SERVICE MANUAL

MOBILE ELEVATING WORK PLATFORM
AJ48D

EN - 9813/9250 - ISSUE 2 - 05/2023

This manual contains original instructions, verified by the manufacturer (or their authorized representative).

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Foreword

The Operator's Manual

⚠

You and others can be killed or seriously injured if you operate or maintain the machine without first studying the Operator's Manual. You must understand and follow the instructions in the Operator's Manual. If you do not understand anything, ask your employer or JCB dealer to explain it.

Do not operate the machine without an Operator's Manual, or if there is anything on the machine you do not understand.

Treat the Operator's Manual as part of the machine. Keep it clean and in good condition. Replace the Operator's Manual immediately if it is lost, damaged or becomes unreadable.

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Acronyms Glossary

LED	Light Emitting Diode
PIL	Parts Identification List
PPE	Personal Protective Equipment
RPM	Revolutions Per Minute
VIN	Vehicle Identification Number

03 - Safety

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03 - Safety - Yours and Others

Introduction

All machinery can be hazardous. When a machine is correctly operated and maintained, it is a safe machine to work with. When it is carelessly operated or poorly maintained it can become a danger to you (the operator) and others.

In this manual and on the machine you will find warning messages, you must read and understand them. They inform you of potential hazards and how to avoid them. If you do not fully understand the warning messages, ask your employer or JCB dealer to explain them.

Safety is not just a matter of responding to the warnings. All the time you are working on or with the machine you must be thinking of what hazards there might be and how to avoid them.

Do not work with the machine until you are sure that you can control it.

Do not start any work until you are sure that you and those around you will be safe.

If you are not sure of anything, about the machine or the work, ask someone who knows. Do not assume anything.

Remember:

- Be careful.
- Be alert.
- Be safe.

06 - Safety Warnings

Introduction

In this manual there are safety notices. Each notice starts with a signal word. The signal word meanings are given below.

The signal word 'DANGER' indicates a hazardous situation which, if not avoided, will result in death or serious injury.

The signal word 'WARNING' indicates a hazardous situation which, if not avoided, could result in death or serious injury.

The signal word 'CAUTION' indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

The signal word 'Notice' indicates a hazardous situation which, if not avoided, could result in machine damage.

The safety alert system symbol (shown) also helps to identify important safety messages in this manual. When you see this symbol your safety is involved, carefully read the message that follows.

Figure 1. The safety alert system symbol

09 - General Safety

Introduction

Training

To operate the machine safely you must know the machine and have the skill to use it. You must abide by all relevant laws, health and safety regulations that apply to the country you are operating in. The operator's manual instructs you on the machine, its controls and its safe operation; it is not a training manual. Ensure that you receive the correct training before operating any machinery. Failing to do so will result in incorrect operation of the machine and you will be putting yourself and others at risk. In some markets, and for work on certain jobsites, you may be required to have been trained and assessed in accordance with an operator competence scheme. Make sure that you and your machine comply with relevant local laws and jobsite requirements – it is your responsibility.

Clothing

You can be injured if you do not wear the correct clothing. Loose clothing can get caught in the machinery. Keep cuffs fastened. Do not wear a necktie or scarf. Keep long hair restrained. Remove rings, watches and personal jewellery.

Care and Alertness

All the time you are working with or on the machine, take care and stay alert.

Alcohol and Drugs

It is extremely dangerous to operate machinery when under the influence of alcohol or drugs. Do not consume alcoholic drinks or take drugs before or while operating the machine or attachments. Be aware of medicines which can cause drowsiness.

Feeling Unwell

Do not attempt to operate the machine if you are feeling unwell. By doing so you could be a danger to yourself and those you work with.

Mobile Phones

Switch off your mobile phone before entering an area with a potentially explosive atmosphere. Sparks in such an area could cause an explosion or fire resulting in death or serious injury.

Switch off and do not use your mobile phone when refuelling the machine.

Lifting Equipment

You can be injured if you use incorrect or faulty lifting equipment. You must identify the weight of the item to be lifted then choose lifting equipment that is strong enough and suitable for the job. Make sure that lifting equipment is in good condition and complies with all local regulations.

Raised Equipment

Never walk or work under raised equipment unless it is supported by a mechanical device. Equipment which is supported only by a hydraulic device can drop and injure you if the hydraulic system fails or if the control is operated (even with the engine stopped).

Make sure that no-one goes near the machine while you install or remove the mechanical device.

Raised Machine

Never position yourself or any part of your body under a raised machine which is not correctly supported. If the machine moves unexpectedly you could become trapped and suffer serious injury or be killed.

Lightning

Lightning can kill you. Do not use the machine if there is lightning in your area.

Machine Modifications

This machine is manufactured in compliance with prevailing legislative requirements. It must not be altered in any way which could affect or invalidate its compliance. For advice consult your JCB dealer.

12 - Maintenance Safety

Introduction

Raised Machine

Never position yourself or any part of your body under a raised machine which is not correctly supported. If the machine moves unexpectedly you could become trapped and suffer serious injury or be killed.

Compressed Air

Compressed air is dangerous. Wear personal protective equipment. Never point a compressed air jet at yourself or others.

Springs

Always wear personal protective equipment when dismantling assemblies containing components under pressure from springs. This will protect against eye injury from components accidentally flying out.

Metal Splinters

You can be injured by flying metal splinters when driving metal pins in or out. Use a soft faced hammer or copper drift to remove and install metal pins. Always wear personal protective equipment.

Repairs

If your machine does not function correctly in any way, get it repaired straight away. Neglect of necessary repairs could result in an accident or affect your health. Do not try to do repairs or any other type of maintenance work you do not understand. To avoid injury and/or damage get the work done by a specialist engineer.

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before connecting or removing any hydraulic hose, residual hydraulic pressure trapped in the service hose line must be vented. Make sure the hose service line has been vented before connecting or removing hoses. Make sure the engine cannot be started while the hoses are open.

'O' rings, Seals and Gaskets

Badly installed, damaged or rotted 'O' rings, seals and gaskets can cause leakages and possible accidents. Renew whenever disturbed unless otherwise instructed. Do not use Trichloroethane or paint thinners near 'O' rings and seals.

Counterweights

Your machine may be installed with counterweights. They are extremely heavy. Do not attempt to remove them.

Soft Ground

A machine can sink into soft ground. Never work under a machine on soft ground.

Working Under the Machine

Make the machine safe. Make sure the park brake is engaged and machine is fully isolated. Remove the machine key switch, disconnect the battery. Use blocks to prevent unintentional movement of the wheels.

Lifting the Machine

Under no circumstances must the engine be run with the transmission in gear and only one driving wheel jacked clear of the ground, since the wheel on the ground will move the machine.

Chemicals

Certain seals and gaskets (e.g. crankshaft oil seal) on JCB machines contain fluoroelastomeric materials such as Viton®, FluorelTM and Technoflon®. Fluoroelastomeric materials subjected to high temperatures can produce highly corrosive hydrofluoric acid. This acid can severely burn. New fluoroelastomeric components at ambient temperature require no special safety precautions. Used fluoroelastomeric components whose temperatures have not exceeded 300 °C (572 °F) require no special safety precautions. If evidence of decomposition (e.g. charring) is found, refer to the next paragraph for safety instructions. Do not touch component or surrounding area. Used fluoroelastomeric components subjected to temperatures greater than 300 °C (572 °F) (e.g. engine fire) must be treated using the following safety procedure. Make sure that heavy duty gloves and special safety glasses are worn: Thoroughly wash contaminated area with 10% calcium hydroxide or other suitable alkali solution, if necessary use wire wool to remove burnt remains. Thoroughly wash contaminated area with detergent and water. Contain all removed material, gloves etc. used in this operation in sealed plastic bags and dispose of in accordance with Local Authority Regulations. Do not burn fluoroelastiometric materials.

Hydraulic Hoses

Never re-use hydraulic hose end crimps or use reusable hose end crimps.

Personal Protective Equipment

Use the appropriate personal protective equipment before performing maintenance on the machine, otherwise you could be injured.

Working at Height

Use appropriate access equipment such as ladders or a working platform if it is necessary to work at height to perform maintenance tasks on the machine. If you do not use suitable access equipment there is a risk of falling, resulting in personal injury or death.

18 - Operating Safety

Introduction

Training

Make sure that you have had adequate training and that you are confident in your ability to operate the machine safely before you use it. Practice using the machine and its attachments until you are completely familiar with the controls and what they do. Where applicable you may be required to show competency to a national certification scheme. Ensure you comply with local legislation and jobsite rules. With a careful, well trained and experienced operator, your machine is a safe and efficient machine. With an inexperienced or careless operator, it can be dangerous. Do not put your life, or the lives of others, at risk by using the machine irresponsibly. Before you start to work, tell your colleagues what you will be doing and where you will be working. On a busy site, use a signalman.

Before doing any job not covered in this manual, find out the correct procedure. Your local JCB distributor will be glad to advise you.

Fuel

Fuel is flammable, keep naked flames away from the fuel system. Stop the engine immediately if a fuel leak is suspected. Do not smoke while refuelling or working on the fuel system. Do not refuel with the engine running. Completely wipe off any spilt fuel which could cause a fire. There could be a fire and injury if you do not follow these precautions.

Machine Condition

A defective machine can injure you or others. Do not operate a machine which is defective or has missing parts. Make sure the maintenance procedures in this manual are completed before using the machine.

Machine Limits

Operating the machine beyond its design limits can damage the machine, it can also be dangerous. Do not operate the machine outside its limits. Do not try to upgrade the machine performance with unapproved modifications or additional equipment.

Engine/Steering Failure

If the engine or steering fails, stop the machine as quickly as possible. Do not operate the machine until the fault has been corrected.

Exhaust Gases

Machine exhaust gases can harm and possibly kill you or bystanders if they are inhaled. Do not operate the machine in closed spaces without making sure there is good ventilation. If possible, install an exhaust extractor. If you begin to feel drowsy, stop the machine at once and get into fresh air.

Worksites

Worksites can be hazardous. Examine the site before working on it. You could be killed or injured if the ground gives way under your machine or if piled material collapses onto it. Check for potholes and hidden debris, logs, ironwork etc. Any of these could cause you to lose control of your machine. Check for utilities such as electric cables (overhead and underground), gas and water pipes etc. Mark the positions of the underground cables and pipes. Make sure that you have enough clearance beneath overhead cables and structures.

If the machine is used in coordination with other machines, vehicles and/or people on the jobsite the operator must follow jobsite organisation rules.

Communications

Bad communications can cause accidents. Keep people around you informed of what you will be doing. If you will be working with other people, make sure any hand signals that may be used are understood by everybody. Worksites can be noisy, do not rely on spoken commands.

You must stop the machine operation, isolate the controls and turn off the machine when persons are required to interact with it.

Parking

An incorrectly parked machine can move without an operator. Follow the instructions in the Operator's Manual to park the machine correctly.

Banks and Trenches

Banked material and trenches can collapse. Do not work or drive too close to banks and trenches where there is danger of collapse.

Safety Barriers

Unguarded machines in public places can be dangerous. In public places, or where your visibility is reduced, place barriers around the work area to keep people away.

Sparks

Explosions and fire can be caused by sparks from the exhaust or the electrical system. Do not use the machine in closed areas where there is flammable material, vapour or dust.

Regulations

Obey all laws, worksite and local regulations which affect you and your machine.

Electrical Power Cables

You could be electrocuted or badly burned if you get the machine or its attachments too close to electrical power cables.

You are strongly advised to make sure that the safety arrangements on site comply with the local laws and regulations concerning work near electric power lines.

Before you start using the machine, check with your electricity supplier if there are any buried power cables on the site.

There is a minimum clearance required for working beneath overhead power cables. You must obtain details from your local electricity supplier.

Machine Safety

Stop work at once if a fault develops. Abnormal sounds and smells can be signs of trouble. Examine and repair before resuming work.

Hot Components

Touching hot surfaces can burn skin. The engine and machine components will be hot after the unit has been running. Allow the engine and components to cool before servicing the unit.

Travelling at High Speeds

Travelling at high speeds can cause accidents. Always travel at a safe speed to suit working conditions.

Hillsides

Operating the machine on hillsides can be dangerous if the correct precautions are not taken. Ground conditions can be changed by rain, snow, ice etc. Check the site carefully. When applicable, keep all attachments low to the ground.

Confined Areas

Pay extra attention to proximity hazards when operating in confined areas. Proximity hazards include buildings, traffic and bystanders.

Safe Working Loads

Overloading the machine can damage it and make it unstable. Study the specifications in the Operator's Manual before using the machine.

21 - Worksite Safety

Introduction

"Workplace Inspection" will help operators to determine whether the workplace is suitable for operation. Operators must inspect the workplace before they move machines there. It is the operator's responsibility to understand and keep in mind the hazards in the workplace, He/she must pay attention and avoid these problems when moving, installing and operating the machine. Check for hazards such as but not limited to:

- Drop-offs, or potholes including those concealed by water mud, etc.
- Slopes.
- Bumps and floor obstructions.
- Debris.
- Over head obstructions and electrical conductors.
- Hazardous locations and atmospheres.
- Inadequate surface and support to withstand all load forces imposed by the platform in all operating configurations.
- Wind and weather conditions.
- Presence of unauthorized persons.
- Other possible unsafe conditions.
- Underground utilities and pipes.
- Overhanging objects, tree branches.

24 - Risk Assessment

Introduction

It is the responsibility of the competent people that plan the work and operate the machine to make a judgement about the safe use of the machine, they must take into account the specific application and conditions of use at the time.

It is essential that a risk assessment of the work to be done is completed and that the operator obeys any safety precautions that the assessment identifies.

If you are unsure of the suitability of the machine for a specific task, contact your JCB dealer who will be pleased to advise you.

The following considerations are intended as suggestions of some of the factors to be taken into account when a risk assessment is made. Other factors may need to be considered.

A good risk assessment depends on the training and experience of the operator. Do not put your life or the lives of others at risk.

Personnel

- Are all persons who will take part in the operation sufficiently trained, experienced and competent? Are they fit and sufficiently rested? A sick or tired operator is a dangerous operator.
- Is supervision needed? Is the supervisor sufficiently trained and experienced?
- As well as the machine operator, are any assistants or lookouts needed?

The Machine

- Is it in good working order?
- Have any reported defects been corrected?
- Have the daily checks been carried out?
- Are the tyres in good condition?
- Is there sufficient fuel to complete the job?

Working Area

- Is it level?
- Is the ground solid? Will it support the weight of the machine when loaded?
- How rough is the ground? Are there any sharp projections which could cause damage, particularly to the tyres?
- Are there any obstacles or hazards in the area, for example, debris, excavations, manhole covers, power lines?
- Is the space sufficient for safe manoeuvring?
- Are any other machines or persons likely to be in or to enter the area while operations are in progress?

The Route to be Travelled

- How solid is the ground, will it provide sufficient traction and braking? Soft ground will affect the stability of the machine and this must be taken into account.
- How steep are any slopes, up/down/across? A cross slope is particularly hazardous, is it possible to detour to avoid them?

Weather

- How windy is it? High wind will adversely affect the stability of a loaded machine. For maximum allowable wind speed of your machine.
- Is it raining or is rain likely? The ground that was solid and smooth when dry will become uneven and slippery when wet, and it will not give the same conditions for traction, steering or braking.

Emergency Plan

Make sure that emergency rescue plan is in place and understood, It is important to make sure that those involved in the rescue plan are aware of the location of the lowering controls and how to operate the machine from platform controller at height.

27 - Maintenance Positions

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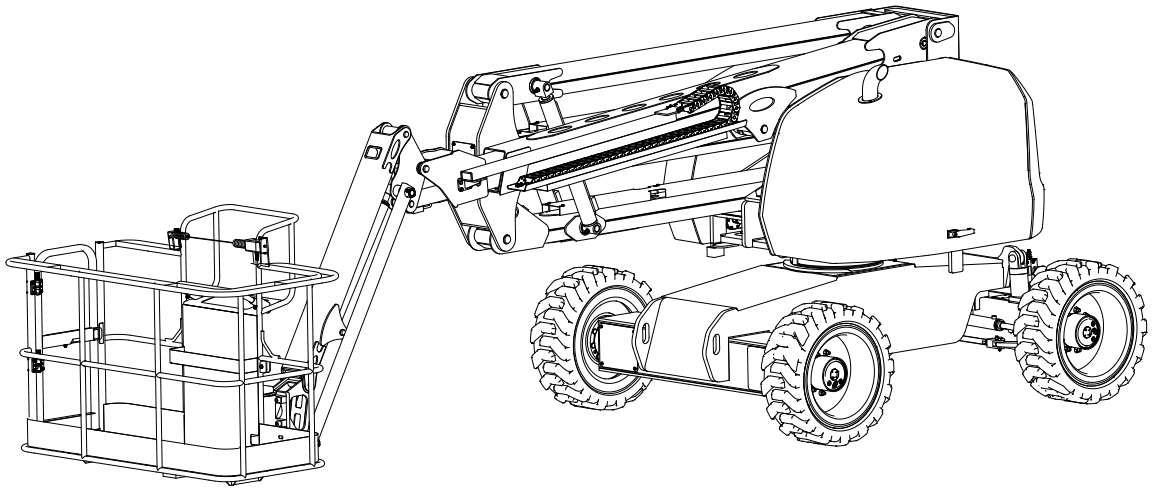
Introduction

Make the machine safe before you start the maintenance procedure.

1. Park the machine on level and firm ground.
2. Platform Lowered and machine in stowed position. Unless boom position is specified in procedure, boom must be at lower position.
3. Set Engine to OFF and Ignition key removed from ignition switch.
4. Disconnect the battery with isolator.
5. Put the wheel chocks at both sides of front/rear wheels to prevent unintentional movement of the machine.

Figure 2. Platform Lowered Position



Health and Safety

⚠ **WARNING** Maintenance must be done only by suitably qualified and competent persons.

Before doing any maintenance make sure the machine is safe, it must be correctly parked on firm, level ground.

To prevent anyone starting the engine, remove the ignition key. Disconnect the battery (by means of the battery isolator if installed) when you are not using electrical power. If you do not take these precautions you could be killed or injured.

WARNING Make the machine safe before getting beneath it. Make sure that any attachments on the machine are correctly attached. Engage the park brake, remove the ignition key, isolate the battery.

Make the machine safe before you start a maintenance procedure.

You can complete most of the maintenance procedures with the lift arm lowered. Unless a maintenance procedure instructs you differently, you must lower the lift arm.

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03 - Model and Serial Number

Introduction

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For: AJ48D [T0] ..... Page 01-15

(For: AJ48D [T4F])

This manual provides information for the following model(s) in the JCB machine range:

Table 1.

Model	**VIN (Vehicle Identification Number) Prefix.** **Refer to: PIL 06-63-03.**
AJ48D	RAJA1024

(For: AJ48D [T0])

This manual provides information for the following model(s) in the JCB machine range:

Table 2.

Model	**VIN Prefix.** **Refer to: PIL 06-63-03.**
AJ48D	RAJA1004

06 - Using the Manual

Introduction

Information in this manual conforms to a standard JCB service manual format. The format uses section headings taken from a PIL (Parts Identification List). These headings are assigned numerical identification references.

Table 3.

Example	Section	Main Assembly / Heading	Component / Sub-heading
PIL reference	33	03	03
Heading	Electrical System	Battery	Isolator Switch

Information within each PIL reference is included under a set of standard headings such as Introduction, Health and Safety, Technical Data and Operation for example. Where additional relevant information is contained within another PIL reference a cross reference is provided.

The main systems information is contained in the manual as follows.

Table 4.

System	PIL Reference	Heading
Hydraulic System	PIL 30-00-50	Schematic Circuit
Electrical System	PIL 33-03-03	Battery - Isolator Switch
	PIL 33-09-00	Power Distribution (including fuses and relays)
	PIL 33-00-50	Schematic Circuit
Electronic Diagnostic	PIL 33-57-00	Electronic Diagnostic (including Servicemaster)

Machine Variants

Where information is different depending on machine variant, the applicable information sets are included within the same PIL reference. Headings are included to identify which information is for which variant. Make sure you use the correct information.

Routine Maintenance

A dedicated section for routine maintenance procedures is not included. Instead, procedures are included in the relevant PIL headings. For example, procedures for the engine oil filter are given in Engine, Oil Filter (PIL 15-21).

Routine maintenance must be carried out in accordance with the applicable maintenance schedule.
Refer to: PIL 78-24.

Diagnostics

Information in this manual can help you diagnose machine faults.

Before attempting to diagnose possible faults check the following.

