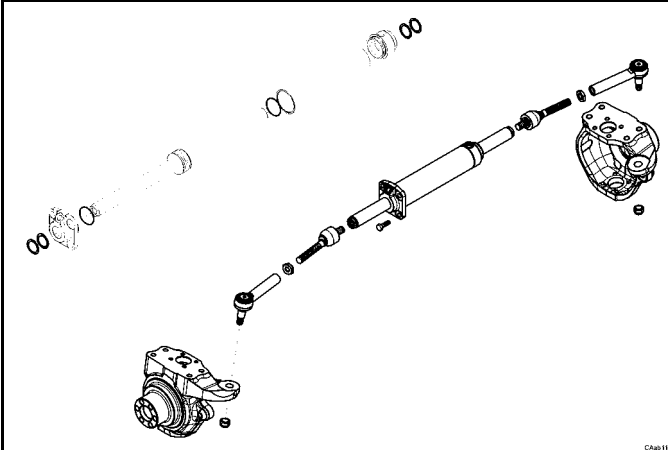
## SERVICE OPERATIONS TIME SCHEDULE

The times indicated are referred to medium values times of operations made by trained personnel in laboratory provided with all necessary tools for the good execution of the requested operations.

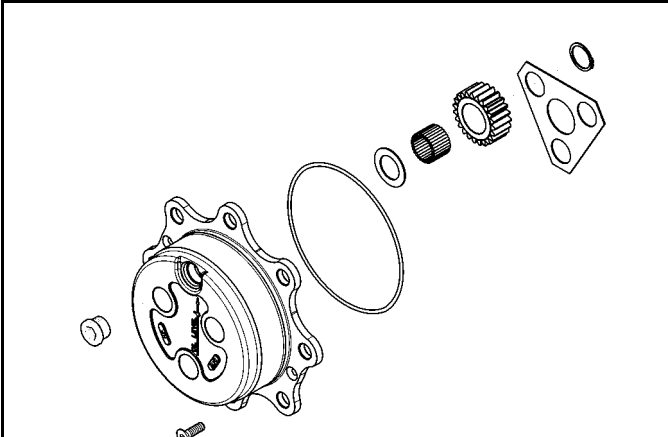
Reparation and/or substitution times are indicated in minutes.

This time schedule presumes that the axle has already been removed from the vehicle. To know the removal time of the axle from the vehicle refer to manual provided from vehicle manufacturer.

### Steering Cylinder Group (G3)

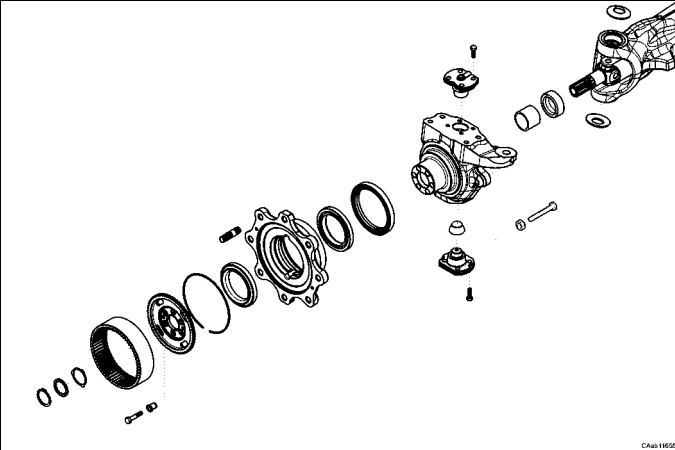
|  | Cod. | Operation                                 | Min. |
|-----------------------------------------------------------------------------------|------|-------------------------------------------|------|
|                                                                                   | C1   | Steering cylinder replacement             | 60   |
|                                                                                   | C2   | Steering rod replacement (x 1)            | 30   |
|                                                                                   | C3   | Steering rod ball joint replacement (x 1) | 15   |
|                                                                                   | C4   | Steering rod tie rod replacement (x 1)    | 30   |
|                                                                                   | C5   | Ball joint protection replacement (x 1)   | 15   |
|                                                                                   | C6   | Tie rod protection replacement (x 1)      | 15   |
|                                                                                   | C8   | Steering cylinder overhauling             | 120  |

