

# COMBINES 360/330/430/530/630/730

Technical Manual  
TM-4222 (Jan-74)

## CONTENTS

### SECTION 10 — GENERAL INFORMATION

- Group 5 - Specifications
- Group 10 - Pre-Delivery, Delivery and After-Sales Inspections
- Group 15 - Service and Lubrication
- Group 20 - Engine and Combine Tune-Up
- Group 25 - Separation

### SECTION 20 — ENGINE

- Group 5 - General Information, Diagnosing Malfunctions
- Group 10 - Cylinder Head and Camshaft
- Group 15 - Cylinder Block, Liners, Pistons and Connecting Rods
- Group 16 - Installation of 3-Seal Cylinder Liners
- Group 20 - Crankshaft, Main Bearings and Flywheel
- Group 25 - Timing Gear Train
- Group 30 - Oil Pump, Pressure Regulating Valve and Oil Filter
- Group 35 - Cooling System
- Group 40 - Speed Control Linkage

### SECTION 30 — FUEL SYSTEM

- Group 5 - Diagnosing Malfunctions
- Group 10 - Fuel Tank, Transfer Pump, Fuel Filters, Air Cleaner
- Group 15 - Roto Diesel Fuel Injection Pump
- Group 20 - Roosa Master Model DB Fuel Injection Pump
- Group 25 - Roosa Master Model CB Fuel Injection Pump
- Group 30 - Roosa Master Injection Nozzles
- Group 35 - CAV Injection Nozzles
- Group 40 - Cold Weather Starting Aid

### SECTION 40 — ELECTRICAL SYSTEM

- Group 5 - Diagnosing Malfunctions
- Group 10 - Individual Parts and Wiring Diagram
- Group 11 - Reverser Clutch, Linkage and Control
- Group 15 - Bosch Helical-Spline Sliding Gear Starting Motor
- Group 20 - Delco Remy Helical-Spline Sliding Gear Starting Motor
- Group 25 - Generator
- Group 30 - Enclosed-Type Alternator

### SECTION 50 — POWER TRAIN

- Group 5 - Clutch and Clutch Linkage - Combines 330/430
- Group 10 - Clutch and Clutch Linkage - Combines 530/630/730
- Group 15 - Front Axle - Combines 330/430 up to Serial No. 303995 and 402960
- Group 20 - Front Axle - Combines 330/430, Serial No. 303996 and 402961 - Up
- Group 25 - Front Axle - Combines 530/630/730
- Group 30 - Track System for Combines 630/730
- Group 35 - Separator Drive
- Group 40 - Variable Drives
- Group 45 - Power Drive Gear - Combine 360

### SECTION 60 — REAR AXLE, MANUAL STEERING AND MECHANICAL BRAKES

- Group 5 - Foot Brakes - Combines 530/630/730
- Group 10 - Foot Brakes - Combines 330/430
- Group 15 - Manual Steering
- Group 20 - Parking Brake - Combines 530/630/730
- Group 25 - Parking Brake - Combines 330/430
- Group 30 - Rear Axle - Combines 330/430/530/630/730

### SECTION 70 — HYDRAULIC SYSTEM

- Group 5 - General Information, Pressure Tests, Diagnosing Malfunctions
- Group 10 - Hydraulic Oil Reservoir, Filter and Oil Lines
- Group 15 - Hydraulic Pumps and Flow Divider
- Group 20 - Three-Spool Control Valve
- Group 25 - Hydraulic Cylinders
- Group 30 - Steering Cylinder (Power Assisted)
- Group 35 - Hydrostatic Steering
- Group 40 - Hydraulic System of 360 Combine
- Group 45 - Hydraulic Brakes
- Group 50 - Reverser Clutch Control

### SECTION 80 — MISCELLANEOUS

- Group 5 - Cutting Platform and Cutter Bar Drive
- Group 10 - Cylinder, Concave and Rotary Deflector
- Group 15 - Separating and Cleaning Units
- Group 20 - Bearings
- Group 25 - Fundamentals about V-Belts, Flat Belts and Chain Drives

---

## INTRODUCTION

This technical manual for model 360/330/430/530/630 and 730 combines is a concisely written publication for the service personnel. It contains procedures and specifications which an individual cannot be expected to remember. The table of contents on the first page of this manual lists the individual sections and their groups. A table of contents on the first page of each section lists the groups in the section and the page number of the major subjects found in each group. Coloured tabs make it easy to locate the individual sections.

Coverage for each components includes:

General information, diagnosing malfunctions, checks (if necessary), removal (if necessary), disassembly, repair, assembly (if necessary), installation (if necessary, adjustments, specifications and special tools.

Specifications and special tools are always listed at the end of each group.

The section "GENERAL INFORMATION" includes detailed specifications and instructions for "Pre-delivery, delivery and after-sales inspections" as well as "Engine and combine tune-up" to restore full performance.

Combine service and lubrication as well as lubricants required are described in the Operator's Manual.

In principle, the present technical manual contains specifications and service information on 3, 4 and 6 cylinder John Deere engines only — as far as the engine is concerned. However, section "General Information" includes vital specifications on Perkins 6.354 engine. Nevertheless, when doing repair work on a Perkins 6.354 6-cylinder engine, the "Perkins Shop Manual" on 6.354 engine should be consulted in any case.

Little explanation is given about theory of operation in this manual unless the theory is peculiar only to the component in the combine. Basic theory of operation and general information about the systems or components of the tractor will be found in the "JOHN DEERE Fundamentals of Service" manuals.

This manual was planned and written for the mechanic charged with combine service. Keep it in the shop where it is readily accessible and refer to it whenever in doubt about correct service procedures. Using it as a guide for any and all service problems will reduce error and costly delay.

Thus, make it a habit to use this manual when doing any repair work on a combine of the Zweibrücken series and keep it always close at hand. You will see that it becomes your most important special tool.

## Section 10

# GENERAL INFORMATION

### CONTENTS OF THIS SECTION

| GROUP 5 — SPECIFICATIONS                |  | Page |                                              | Page  |
|-----------------------------------------|--|------|----------------------------------------------|-------|
| Serial numbers                          |  | 5-2  | Removing and installing transmission on      |       |
| Model numbers                           |  | 5-3  | combines 330/430 from serial                 |       |
| Engine                                  |  | 5-4  | No. 303996 and 402961                        | 25-5  |
| Cutter bar                              |  | 5-6  | Removal                                      | 25-5  |
| Knife                                   |  | 5-6  | Installation                                 | 25-5  |
| Reel                                    |  | 5-6  | Removing and installing transmission on      |       |
| Cutting platform                        |  | 5-8  | combines 530/630/730                         | 25-6  |
| Auger                                   |  | 5-8  | Removal                                      | 25-6  |
| Cylinder                                |  | 5-8  | Installation                                 | 25-7  |
| Concave                                 |  | 5-10 | Removing and installing final drive on       |       |
| Beater                                  |  | 5-10 | combines 530/630/730                         | 25-7  |
| Separator                               |  | 5-10 | Removal                                      | 25-7  |
| Chaffer                                 |  | 5-10 | Installation                                 | 25-7  |
| Grain sieve                             |  | 5-12 | Removing and installing front axle on        |       |
| Chaffer extension                       |  | 5-12 | combines 530/630/730                         | 25-7  |
| Fan                                     |  | 5-12 | Removal                                      | 25-7  |
| Clutch                                  |  | 5-12 | Installation                                 | 25-9  |
| Electrical system                       |  | 5-12 | Removing and installing rear axle            |       |
| Starting motor                          |  | 5-14 | on combines 330-730                          | 25-9  |
| Transmission                            |  | 5-14 | Removal                                      | 25-9  |
| Hydraulic system                        |  | 5-14 | Installation                                 | 25-9  |
| Steering system                         |  | 5-16 | Removing and installing steering pump on     |       |
| Brakes                                  |  | 5-16 | combines 430-730 with hydrostatic            |       |
| Capacities                              |  | 5-18 | steering                                     | 25-10 |
| Tires                                   |  | 5-18 | Removal                                      | 25-10 |
| Tire inflation pressure                 |  | 5-20 | Installation                                 | 25-10 |
| Travel speeds                           |  | 5-20 | Removing and installing steering valve on    |       |
| Weight                                  |  | 5-20 | combines 430-730 with hydrostatic            |       |
| Dimensions                              |  | 5-20 | steering                                     | 25-10 |
| GROUP 10 — PREDELIVERY, DELIVERY        |  |      | Removal                                      | 25-10 |
| AND AFTER-SALES INSPEC-                 |  |      | Installation                                 | 25-11 |
| TIONS                                   |  |      | Removing and installing selective control    |       |
| General Information                     |  | 10-1 | valve on combines 330-730                    | 25-11 |
| GROUP 15 — LUBRICATION AND              |  |      | Removal                                      | 25-11 |
| PERIODIC SERVICE                        |  | 15-1 | Installation                                 | 25-11 |
| GROUP 20 — ENGINE AND COMBINE           |  |      | Removing and installing steering cylinder on |       |
| TUNE-UP                                 |  | 20-1 | combines 430-730 with hydrostatic            |       |
| General information                     |  | 20-1 | steering                                     | 25-11 |
| Preliminary engine testing              |  | 20-1 | Removal                                      | 25-11 |
| Engine tune-up                          |  | 20-2 | Installation                                 | 25-12 |
| Checking engine performance             |  | 20-4 | Removing and installing power-assisted stee- |       |
| Combine tune-up                         |  | 20-4 | ring cylinder on earlier combine models      | 25-12 |
| Standard torques                        |  | 20-6 | Removal                                      | 25-12 |
| Special tools                           |  | 20-7 | Installation                                 | 25-12 |
| GROUP 25 — COMBINE SEPARATION           |  |      | Removing and installing hydraulic pump on    |       |
| Removing engine                         |  | 25-1 | combines 330-730                             | 25-12 |
| General information                     |  | 25-1 | Removal                                      | 25-12 |
| Installing engine                       |  | 25-2 | Installation                                 | 25-13 |
| Removing and installing transmission on |  |      | Removing and installing brake valve          | 25-13 |
| combine 330/430 up to serial            |  |      | Removal                                      | 25-13 |
| No. 303995 and 402 960                  |  | 25-3 | Installation                                 | 25-13 |
| Removal                                 |  | 25-3 | Removing and installing clutch operating     |       |
| Installation                            |  | 25-3 | cylinder                                     | 25-14 |
| Removing and installing front axle on   |  |      | Removal                                      | 25-14 |
| combines 330/430 from serial            |  |      | Installation                                 | 25-14 |
| No. 303996 and 402961                   |  | 25-3 | Specifications                               | 25-14 |
| Removal                                 |  | 25-3 | Torques for hardware                         | 25-14 |
| Installation                            |  | 25-5 | Special tools                                | 25-14 |

**<https://www.ebooklibonline.com>**

Hello dear friend!

Thank you very much for reading.

Enter the link into your browser.

The full manual is available for immediate download.

**<https://www.ebooklibonline.com>**

## Group 5

# SPECIFICATIONS

### SERIAL NUMBERS

The combine serial number is stamped into the name plate on the right-hand side of the operator's platform.

The serial number is also stamped into the right-hand angle frame of the combine (see figs. 1 and 2) if the name plate gets lost for any reason.