- Make sure that the operator understands the machine controls, functions and use. Refer to the applicable Operator Manual.
- Check that the maintenance record complies with the applicable schedule for the operating environment.
- Check that the fluids in use comply with the standards specified.
- Make sure that the machine electronic set-up is applicable. Use the applicable Servicemaster vehicle set-up tool.
- Use the applicable Servicemaster diagnostics tools.

Remove and Install

Before removal of components or assemblies, clean the applicable parts of the machine. After removal cap open ports and hoses to prevent contamination.
Refer to: PIL 01-33-00.

Use new sealing elements such as gaskets and O-rings.

Do not install defective components or assemblies. if necessary replace them with new ones.

Dismantle and Assemble

Before dismantling an assembly clean it.

After dismantling, clean the individual components and check them for wear and defects. If necessary replace them with new ones.

During assembly use new sealing elements such as gaskets and O-rings.

Torque Tightening

When you replace components, always tighten the applicable fixings to the correct torque value. Use the torque tightening values contained in the individual procedures (Remove and Install, Disassemble and Assemble etc.). If no torque values are specified, use the standard torque tightening values. For the torque setting to be effective, do the following before you install the fixings.
Refer to: PIL 72-00-00.

- Make sure that all the applicable component assemblies are correct.
- Make sure that the applicable fixings are to the correct specification. If necessary discard the original fixings and replace them with new ones. The relevant procedures indicate when this is necessary.
- Make sure that the applicable fixings and threaded holes are free from contamination. This includes dirt, debris, old sealants and compounds, fluids and lubricants.

Consumable Products

Some procedures require the use of consumable products such as lubricants, sealants, adhesives and locking fluids. Use the correct products. Where products are available from JCB the applicable part numbers are given in the procedures. A complete list of consumable products available from JCB is given in this manual.
Refer to: PIL 75-00.

After Sales

Some procedures require the use of equipment such as special tools and PPE (Personal Protective Equipment). Where special tools are available from JCB the applicable part numbers are given in the procedures. Full details about the applicable special tools are given in this manual. Refer to (PIL 78-00).

Use the correct PPE to comply with local and employer regulations.

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15 - Service Point Locations

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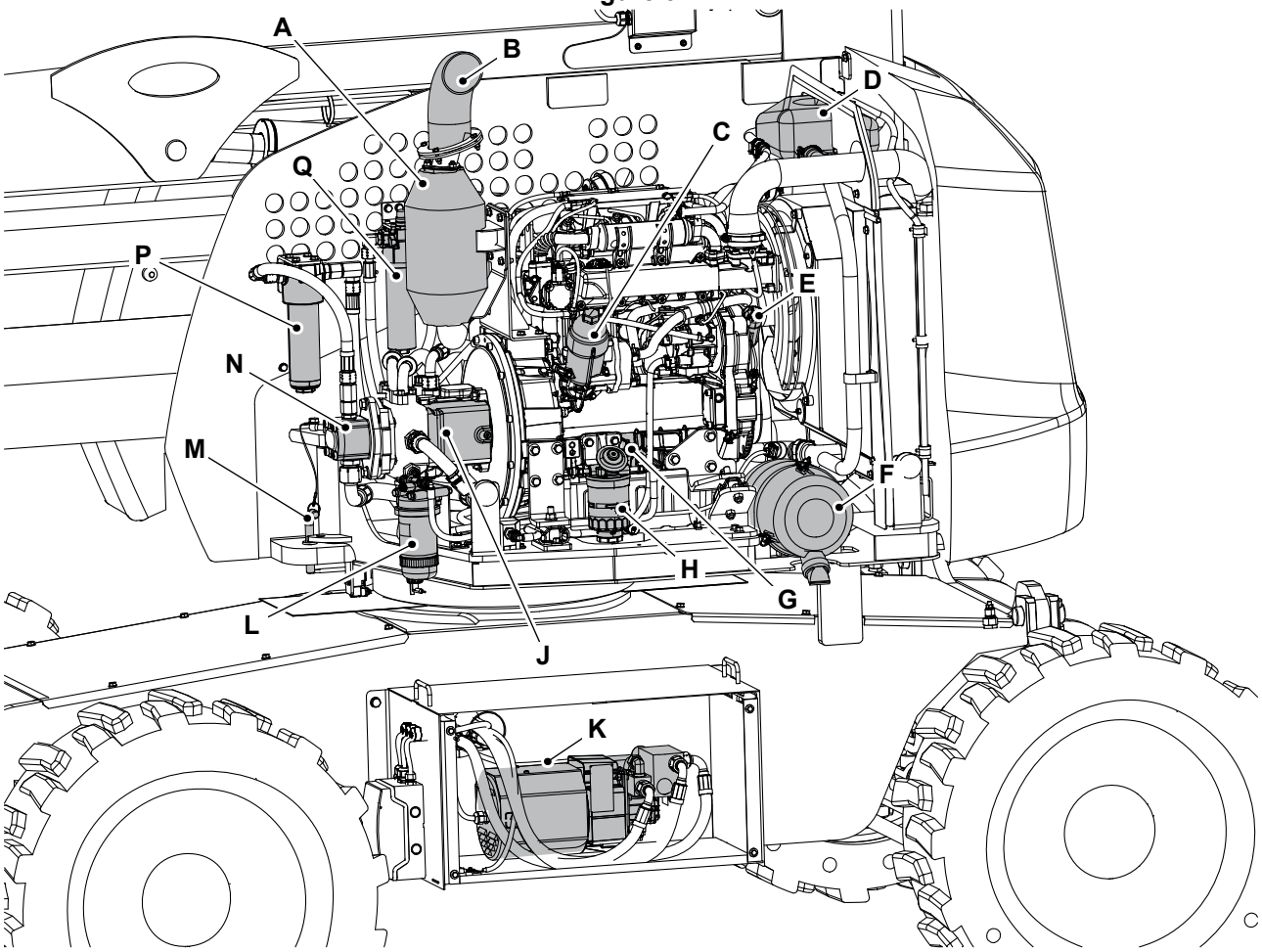
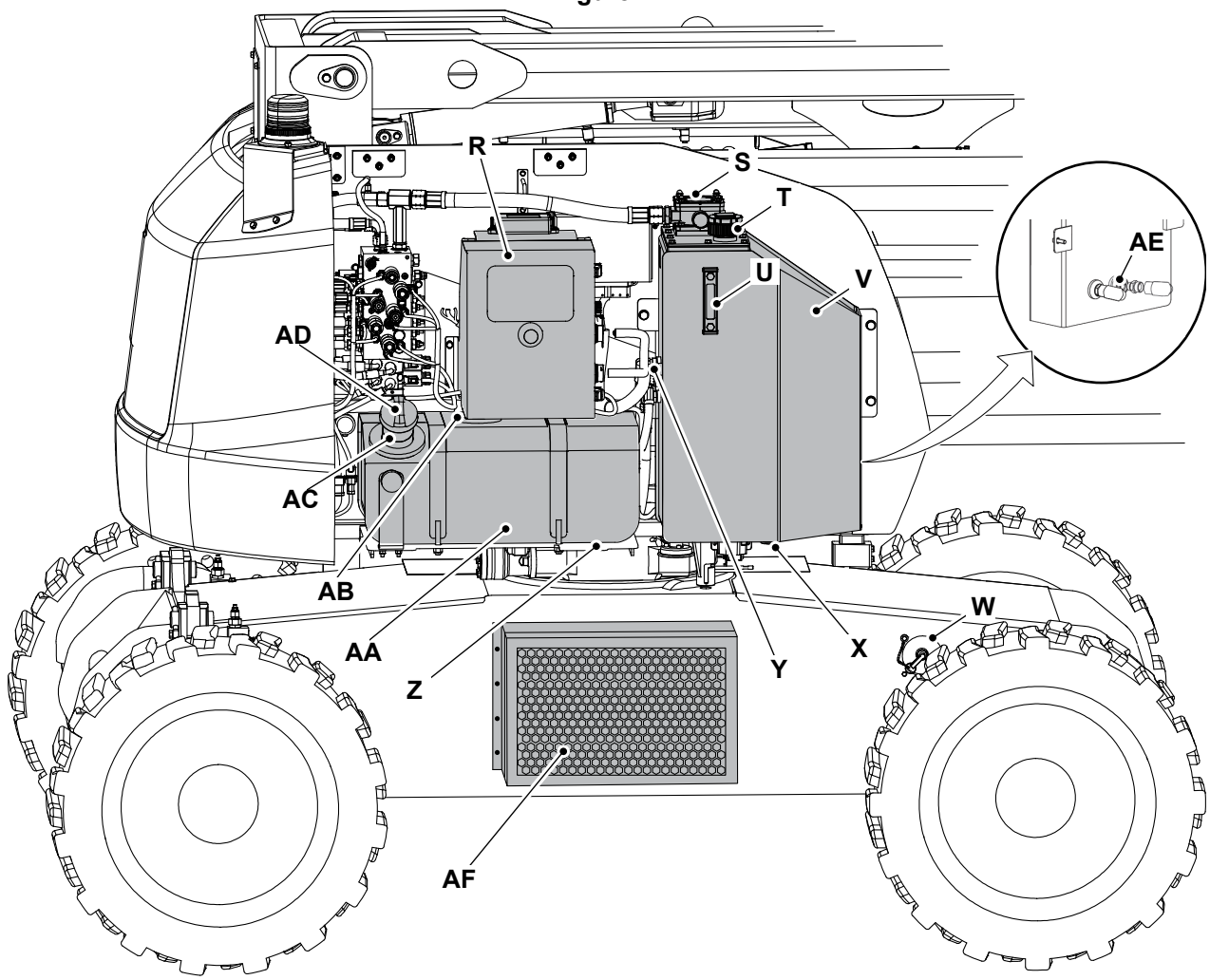
(For: AJ48D [T4F])

Figure 3.



A Engine exhaust
B Exhaust outlet pipe
C Oil filter
D Coolant expansion bottle
E Oil filler
F Air cleaner
G Dipstick
H Engine fuel filter
J Hydraulic transmission pump
K Hydraulic generator (optional)
L Pre filter
M Locking pin
N Hydraulic boom pump
P Hydraulic high pressure filter
Q Charge pump filter

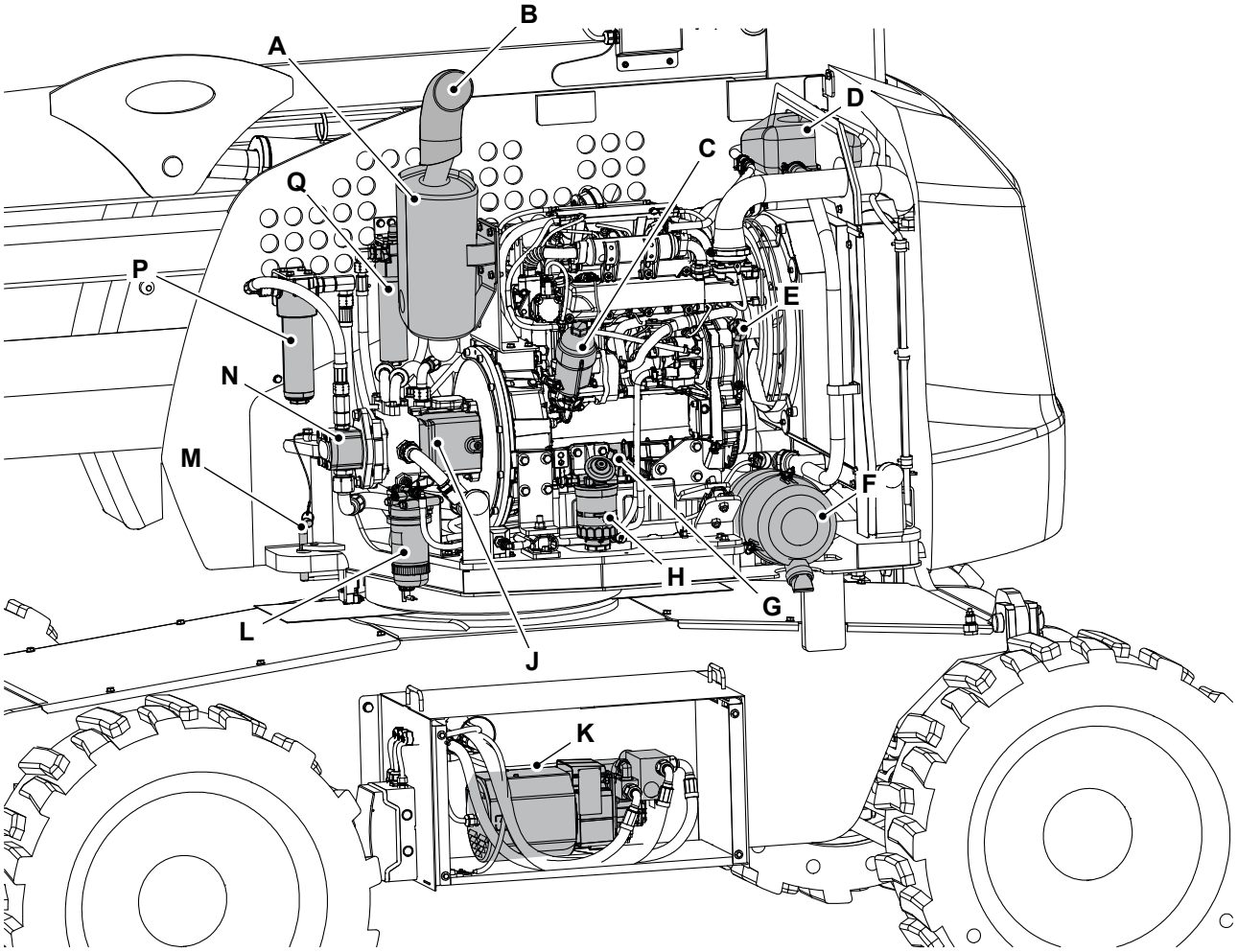
Figure 4.



R Base control panel
S Return line filter
T Filler breather
U Level gauge/ oil temperature
V Hydraulic tank
W Battery isolator
X Hydraulic tank drain plug
Y Hydraulic fittings
Z Fuel tank drain plug
AA Fuel tank
AB Fuel sender
AC Fuel filler
AD Fuel filler cap
AE Suction strainer
AF Hot weather kit (Not applicable for US market)

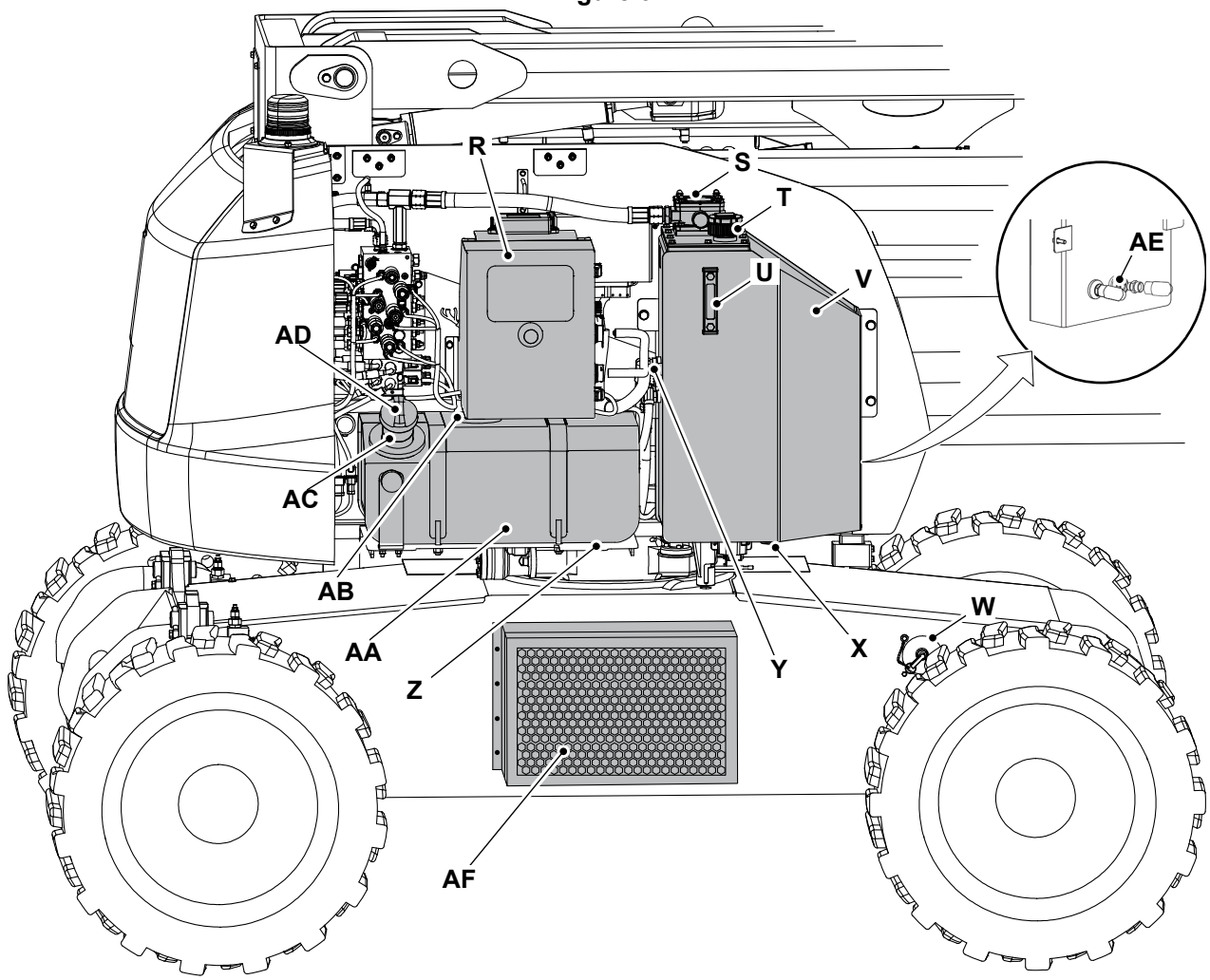
(For: AJ48D [T0])

Figure 5.



A Exhaust muffler
B Exhaust outlet pipe
C Oil filter
D Coolant expansion bottle
E Oil filler
F Air cleaner
G Dipstick
H Engine fuel filter
J Hydraulic transmission pump
K Hydraulic generator (If installed)
L Pre filter
M Locking pin
N Hydraulic boom pump
P Hydraulic high pressure filter
Q Charge pump filter

Figure 6.



R Base control panel
S Return line filter
T Filler breather
U Level gauge/ oil temperature
V Hydraulic tank
W Battery isolator
X Hydraulic tank drain plug
Y Hydraulic fittings
Z Fuel tank drain plug
AA Fuel tank
AB Fuel sender
AC Fuel filler
AD Fuel filler cap
AE Suction strainer
AF Hot weather kit

12 - Operation

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00 - General

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Check (Operation)

You must check the machine and platform for correct operation at regular intervals.
Refer to: PIL 78-24-00.

Make a note of the following.

- The correct drive function is necessary for safe machine operation.
- The drive function must respond quickly and smoothly to operator control.
- The drive performance must be free of hesitation, jerking and unusual noise over the entire proportionally controlled speed range.
- Do this procedure with the machine on a firm, level surface that is free of obstructions.

Calibrate

If any component or part is changed on this machine, it is recommended to calibrate full machine in the specified sequence only. Refer to Table 5.

Table 5. Machine Calibration Sequence

Sequence	Check	Description
1	Calibrate and test the tilt sensor	Calibrate level sensor on 0° ground and test sensor on rated ramps. Refer to: Calibrate (PIL 33-84-60).
2	Setting of elevated limit switches	Set up main boom limit switch. Refer to: Calibrate (PIL 33-85-05). Set up articulated boom limit switch. Refer to: Calibrate (PIL 33-85-10). Set up telescopic boom limit switch. Refer to: Calibrate (PIL 33-85-15).
3	Calibrate and test the weight sensor	On flat level ground.
4	Check for 125% structural overload test	Perform the overload test with 125% basket load. For more details refer structural load section below.
5	Check for 110% functional test	Check and record maximum function speeds in tortoise and hare engine condition Refer to: PIL 01-48-12.
6	Parking brake Test	Check the parking brake holds the machine on 40% ramp.
7	Gradeability Test	Check the machine can drive on 40% ramp.
8	Check for base override	Switch the machine off. Press and hold base override switch. Switch the machine ON. Continue to press down and hold the 'base override' icon while pushing the boom function button. Clear the 'base override' icon. Refer to: Introduction (PIL 33-24-02).
9	Check for slew acknowledgement LED (Light Emitting Diode) and travel	Slew the turntable outside forward position (90°), check slew acknowledgement LED flashing and check the travel function is not enabled. Press foot pedal and slew acknowledgement button, check the LED turns solid and check the travel function enabled. Release the foot switch and check platform slew acknowledgement LED flashing. Slew inside forward position, check platform slew acknowledgement LED is off. Refer to: PIL 33-84-76. Refer to: PIL 27-00-00.