### Epicyclic Reduction Gear Group (G1)

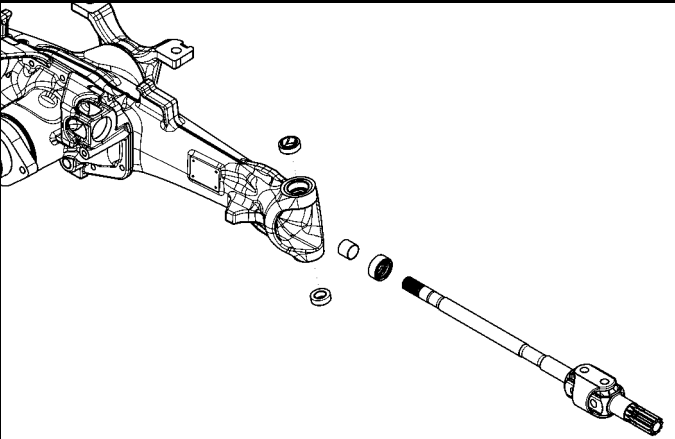
|  | Cod. | Operation                               | Min. |
|-------------------------------------------------------------------------------------|------|-----------------------------------------|------|
|                                                                                     | A1   | Planetary carrier replacement           | 20   |
|                                                                                     | A2   | Planetary carrier overhauling (3 gears) | 35   |
|                                                                                     |      | Planetary carrier overhauling (4 gears) | 45   |
|                                                                                     |      |                                         |      |

## Service Operations Time

### Wheel Hub Group (G1)

|  | Cod. | Operation                              | Min. |
|-----------------------------------------------------------------------------------|------|----------------------------------------|------|
|                                                                                   | A3   | Wheel carrier replacement              | 30   |
|                                                                                   | A5   | Wheel hub bearing and seal replacement | 75   |
|                                                                                   | A6   | Stud replacement (x 1)                 | 5    |
|                                                                                   | A7   | Swivel housing overhauling             | 90   |
|                                                                                   | A8   | Swivel housing replacement             | 70   |
|                                                                                   | A9   | Double U-joint replacement             | 30   |
|                                                                                   | A10  | Double U-joint overhauling             | 60   |
|                                                                                   | A11  | King pin replacement (x 1)             | 30   |
|                                                                                   | A12  | King pin bearing replacement (x 1)     | 45   |
|                                                                                   | A14  | Crown gear replacement (x 1)           | 30   |

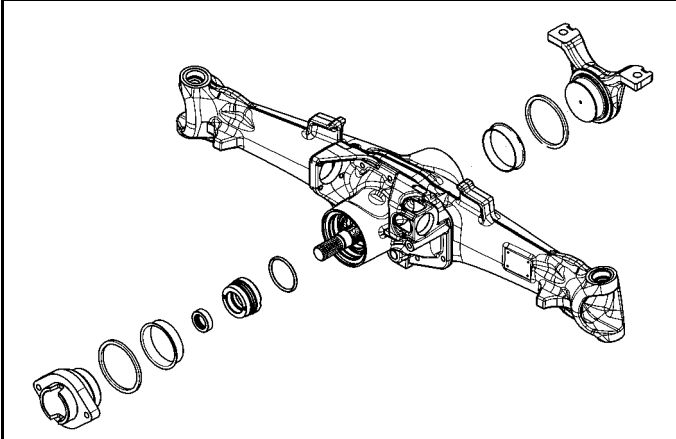
### Axle Beam Group (G4)

|  | Cod. | Operation                           | Min. |
|-------------------------------------------------------------------------------------|------|-------------------------------------|------|
|                                                                                     | D1   | Axle Beam replacement               | 180  |
|                                                                                     | D2   | Spherical bearing replacement (x 1) | 45   |
|                                                                                     | D3   | Double U-joint seal replacement     | 45   |
|                                                                                     | D4   | Double U-joint bush replacement     | 60   |
|                                                                                     |      |                                     |      |