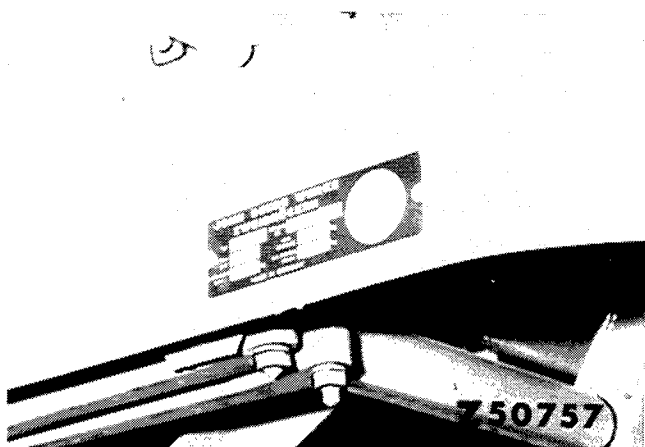


Fig. 1 — Serial Number Plate on Operator's Platform

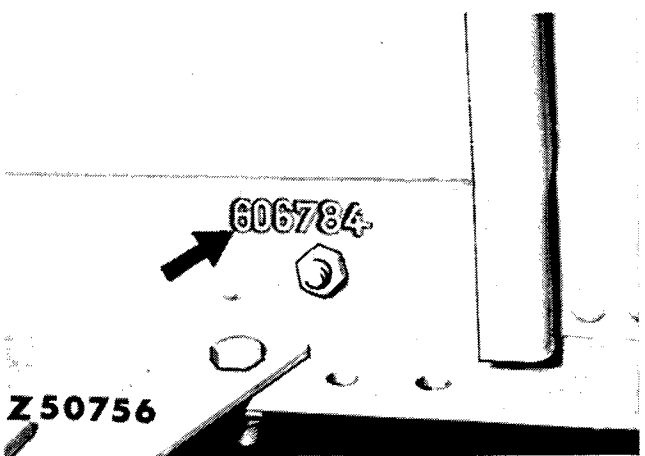


Fig. 2 — Serial Number Stamped into Angle Frame

The serial number of a John Deere engine is stamped into the name plate on the lower right of the cylinder block (see fig. 3).

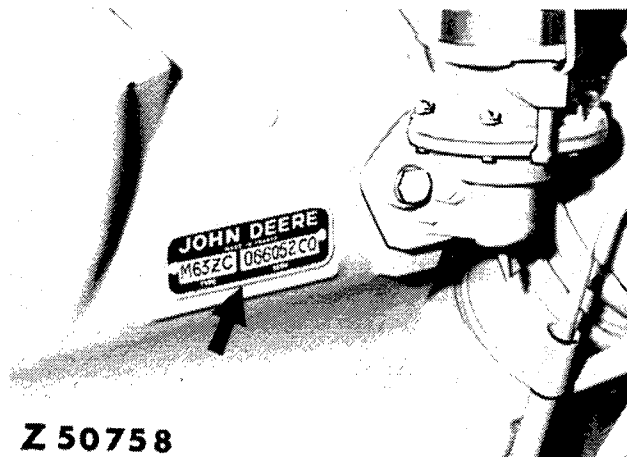


Fig. 3 — Engine Serial Number on a John Deere Engine

The serial number of a 6.354 Perkins engine is stamped into a level face on the injection pump drive housing at the left of the cylinder block (see fig. 4).

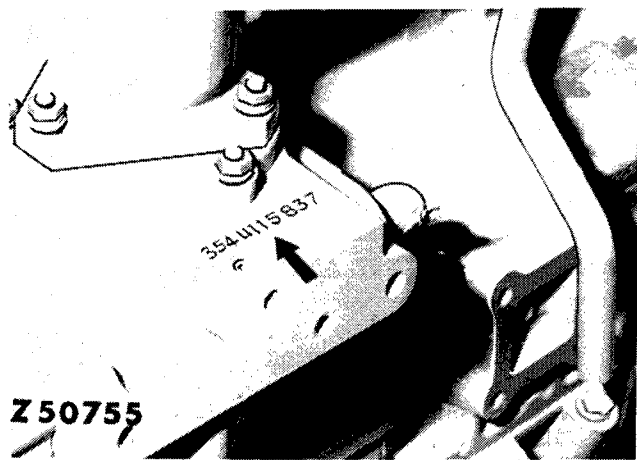


Fig. 4 — Serial Number Stamped into Perkins Engine

The serial number of the cutting platform is stamped into a plate on the outer right side panel of the platform (see fig. 5).

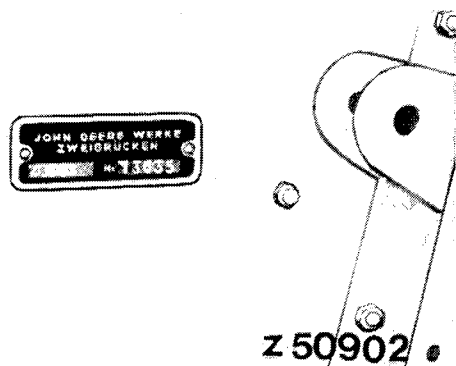


Fig. 5 — Serial Number of Cutting Platform

*NOTE: When ordering parts or making out a warranty claim, always state the serial numbers required as they are vital for proper parts delivery or processing of claims, resp.*

#### MODEL NUMBERS

The injection pump, injection nozzles, generator, starter and the main hydraulic pump have model numbers to facilitate identification of different makes of a given unit.

## Group 25

# SEPARATION

### Removal of engine

#### GENERAL INFORMATION

A hoist is required for removing engine from combine. The hoist should be high enough to lift the engine approx. 6 in. (150 mm) and to remove it sideways or to the rear (see fig. 1).

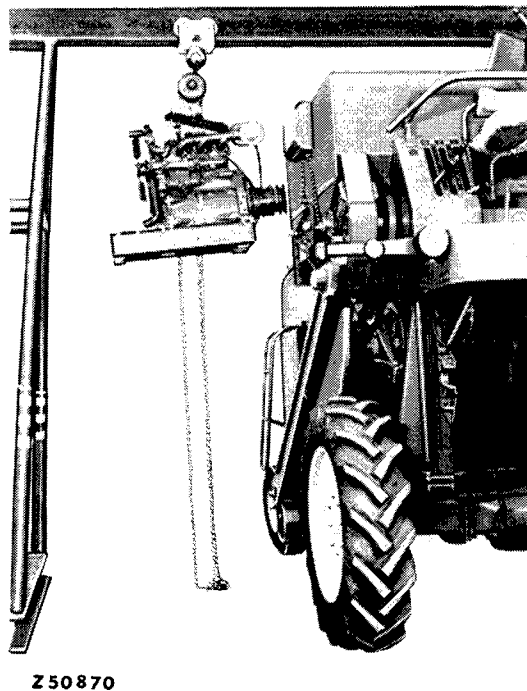


Fig. 1 — Hoist (Engine Being Removed Sideways from Combine)

*NOTE: For most service operations the engine need not be removed. However, remove the engine in case of major overhaul or if the crankshaft needs repair.*

*It will be best to remove the engine to the right of the combine as on the left the belt guide of unloading auger drive will be in the way.*

For safety, disconnect ground cable of battery and clean outside of engine. Remove right-hand engine baffle.

Disconnect wiring harness at connector 1 on engine (fig. 2). Loosen clamp 2 of fuel hoses on combine.

Remove 3 or 4 attaching screws 3 (depending on combine model) from right-hand engine support section.

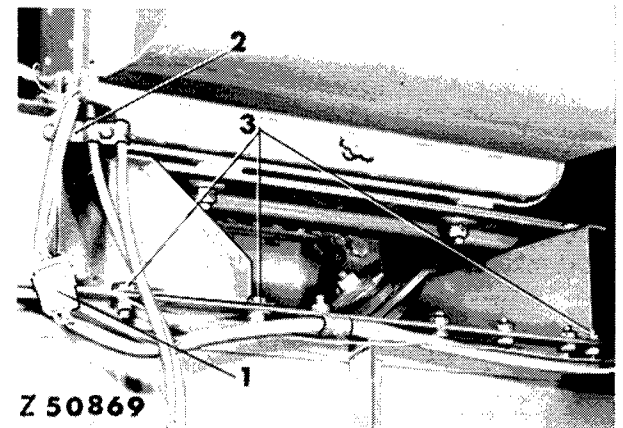


Fig. 2 — Removing Various Engine Connections on Radiator Side

- 1 Wiring harness - connector at engine
- 2 Fuel hose clamp
- 3 Attaching screws of engine supports

Remove fuel suction and return hoses 1 (fig. 3) from fuel transfer pump and fuel return line.

Disconnect positive (+) cable 3 at battery. Loosen attaching screws 2 of hydraulic pump bracket. Take off drive belt and remove hydraulic pump with bracket from engine. Loosen clamp 4 of vent pipe and withdraw vent pipe from rocker arm cover.

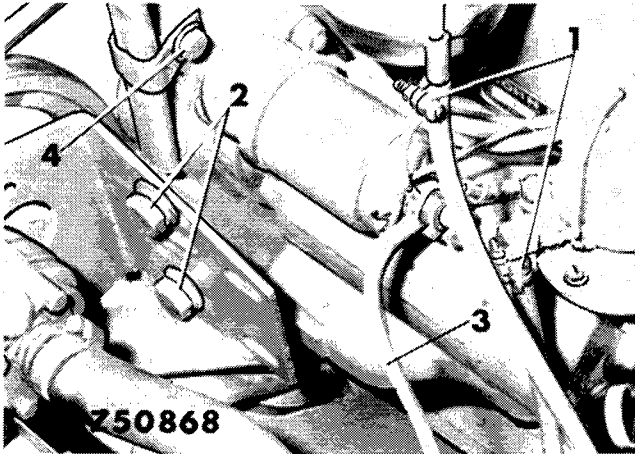


Fig. 3 — Removing Various Engine Connections Near Hydraulic Pump and Starter

- 1 Disconnect fuel hoses here
- 2 Attaching screws of hydraulic pump bracket
- 3 Positive cable
- 4 Vent pipe clamp

Disconnect throttle and stop control linkage 2 and 3 from control rods 1 at grain tank.

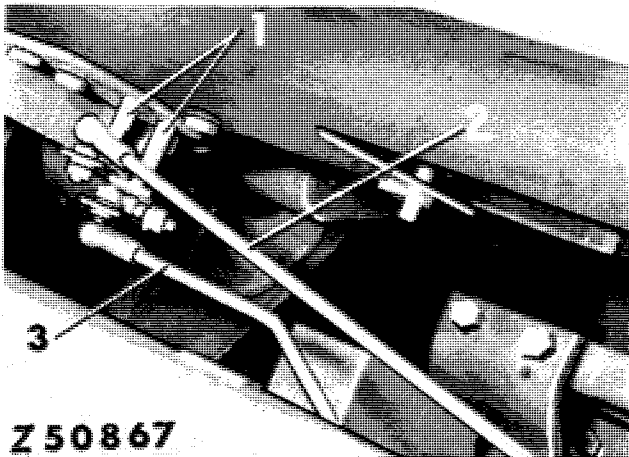


Fig. 4 — Removing Various Engine Connections Near Injection Pump

- 1 Control Rods at Grain Tank
- 2 Throttle linkage
- 3 Stop control linkage

Take unloading auger drive belt 1 (fig. 5) from engine drive pulley and move control lever of unloading auger in operating position.

Slacken ground drive belt 2 (see "Removal of Variable Ground Drive") and take it off the engine drive pulley.

Take off flat belt 3 and hydraulic pump drive belt 6. Remove grain tank braces 5 and 3 or 4 attaching screws 4 (fig. 5) from engine support sections.

Remove tightener pulley from its bracket on engines where bracket is attached to engine.