Sequence	Check	Description
10	Secondary guarding check	Start the engine, press the secondary guarding cable. Refer to: PIL 06-97-00. Check the operator caution, LED flashes and buzzer beeps. Check drive, slew, raise and extend functions are disabled. Check articulated and main boom lower and telescopic boom retract are enabled. Operate platform levelling, function is disabled. Reset secondary guarding pull switch and check all the functions are enabled.
11	Check oscillating axle	Refer to: PIL 27-20-01. for oscillating axle safety check.
12	Alternator motor/ hydraulic generator(if installed)	Refer to: PIL 30-06-00. for Pat test.
13	Hydraulic tank body/ joint seal	No leakage in the hydraulic tank body and splice.

Tilt Sensor Check

For tilt sensor calibration-
Refer to: Calibrate (PIL 33-84-60).

Calibrating the Limit Switches

Main Boom Down Limit Setting

For main boom down limit switch calibration-
Refer to: Calibrate (PIL 33-85-05).

Articulated Boom Down Limit Setting

For articulated boom down limit switch calibration-
Refer to: Calibrate (PIL 33-85-10).

Telescopic Boom Retract Limit Setting

For telescopic boom retract limit switch calibration-
Refer to: Calibrate (PIL 33-85-15).

No Load Calibration

1. Take the machine to suitable testing area.
2. Lower the platform to the stowed position.
3. Make sure that there is no load on the platform.
4. Turn the machine ON and make sure that the both (base and platform) emergency switches are in 'ON' Position.
5. Select the machine settings page of the display. Passcode: 1234 (or set via service master).

   Duration: 5s
6. Select the load cell calibration option in the menu.
7. Select 'No Load' and press the 'Enter (tick)' button
8. Display will ask for confirmation
9. Press the ' Enter (tick)' button again to confirm.
10. Once the calibration is done, the display will show the result of calibration.

Full Load Calibration

1. Take the machine to suitable testing area.
2. Lower the platform to the stowed position.
3. Make sure that there is rated load on the platform.
4. Turn the machine ON and make sure that the both (base and platform) emergency switches are in 'ON' Position.
5. Select the machine settings page of the display. Passcode: 1234 (or set via service master).

   Duration: 5s
6. Select the load cell calibration option in the menu.
7. Select 'Rated Load' and press the 'Enter (tick)' button
8. Display will ask for confirmation
9. Press the ' Enter (tick)' button again to confirm.
10. Once the calibration is done, the display will show the result of calibration.

Table 6. Load Calibration Weights

Machine Model	100% Rated Load
AJ48D	250kg

Overload Calibration - Upper Limit

1. Take the machine to suitable testing area.
2. Raise and lower the platform twice without any load in the platform.
3. Lower the platform to the stowed position.
4. Add 'Upper test load' on the platform. Refer to Table 7.
5. Make sure all movement controls are disabled at the base and platform control panels
6. Make sure the Overload icon is flashing on the Display and the Overload LED is flashing on the Platform. Make sure the buzzers are beeping.

Table 7. Load Calibration Weights

Machine Model	Upper Test Load
AJ48D	265kg

Overload Calibration - Lower Limit

The machine will be raised to full height during the calibration procedure. Make sure that there is sufficient clearance above the platform before starting the calibration.

1. Take the machine to suitable testing area.
2. Raise and lower the platform twice without any load in the platform.
3. Lower the platform to the stowed position.
4. Add 'Lower test load' on the platform. Refer to Table 8.
5. Fully raise and lower the platform.
6. Make sure there should be no buzzers. All movements should be enabled from the base and platform control panels. The overload icon on the display LED should be on but not flashing, and the overload LED on the platform control panel should be on but not flashing.
7. If overload alarm sounds, contact JCB Service.
8. Raise and lower the platform to full working height for 5 cycles with 95% load in the platform.
9. Visually inspect the booms, platform and hydraulic cylinders for structural damage or weakness.
10. Make sure that there are no hydraulic leaks.

Table 8. Load Calibration Weights

Machine Model	Lower Test Load
AJ48D	235kg

Structural Overload Test - at 125% Load

The machine will be raised to full height during the calibration procedure. Make sure that there is sufficient clearance above the platform before starting the procedure.

1. Take the machine to suitable testing area.
2. Test should be done flat level ground.
3. Disable the overload alarm on the base controller.
   - 3.1. Open the service master tab, select your machine, then select 'vehicle setup' option for your machine.
   - 3.2. Once you select 'vehicle setup' option, under 'machine options' you will get 'disable overload' option.
   - 3.3. Tick/ un tick to enable/disable the overload alarm option.
4. Add 125% rated load on the platform.

   Refer to: Technical Data (PIL 01-48-10).
5. Raise the articulated lift arm to its full height. Keep telescopic boom retracted and jib arm horizontal.
6. Extend the telescopic boom to its full reach.
7. It is required to slew to end stop in each direction.
8. Raise the boom to its full height.
9. It is required to slew to end stop in each direction.
10. Lower the boom, articulated lift arm, and jib to the fully stowed position.

Functional Load Test- at 110% Load

The machine will be raised to full height during the calibration procedure. Make sure that there is sufficient clearance above the platform before starting the procedure.

1. Take the machine to suitable testing area.
2. Test should be done on flat level ground.
3. Disable the overload alarm on the base controller.
   - 3.1. Open the service master tab, select your machine, then select 'vehicle setup' option for your machine.
   - 3.2. Once you select 'vehicle setup' option, under 'machine options' you will get 'disable overload' option.

3.3. Tick/ un tick to enable/disable the overload alarm option.

4. Add 110% rated load on the platform.

   Refer to: Technical Data (PIL 01-48-10).

5. Follow the raising and lowering speed test procedure given below.

Raising and Lowering Speed

1. Make the machine safe.

   Refer to: PIL 01-03-27.

2. Test should be done on flat level ground.

3. Park the machine in a solid and even test area free from any overhead obstructions.

4. Pull out the base emergency stop button to the ON position.

5. Pull out the platform emergency stop button to the ON position.

6. Turn the ignition switch to base control position.

7. Check the articulated boom lift cycle time as follows.

   7.1. Set the machine RPM (Revolutions Per Minute) at 1500.

   7.2. Raise the articulated boom.

   7.3. Make a note of the duration required for raising the articulated boom.

   7.4. Make sure that the cycle time is within the specified limits.

   7.5. Lower the articulated boom to its fully stowed position.

   7.6. Make a note of the cycle time required for lowering the articulated boom.

   7.7. Make sure that the cycle time is within the specified limits.

   Refer to: PIL 01-48-12.

   7.8. Set the machine RPM at 2500.

   7.9. Raise the articulated boom.

   7.10. Make a note of the duration required for raising the articulated boom.

   7.11. Make sure that the cycle time is within the specified limits.

   Refer to: PIL 01-48-12.

   7.12. Lower the articulated boom to its fully stowed position.

   7.13. Make a note of the cycle time required for lowering the articulated boom.

   7.14. Make sure that the cycle time is within the specified limits.

   Refer to: PIL 01-48-12.

   7.15. If the articulated boom raising and lowering speeds are not within the range, adjust the orifice or adjust the maximum solenoid currents through service master.

8. Check the main boom lift cycle time as follows.

   8.1. Set the machine RPM at 1500.

   8.2. Raise the main boom.

   8.3. Make a note of the duration required for raising the main boom.

   8.4. Make sure that the cycle time is within the specified limits.

   Refer to: PIL 01-48-12.

   8.5. Lower the main boom to its fully stowed position.

   8.6. Make a note of the cycle time required for lowering the main boom.

   8.7. Make sure that the cycle time is within the specified limits.

   Refer to: PIL 01-48-12.

   8.8. Set the machine RPM at 2500.

   8.9. Raise the main boom.

   8.10. Make a note of the duration required for raising the main boom.

   8.11. Make sure that the cycle time is within the specified limits.

   Refer to: PIL 01-48-12.

   8.12. Lower the main boom to its fully stowed position.

   8.13. Make a note of the cycle time required for lowering the main boom.

   8.14. Make sure that the cycle time is within the specified limits.

   Refer to: PIL 01-48-12.

   8.15. If the main boom raising and lowering speeds are not within the range, adjust the orifice or adjust the maximum solenoid currents through service master.

9. Check the telescopic boom (extended / retracted) telescopic boom lift cycle time as follows.

   9.1. Set the machine RPM at 1500.

   9.2. Raise the telescopic boom (extended / retracted).

9.3. Make a note of the duration required for raising the telescopic boom.

9.4. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

9.5. Lower the telescopic boom to its fully stowed position.

9.6. Make a note of the cycle time required for lowering the telescopic boom.

9.7. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

9.8. Set the machine RPM at 2500.

9.9. Raise the telescopic boom (extended / retracted).

9.10. Make a note of the duration required for raising the telescopic boom.

9.11. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

9.12. Lower the telescopic boom to its fully stowed position.

9.13. Make a note of the cycle time required for lowering the telescopic boom.

9.14. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

9.15. If the telescopic boom raising and lowering speeds are not within the range, adjust the orifice or adjust the maximum solenoid currents through service master.

10. Check the jib boom telescopic boom lift cycle time as follows.

10.1. Set the machine RPM at 1500.

10.2. Raise the jib boom.

10.3. Make a note of the duration required for raising the jib boom.

10.4. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

10.5. Lower the jib boom to its fully stowed position.

10.6. Make a note of the cycle time required for lowering the jib boom.

10.7. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

10.8. Set the machine RPM at 2500.

10.9. Raise the jib boom.

10.10. Make a note of the duration required for raising the jib boom.

10.11. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

10.12. Lower the jib boom to its fully stowed position.

10.13. Make a note of the cycle time required for lowering the jib boom.

10.14. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

10.15. If the jib boom raising and lowering speeds are not within the range, adjust the orifice or adjust the maximum solenoid currents through service master.

11. Check the platform rotate cycle time as follows.

11.1. Set the machine RPM at 1500.

11.2. Rotate the platform clockwise.

11.3. Make a note of the duration required for rotating the platform.

11.4. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

11.5. Set the machine RPM at 2500.

11.6. Rotate the platform anti- clockwise.

11.7. Make a note of the duration required for rotating the platform.

11.8. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

11.9. If the platform rotate clockwise and anti-clockwise speeds are not within the range, adjust the orifice or adjust the maximum solenoid currents through service master.

12. Check the slew- 90° cycle time as follows.

12.1. Set the machine RPM at 1500.

12.2. Slew the machine at 90° to its fully stowed position.

12.3. Make a note of the duration required to slew- 90°.

12.4. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

12.5. Slew the machine at 90° to its fully extended position.

12.6. Make a note of the cycle time required to slew- 90°.

12.7. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

12.8. Set the machine RPM at 2500.

12.9. Slew the machine at 90° to its fully stowed position.

12.10. Make a note of the duration required to slew- 90°.

12.11. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

12.12. Slew the machine at 90° to its fully extended position.

12.13. Make a note of the cycle time required to slew- 90°.

12.14. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

12.15. If the slew- 90° stowed and extended speed are not within the range, adjust the orifice or adjust the maximum solenoid currents through service master.

13. Check the platform levelling cylinder lift cycle time as follows.

13.1. Set the machine RPM at 1500.

13.2. Raise the platform levelling cylinder.

13.3. Make a note of the duration required for raising the platform levelling cylinder.

13.4. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

13.5. Lower the platform levelling cylinder to its fully stowed position.

13.6. Make a note of the cycle time required for lowering the platform levelling cylinder.

13.7. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

13.8. Set the machine RPM at 2500.

13.9. Raise the platform levelling cylinder.

13.10. Make a note of the duration required for raising the platform levelling cylinder.

13.11. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

13.12. Lower the platform levelling cylinder to its fully stowed position.

13.13. Make a note of the cycle time required for lowering the platform levelling cylinder.

13.14. Make sure that the cycle time is within the specified limits.

Refer to: PIL 01-48-12.

13.15. If the platform levelling cylinder raising and lowering speeds are not within the range, adjust the orifice or adjust the maximum solenoid currents through service master.

Machine Travel Speed Calibration

Make a note of the following.

- The correct drive function is necessary for safe machine operation.
- The drive function must respond quickly and smoothly to operator control.
- The drive performance must be free of hesitation, jerking and unusual noise over the entire proportionally controlled speed range.
- Do this procedure with the machine on a firm, level surface that is free of obstructions.

You must check the platform for correct operation in three different modes as follows.

At fast speed and platform in lowered position

1. Make the machine safe with the platform lowered.

   Refer to: PIL 01-03-27.

2. Put marks on the ground for start and finish lines. Make sure that the distance between the lines is as specified.

   Distance: 20m

3. Turn the ignition switch to ON position.

4. Pull out the base emergency stop button to the ON position.

5. Pull out the platform emergency stop button to the ON position.

6. Make a note of the point on the machine (contact patch of a tyre) as a visual reference when you cross the test line.

7. Make sure that the engine speed is in Hare mode, and the high torque setting is OFF.

8. Press and hold the foot pedal at the platform control position
9. Move the drive joystick in the forward direction.
10. Bring the machine to top drive speed before you reach the start line.
11. Start the timing when the selected reference point on the machine crosses the start line.
12. Continue at full speed and note the time when your reference point on the machine passes the finish line.
13. Make sure that the values are within the specified limits.

    Refer to: PIL 01-48-12.

At slow speed and platform in lowered position

1. Make the machine safe with platform lowered.

   Refer to: PIL 01-03-27.
2. Put marks on the ground for start and finish lines. Make sure that the distance between the lines is as specified.

   Distance: 20m
3. Turn the ignition switch to ON position.
4. Pull out the base emergency stop button to the ON position.
5. Pull out the platform emergency stop button to the ON position.
6. Make a note of the point on the machine (contact patch of a tyre) as a visual reference when you cross the test line.
7. Change the engine speed and high torque setting for required drive speed.
8. Press and hold the foot pedal at the platform control position
9. Move the drive joystick in the forward direction.
10. Bring the machine to top drive speed before you reach the start line.
11. Start the timing when the selected reference point on the machine crosses the start line.
12. Continue at full speed and note the time when your reference point on the machine passes the finish line.
13. Make sure that the values are within the specified limits.

    Refer to: PIL 01-48-12.

At platform in raised position

When the platform is raised, the machine automatically goes to the slow speed mode.

1. Make the machine safe.

   Refer to: PIL 01-03-27.
2. Put marks on the ground for start and finish lines. Make sure that the distance between the lines is as specified.

   Distance: 10m
3. Turn the ignition switch to platform control position.
4. Pull out the ground emergency stop button to the ON position.
5. Pull out the platform emergency stop button to the ON position.
6. Extend the telescopic boom until the display shows the machine is in the raised position.

   Distance: 0.5m
7. Make a note of the point on the machine (contact patch of a tyre) as a visual reference when you cross the test line.
8. Make sure that the engine speed is in Hare mode, and the high torque setting is OFF.
9. Press and hold the foot pedal at the platform control position.
10. Move the drive joystick in the forward direction.
11. Bring the machine to top drive speed before you reach the start line.
12. Start the timing when the selected reference point on the machine crosses the start line.
13. Continue at full speed and note the time when your reference point on the machine passes the finish line.
14. Calculate the speed of the machine.
15. Make sure that the speed is as specified limits.

    Refer to: PIL 01-48-12.

Brake Test

Make a note of the following.

- You must check the brakes for correct operation at regular intervals. Refer to Maintenance Schedules.
- The correct brake function is necessary for safe machine operation.

- The brake function must operate smoothly, free of hesitation, jerking and unusual noise.
- Do this procedure with the machine on a firm, level surface that is free of obstructions.

1. Make the machine safe with the platform lowered.

   Refer to: PIL 01-03-27.

2. Put a mark on the ground to use as a test line.
3. Turn the ignition switch to platform control.
4. Pull out the ground emergency stop button to the ON position.
5. Pull out the platform emergency stop button to the ON position.
6. Make a note of the point on the machine (contact patch of a tyre) as a visual reference when you cross the test line.
7. Press and hold the foot pedal at the platform control position
8. Move the drive joystick in the forward direction.
9. Bring the machine to top drive speed before you reach the test line.
10. Release the control lever when the selected reference point on the machine crosses the test line.
11. Measure the distance between the test line and the machine reference point.
12. Make sure that the braking distance is within the specified limits.
13. Extend the telescopic boom.

    Distance: 0.5m

14. Do the steps 2 to 11 with the telescopic boom partly extended.
15. Make sure that the braking distance is within the specified limits.

Gradeability Test

The brakes must be able to hold the machine upto 40% slope. Refer to operators manual.

Make a note that the machine must be in high torque mode for the duration of this test..

1. Start the machine on specified slope ramp from base of the ramp and slowly drive up the ramp until both sets of wheels are on the ramp.

   Percentage: 40%

2. Hold/Park the machine on ramp for specified duration.

   Duration: 5s

   2.1. The Machine should stop on ramp.

3. Drive the machine slowly down the slope. Stop while both sets of wheels are on the ramp.
4. Hold/Park the machine on ramp for specified duration.

   Duration: 5s

   4.1. The Machine should stop on ramp.

27 - Lifting

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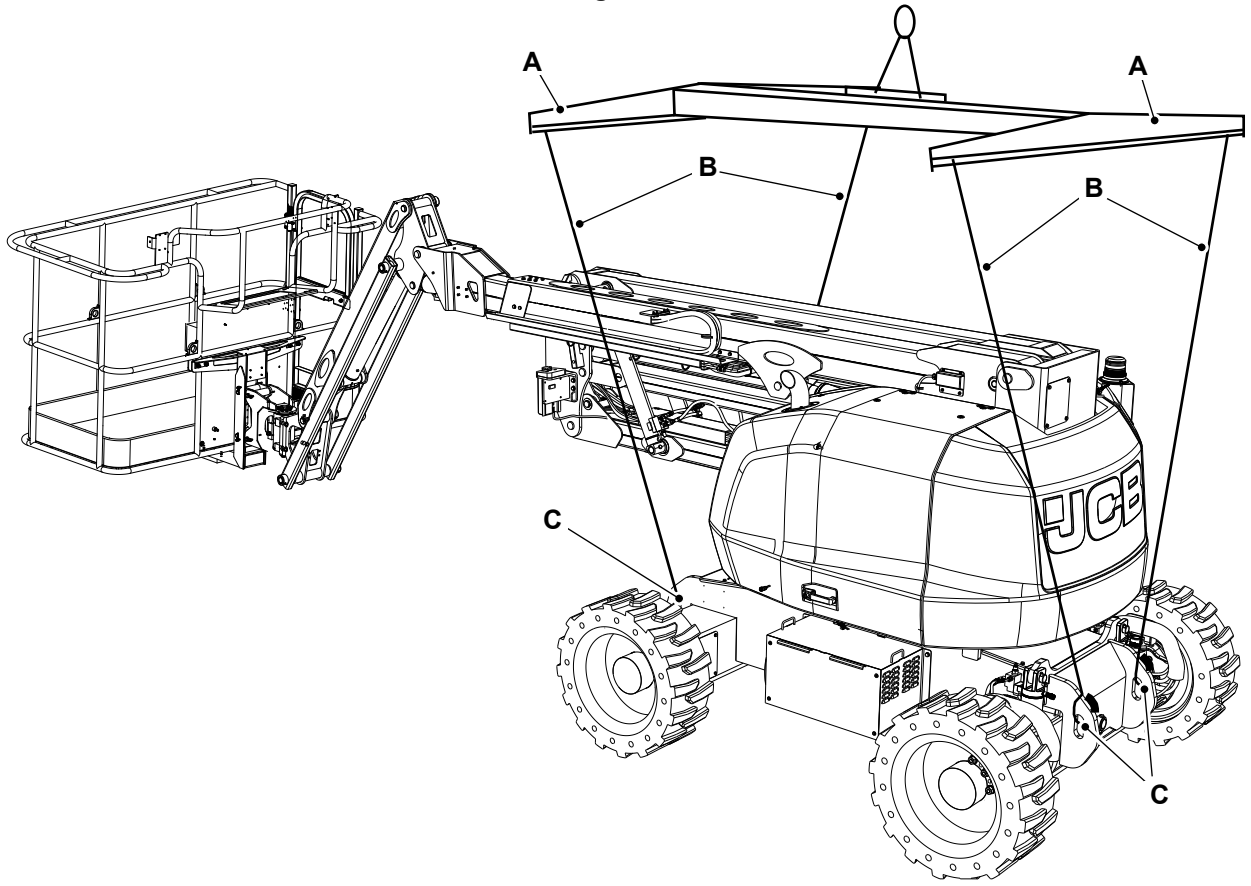
1. Make the machine safe with the platform lowered.
2. Remove any loose item from the machine.
3. Make sure all the access covers and canopies are securely shut.
4. Use the correct length of hoisting rope to prevent damage to the platform base and guardrail.
5. Make sure the hoist rigging is in the correct position. Adjust the hoist rigging to prevent machine damage and keep the machine in the level position.
   - 5.1. You must consider the location of the centre of gravity on the machine, when you lift the machine.
   - 5.2. Use foam to protect booms and counterweight at suitable contact points to avoid damage.