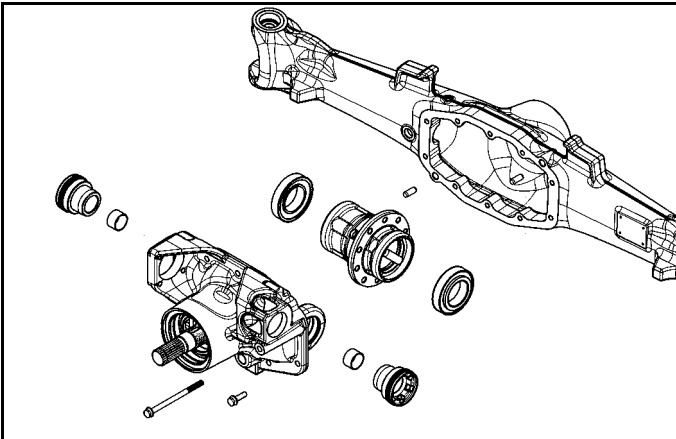


# Service Operations Time

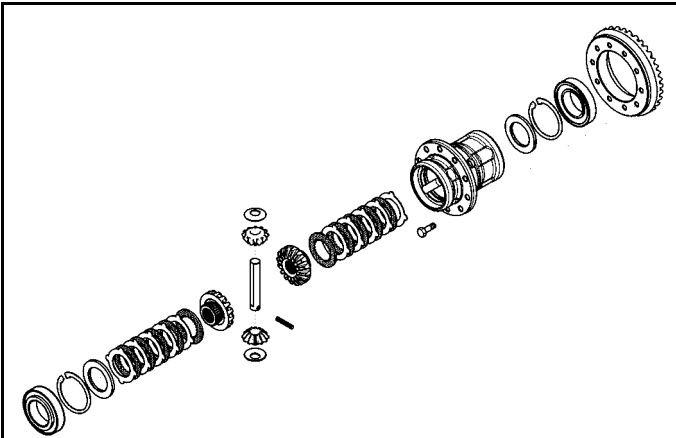
## Trunnions Group (G2-G4)

|  | Cod. | Operation                            | Min. |
|-----------------------------------------------------------------------------------|------|--------------------------------------|------|
|                                                                                   | D11  | Trunnion overhauling                 | 60   |
|                                                                                   | D12  | Trunnion replacement                 | 30   |
|                                                                                   | B2   | Pinion/input flange seal replacement | 30   |
|                                                                                   |      |                                      |      |

## Differential Support Group (G2)

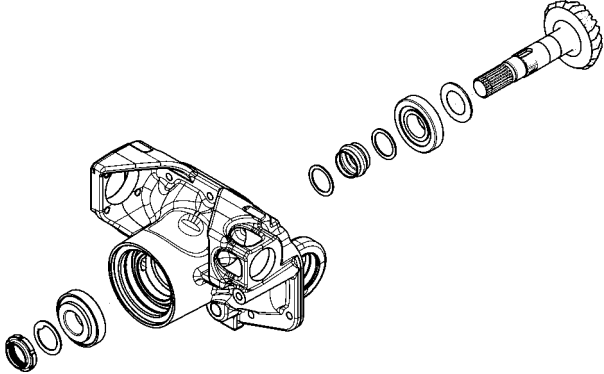
|  | Cod. | Operation                                 | Min. |
|------------------------------------------------------------------------------------|------|-------------------------------------------|------|
|                                                                                    | B1   | Differential replacement                  | 150  |
|                                                                                    | B4   | Differential housing bearings replacement | 180  |
|                                                                                    |      |                                           |      |
|                                                                                    |      |                                           |      |

## Differential Group (G2)

|  | Cod. | Operation                                                                              | Min. |
|-------------------------------------------------------------------------------------|------|----------------------------------------------------------------------------------------|------|
|                                                                                     | B1   | Differential replacement                                                               | 150  |
|                                                                                     | B5   | Bevel gear, planetary gears, side gears, spiders and ring nuts replacement/overhauling | 240  |
|                                                                                     | B8   | Differential housing bearings replacement                                              | 180  |
|                                                                                     |      |                                                                                        |      |

## Service Operations Time

### Pinion Group

|  | Cod. | Operation        | Min. |
|-----------------------------------------------------------------------------------|------|------------------|------|
|                                                                                   | B3   | Pinion bearings. | 180  |
|                                                                                   |      |                  |      |
|                                                                                   |      |                  |      |
|                                                                                   |      |                  |      |
|                                                                                   |      |                  |      |

# Service Operations Time

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