Attach lifting eyes (see Special Tools) to engine and lift up complete engine approx. 6 in. (150 mm) by means of a suitable hoist. Then slide engine out of combine.

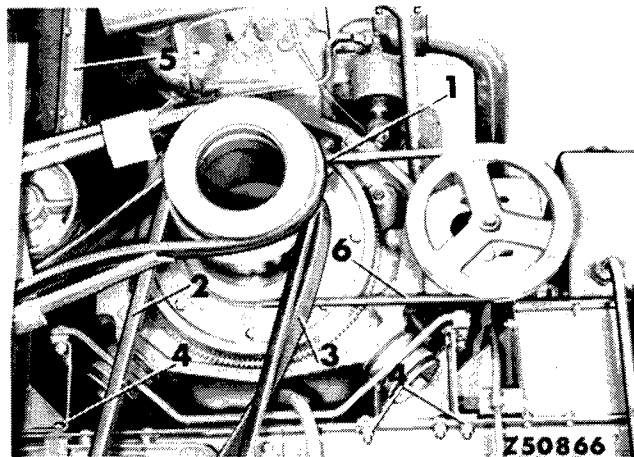


Fig. 5 — Removing Various Engine Connections Near Drive Pulley

- 1 Unloading auger drive belt
- 2 Ground drive belt
- 3 Flat belt
- 4 Attaching screws of engine support sections
- 5 Grain tank braces
- 6 Hydraulic pump drive belt

## Installation of engine

When installing the engine, reverse removal procedure.

When engine is installed, check crankcase oil and coolant level. Make a trial run of the engine.

After the trial run, check all attaching screws for tightness. Then check all drive belts (ground drive, hydraulic pump, separator and unloading auger) for proper adjustment and tension.

## Removal and installation of transmission combines 330/430 up to serial No. 303995 or 402960

### REMOVAL

For safety, disconnect ground cable of battery. Remove drive clutch (see Section 50) and drain transmission case.

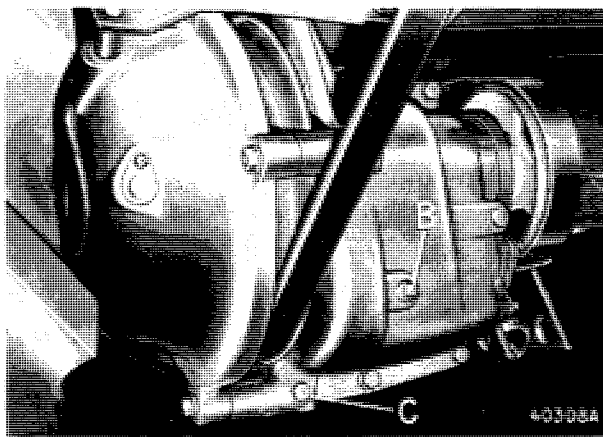


Fig. 6 — Transmission of Combines 330/430

- B Oil level check plug
- C Drain plug

Remove brake band from parking brake. Detach transmission case from differential, removing attaching screws 3 (fig. 7). Thoroughly clean exterior of transmission case in a suitable solvent cleaning agent. Place transmission case on a work bench.

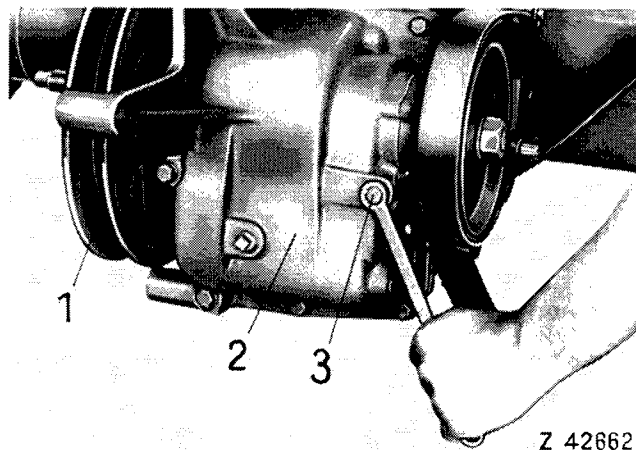


Fig. 7 — Removing Transmission from Combines 330/430

- 1 Transmission drive sheave
- 2 Transmission case
- 3 Attaching screws

### INSTALLATION

When installing transmission, reverse removal procedure.

**CAUTION:** Fill up transmission case with proper oil when transmission is installed.

## Removal and installation of front axles on combines 330/430 from serial No. 303996 or 402961

### REMOVAL

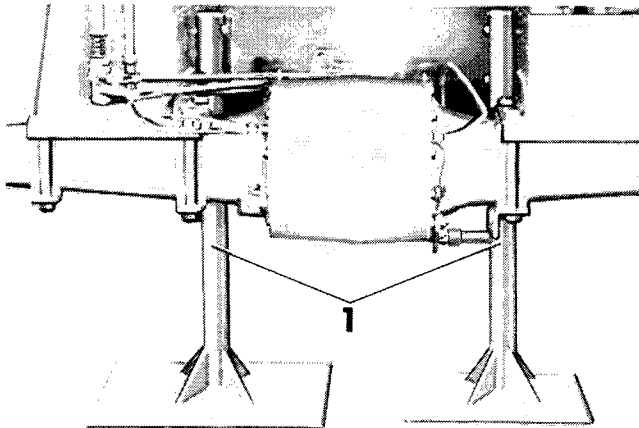
Disconnect ground cable from battery. Remove cutting platform with feeder conveyor and place it aside. Clean front axle.

Remove drive clutch (see Removal of Clutch, Section 50, Group 5). Disconnect clutch cable from lever on clutch housing and cable guide from bracket on angle frame. Also loosen hydraulic lines at clamp 7 (fig. 10) from bracket.

*NOTE: Drive clutch, control cable and hydraulic line should be removed to allow attachment, of left support stand to bracket, using provided holes (see fig. 8).*

Loosen front wheel bolts. Raise combine by means of a hoist (e. g. car jack) and support safely, using support stands 1.

The support stands shown in fig. 8 can be made in the workshop (see Specifications).



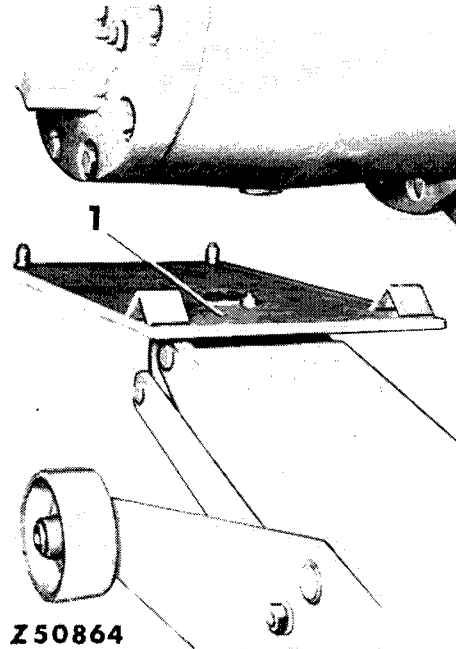
**Z 50865**

Fig. 8 — Combine Supported Safely

#### 1 Support stands

Remove front wheel bolts and slide off both front wheels.

Remove platform lift cylinders 4 (fig. 10) from supports on front axle. Support front axle under transmission case by means of car jack and the mounting plate recommended for manufacture in the workshop (see Specifications under Mounting Plate for Front Axle or Transmission) (see fig. 9).

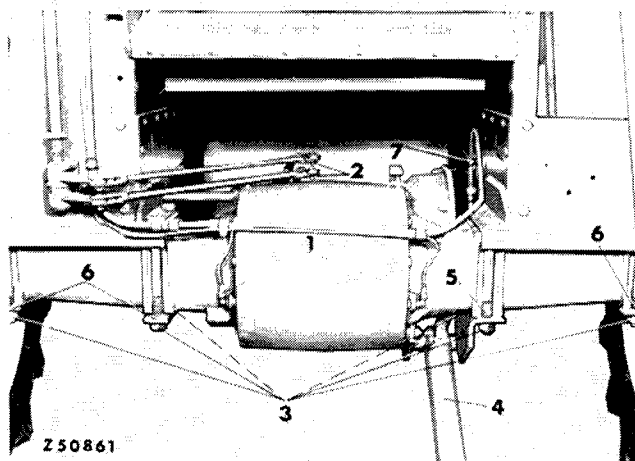


**Z 50864**

Fig. 9 — Mounting Plate

#### 1 Mounting plate on car jack

Disconnect pressure lines 1 of hydraulic brakes at adapters on both axle tubes. Remove shift linkage 2 from shifter levers of transmission.



**Z 50861**

Fig. 10 - Before Removing Front Axle

- 1 Brake lines
- 2 Shift linkage
- 3 Front axle attaching screws
- 4 Platform lift cylinders
- 5 Support plate of lift cylinders
- 6 Support plates
- 7 Clamp of hydraulic line

Disconnect parking brake linkage 1 (fig. 11) from brake shaft. Remove cotter pin from shaft and slide parking brake shaft 3 with brake band off brake disk (to the right).

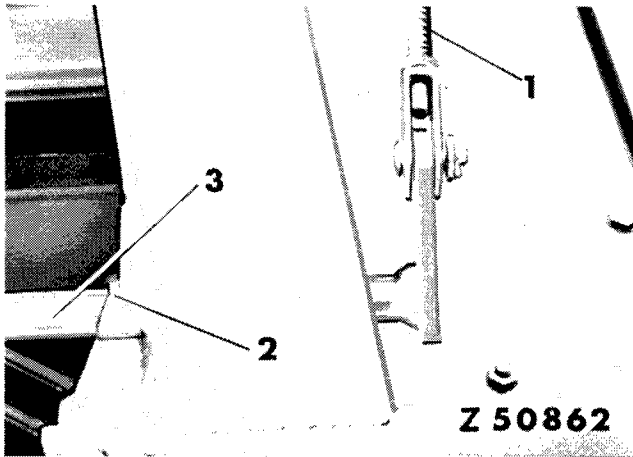


Fig. 11 — Removal of Parking Brake

- 1 Parking brake linkage
- 2 Cotter pin
- 3 Parking brake shaft

Remove nuts 3 (fig. 10) from screws attaching front axle to combine frame. Remove left support plate 5 of platform lift cylinder and three support plates 6 of front axle. The front axle resting on the mounting plate can now be separated from combine frame by means of the car jack.

### INSTALLATION

When installing the front axle, reverse removal procedure.

When front axle is installed, tighten screws attaching front axle to combine frame, and front wheel bolts to the specified torque (see Specifications).

Bleed brake (see Section 70), check and adjust clutch pedal free travel (if necessary), attach cutting platform to combine and connect ground cable to negative pole of battery.

*NOTE: If front axle was removed to facilitate repair of transmission, do not forget to fill up transmission case with proper oil after re-installing front axle.*

## Removal and installation of transmission on combines from serial No. 303996 or 402961

### REMOVAL

*NOTE: If the transmission needs repair, the front axle does not have to be removed. However, if the differential or the differential pinion shaft requires repair, first remove the front axle.*

Remove front axle assembly (see Removal and Installation of Front Axle).

Remove clutch housing from transmission case.

Turn attaching screws out of axle tubes 2 (fig. 12) and separate axle tubes from transmission case 1.

The transmission assembly can now be removed (see Section 50, Group 20).