Figure 7.



A Spreader bars
B Lifting chains
C Lifting points

The machine should be in fully stowed position and machine in 0° slewing position and forward drive position. If necessary, slew the machine to 5° which will let the vertical chains to lift the machine without impacting the boom structure.

You must consider the location of the centre of gravity on the machine, when you lift the machine. The origin of centre of gravity is from the front left wheel centre. Refer to Figure 8.

Figure 8.

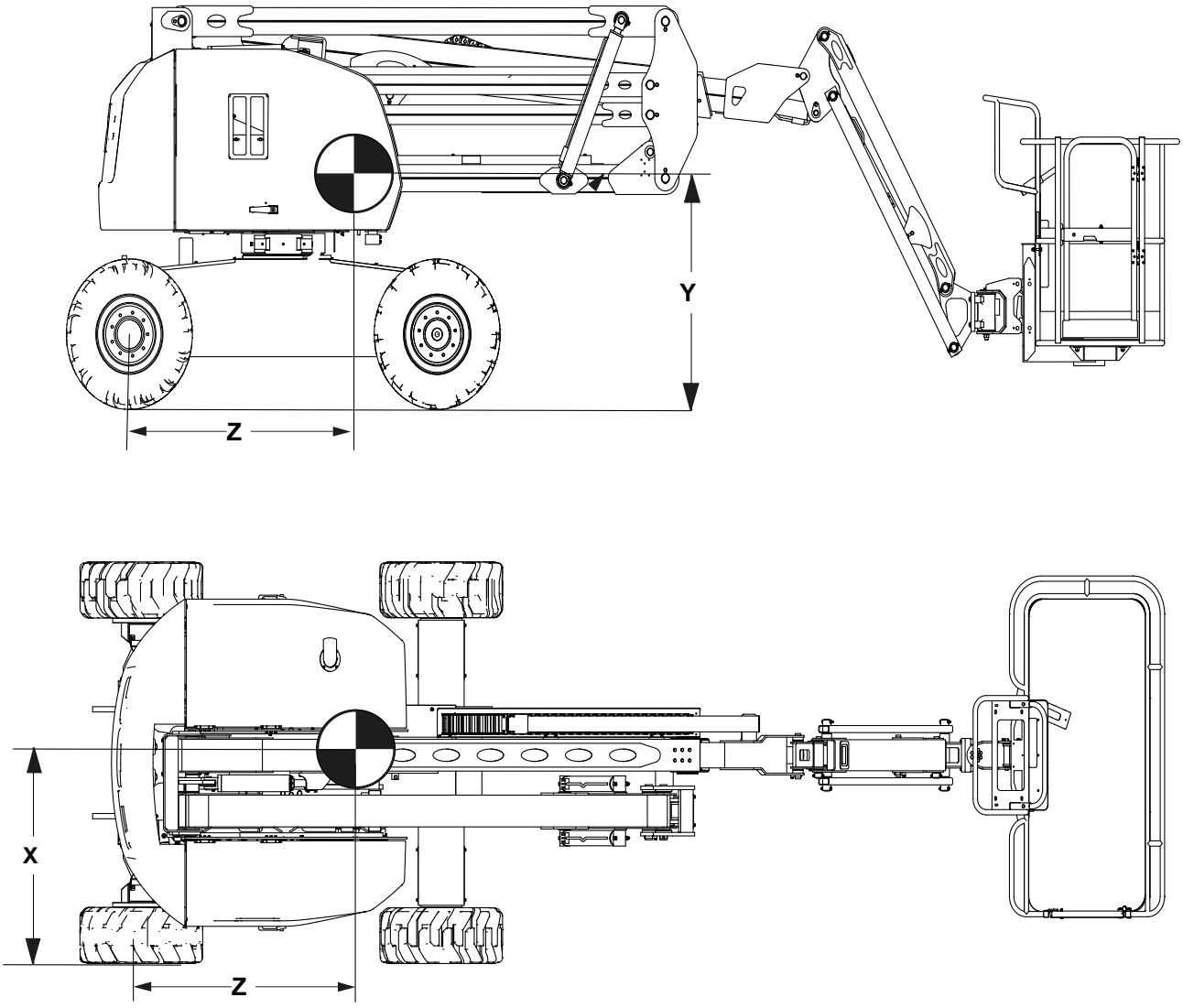


Table 9. Location of the Centre of Gravity

X- axis	Y- axis	Z- axis
1,050mm	1,209mm	1,198mm

33 - Cleaning

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Introduction

⚠ **WARNING** When using cleaning agents, solvents or other chemicals, you must adhere to the manufacturer's instructions and safety precautions.

CAUTION To avoid burning, wear personal protective equipment when handling hot components. To protect your eyes, wear goggles when using a brush to clean components.

Notice: Cleaning metal parts with incorrect solvents can cause corrosion. Use only recommended cleaning agents and solvents.

Notice: The efficiency of the rams will be affected if they are not kept free of solidified dirt. Clean dirt from around the rams regularly. When leaving or parking the machine, close all rams if possible to reduce the risk of weather corrosion.

Notice: Never use water or steam to clean inside the operator station. The use of water or steam could damage the machine electrics and render the machine inoperable. Remove dirt using a brush or damp cloth.

Clean the product with water and/or steam. Do not let mud, debris etc. to collect on the product.

Before you do any service procedures that require components to be removed:

- The cleaning must be done either in the area of components to be removed, or in the case of major work, or work on the fuel system, the whole engine and the surrounding product must be cleaned.
- When cleaning is complete, move the product away from the wash area or alternatively, remove the material washed from the product.

When you remove components, be aware of exposure to dirt and debris. Cover any open ports and remove the deposits before proceeding.

Detergents

Do not use a full strength detergent. Always dilute the detergents as per the manufacturer's recommendations, or damage to the paint finish can occur.

Always obey the local regulations regarding the disposal of debris created from cleaning the product.

Pressure Washing and Steam Cleaning

⚠ **CAUTION** When using a steam cleaner, wear safety glasses or a face shield as well as protective clothing. Steam can cause personal injury.

Notice: The batteries and other electrical components could be damaged by high pressure washing systems. Special precautions must be taken if the machine is to be washed using a high pressure system.

Use a low pressure washer and brush to remove dried mud or dirt.

Use a steam cleaner to remove soft dirt and oil.

When cleaning around decals:

- Ensure the water pressure is kept below 138bar (2,001.5psi).
- Keep water temperature below 80°C (175.9°F).
- Use a spray nozzle with a 40° wide angle spray pattern.
- Keep the nozzle at least 300mm away from and perpendicular (at 90° degrees) to the decal.

The machine must always be greased (if appropriate) after pressure washing or steam cleaning.

Preparation

1. Make the machine safe. Stop the machine and let it cool for at least one hour. Do not try to clean any part of the machine while it is running.
2. Make sure that all of the electrical connectors are correctly coupled.
3. If the connectors are open, attach the correct caps or seal with waterproof tape.

Clean

⚠ **WARNING** When using cleaning agents, solvents or other chemicals, you must adhere to the manufacturer's instructions and safety precautions.

CAUTION To avoid burning, wear personal protective equipment when handling hot components. To protect your eyes, wear goggles when using a brush to clean components.

Notice: Cleaning metal parts with incorrect solvents can cause corrosion. Use only recommended cleaning agents and solvents.

Notice: The efficiency of the rams will be affected if they are not kept free of solidified dirt. Clean dirt from around the rams regularly. When leaving or parking the machine, close all rams if possible to reduce the risk of weather corrosion.

The following guidelines are for internal boom cleanliness for machines that are used in excessively dirty environments.

1. JCB recommends the use of the JCB kit to keep the internal portions of a boom cleaner and to help prevent dirt and debris from entering the boom. This package reduces the amount of contamination which can enter the boom but does not eliminate the need for more frequent inspections and maintenance when used in these types of environments.
2. JCB recommends you to follow all guidelines for servicing your equipment in accordance with the instructions outlined in the JCB Service Manual. Periodic maintenance and inspection is vitally important to the proper operation of the machine. The frequency of service and maintenance must be increased as environment severity and frequency of usage requires.
3. Debris and foreign matter inside of the boom can cause premature failure of components and should be removed. Methods to remove debris should always be done using all applicable safety precautions outlined in the JCB Operators Manual and JCB Service Manual.
4. The first attempt to remove the debris from inside the boom must be to utilise pressurised air to blow the debris towards the nearest exiting point from the boom. Make sure that all debris is removed before operating the machine.
5. If pressurised air cannot dislodge the debris, use water with mild solvents applied via a pressure washer. Wash the debris towards the nearest exiting point from the boom. Make sure that all debris is removed, Make sure that no puddles of water have occurred and the boom internal components are dry prior to operating the machine. The collection and disposal of wash water and debris should be in accordance with any local regulations.
6. If neither pressurised air nor washing of the boom dislodges and removes the debris, disassemble the boom in accordance to the instructions outlined in the JCB Service Manual to remove the debris.

48 - Specifications

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09 - Static Dimensions

Technical Data

Figure 9.

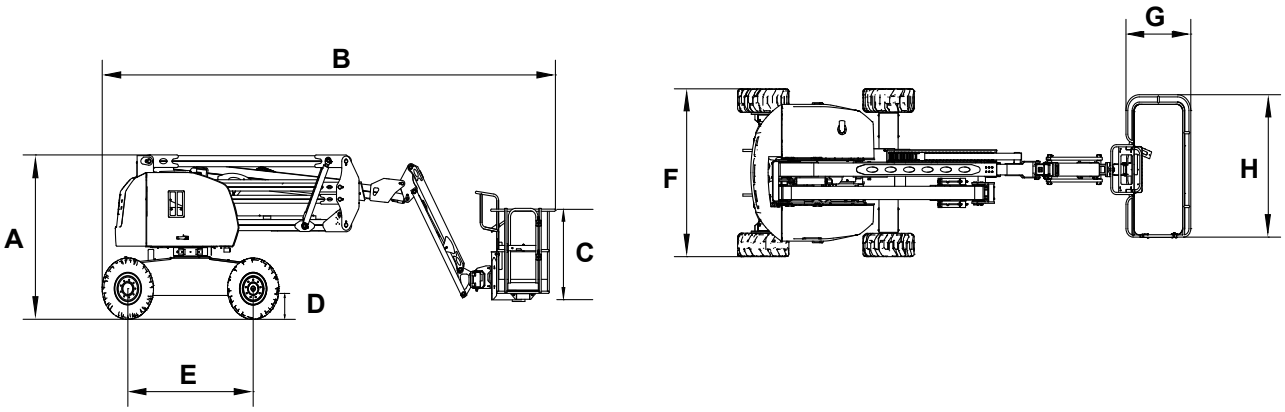

Figure 10.

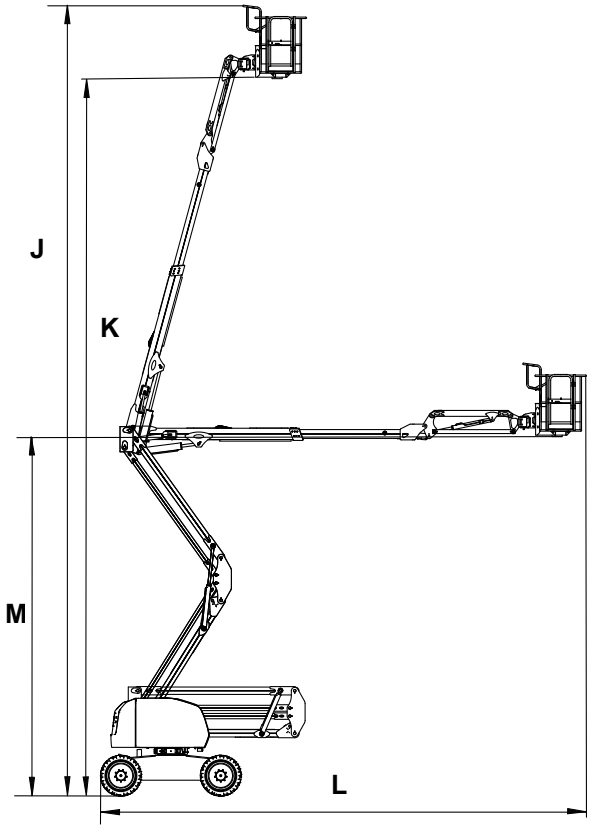

Table 10.

Items	Description	Length
A	Height- stowed	2.23m (7ft 3.8in)
B	Length- stowed	7.35m (24ft 1.3in)

Items	Description	Length
C	Platform height	1.1m (3ft 7.3in)
D	Ground clearance	0.32m (1ft 0.6in)
E	Wheelbase	2.03m (6ft 8in)
F	Width	2.26m (7ft 5in)
G	Platform- width	1.83m (6ft 0in)
H	Platform-length	0.85m (2ft 9.5in)
J	Maximum working height	16.7m (54ft 4in)
K	Maximum platform height[2]	14.7m (48ft 4in)
L	Maximum horizontal reach	8.3m (27ft 2.8in)
M	Up and over clearance[1]	7.46m (24ft 5.7in)

(1) The maximum height that the basket can reach when the main telescopic boom is angled horizontally.
(2) Maximum working height adds 2m to the metric platform height, and adds 6ft to the imperial platform height, based on regional norms.

10 - Weights

Technical Data

Table 11.

Description	Weight
Overall weight with generator (approximate)	7,885kg
Overall weight without generator (approximate)	7,840kg
Load capacity	250kg
Platform entry type	Gate
Platform entry number	1
Platform occupancy	2 persons
Maximum manual force	400N
Maximum ground wheel load	4,230kg
Maximum localised ground pressure per tyre	5,798 kN/m2

12 - Lift Arm Dimensions and Performance

Technical Data

Table 12. Drive Speed Checks

Description	Data
Maximum stowed drive speed	6.8km/h (4.2mph)
Engine at hare speed, wheel motor at low torque (20m)	10–14s
Engine at tortoise speed, wheel motor at low torque (20m)	17–21s
Engine at hare speed, wheel motor at high torque (20m)	25–29s
Engine at tortoise speed, wheel motor at high torque (20m)	45–49s
Maximum elevated drive speed (kph)	1.1km/h (0.7mph)
Elevated drive speed, engine at hare speed (10m)	33–37s
Elevated drive speed, engine at tortoise speed (10m)	56–32s
Maximum wind speed	12.5m/s
Maximum inclination (front/ side/ rear)	5°
Maximum gradeability	40%
Turning radius (outside)	4.7m
Turning radius (inside)	2.7m
Drive and steer	4WD, 2WS
Brake	4

Table 13. Check Cycle Time

Description	Data- 1500 rpm	Data- 2500 rpm
Articulated boom- raise	26–32s	17–23s
Articulated boom- lower	32–38s	32–38s
Main boom- raise	24–30s	21–27s
Main boom- lower	18–24s	18–24s
Telescopic boom- extend (lowered)	24–30s	16–22s
Telescopic boom- retract (lowered)	14–20s	14–20s
Telescopic boom- extend (raised)	24–30s	16–22s
Telescopic boom- retract (raised)	14–20s	14–20s
Jib boom- raise	20–26s	20–26s
Jib boom- lower	14–20s	14–20s
Platform rotate	15–21s	15–21s
Slew (stowed) - 90°	16–24s	16–24s
Slew (extended) - 90°	26–38s	26–38s
Platform levelling- raise	46–70s	46–70s
Platform levelling- lower	33–57s	33–57s
Raise to maximum height	92–116s	75–99s
Lower from maximum height	66–90s	63–87s
Steer	2–4s	1–3s

Table 14. Braking Distance

Test conditions	Braking distance
Stowed condition, low torque, hare mode on flat ground	2m
Stowed condition, low torque, tortoise mode on flat ground	1m
Elevated mode, low torque, hare mode on flat ground	0.1m

06 - Body and Framework

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Acronyms Glossary

PIN	Product Identification Number
VIN	Vehicle Identification Number

00 - Body and Framework

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Introduction

This machine mainly consists of chassis, turntable, articulated boom, main telescopic boom, jib and work platform.

Check (Condition)

1. Make sure that all of the guards and protective devices are in position, secured by their locking devices and free from damage.
2. Inspect all the steelwork for damage. Include the following:
   2.1. Examine all the pivot point welds.
   2.2. Examine the condition of all pivot pins.
   2.3. Check the pivot pins are correctly in position and secured by their locking devices.
3. Check the guardrails are undamaged and correctly attached.
4. Check that all the safety and instructional labels are undamaged and in position. Install new labels where necessary.
5. Note any damaged paintwork for future repair.
6. Inspect the machine for broken or loose fasteners.

06 - Moveable Panel and Cover

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Introduction

Access panels provide easy access to the machine major components test and service points and other parts which require routine testing, servicing, adjusting, replacement or repair.

Before you operate the machine, make sure that all of the access panels are in their operation position and secure.

Remove and Install

Hot Components

When working on the machine ensure machine is cool, unless otherwise advised. Checking, servicing or working on a machine at or close to working temperature could lead to burn injury.

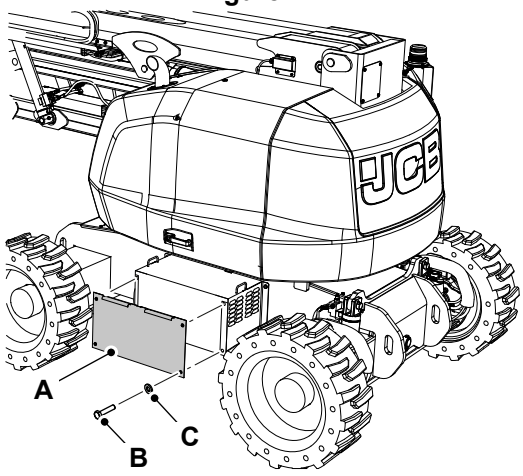
Remove

1. Make the machine safe

   Refer to: PIL 01-03.

2. Access the hydraulic generator box.
3. Remove set screw (x4) and washer (x4).

Figure 11.



A Cover
B Set screw (x4)
C Washer (x4)

Install

1. The installation procedure is opposite of the removal procedure. Additionally do the following steps:
2. Tighten the set screw (x4) to correct torque value.

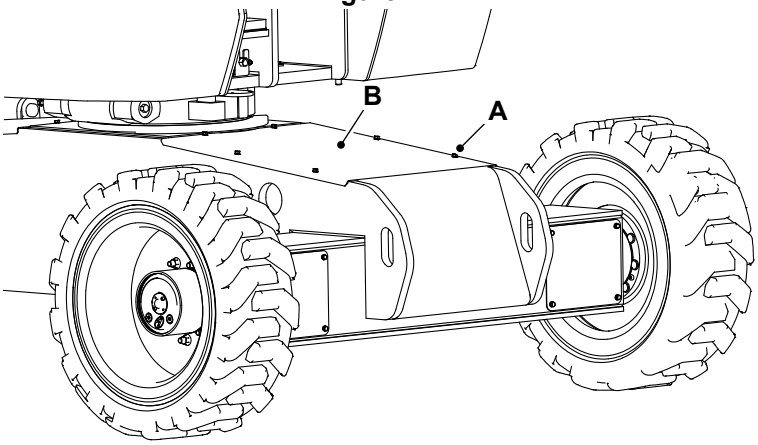
   Torque: 9N·m

03 - Battery Compartment

Open and Close

1. Make the machine safe.
2. Remove the key from the machine.
3. Loosen the bolts.
4. Remove the chassis cover to get access to the batteries.

Figure 12.