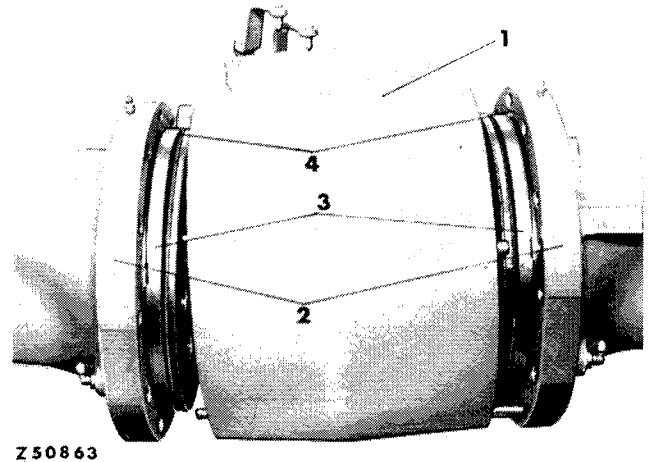


Fig. 12 — Transmission with Axle Tubes

- 1 Transmission case
- 2 Axle tubes
- 3 Brake actuating disk

### INSTALLATION

Before attaching axle tubes to transmission case, make sure flange gaskets 4 are still serviceable. Use new gaskets, if necessary.

Position both axle tubes against transmission case. Make sure brake actuating disk 3 remains seated on dowel pins.

Tighten axle tube attaching screws to the specified torque (see Specifications).

Attach clutch housing to transmission case. Install front axle (see Removal and Installation of Front Axle on Combines 330/430 from Serial No. 303996 resp. 402961). Fill up transmission case with proper oil (see Operator's Manual) when front axle is installed.

**CAUTION:** Connect ground cable to battery.

## Removal and installation of transmission on combines 530/630/730

### REMOVAL

For safety, disconnect ground cable at battery.

Remove cutting platform and feeder conveyor. Clean exterior of transmission case. Slacken ground drive belt (see Removal and Installation of Variable Ground Drive) and take it off the belt pulley.

Drive roll pin 1 (fig. 14) out of sleeve 2. Slide sleeve off splined shaft (differential shaft). Secure transmission against dropping by means of a car jack and mounting plate (see Specifications under Mounting Plate for Transmission on Combines 530/630/730).

*NOTE: The recommended mounting plate can be made in the workshop (see Specifications and sketch).*

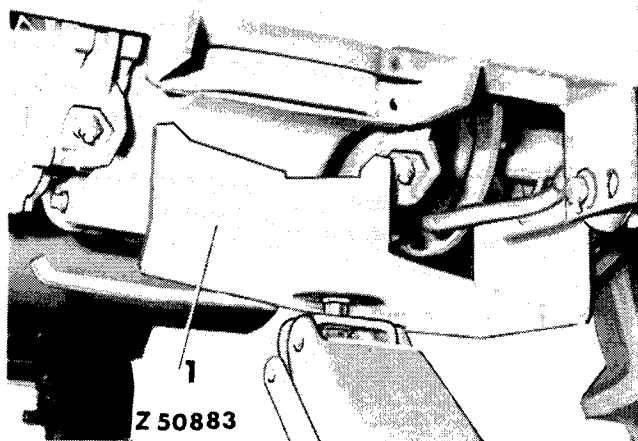


Fig. 13 — Transmission Supported by Means of Mounting plate  
1 Mounting plate for transmission of combines 530/630/730 on car jack

Disconnect shift linkage 3 (fig. 14) from shifter rods on transmission. Unhook return springs 4 of brake pedals and loosen both brake linkages 5. Remove attaching screws 6 from transmission case and front axle.

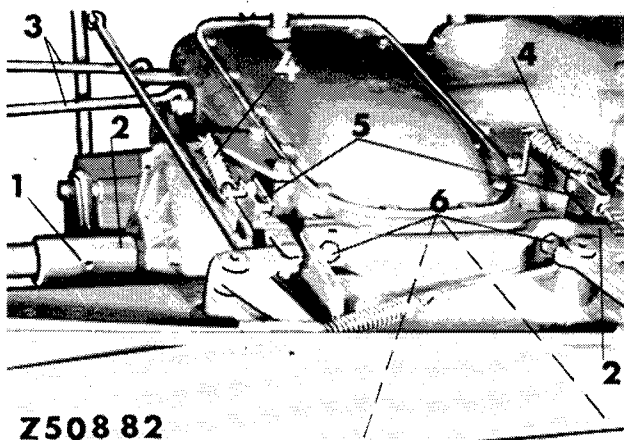


Fig. 14 — Shift Linkage on Transmission

- |                 |                      |
|-----------------|----------------------|
| 1 Roll pin      | 4 Return springs     |
| 2 Sleeve        | 5 Foot brake linkage |
| 3 Shift linkage |                      |

Disconnect parking brake linkage 1 (fig. 15) and clutch linkage 2 from relative levers on transmission. Unlock attaching screws 3 and remove from clutch housing.

The transmission now supported by the mounting plate can be separated from the front axle by means of the car jack.

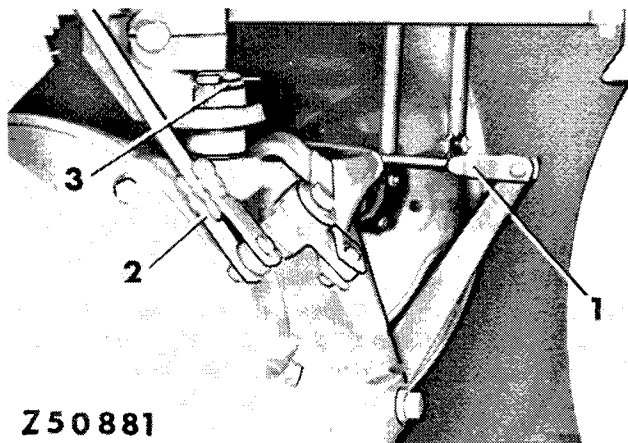


Fig. 15 — Removing Parking Brake and Clutch Linkage

- |                          |
|--------------------------|
| 1 Parking brake linkage  |
| 2 Clutch linkage         |
| 3 Front attaching screws |

## INSTALLATION

When installing transmission, reverse removal procedure.

If necessary, use new lock plates on clutch housing attaching screws 3 (fig. 15). When transmission is installed, tighten ground drive belt and check pedal free travel.

*NOTE: If transmission has been repaired, always refill with proper oil (see Operator's Manual).*

## Removal and installation of final drives on combines 530/630/730

### REMOVAL

For safety, disconnect ground cable from battery.

Loosen front wheel bolts from final drive to be removed. Raise combine and support front axle safely. Remove wheel bolts and pull off front wheel. Drive roll pin 1 (fig. 16) out of splined sleeve 2 and slide sleeve off final drive shaft 4. Secure final drive against dropping by means of a rope and hoist. Turn out final drive attaching screws 3. Separate final drive from front axle.

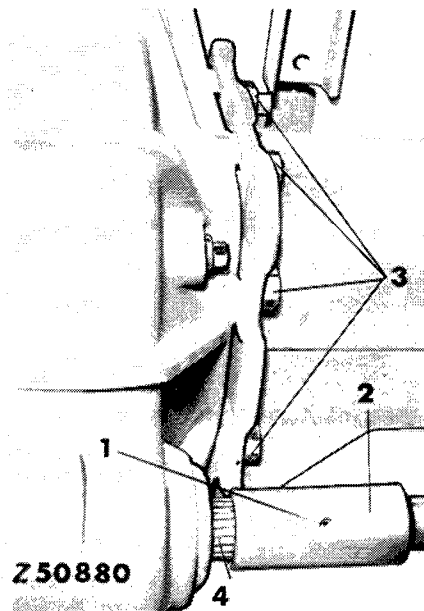


Fig. 16 — Removing Final Drive

- 1 Roll pin
- 2 Splined sleeve
- 3 Final drive attaching screws
- 4 Drive shaft

## INSTALLATION

When installing final drive, reverse removal procedure.

If final drive is installed, tighten attaching screws 3 and front wheel bolts to the specified torque (see Specifications).

**CAUTION:** If final drive has been removed for repair, fill up housing with proper oil (see Operator's Manual).

## Removal and installation of front axle on combines 530/630 and 730

### REMOVAL

Remove cutting platform and feeder conveyor. For safety, disconnect ground cable from battery. Clean front axle. Loosen front wheel bolts. Raise combine by placing car jack under front axle and support safely under combine frame.

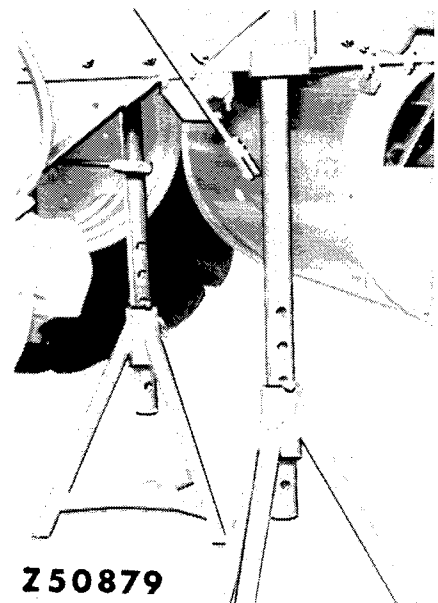


Fig. 17 — Combines 530/630/730 Supported with Support Stands under Combine Frame

Slacken ground drive belt (see Installation and Removal of Variable Ground Drive) and take it off the V-belt pulley. Turn out front wheel bolts and pull off front wheels.

Disconnect pressure hose of platform lift cylinder from pressure line 7 (fig. 18) and plug openings. Remove lift cylinder from its support on front axle.

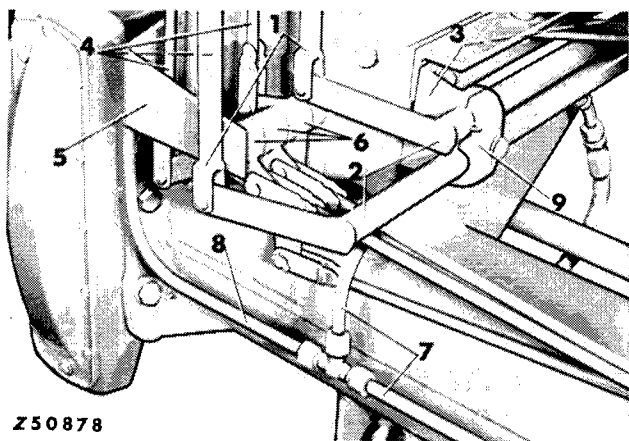


Fig. 18 — Removing Shift Linkage

- 1 Shift rods
- 2 Shift shafts
- 3 Brackets
- 4 Foot and parking brake linkage
- 5 Retainer
- 6 Bell cranks
- 7 Pressure line (of both lift cylinders)
- 8 Pressure line (from control valve)
- 9 Retainer

Disconnect clutch linkage 2 (fig. 15) from clutch housing lever. Unlock attaching screw 3 on clutch housing and turn out.

Disconnect shift linkage 3 (fig. 14) from transmission shift shafts. To secure front axle against dropping, support it under transmission case by means of recommended mounting plate 1 (fig. 13).

Disconnect shift rods 1 (fig. 18) from shift shafts 2 and remove shafts with brackets 3.