A Bolt

B Battery access cover

5. Install the chassis cover and tighten the bolts.

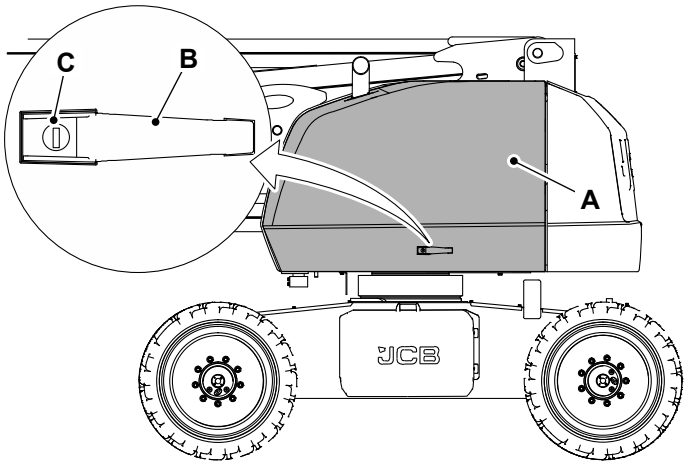
06 - Engine Compartment

Open and Close

To open the cover:

1. Unlock the right hand side body panel with the ignition key.
2. Push the button on the lock barrel.
3. Pull the handle to release the latch and open the cover.
4. Open cover is supported by gas springs.

Figure 13.



A Engine compartment cover
B Handle
C Lock

To close the cover

1. Close the cover by pushing the handle firmly; it will latch itself.

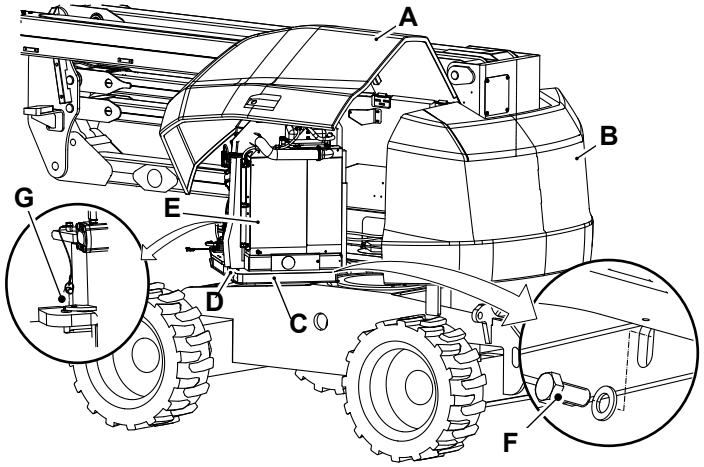
Engine Access

To open the engine tray:

1. Remove the securing bolt with specified A/F spanner.

   Length: 22mm
2. Remove the locking pin from swivel side.
3. Pull the engine tray out with a door stop.
4. Insert the locking pin to keep the engine tray in locked position.

Figure 14.



A Engine compartment cover
B Counter weight
C Engine tray
D Door stop
E Engine
F Securing bolt
G Locking pin

To close the engine tray:

1. Remove the locking pin and push the tray with door stop.
2. Insert locking pin at swivel side.
3. Install and torque tighten the securing bolt with 22mm A/F spanner.

   Torque: 184N·m
4. Close the cover by pushing the handle firmly; it will latch itself.

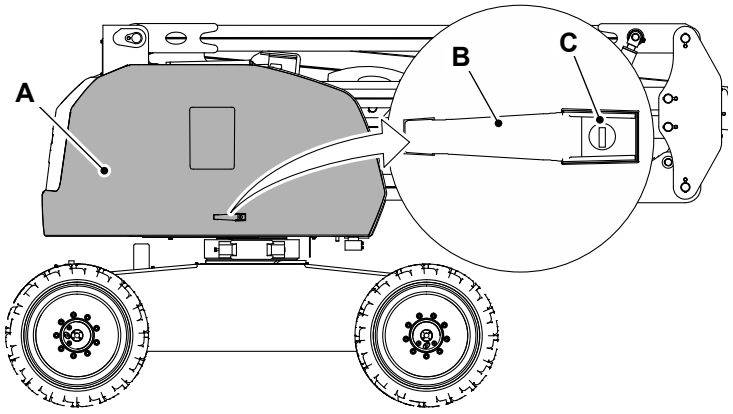
09 - Hydraulic Compartment

Open and Close

To open the cover:

1. Unlock the cover with the ignition key.
2. Push the button on the lock barrel.
3. Pull the handle to release the latch.

Figure 15.



A Body panel left side
B Handle
C Lock

To close the cover:

1. Close the cover by pushing the handle firmly; it will latch itself.

16 - Articulated Lift Arm

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Introduction

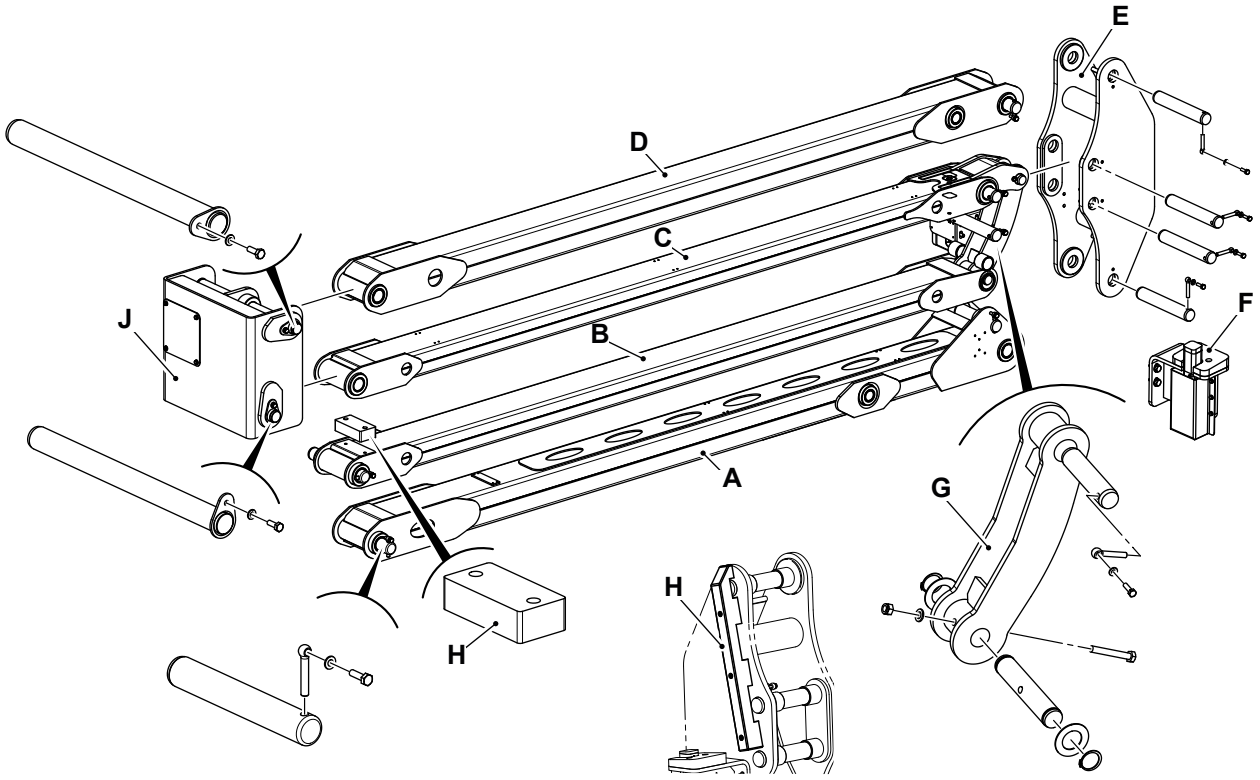
The articulated boom is constructed of four stages and is directly mounted on the turntable.

This is a heavy component, you must use suitable lifting equipment.

There are two cylinder rams installed on the lift arm, both cylinder rams are operated simultaneously to give the desired lift.

Component Identification

Figure 16.



A Articulated boom stage 1
B Articulated boom stage 2
C Articulated boom stage 3
D Articulated boom stage 4
E Articulated boom rear knuckle
F Rest pad
G Tie rod
H Cushion pad
J Articulated boom front knuckle

Operation

⚠ **CAUTION** This component is heavy. It must only be removed or handled using a suitable lifting method and device.

The articulated boom assembly has 4 sections as mentioned below.

- Four stage booms.
- Two knuckles.

When power is applied to one lift boom, the linkages causes the other lift boom also to raise simultaneously. Each is a fabricated construction and they are all permanently mounted to the machine. Together they are called the articulated boom/lift arm.

There are two cylinder rams installed on the lift arm, both raise the arm parallel to each other. The lower boom rests on a replaceable wear pad installed on the turntable when it is fully stowed.

Check (Condition)

1. Check the condition of the boom pivot pin for excessive wear, scoring, tapering, ovality or other damage. If necessary, replace them.
2. Check the condition of the stage 1 and stage 2 attaching rear knuckle pivot pins for scoring, tapering and ovality. If necessary, replace the pivot pin.
3. Check the condition of the stage 3 and stage 4 attaching front knuckle pivot pins for wear, scoring, tapering, ovality or other damage.

   3.1. Make sure that the pivot pin surfaces are protected prior to installation. If necessary, replace the pivot pin.
4. Check the condition of the inner diameter of boom pivot bearing for scoring, distortion, wear or other damage. If necessary, replace the bearing.
5. Check the condition of all wear pads for excessive wear or other damage.

   5.1. Replace the pads when worn to the specified dimension of threaded insert.

   Dimension: 3.2mm
6. Check the condition of all threaded components for damage such as stretching, thread deformation or twisting. If necessary, replace the damaged components.
7. Check the condition of structural components of the boom assembly for bending, cracking, separation of welds or other damage. Repair the boom sections as required.

Remove and Install

⚠ **CAUTION** This component is heavy. It must only be removed or handled using a suitable lifting method and device.

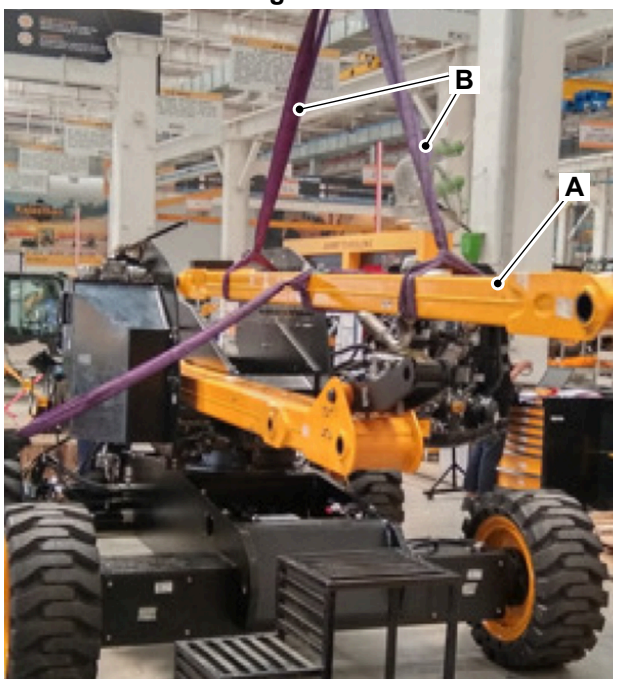
Notice: Do not allow dirt to enter the system. Before disconnecting any part of the system, thoroughly clean around the connection. When a component has been disconnected, always install protective caps and plugs to prevent dirt ingress.

Failure to follow these instructions will lead to dirt entering the system. Dirt in the system will seriously damage the systems components and could be expensive to repair.

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
   Refer to: Discharge and Pressurise (PIL 30-00-00).
3. Disconnect the hydraulic hoses from the lift arm.
   3.1. Put a label and caps on the hoses to help or prevent installation.
   3.2. Plug all the open ports and hoses to prevent contamination.
4. Disconnect the related wiring harness.
5. Remove the platform.
   Refer to: Remove and Install (PIL 06-97-00).
6. Remove the rotary actuator assembly.
   Refer to: Remove and Install (PIL 06-73-00).
7. Remove the lift arm.
8. Open the hydraulic compartment.
   Refer to: Open and Close (PIL 06-06-09).
9. Use an appropriate rated load overhead crane and suitable lifting equipment to support the articulated lift arm and related assembly.

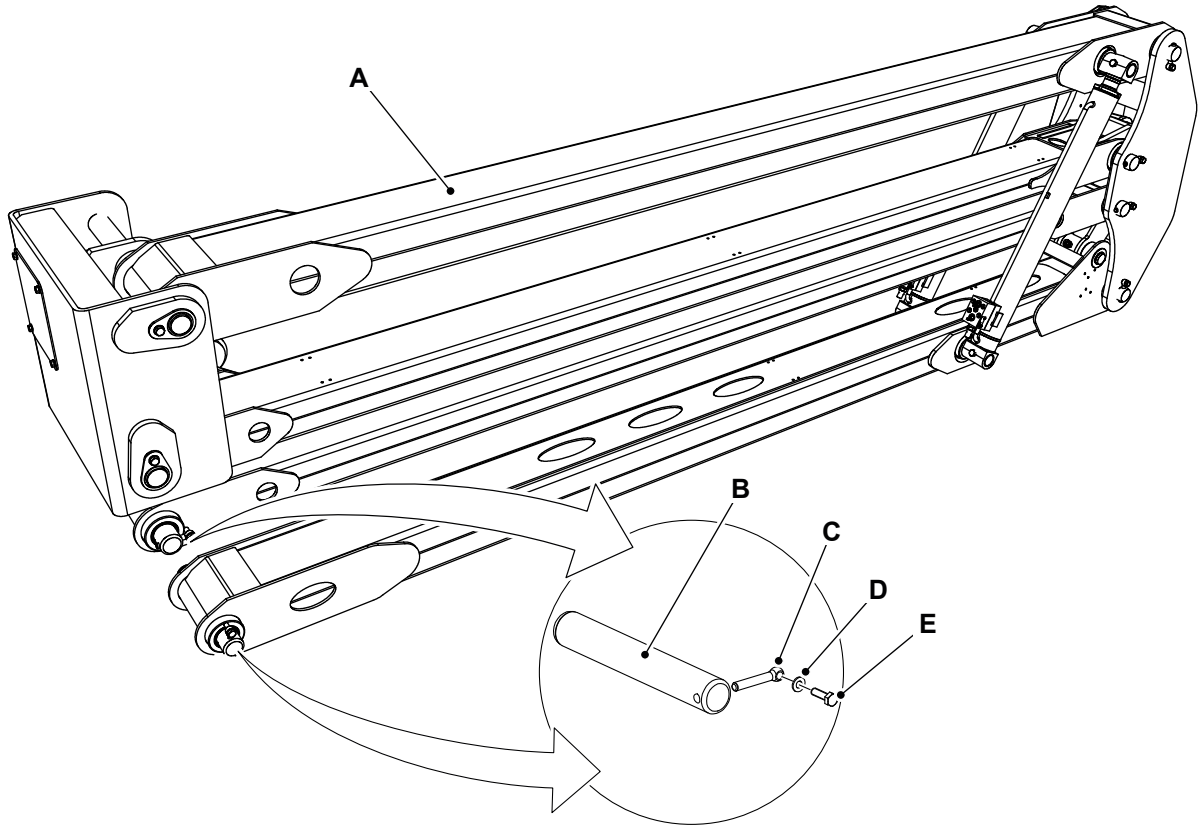
Figure 17.



A Articulated lift arm
B Lifting equipment

   9.1. An appropriate spreader bar is recommended to lift this component.
10. Remove the setscrew (x2), plain washer (x2) and lock pivot pin (x2). Refer to Figure 18.
11. Use suitable brass or drift hammer to remove the pivot pin (x2) from the articulated lift arm.
12. Remove the articulated lift arm from the machine.
13. Lift the assembly carefully and lower to ground or suitable supported work surface.

Figure 18.



A Articulated boom
B Pivot pin (x2)
C Pivot lock pin (x2)
D Plain washer (x2)
E Setscrew (x2)

Install

1. The installation procedure is the opposite of the removal procedure.
2. Tighten the setscrew to the correct torque value.
   Refer to: PIL 72-03-00.

17 - Telescopic Boom

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Introduction

The telescopic boom is a fabricated steel construction and is permanently mounted to the articulated lift arm with the upright assembly. It has two structure component, inner telescopic boom and outer telescopic boom

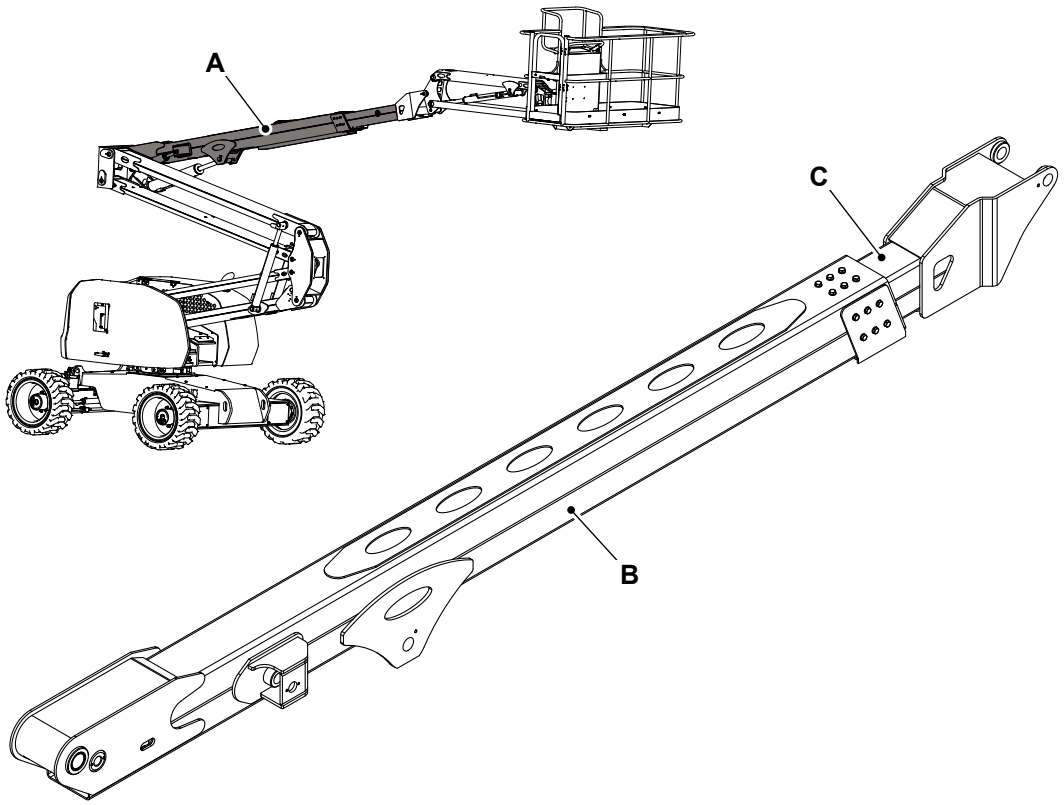
This assembly is a heavy item, you must use suitable lifting equipment to lift this component.

There are four cylinder rams installed on the telescopic boom; one for raising the boom, one for extending the secondary inner arm and the other two for levelling the platform as the main boom raises & lowers. The inner boom section slides against adjustable / replaceable wear pads installed in the boom section.

Telescopic boom has two structure component, inner telescopic boom and outer telescopic boom

Component Identification

Figure 19.



A Main boom assembly
B Outer boom
C Inner boom

Operation

The main telescopic boom consists of inner and outer arm. This assembly is supported by three rams. Refer to: Component Identification (PIL 06-17-00).

- Lifting ram
- Levelling/lowering ram
- Telescopic ram.

Lift arm assembly is attached to Jib knuckle and front articulated boom knuckle.

Check (Condition)

1. Check condition of the upright assembly pivot pin for wear, scoring, tapering and ovality or other damage. If necessary, replace them.
2. Check condition of the upright assembly pivot pin attach points for scoring, tapering and ovality or other damage. If necessary, replace them.
3. Check condition of the inner diameter of upright assembly pivot bearings for scoring, distortion, wear or other damage. If necessary, replace them.
4. Check condition of the primary lift cylinder attach pin for wear, scoring, tapering and ovality or other damage.
   4.1. Make sure that the pin surfaces are protected prior to installation. If necessary, replace the pivot pin.
5. Check condition of the inner diameter of upright assembly attach point bearings for scoring, distortion, wear or other damage. If necessary, replace the bearings.
6. Check condition of all the threaded components for damage such as stretching, thread deformation or twisting. If necessary, replace the damaged components.
7. Check condition of the structural components of the upright assembly for bending, cracking, separation of welds or other damage. Repair the boom sections as required.
8. Check the condition of the power track for damage such as cracking, wear or other damage. If necessary, replace the damaged components.
9. Check condition of the underside of the outer and inner boom sections for rippling or other damage.