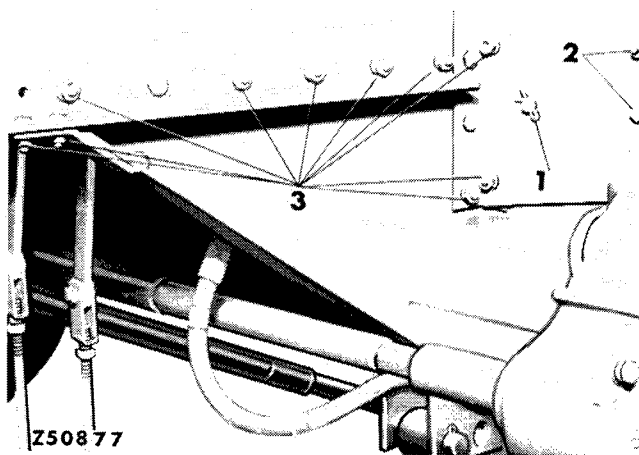


Fig. 19 — Front Axle Support on Combines 530/630/730

- 1 Cotter pin
- 2 Attaching screws of retainer
- 3 Screws attaching front axle to combine frame, r.h. side

Withdraw cotter pin 1 (fig. 19). Remove retainer attaching screws (fig. 18) and retainer 9. Disconnect foot and parking brake linkage 4 from bell cranks 6.

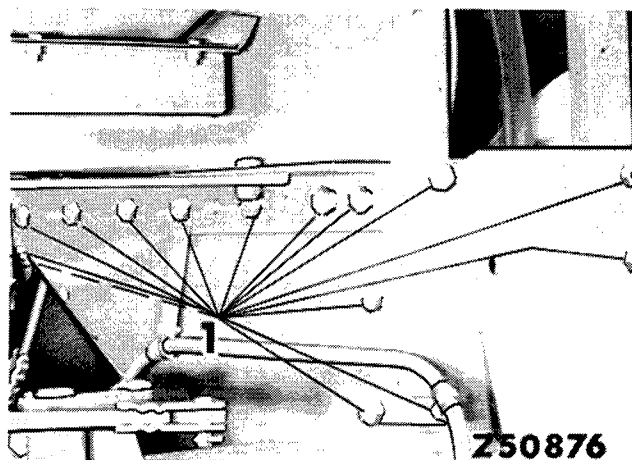


Fig. 20 — Front Axle Attached

- 1 Screws attaching front axle to combine frame, l.h. side

Remove screws 3 (fig. 19) on r.h. side and screws 1 on l.h. side attaching front axle to combine frame. Disconnect line 7 (fig. 18) from line 8 and plug openings. Remove lines with retainers and clamps. Remove front axle resting on mounting plate from combine.

## INSTALLATION

When installing front axle, reverse removal procedure. When front axle is installed, tighten screws attaching front axle to combine frame and front wheel bolts to the specified torque (see Torque Chart or Specifications).

## Removal and installation of rear axle on combines 330 through 730

For safety, disconnect ground cable at battery. Raise rear axle of combine by means of car jack and support safely on both sides under combine frame (See fig. 21).

Use commercial support stands for supporting the combine.

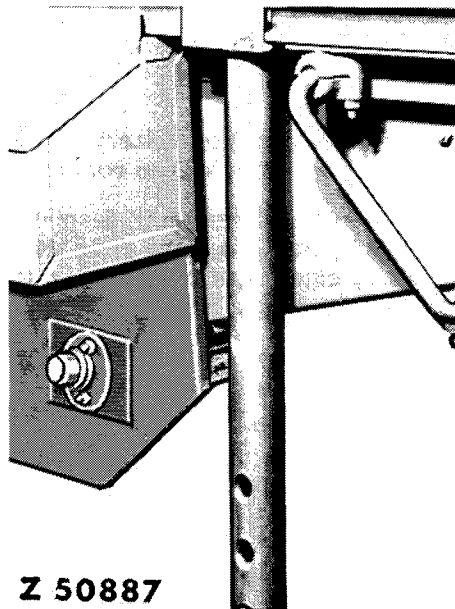


Fig. 21 — Combine Safely Supported for Removal of Rear Axle

To prevent dropping of rear axle, support it by means of car jack.

Withdraw cotter pin 1 (fig. 22) and remove slotted nut 2.

Pull socket 3 of drag link off steering arm 4, using a commercial socket puller (see fig. 27).

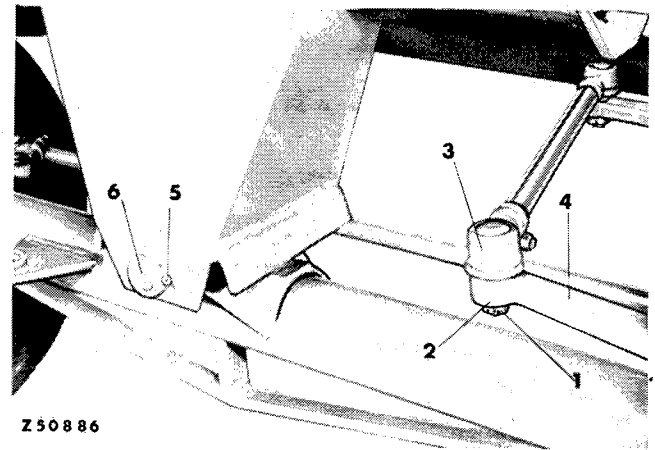


Fig. 22 — Remove Drag Link

- 1 Cotter pin
- 2 Slotted nut
- 3 Socket of drag link
- 4 Steering arm
- 5 Roll pin
- 6 Rear axle bolt

*NOTE: On tractors provided with hydrostatic steering, remove pressure hoses of steering cylinder (see Removing and Installing Steering Cylinder with Hydrostatic Steering) instead of drag link.*

Withdraw roll pin 5 (fig. 22) from rear axle support.

Drive rear axle bolt 6 out of axle, using a brass driver and hammer. Lower rear axle by means of car jack until wheels contact ground and remove to the rear.

## INSTALLATION

When installing rear axle, reverse removal procedure.

## Removing and installing steering pump on combines with hydrostatic steering (combines 430 through 730)

### REMOVAL

Disconnect ground cable at battery. Remove steering column cover. Unlock and turn off attaching nuts.

Pull off steering wheel by means of a commercial puller. Remove dashboard from steering column (see fig. 23).

Drive roll pin 1 (fig. 23) out of ground speed control lever and withdraw locking lever 2 with shaft 3 to the right.

**CAUTION:** When withdrawing shaft 3, make sure shims 4 do not drop into steering column. Turn union nuts 5 of hydraulic lines off steering pump fittings. Remove attaching screws 6 and lift cast bearing housing with steering pump off steering column. Plug hydraulic lines to keep dirt or other foreign particles out of hydraulic system.

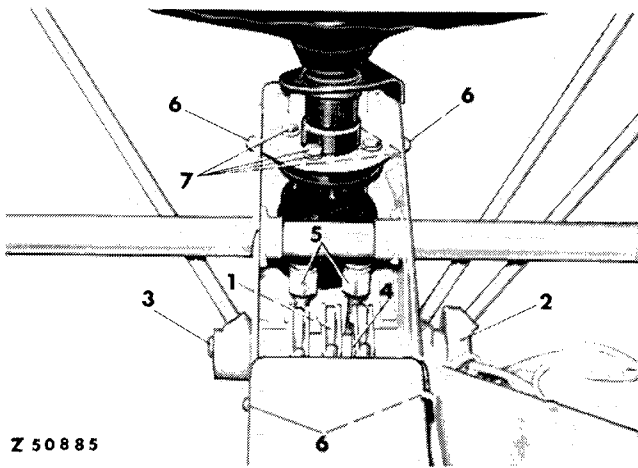


Fig. 23 — Removing and Installing Steering Pump

- 1 Roll pin
- 2 Locking lever
- 3 Shaft
- 4 Shims
- 5 Union nuts of hydraulic lines
- 6 Attaching screws of bearing housing
- 7 Attaching screws of steering pump

Clamp cast bearing housing with steering pump in a vise. Remove attaching screws 7 and pull steering pump downward out of bearing housing.

**CAUTION:** Use utmost care and cleanliness when working on the hydraulic system. Be especially careful to keep dirt or other foreign particles out of hydraulic system.

### INSTALLATION

When installing the steering pump, reverse removal procedure.

Tighten union nuts 5 of hydraulic lines.

After installation, bleed hydraulic system (see Section 70, Group 5).

## Removing and installing steering valve on combines with hydrostatic steering (combines 430 through 730)

### REMOVAL

Disconnect ground cable of battery. Drain oil in hydraulic oil reservoir into a clean container.

**CAUTION:** Use utmost care and cleanliness when working on the hydraulic system. Even the smallest dirt or other foreign particles may impair proper operation of the hydraulic system.

Clean valve located under operator's platform.

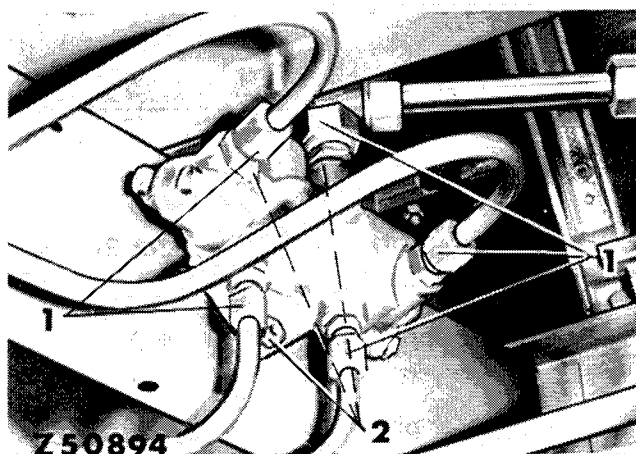


Fig. 24 — Location of Steering Valve

- 1 Hydraulic line union nuts
- 2 Attaching screws of steering valve

Turn union nuts of lines 1 (fig. 24) off steering valve fittings. Remove attaching screws 2 and steering valve assembly. Plug all line openings as well as steering valve adapters.

### INSTALLATION

When installing steering valve, reverse removal procedure. Fill up with hydraulic oil, connect ground cable and start combine. Make sure installed steering valve does not leak. Tighten leaking connections.

**IMPORTANT:** Bleed hydraulic system (see Section 70, Group 5).

## Removing and installing control valve (combines 330 through 730)

### REMOVAL

Lower cutting platform and reel to relieve hydraulic lines. Disconnect ground cable to prevent accidental starting of engine. Drain hydraulic oil into a clean container.

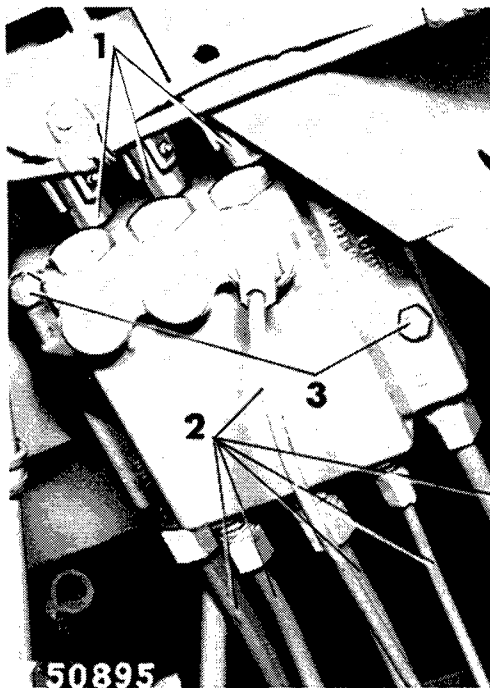


Fig. 25 — Location of Control Valve

- 1 Control linkage
- 2 Hydraulic lines
- 3 Attaching screws

Clean exterior of control valve and its vicinity. Disconnect control linkage 1 (fig. 25) from control valve spools. Disconnect hydraulic lines 2 from control valve fittings. Remove attaching screws 3 and take off control valve. Plug lines and control valve fittings to keep dirt out of hydraulic system.

### INSTALLATION

When installing control valve, reverse removal procedure. Fill up with hydraulic oil, replacing any spilled oil. With the engine running, check control valve for leakage. Tighten loose connections.

## Removing and installing steering cylinder on combines with hydrostatic steering (combines 430 through 730)

### REMOVAL

For safety, disconnect ground cable at battery. Disconnect pressure hoses 1 (fig. 26) from adapters of steering cylinder 3 and plug openings to keep out dirt and other foreign particles. Remove nuts 2 of socket bolts. Pull sockets off steering arms (see fig. 27) by means of a commercial puller.

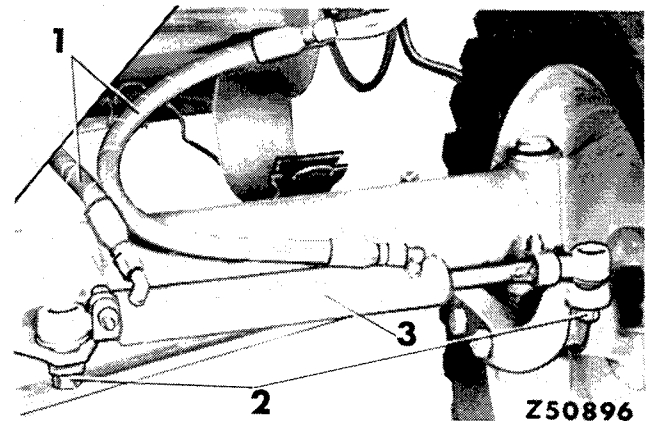


Fig. 26 — Steering Cylinder (Hydrostatic Steering Shown)

- 1 Pressure hoses
- 2 Socket attaching nuts
- 3 Steering cylinder

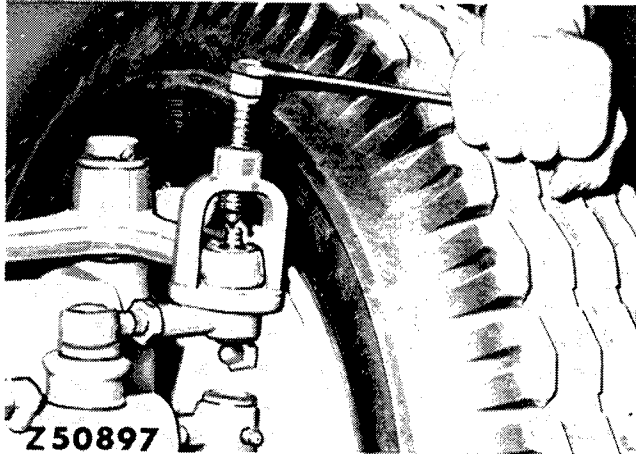


Fig. 27 — Using the Socket Puller

Fig. 27 shows how to pull off a socket by means of a commercial puller.

### INSTALLATION

When installing steering cylinder, reverse removal procedure. Tighten nuts 2 to the specified torque.

Check adjustment of steering cylinder to assure proper operation of steering system (see Section 70, Group 35).

*NOTE: When installing steering cylinder, be sure to use new stop nuts to fasten sockets securely.*

## Removing and installing steering cylinder on earlier units (power-assisted steering)

### REMOVAL

For safety, disconnect ground cable at battery. Disconnect pressure hoses 1 (fig. 26) from adapters of steering cylinder and plug all openings. Unlock slotted nuts of socket bolts and remove. Pull sockets off steering arms or bracket on axle support (see fig. 27), using a commercial puller.

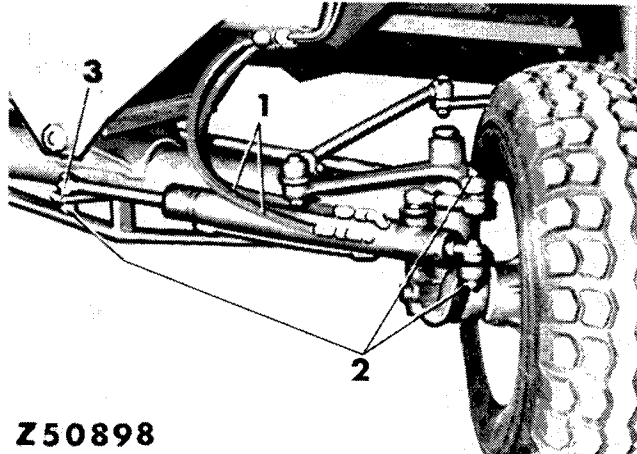


Fig. 28 — Power-Assisted Steering Cylinder Installed

- 1 Pressure hoses
- 2 Socket nuts
- 3 Bracket on Axle

### INSTALLATION

When installing power-assisted steering cylinder, reverse removal procedure.

## Removing and installing hydraulic pump (combines 330 through 730)

### REMOVAL

For safety, disconnect ground cable at battery. Drain hydraulic oil into a clean container. Loosen attaching screws 1 (fig. 29). Slacken hydraulic pump drive belt and take it off pulley. Disconnect suction hose 3 as well as two pressure lines 4 from hydraulic pump. Plug all openings to keep dirt and other foreign particles out of hydraulic system. Remove nut 2 (fig. 29) and pull V-belt pulley off hydraulic pump by means of a commercial puller.

Remove two attaching screws 1 and take hydraulic pump from its bracket.

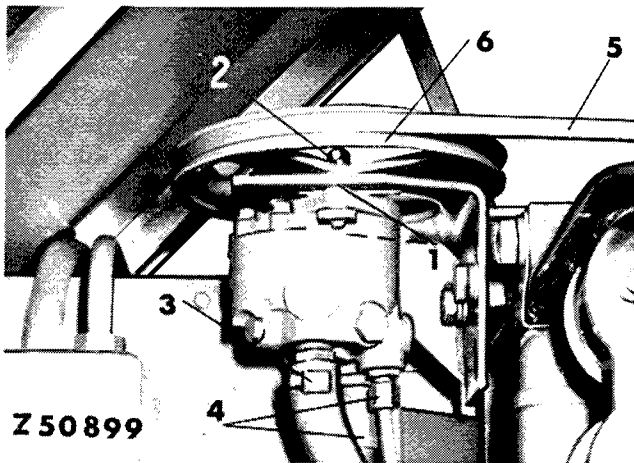


Fig. 29 — Hydraulic Pump Installed

- 1 Screws attaching hydraulic pump to its bracket
- 2 Belt pulley attaching nut
- 3 Suction hose
- 4 Pressure lines\*
- 5 Drive belt
- 6 V-belt pulley

\* Combines without power steering only have 1 pressure line in this location.

### INSTALLATION

When installing hydraulic pump, reverse removal procedure.

Fill up with hydraulic oil, replacing any spilled oil. Connect ground cable. Start the engine and check hydraulic pump for leakage. Tighten pressure line connections or clamp of suction hose, if necessary.

## REMOVING AND INSTALLING MASTER CYLINDER (FROM COMBINE NOS. 303 996 AND 402 961)

### REMOVAL

For safety, disconnect battery ground cable. Drain hydraulic oil from reservoir into a suitable clean container. Install clamping device (see Special Tools) as shown in fig. 30. This tool prevents damage to check valves and brake pistons caused by sudden release of pistons when removing brake pedals. The clamping device must not be removed until pressure behind pistons has been relieved.

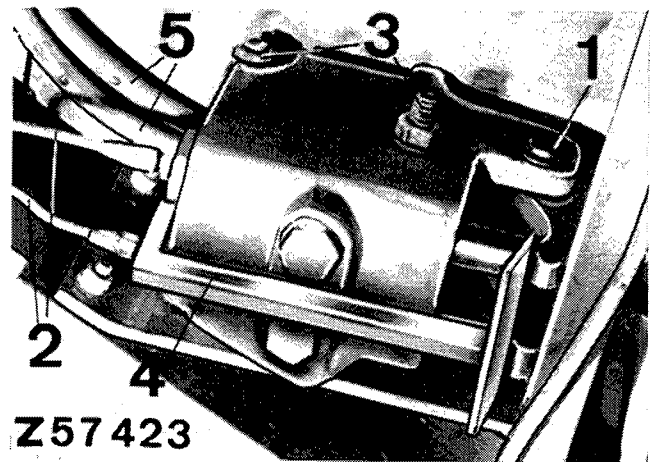


Fig. 30 — Brake Master Cylinder with Special Tool Installed

- |                    |                   |
|--------------------|-------------------|
| 1 Pedal shaft      | 4 Clamping device |
| 2 Brake lines      | 5 Inlet lines     |
| 3 Attaching screws |                   |

### INSTALLATION

Install master cylinder, reversing removal procedure as described under "Removal".

Fill reservoir with recommended oil (see Section 70 and Operators's Manual). Finally adjust and bleed brakes as described in Section 70.

# REMOVAL AND INSTALLATION OF CLUTCH MASTER CYLINDER

## REMOVAL

For safety, disconnect battery ground cable. Drain hydraulic oil from reservoir into a suitable clean container. Disconnect lines to oil reservoir and clutch master cylinder. Remove snap ring and drive out pedal shaft 1. Remove attaching screws 4.

When removing clutch pedal make sure that piston does not slide to end position and damage check valve.

## INSTALLATION

Install clutch master cylinder, reversing removal procedure as described under "Removal".

Fill oil reservoir with recommended oil (see Section 70 and Operator's Manual). Finally carefully bleed system.

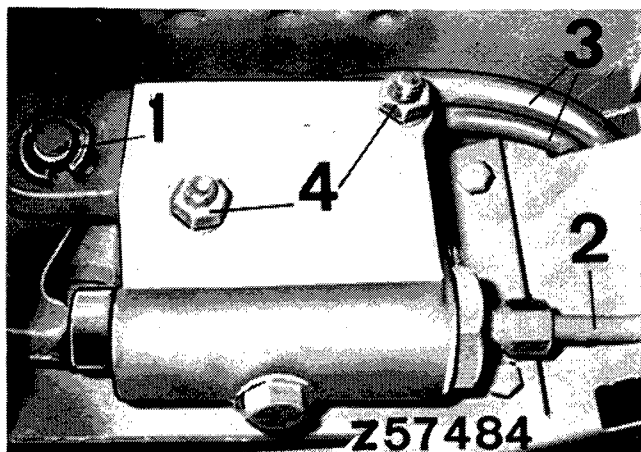


Fig. 31 — Removing Clutch Master Cylinder

- |                 |                    |
|-----------------|--------------------|
| 1 Pedal shaft   | 3 Inlet lines      |
| 2 Pressure line | 4 Attaching screws |

## SPECIFICATIONS

### TORQUES FOR HARDWARE

|                                                              |               |         |
|--------------------------------------------------------------|---------------|---------|
| Socket nuts of steering cylinder . . . . .                   | 72 ft.lbs.    | 10 mkg  |
| Hydraulic lines of steering pump . . . . .                   | 44.8 ft.lbs.  | 6.2 mkg |
| Front axle to combine frame - combines 330, 430 . . . . .    | 144.6 ft.lbs. | 9 mkg   |
| Axle tube to transmission case - combines 330, 430 . . . . . | 65 ft.lbs.    | 20 mkg  |
| Final drive to axle support - combine 530-730 . . . . .      | 79.5 ft.lbs.  | 11 mkg  |
| Front wheel bolts - combines 330-730 . . . . .               | 238.6 ft.lbs. | 33 mkg  |