Remove and Install

⚠ **CAUTION** This component is heavy. It must only be removed or handled using a suitable lifting method and device.

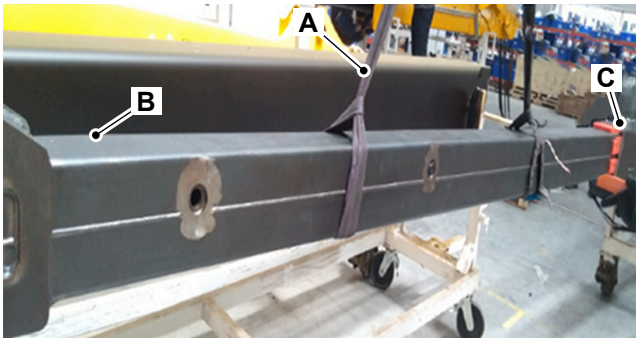
Notice: Do not allow dirt to enter the system. Before disconnecting any part of the system, thoroughly clean around the connection. When a component has been disconnected, always install protective caps and plugs to prevent dirt ingress.

Failure to follow these instructions will lead to dirt entering the system. Dirt in the system will seriously damage the systems components and could be expensive to repair.

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
   Refer to: Discharge and Pressurise (PIL 30-00-00).
3. Disconnect the hydraulic hoses from the articulated boom (4 stage).
   3.1. Put a label on the hoses to help installation.
   3.2. Plug all the open ports and hoses to prevent contamination.
4. Disconnect the applicable electrical harness.
5. Remove the platform.
   Refer to: Remove and Install (PIL 06-97-00).
6. Remove the rotary actuator.
   Refer to: Remove and Install (PIL 30-80-00).
7. Remove the jib ram.
   Refer to: Remove and Install (PIL 30-15-78).
8. Remove the jib.
   Refer to: Remove and Install (PIL 06-73-00).
9. Remove the jib lift ram.
   Refer to: PIL 30-15-17.
10. Remove the articulated boom (4 stage) ram.
11. Use suitable lifting equipment to support the articulated boom (4 stage) assembly.

Figure 20.

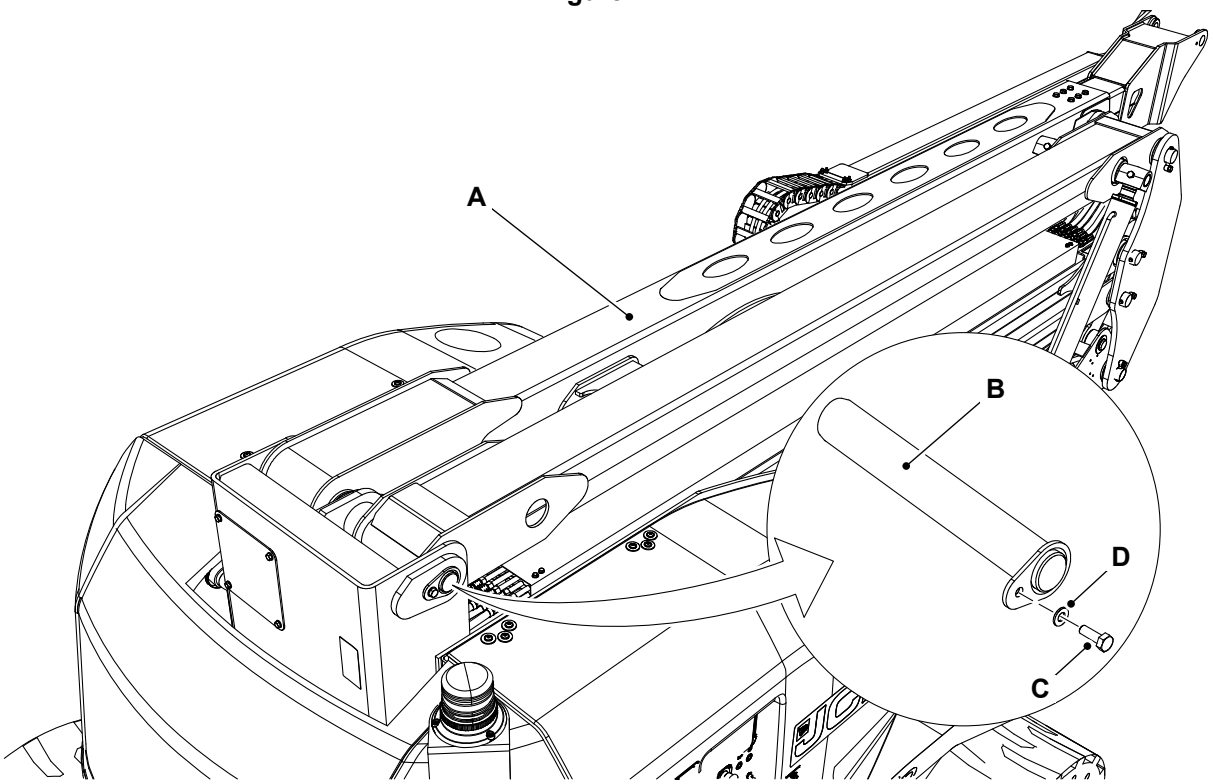


A Lifting equipment
B Inner boom
C Outer boom

11.1. An appropriate spreader bar is recommended to lift this component.

12. Remove the retaining screw and washer.Refer to Figure 21.
13. Remove the pivot pin from the articulated boom (4 stage) assembly.
14. Remove the articulated boom (4 stage) along from the machine.

Figure 21.



A Articulated boom (4 stage)
B Pivot pin
C Retaining screw
D Washer

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Tighten the retaining screw to the correct torque value.

   Torque: 43N·m

Disassemble and Assemble

Disassemble

1. Remove the lift arm assembly from the machine.
   Refer to: PIL 01-03-27.
2. Remove the fasteners from brackets.
3. Remove the bracket.
4. Put a label on the hoses and wiring to help installation.
5. Remove the hoses and wiring from the outer lift arm powertrack.
6. Remove the fasteners from the inner lift arm.
7. Remove the fasteners from the push tubes.
8. Remove the push tubes.
9. Remove the powertrack.
   Refer to: PIL 06-70-00.
10. Remove fasteners from the primary lift extension cylinder (Piston end).
11. Remove the fasteners from the wear pads on the outer lift arm.
    11.1. Remove the wear pads from the top, sides and bottom of the outer lift arm.
    11.2. Make a note of the quantity and thickness of the shims to help installation.
12. Use a suitable lifting device to support the outer lift arm.
    12.1. Remove the outer lift arm from the inner lift arm.
13. Remove the fasteners from the primary lift extension cylinder (Head end).
    13.1. Use a suitable brass drift and hammer to remove the lift extension cylinder pin from inner lift arm.
14. Remove the fasteners from the wear pads on the inner lift arm.
    14.1. Remove the wear pads from the top, sides and bottom of the inner lift arm.
    14.2. Make a note of the quantity and thickness of the shims to help installation.
15. Remove the fasteners from the upright leveling cylinder (Piston end).
    15.1. Use a suitable brass drift and hammer to remove the upright leveling cylinder pin from inner lift arm.
16. Remove the fasteners from the wear pads on the inner lift arm.
    16.1. Remove the wear pads from the top, sides and bottom of the inner lift arm.
    16.2. Make a note of the quantity and thickness of the shims to help installation.

Assemble

When you assemble the boom sections, make sure that the boom sliding area is clear of chains, tools and other obstructions.

1. Check condition of the boom sections.
2. Measure the inside dimensions of the outer lift arm to determine the number of shims required for proper installation.
   2.1. Install side, top and bottom wear pads to the aft end of inner lift arm.
   2.2. Install the shim evenly to the inside of the outer lift arm.
   2.3. Install the shim evenly to the inside of the outer lift arm.
3. Align the attachment holes in the inner lift arm with the hole in piston end of upright leveling cylinder.
   3.1. Use a soft faced hammer to install the cylinder pivot pin into the inner lift arm.
   3.2. Install the fastener on the pivot pin.
4. Align the attachment holes in the inner lift arm with the hole in rod end of primary lift extension cylinder.
   4.1. Use a soft faced hammer to install the cylinder pivot pin into the inner lift arm.
   4.2. Install the fastener on the pivot pin.
5. Secure the inner lift arm assembly with a suitable sling and lifting device approximately at the centre of gravity.
6. Slide the inner lift arm assembly into the outer lift arm.
   6.1. Add or remove the shims to get the specified clearance.
   Distance: 1.59mm
7. Install the wear pads into the forward position on the outer lift arm.

7.1. Add or remove the shims to get the specified clearance.

Distance: 5.08mm

8. Align the primary lift extension cylinder with the slots at the aft end of the outer lift arm.

8.1. Secure the lift extension cylinder with fasteners.

9. Install the powertrack.

Refer to: PIL 06-70-00.

10. Install the push tubes.

11. Connect the hoses and wiring.

12. Install the bracket.

30 - Wear Pads

Adjust 06-30
Remove and Install 06-31

Adjust

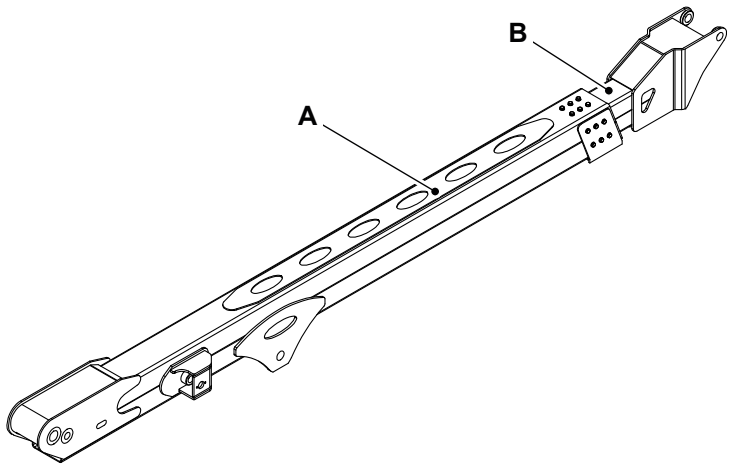
1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Measure the wear pad to boom clearance with a gauge.
   2.1. Clearance of specific value is required for each side of wear pads.
   Distance: 1.5mm
   2.2. Use shims to adjust the clearance.
3. Remove the bolts from the cover at the end of the lift arm.
4. Remove the cover.
5. Extend the boom until the wear pads can be touched.
6. Loosen the bolts on the wear pads.
7. Install the mat for the wear pads at the top and the bottom of the lift arm until they are close to the lift arm.
8. Install the mat for the wear pads at the two sides of the lift arm until they are close to the lift arm.
9. Install the wear pad bolts.
10. Fully retract and extend the lift arm.
11. Inspect the key positions which may cause the wear pads to stick.
12. Remove the mats.
13. Measure the thickness of the mats.
14. Compare the thickness of the mats and wear pads.
15. Install the wear pads to their original positions.
16. Adjust the wear pads accordingly.
17. Replace the wear pads in case of external damages.

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Lubricate all pins through the grease nipples before attempting to remove them. This will ease the removal procedure and reduce damage.
3. Remove the telescopic boom.
   Refer to: Remove and Install (PIL 06-17-00).

Figure 22.

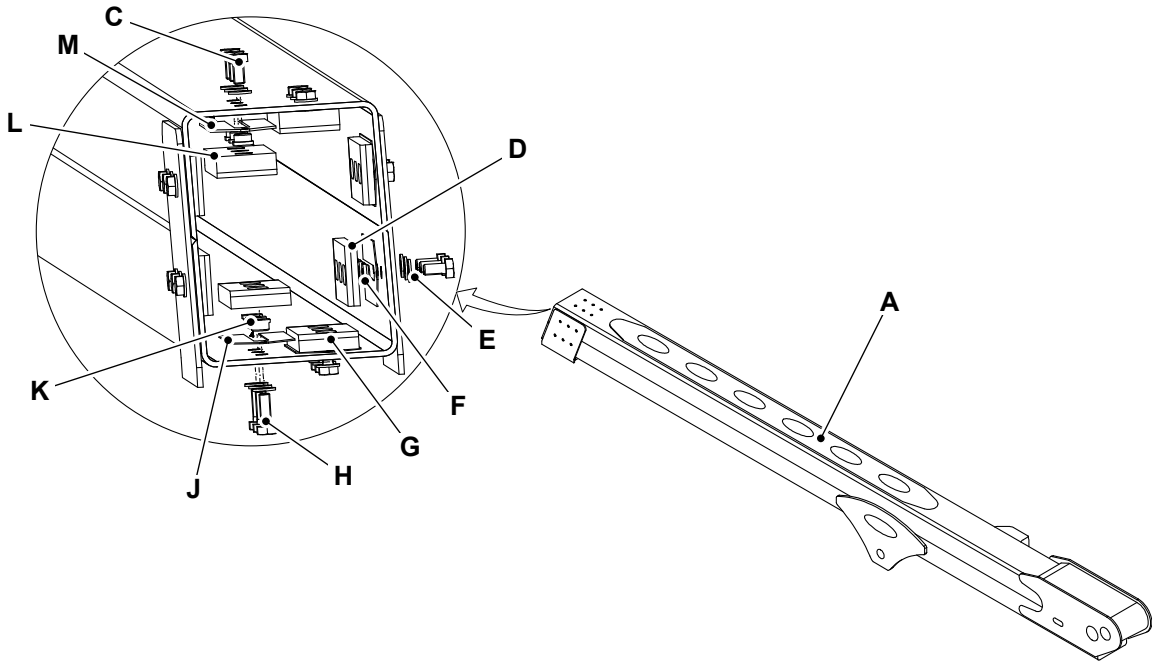


A Outer boom

B Inner boom

4. Remove the wear pads from outer boom as follows:

Figure 23. Outer boom wear pad



C Set screw 1 (x12)

D Side wear pads (x4)

E Washer
G Bottom wear pad (x2)
J Shim 2
L Top wear pad (x2)

4.1. Remove the set screw 1 (x6), nut 1(x6), washer (x6), top wear pads (x2) and shim 1.

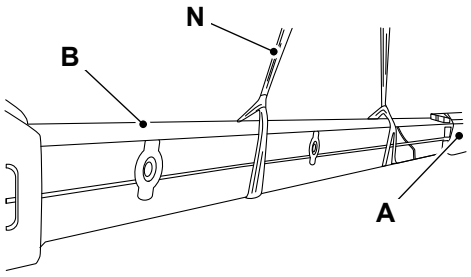
4.2. Remove the bolt (x6), nut 1 (x6), washer, bottom wear pads (x2) and shim 2.

4.3. Remove the set screw 1 (x12), nut 2 (x12), washer, LH and RH side wear pads (x4) and shim 2. Refer to Figure 23.

5. Remove the inner boom from the outer boom with suitable lifting equipment.

F Nut 2 (x12)
H Bolt (x6)
K Nut 1 (x12)
M Shim 1

Figure 24.



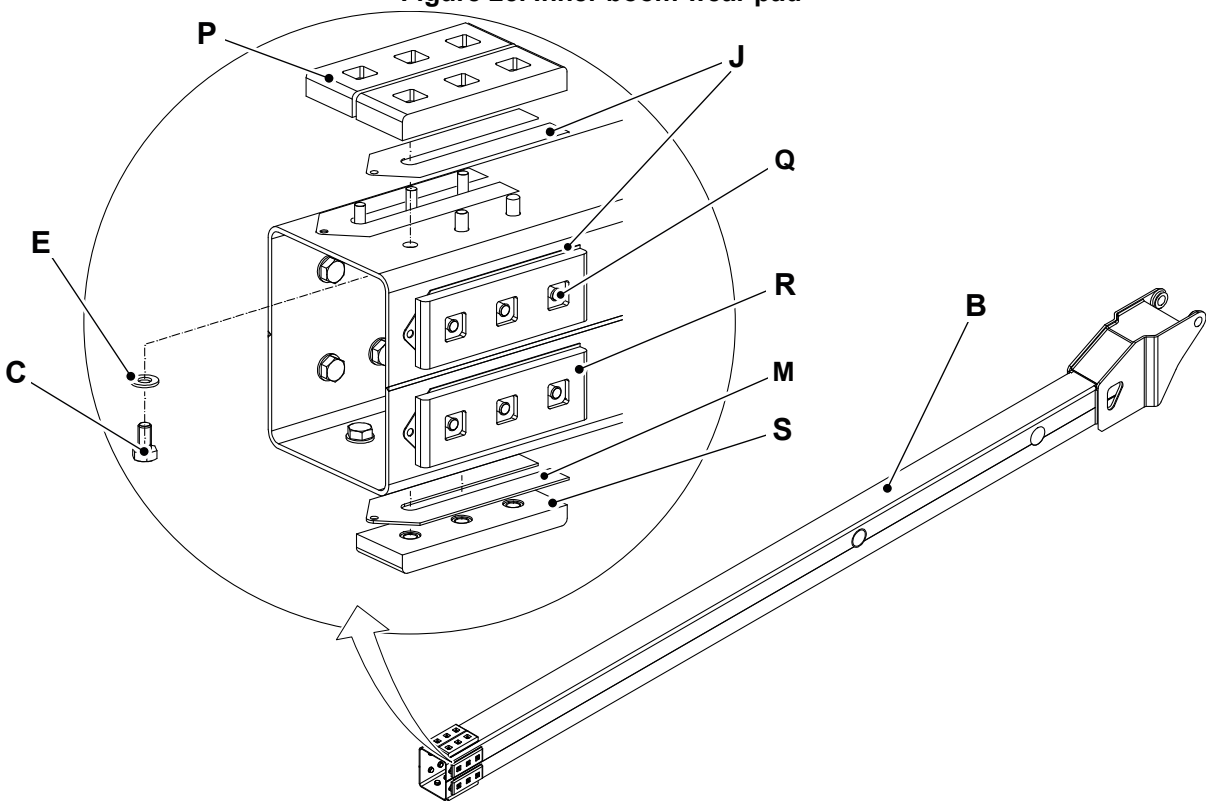
N Lifting equipment

6. Remove the wear pad from ram.

Refer to: Remove and Install (PIL 30-15-07).

7. Remove the wear pads from the inner boom as follows:

Figure 25. Inner boom wear pad



P Top wear pad (x2)
R Side wear pad (x4)

7.1. Remove the set screw 1 (x6), nut 1(x6), washer (x6), top wear pads (x2), and shim 2.

Q Set screw 2 (x12)
S Bottom wear pad (x2)

7.2. Remove the set screw 1 (x6), nut 1 (x6), washer (x6), bottom wear pads (x2) and shim 1.

7.3. Remove the set screw 2 (x12), nut 2 (x12), washer (x12), LH and RH side wear pads (x4) and shim 2. Refer to Figure 25.

Install

1. Installation procedure is opposite to the removal procedure.
2. Lubricate all pins before attempting to install them. This will make ease the installation procedure and reduce damage.
3. Make sure of the following points during installation.
   3.1. Proper alignment of ram inside the inner boom.
   3.2. After half insertion of inner boom inside outer boom, install the top wear pad, bottom wear pad and LH and RH wear pad on the outer boom.
4. Refer torque table for tightening the bolt.

Table 15. Torque Values

Item	Nm
C	53.5
H	53.5
Q	53.5

19 - Knuckle

Contents **Page No.**

06-19-00 General 06-35

00 - General

Introduction 06-35
Component Identification 06-36
Remove and Install 06-36

Introduction

There are two knuckles installed in this machine.

The front knuckle pivot pins connects stage 3 articulated boom and stage 4 main telescopic boom.

The rear knuckle connects all 4 stages of articulated boom in sequence of stage 1 to 4 from bottom to top. The rear knuckle also pivots main telescopic boom lift cylinder.

Component Identification

Figure 26.

A Front knuckle
B Rear knuckle

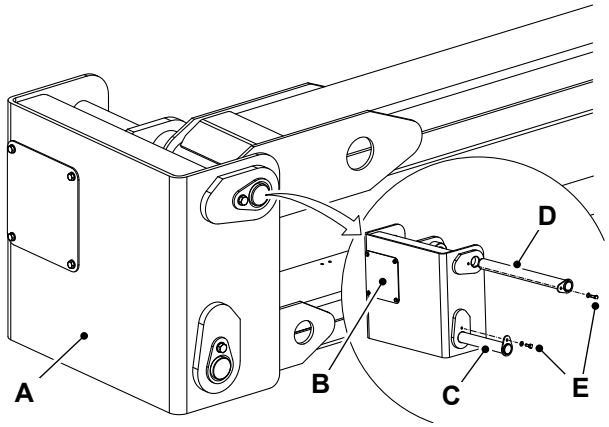
Remove and Install

Front Knuckle

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Support the lift arm and articulated lift arm with suitable lifting equipment.
3. Get access to the front knuckle.
4. Remove the setscrew (x2) and washer (x2).
5. Remove the pivot pin (x2).
6. Remove the front knuckle.
7. If necessary, remove the screw (x4) and remove the cover.