### SPECIAL TOOLS

| Part No. when ordering from<br>JD Parts Depot | Manufacturer       | Description                 | Use                            |
|-----------------------------------------------|--------------------|-----------------------------|--------------------------------|
| L 48524 . . . .                               | JD 244-1** . . . . | Lifting eye, straight . . . | Removing and installing engine |
| L 48525 . . . .                               | JD 244-2** . . . . | Lifting eye, bent . . . .   | ditto                          |

\*\* OWATONNA TOOL COMPANY, OWATONNA/MINNESOTA 55060, USA

*NOTE: The special tools for removing and installing assemblies shown in the following illustrations should be made in your workshop.*

**Support Stand for Removing and Installing Front Axle (on Combines 330/430 - Later Units)**

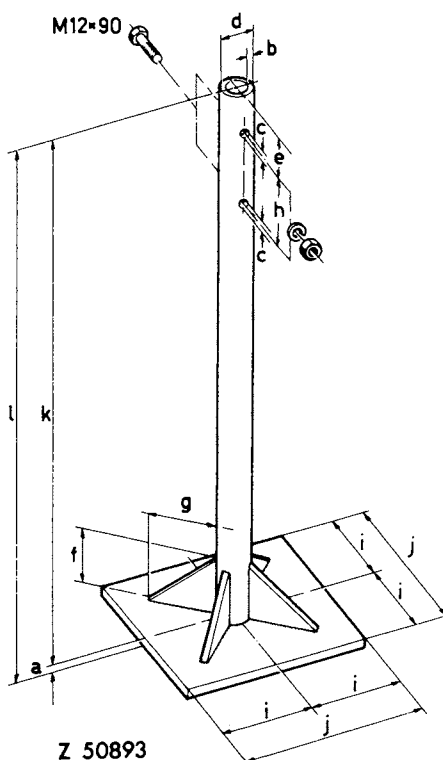


**Fig. 32 — Support Stand**

|     | in.   | mm |
|-----|-------|----|
| a = | 0.315 | 8  |
| b = | 0.394 | 10 |
| c = | 0.512 | 13 |
| d = | 1.968 | 50 |

|     | in.   | mm  |
|-----|-------|-----|
| e = | 2.632 | 60  |
| f = | 3.543 | 90  |
| g = | 3.937 | 100 |
| h = | 4.803 | 122 |

|     | in.    | mm  |
|-----|--------|-----|
| i = | 5.905  | 150 |
| j = | 11.811 | 300 |
| k = | 37.402 | 950 |
| l = | 37.716 | 958 |

**Mounting Plate for Removing and Installing Transmission  
or Front Axle (on Combines 530/630/730)**

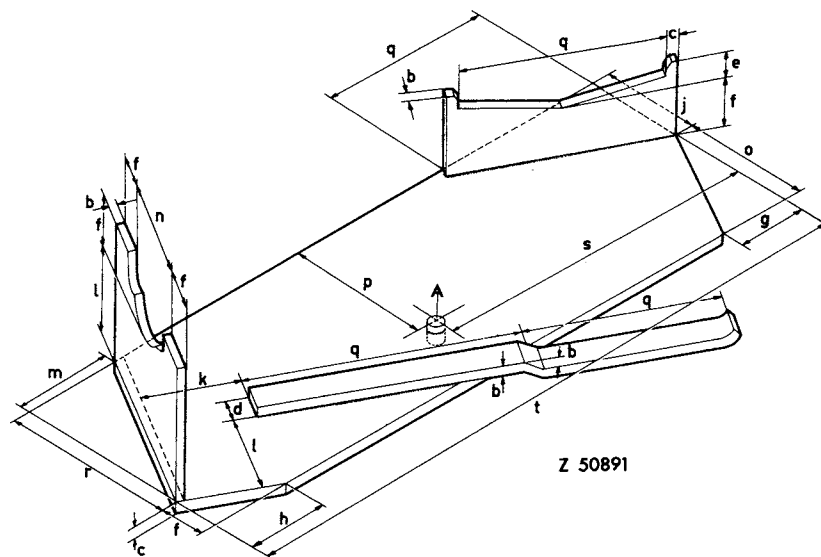


**Fig. 33 — Mounting Plate**

| in.       | mm | in.       | mm  | in.       | mm  | in.        | mm  |
|-----------|----|-----------|-----|-----------|-----|------------|-----|
| b = 0.472 | 12 | f = 2.632 | 60  | k = 5.118 | 130 | p = 7.874  | 200 |
| c = 0.590 | 15 | g = 3.740 | 95  | l = 5.512 | 140 | q = 9.055  | 230 |
| d = 1.378 | 35 | h = 4.330 | 110 | m = 5.708 | 145 | r = 9.449  | 240 |
| e = 1.575 | 40 | j = 4.921 | 125 | n = 6.299 | 160 | s = 17.520 | 445 |
|           |    |           |     | o = 6.889 | 175 | t = 35.039 | 890 |

"A" depending on car jack model

**Mounting Plate for Removing and Installing Front Axle  
(on Combines 330/430 - Earlier Units)**

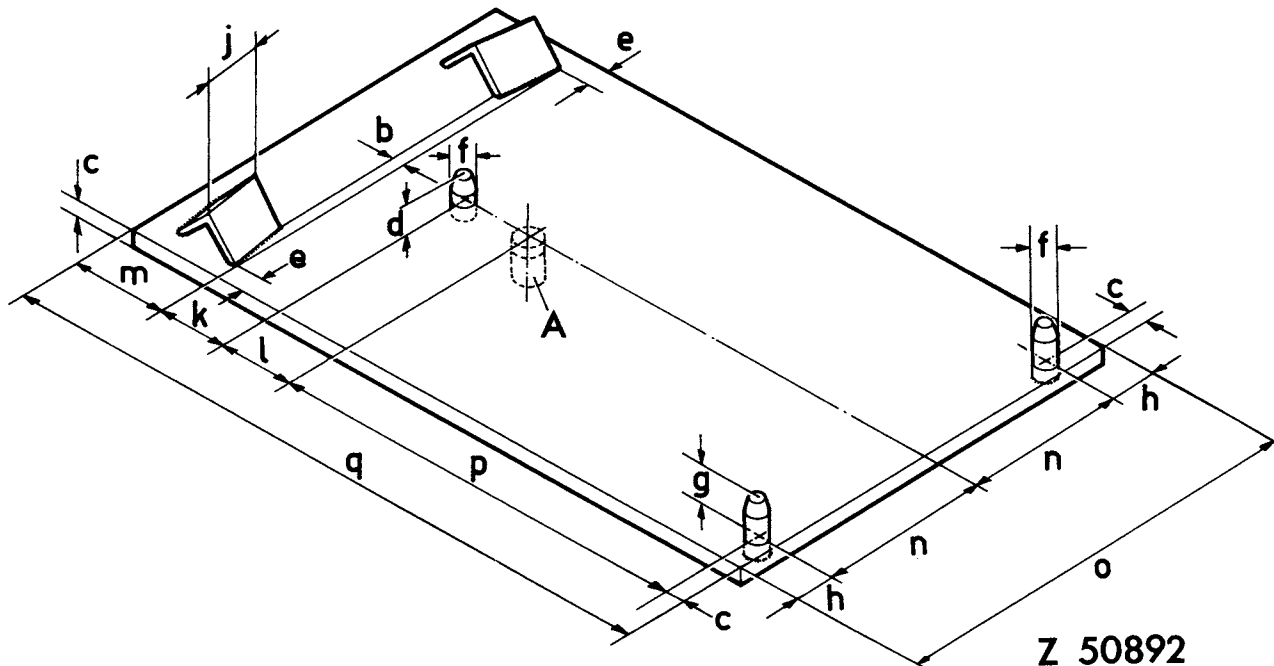


**Fig. 34 — Mounting Plate**

| in.       | mm | in.       | mm | in.        | mm  |
|-----------|----|-----------|----|------------|-----|
| b = 0.118 | 3  | g = 0.984 | 25 | m = 2.480  | 63  |
| c = 0.394 | 10 | h = 1.102 | 28 | n = 4.409  | 112 |
| d = 0.551 | 14 | j = 1.378 | 35 | o = 11.023 | 280 |
| e = 0.590 | 15 | k = 1.850 | 47 | p = 11.220 | 285 |
| f = 0.630 | 16 | l = 1.968 | 50 | q = 17.913 | 455 |