Figure 27.



A Front knuckle
B Hose access cover
C Pivot pin 1
D Pivot pin 2
E Setscrew (x2)

Install

1. The installation procedure is opposite of the removal procedure. Additionally do the following step.
2. Tighten the setscrew (x2) the correct torque value.
   Refer to: PIL 72-03-00.

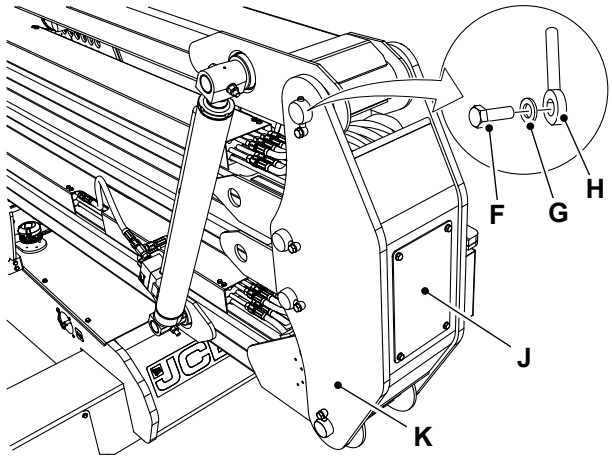
Rear Knuckle

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.

2. Support the lift arm and articulated lift arm with suitable lifting equipment.
3. Get access to rear knuckle.
4. Remove the setscrew (x4) and washer (x4).
5. Remove the pivot lock pin (x4)
6. Remove the pivot pin (x4).
7. Remove the rear knuckle.
8. If necessary, remove the screw (x4) and remove the cover.

Figure 28.



F Setscrew (x4)
G Washer (x4)
H Pivot lock pin (x4)
J Hose access cover
K Rear knuckle

Install

1. The installation procedure is opposite of the removal procedure. Additionally do the following step.
2. Tighten the setscrew (x4) the correct torque value.

   Refer to: PIL 72-03-00.

24 - Slew Ring

Contents **Page No.**

06-24-00 General 06-39
06-24-03 Bearing 06-42

00 - General

Introduction 06-39
Component Identification 06-40
Remove and Install 06-41

Introduction

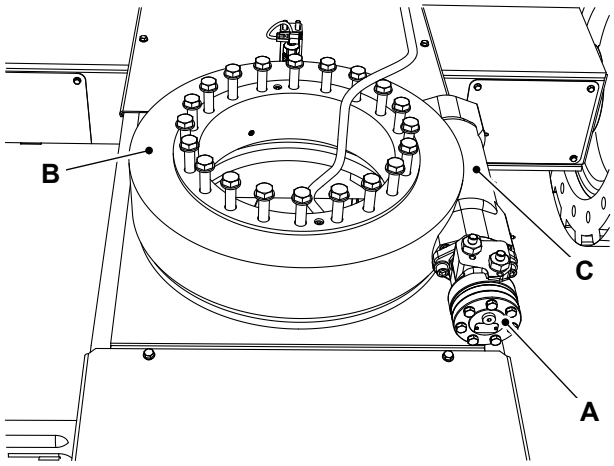
The slew ring is a rotational rolling-element bearing that supports the heavy but slow-turning upper structure.

An inner and outer ring rotate on an integrated bearing. Gear teeth on the outer ring mesh with a slew motor worm gear, which is used to drive the platform relative to the chassis.

Component Identification

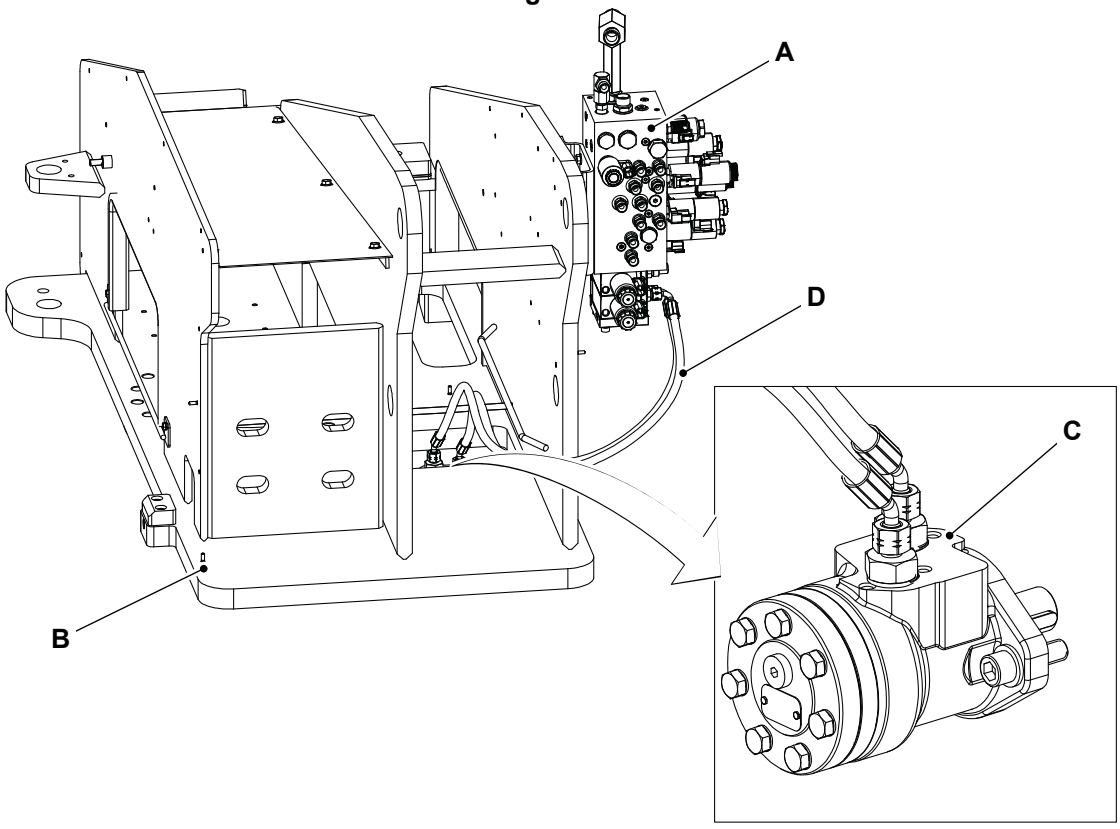
(For: AJ48D)

Figure 29.



A Slew motor
B Slew ring
C Slew worm gear

Figure 30.



A Main control valve
B Turntable
C Slew drive motor
D Hose - main control valve to slew drive motor

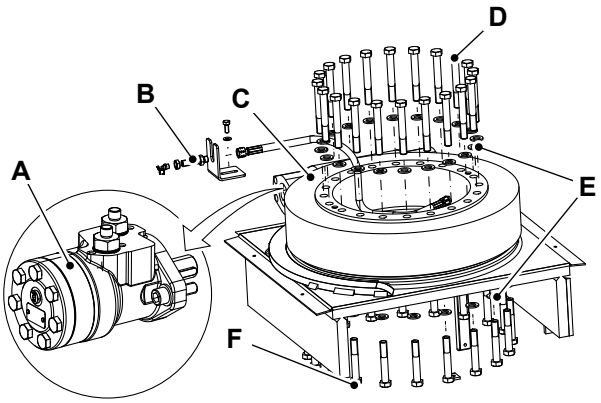
Remove and Install

⚠ **CAUTION** You can be injured if you use incorrect or faulty lifting equipment. You must identify the weight of the item to be lifted then choose lifting equipment that is strong enough and suitable for the job. Make sure that lifting equipment is in good condition and complies with all local regulations.

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
3. Remove the telescopic boom.
   Refer to: Remove and Install (PIL 06-17-00).
4. Remove the articulated lift arm.
   Refer to: PIL 06-16-00.
5. Put a mark on the turntable and chassis to aid correct alignment during installation.
6. Remove the slew motor.
   Refer to: PIL 30-39-00.
7. Attach suitable lifting equipment to the turntable.
8. Remove the bolts 1 (x20) that attach the turntable to the slew ring. Refer to Figure 31.
9. Lift the turntable above the machine.
   9.1. Be careful when you lift the turntable, not to foul the rotary coupling.
10. Remove the bolts 2 (x20) that attach the slew ring to the chassis. Refer to Figure 31.
11. Remove the slew ring from the machine.

Figure 31.



A Slew motor
B Remote greasing
C Slew ring
D Bolts 1 (x20)
E Washer (x40)
F Bolts 2 (x20)

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Make sure that the soft spots are aligned with the marks made during the removal procedure.
3. Tighten the bolts to the correct torque value.
4. Check the operation of all the hydraulic services.

Table 16. Torque Values

Item	Nm
D	259
F	259

03 - Bearing

Check (Condition) 06-42
Lubricate 06-43

Check (Condition)

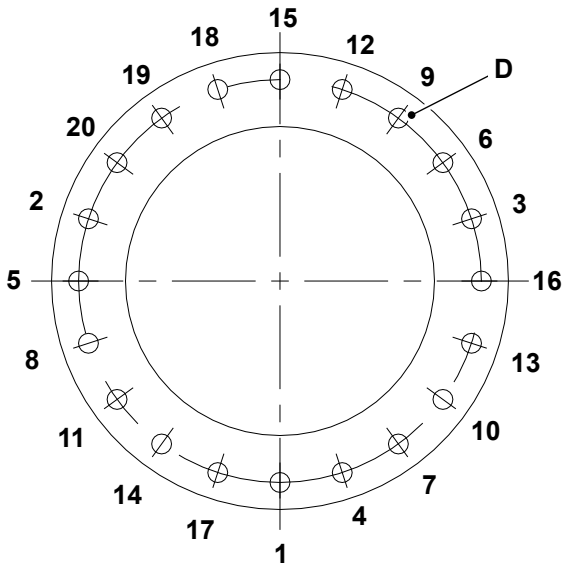
1. Raise the articulated boom.
2. Support the articulation boom with suitable lifting equipment.
3. Lower the articulated boom to the wedge shaped wooden block.
4. Make the machine safe.

   Refer to: PIL 01-03.
5. Turn off the engine.
6. Loosen the coupling bolt of the engine base frame and turntable.
7. Rotate the engine chassis through the specified angle.

   Angle: 45°
8. Tighten the upper set of bolts 1 on the slew ring bearing to the specified torque value. You must follow the specified sequence only. Refer to Figure 32.

   Torque: 259N·m

Figure 32.



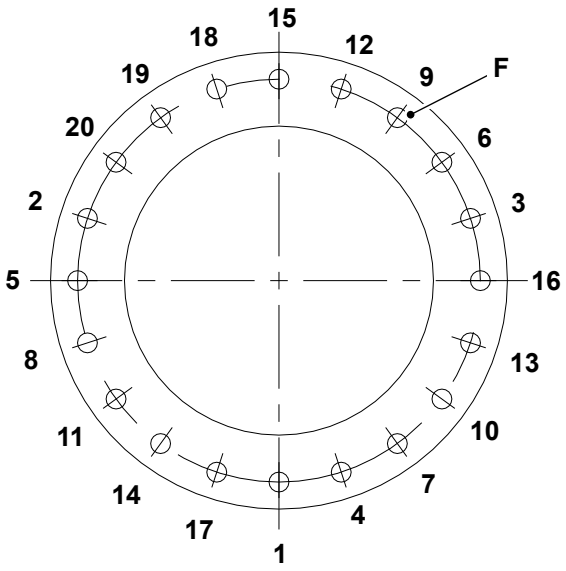
D Bolts 1 (x20)

9. Start the engine from the platform control.
10. Raise the articulated boom.
11. Remove support of the articulation boom.
12. Lower the articulated boom.
13. Remove the cover from the steering end and non-steering end of the machine chassis.

14. Tighten the lower set of bolts 2 on the slew ring bearing and chassis to the specified torque value. You must follow the specified sequence. Refer to Figure 33.

    Torque: 259N·m

Figure 33.



F Bolts 2 (x20)

Lubricate

Consumables

Description	Part No.	Size
Special HP Grease	4003/2020	0.5 kg
	4003/2017	0.4 kg
	4003/2006	12.5 kg
	4003/2005	50 kg

1. Make the machine safe.

   Refer to: PIL 01-03-27.

2. Grease the slew ring bearing until grease extrudes from under the seal around all of the circumference.

   Consumable: Special HP Grease

30 - Pivot Pins

Contents **Page No.**

06-30-00 General 06-45

00 - General

Introduction

Pivot pins are a short shaft or pin that supports something that turns. Pivot pins are installed in numerous positions on the machine. There is usually a greasing point associated with the pivot pin. Make sure that the pivot points are greased at regular intervals. Refer to the Machine Maintenance Schedules.
Refer to: PIL 78-24.

The pivot pins installed on these machines do not require any special tool for removal. You must use a suitable hammer and drift tool to remove the pivot pins.

45 - Gas Strut

Contents **Page No.**

06-45-15 Engine Compartment Cover 06-47

15 - Engine Compartment Cover

Remove and Install

(For: AJ48D)

Remove

1. Make the machine safe with the platform lowered.

   Refer to: Introduction (PIL 01-03-27).

2. Disconnect the battery.

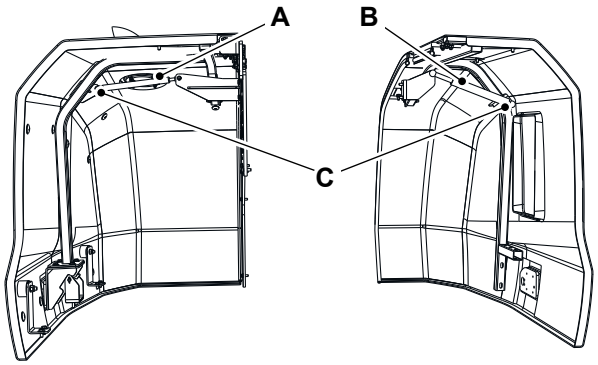
   Refer to: Disconnect and Connect (PIL 33-03-00).

3. Support the engine cover with suitable lifting equipment. Take care when you remove the gas strut, it is under load.

4. Remove the nut, washer and set screws from both the ends of the gas strut.

5. Remove the gas strut.

Figure 34.



A Gas strut right side
B Gas strut left side
C Set screws

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.

2. Do not overtighten the set screws.

   Refer to: PIL 72-03-00.

57 - Counterweight

Contents **Page No.**

06-57-00 General 06-49

00 - General

Introduction 06-49
Remove and Install 06-50

Introduction

⚠ **WARNING** Make sure the machine cannot be used with the counterweight removed. Make sure the ignition key is removed and the battery is isolated.

WARNING Do not use the machine with the counterweights removed. The counterweights are critical to the stability of machine.

The counterweight is an equivalent counterbalancing weight installed to the machine to balance any load.

Remove and Install

⚠ **CAUTION** This component is heavy. It must only be removed or handled using a suitable lifting method and device.

CAUTION You can be injured if you use incorrect or faulty lifting equipment. You must identify the weight of the item to be lifted then choose lifting equipment that is strong enough and suitable for the job. Make sure that lifting equipment is in good condition and complies with all local regulations.

WARNING Make sure the machine cannot be used with the counterweight removed. Make sure the ignition key is removed and the battery is isolated.

1. Make the machine safe.

   Refer to: Health and Safety (PIL 01-03-27).

2. Open the engine compartment to get access to the counterweight.

   Refer to: PIL 06-06-06.

3. Support the counterweight with suitable lifting equipment.

4. Remove the bolt 2 (x4), washer (x4) and spacer (x4).

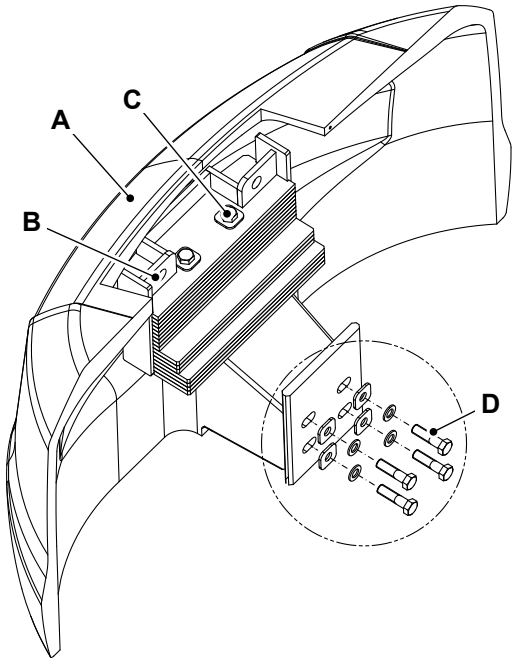
5. Remove the bolt 1 (x2) and spacer (x2)

   Refer to: PIL 72-06-00.

6. Lift the counterweight away from the machine. Make sure that the counterweight does not swing or snag on any other components.

   Weight: 210kg

Figure 35.



A Counterweight
B Lifting point
C Bolt 1
D Bolt 2

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.

2. Tighten the bolt to the correct torque value.

Table 17. Torque Values

Item	Nm
D	621

63 - Identification Label

Contents **Page No.**

06-63-00 General 06-53
06-63-03 Machine 06-54
06-63-06 Engine 06-56

Notes:

00 - General

Introduction

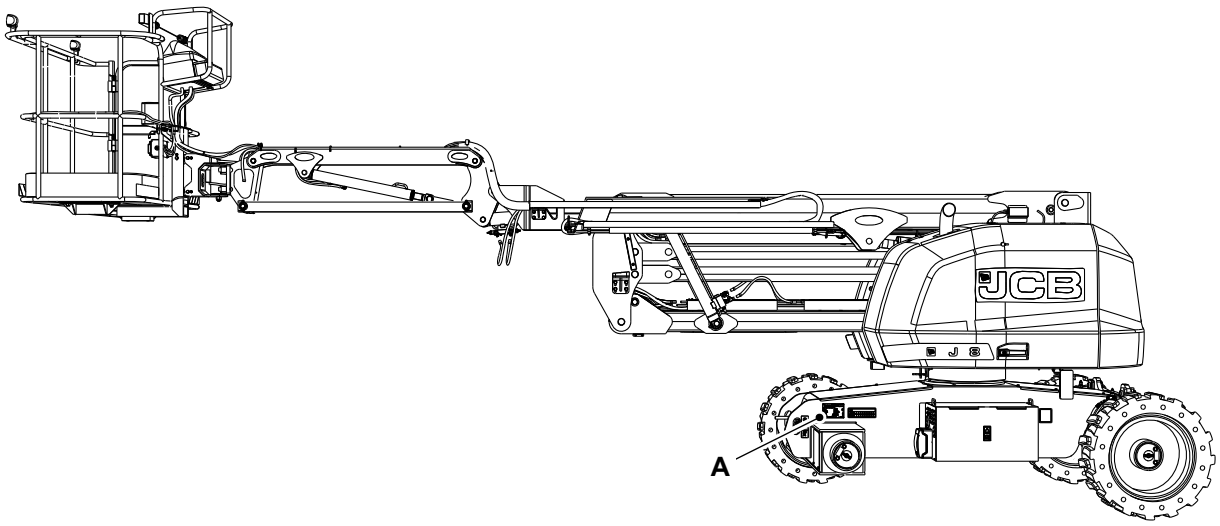
The machine has identification plates that contain important information relating to the specific machine details, for example VIN (Vehicle Identification Number) or PIN (Product Identification Number) and engine serial number. These serial numbers can help you identify exactly which equipment has been installed on the machine.

03 - Machine

Introduction

Your machine has an identification plate as shown.
Refer to Figure 36.

Figure 36.



A Machine identification plate

Note: Tyre is not shown for clarity

Explanation of Machine Identification Plate

Figure 37.