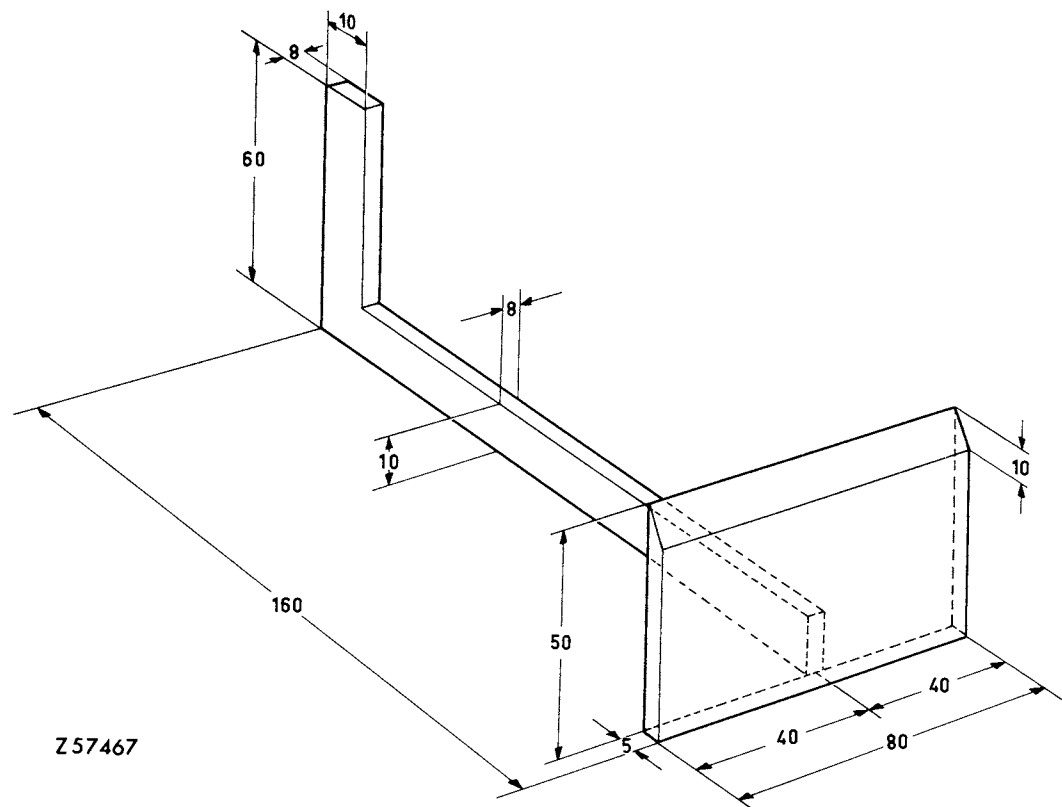


Fig. 35 — Clamping Device for Removing Brake Master Cylinder

## Section 20

# ENGINE

### CONTENTS OF THIS SECTION

|                                                                   |                                                                           |             |
|-------------------------------------------------------------------|---------------------------------------------------------------------------|-------------|
| GROUP 5 — GENERAL INFORMATION,<br>DIAGNOSING MALFUNCTIONS         | Specifications . . . . .                                                  | 20-7        |
|                                                                   | Torques for hardware . . . . .                                            | 20-7        |
|                                                                   | Special tools . . . . .                                                   | 20-8        |
| General information . . . . .                                     |                                                                           | 5-2         |
| Diagnosing malfunctions . . . . .                                 |                                                                           | 5-3         |
| GROUP 10 — CYLINDER HEAD AND CAMSHAFT                             |                                                                           |             |
| General information . . . . .                                     |                                                                           | 10-1        |
| Cylinder head . . . . .                                           |                                                                           | 10-1        |
| Removal . . . . .                                                 |                                                                           | 10-1        |
| Repair . . . . .                                                  |                                                                           | 10-2        |
| Installation . . . . .                                            |                                                                           | 10-2        |
| Adjusting valve clearance . . . . .                               |                                                                           | 10-4        |
| Camshaft . . . . .                                                |                                                                           | 10-4        |
| Removal . . . . .                                                 |                                                                           | 10-4        |
| Repair . . . . .                                                  |                                                                           | 10-4        |
| Installation . . . . .                                            |                                                                           | 10-5        |
| Balancer shafts . . . . .                                         |                                                                           |             |
| Removal . . . . .                                                 |                                                                           | 10-6        |
| Repair . . . . .                                                  |                                                                           | 10-6        |
| Installation . . . . .                                            |                                                                           | 10-8        |
| Specifications . . . . .                                          |                                                                           | 10-9, 10-10 |
| Torques for hardware . . . . .                                    |                                                                           | 10-11       |
| Special tools . . . . .                                           |                                                                           | 10-11       |
| GROUP 15 — CYLINDER BLOCK, LINERS,<br>PISTONS AND CONNECTING RODS |                                                                           |             |
| General information . . . . .                                     |                                                                           | 15-1        |
| Removal . . . . .                                                 |                                                                           | 15-1        |
| Repair . . . . .                                                  |                                                                           | 15-2        |
| Assembly . . . . .                                                |                                                                           | 15-6        |
| Installation . . . . .                                            |                                                                           | 15-7        |
| Specifications . . . . .                                          |                                                                           | 15-9        |
| Torques for hardware . . . . .                                    |                                                                           | 15-11       |
| Engine break-in . . . . .                                         |                                                                           | 15-12       |
| Tune-up data . . . . .                                            |                                                                           | 15-12       |
| Special tools . . . . .                                           |                                                                           | 15-12       |
| GROUPE 16 — INSTALLATION OF 3-SEAL<br>CYLINDER LINERS             |                                                                           |             |
| General information . . . . .                                     |                                                                           | 16-1        |
| Preparing cylinder block . . . . .                                |                                                                           | 16-1        |
| Specifications . . . . .                                          |                                                                           | 16-4        |
| Special tools . . . . .                                           |                                                                           | 16-4        |
| GROUP 20 — CRANKSHAFT, MAIN BEARINGS<br>AND FLYWHEEL              |                                                                           |             |
| General information . . . . .                                     |                                                                           | 20-1        |
| Removal . . . . .                                                 |                                                                           | 20-1        |
| Repair . . . . .                                                  |                                                                           | 20-1        |
| Installation . . . . .                                            |                                                                           | 20-5        |
|                                                                   |                                                                           |             |
|                                                                   | Specifications . . . . .                                                  | 20-7        |
|                                                                   | Torques for hardware . . . . .                                            | 20-7        |
|                                                                   | Special tools . . . . .                                                   | 20-8        |
|                                                                   |                                                                           |             |
|                                                                   | General information . . . . .                                             | 25-1        |
|                                                                   | Removal . . . . .                                                         | 25-2        |
|                                                                   | Repair . . . . .                                                          | 25-2        |
|                                                                   | Installation . . . . .                                                    | 25-3        |
|                                                                   | Specifications . . . . .                                                  | 25-7        |
|                                                                   | Torques for hardware . . . . .                                            | 25-8        |
|                                                                   | Special tools . . . . .                                                   | 25-9        |
|                                                                   |                                                                           |             |
|                                                                   | GROUP 30 — OIL PUMP, OIL PRESSURE REG-<br>ULATING VALVE AND OIL<br>FILTER |             |
|                                                                   | General information . . . . .                                             | 30-1        |
|                                                                   | Removal . . . . .                                                         | 30-2        |
|                                                                   | Repair . . . . .                                                          | 30-3        |
|                                                                   | Installation . . . . .                                                    | 30-5        |
|                                                                   | Adjusting engine oil pressure . . . . .                                   | 30-6        |
|                                                                   | Specifications . . . . .                                                  | 30-6        |
|                                                                   | Torques for hardware . . . . .                                            | 30-7        |
|                                                                   | Tune-up data . . . . .                                                    | 30-7        |
|                                                                   | Special tools . . . . .                                                   | 30-7        |
|                                                                   |                                                                           |             |
|                                                                   | GROUP 35 — COOLING SYSTEM                                                 |             |
|                                                                   | General information . . . . .                                             | 35-1        |
|                                                                   | Diagnosing malfunctions . . . . .                                         | 35-2        |
|                                                                   | Repair . . . . .                                                          | 35-2        |
|                                                                   | Oil cooler . . . . .                                                      | 35-3        |
|                                                                   | Radiator . . . . .                                                        | 35-3        |
|                                                                   | Fan belt adjustment . . . . .                                             | 35-3        |
|                                                                   | Water pump . . . . .                                                      | 35-3        |
|                                                                   | Checking the thermostat . . . . .                                         | 35-6        |
|                                                                   | Specifications . . . . .                                                  | 35-7        |
|                                                                   | Torques for hardware . . . . .                                            | 35-7        |
|                                                                   | Special tools . . . . .                                                   | 35-7        |
|                                                                   |                                                                           |             |
|                                                                   | GROUP 40 — SPEED CONTROL LINKAGE                                          |             |
|                                                                   | General information . . . . .                                             | 40-1        |
|                                                                   | Removal and installation . . . . .                                        | 40-1        |
|                                                                   | Adjustment . . . . .                                                      | 40-3        |

## Group 5

# GENERAL INFORMATION, DIAGNOSING MALFUNCTIONS

### GENERAL INFORMATION

The power units equipping the combines are vertical, cylinder in-line, valve-in-head, four-stroke diesel engines of the open combustion chamber design.

Section 10, Group 5 shows which engine models may be installed in the various combine models.

The cylinder liners are of the replaceable wet-sleeve type. All engines are equipped with aluminum alloy, cam-ground pistons fitted with two compression rings and one oil control ring. All ring grooves are located above the piston pin bore. The case-hardened steel piston pins are fully floating and held in place by 2 snap rings each.

The crankshaft is a one-piece heat-treated steel forging. It is supported on four, five or seven replaceable, two-piece main bearings, depending on the number of cylinders which may be three, four or six.

The connecting rods have a bronze bushing at their upper ends. The lower ends have two replaceable bearing shells.

The camshaft, supported by integral bores in the cylinder block, actuates the valves and drives the fuel transfer pump.

The intake and exhaust valves are located in the cylinder head above the cylinders. They are directly guided in bores drilled into the cylinder head. The valve rocker arm assembly is mounted on top of the cylinder head.

The engines are lubricated by means of a gear-type oil pump. The oil is kept clean by a full-flow oil filter equipped with a bypass valve. If the filter becomes clogged, oil bypasses the filter and continues to lubricate the engine.

6-cylinder engines have an additional water-to-oil cooler internally mounted in the crankcase.

All engines are equipped with a pressurized liquid cooling system. Its main components are the radiator, the water pump, the multi-blade fan and the thermostat.

*NOTE: Cylinders are numerated beginning with cylinder (No. 1) next to radiator.*

## DIAGNOSING MALFUNCTIONS

### ENGINE WILL NOT CRANK

Low battery output

Battery cables improperly connected

Defective main switch or starter push-button switch

Starter solenoid defective

Starter defective

Piston compression rings worn or broken

Stuck or burned valves

Exhaust pipe obstructed

Engine compression too low

Engine overheated

Fuel injection pump defective

### ENGINE HARD TO START OR WILL NOT START

Battery cables loose or corroded

Low battery output

Excessive resistance in starter circuit

Too heavy oil in crankcase

Water, dirt or air in fuel system

Fuel filter clogged

Stuck engine shut-off linkage

Poor nozzle operation

Injection pump defective

Fuel pump defective

Injection pump out of time

### ENGINE MISSES

Water in fuel

Air in fuel system

Poor nozzle operation

Defective fuel injection pump

Nozzles improperly installed

Nozzle sealing ring leaky

Engine overheated

Cams of camshaft worn

Worn valve springs

Fuel pump worn or damaged

Detonation or pre-ignition

Incorrect injection pump timing

Poor compression

Improper valve clearance

Valves damaged, burned or stuck

### ENGINE RUNS IRREGULARLY AND STALLS FREQUENTLY

Coolant temperature too low

Insufficient fuel supply

Nozzle tip holes worn or leaking

Clogged fuel filter or fuel lines

Defective fuel pump

Incorrect injection timing

Improper valve clearance

Cylinder head gasket leaking

### LACK OF ENGINE POWER

Air cleaner clogged or dirty

Air intake system partially obstructed

Fuel filter clogged

Fuel pump defective



**Suggest:**

**If the above button click is invalid.**

**Please download this document first, and then click the above link to download the complete manual.**

**Thank you so much for reading**

---

|                                            |                                                            |
|--------------------------------------------|------------------------------------------------------------|
| Injection pump defective                   | Air intake system partially obstructed                     |
| Poor nozzle operation                      | Restricted oil passages affect oil flow                    |
| Improper crankcase oil                     | Valve guide bores or valve stems worn                      |
| Engine overheats                           | Crankcase oil too light                                    |
| Flat belt slippage                         | Oil pressure too high                                      |
| Cylinder head gasket leaky                 | Excessive wear on piston ring grooves                      |
| Worn cams on camshaft                      | Stuck piston rings                                         |
| Improper valve clearance                   | Poor piston ring tension                                   |
| Valve timing incorrect                     | Piston ring joints not staggered                           |
| Burned, damaged or stuck valves            | Excessive oil clearance at main or connecting rod bearings |
| Valve springs worn                         | Crankcase oil level too high                               |
| Injection pump improperly timed            | External oil leakages                                      |
| Poor engine compression                    | Front or rear crankshaft oil seal damaged                  |
| Temperature of coolant too high or too low |                                                            |
| ENGINE OVERHEATS                           | ENGINE OIL PRESSURE TOO LOW                                |
| Loss of coolant                            | Engine low on oil                                          |
| Exterior of radiator core dirty            | Leakages at internal oil passages                          |
| Loose or damaged fan belt                  | Worn oil pump                                              |
| Thermostat inoperative                     | Excessive oil clearance at main or connecting rod bearings |
| Deposits of rust-scale in cooling system   | Oil pressure regulating valve improperly adjusted          |
| Engine overloaded                          | Improper crankcase oil                                     |
| Injection pump delivers too much fuel      | Oil pressure switch or indicator lamp inoperative          |
| Damaged cylinder head gasket               |                                                            |
| Faulty injection pump timing               | ENGINE OIL PRESSURE TOO HIGH                               |
| Water pump not working                     | Oil pressure regulating valve stuck or improperly adjusted |
| Engine low on oil                          | Oil filter bypass valve damaged or stuck                   |
| Defective radiator cap                     |                                                            |
| ENGINE USES TOO MUCH OIL                   | ENGINE USES TOO MUCH FUEL                                  |
| Oil control rings worn or broken           | Engine overloaded                                          |
| Scored cylinder liners or pistons          | Poor compression                                           |

**<https://www.ebooklibonline.com>**

Hello dear friend!

Thank you very much for reading.

Enter the link into your browser.

The full manual is available for immediate download.

**<https://www.ebooklibonline.com>**