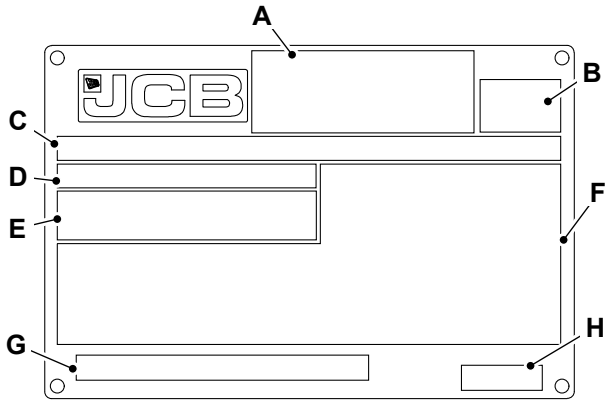


Table 18.

A	Manufacturers address
B	Regional certification mark (if applicable)[1]
C	PIN (Product Identification Number) ISO10261
D	Model
E	Model and manufacture year[2]

F	Model data
G	Product description and relevant design standards
H	Part number

(1) This only applies to markets requiring a certification mark. example a CE mark.
(2) This only applies to markets requiring a model and manufacture year.

06 - Engine

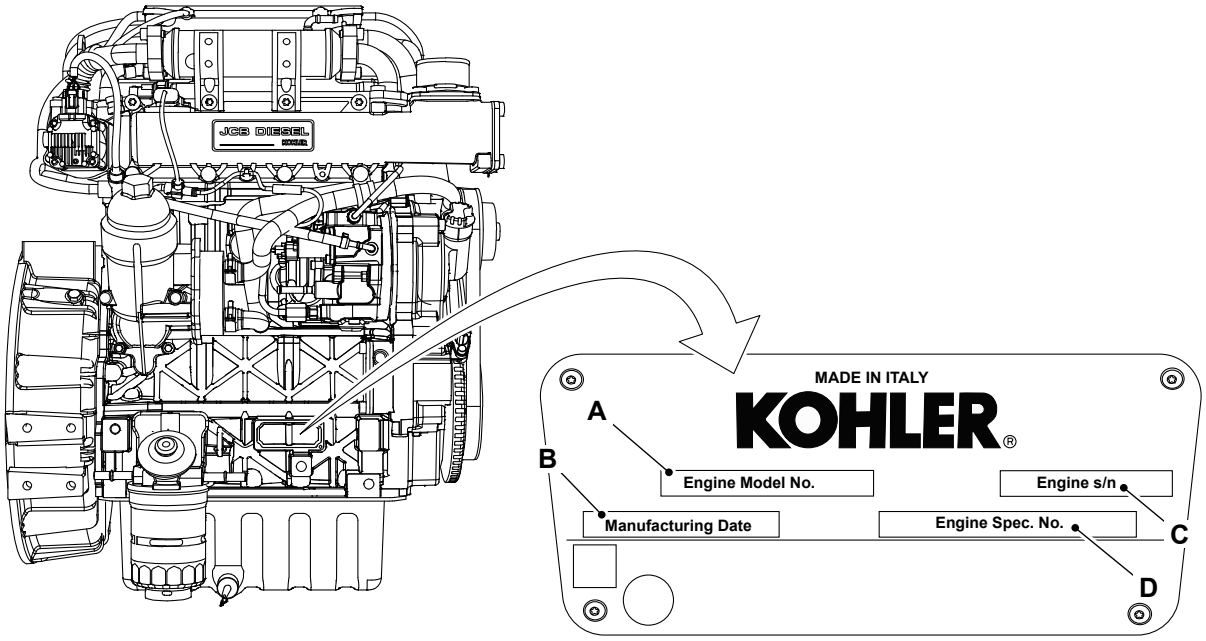
Introduction

(For: AJ48D)

The engine data labels are attached to the cylinder block as shown. Refer to Figure 38. and Refer to Figure 39.

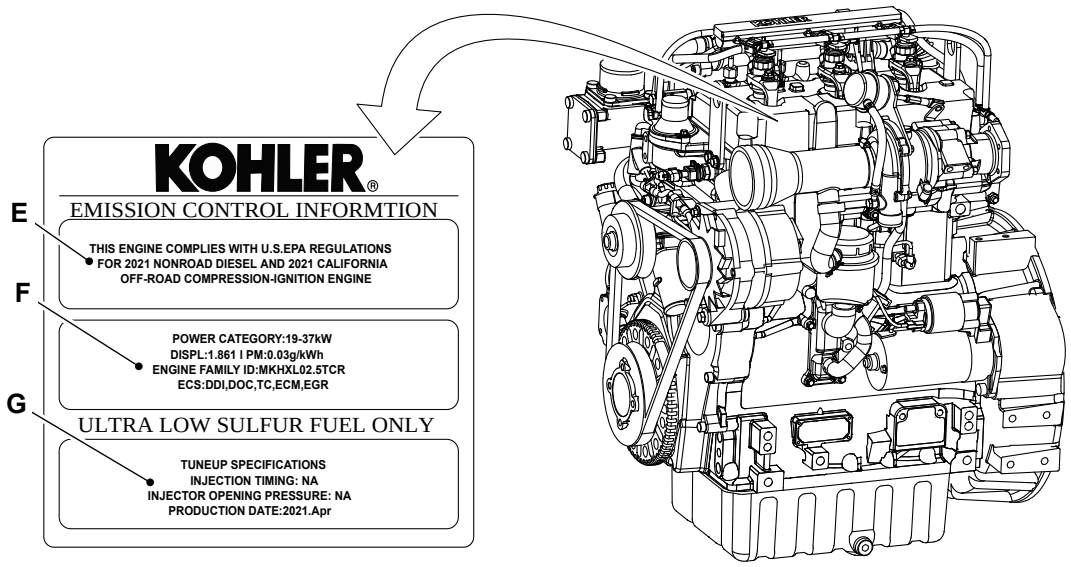
The data label includes the engine identification number.

Figure 38.



A Engine model number
B Manufacturing date
C Engine serial number
D Engine specification number

Figure 39.



E Regional compliance
F Engine specifications
G Fuel specification

70 - Powertrack

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06-70-00 General 06-59

00 - General

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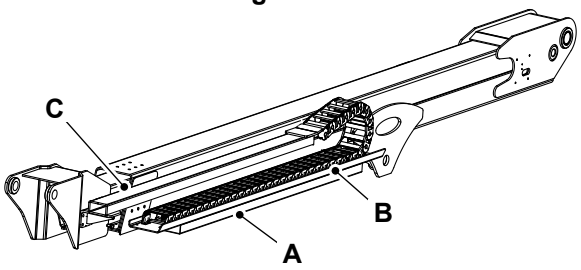
Remove and Install 06-60

Introduction

The powertrack also known as drag chain is installed on the machine to protect the cables and hoses during movement.

The drag chain can be repaired without removing the cables and hoses. It is necessary to remove the drag chain for removal of the lift arm.

Figure 40.



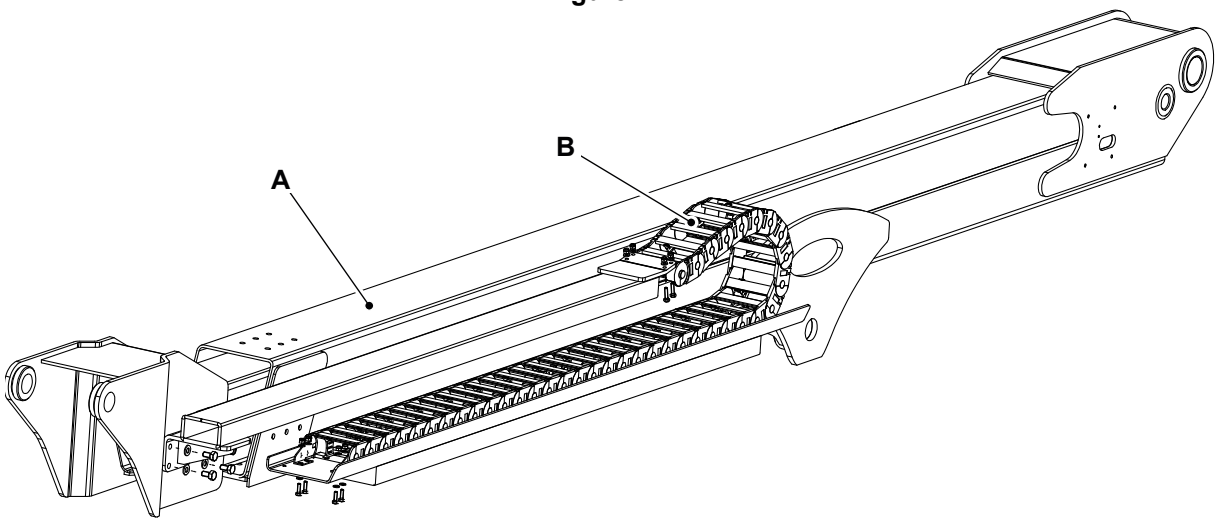
A Drag chain slot
B Drag chain
C Towline catcher

Remove and Install

Remove

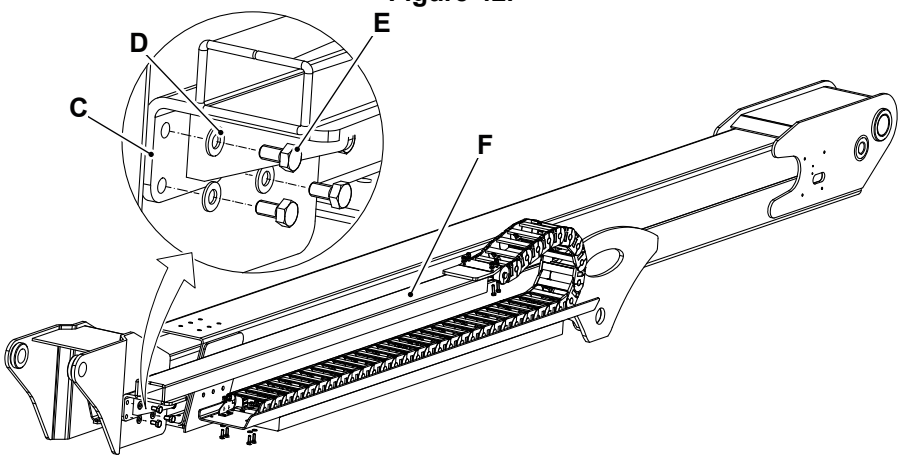
1. Make the machine safe with the platform lowered.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
   Refer to: PIL 30-00.
3. Disconnect the hydraulic hoses.
   Refer to: PIL 30-93.
4. Put a label on the hoses to help installation.
5. Plug all the open ports and hoses to prevent contamination.
6. Disconnect the electrical connector.
7. Disconnect towline catcher from telescopic boom.

Figure 41.



A Telescopic boom
B Drag chain

Figure 42.

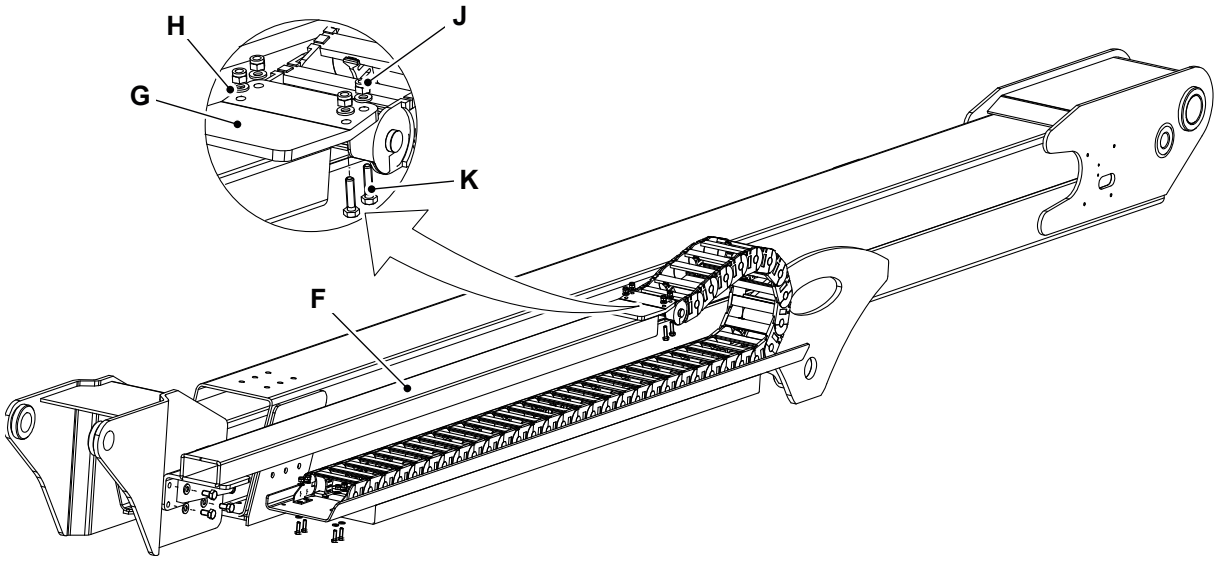


C Catcher plate 1
D Washer 1
E Set screw 1
F Towline catcher

7.1. Remove the set screw 1 (x4) and washer 1 from the towline catcher plate 1.

8. Disconnect drag chain from towline catcher.

Figure 43.

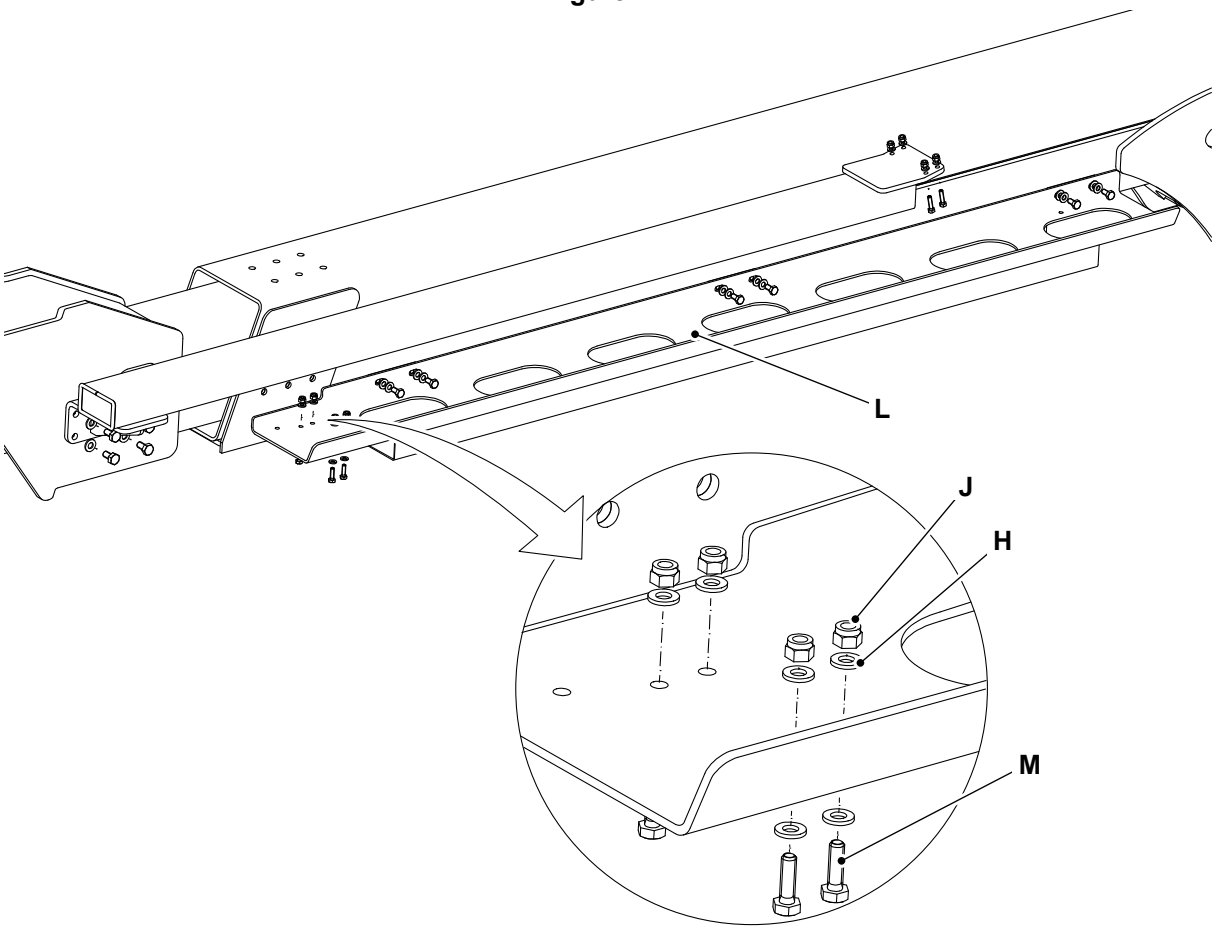


G Catcher plate 2
H Washer 2
J Lock nut
K Set screw 2

8.1. Remove the set screw 2 (x4), lock nut and washer 2 from towline catcher plate 2.

9. Disconnect the drag chain from drag chain bracket. Refer to Figure 42.

Figure 44.



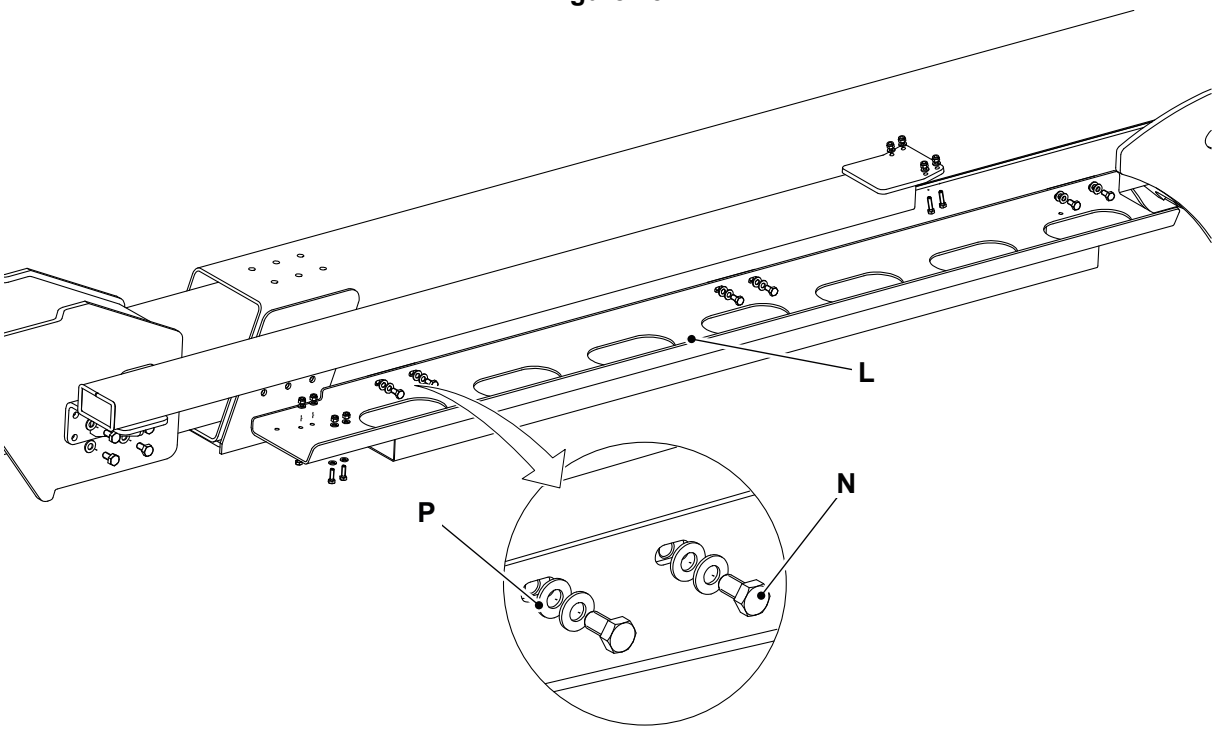
L Drag chain bracket

M Set screw 3

9.1. Remove the set screw 3 (x4), lock nut and washer 2.

10. Remove drag chain bracket from telescopic boom. Refer to Figure 42.

Figure 45.



N Set screw 4

P Washer 3

10.1. Remove the set screw 4 (x6) and washer 3.

11. Lock the two ends of the drag chain with suitable lifting equipment.

12. Lift the drag chain carefully and place it on the backstop with adequate capacity.

Install

1. The installation procedure is the opposite of the removal procedure.

2. Refer the torque table to tighten the set screw and lock nut to specified torque value.

Table 19. Torque Values

Item	Nm
E	43
N	22
J	12

73 - Jib

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06-73-00 General 06-65

00 - General

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Component Identification 06-66
Check (Condition) 06-67
Remove and Install 06-68

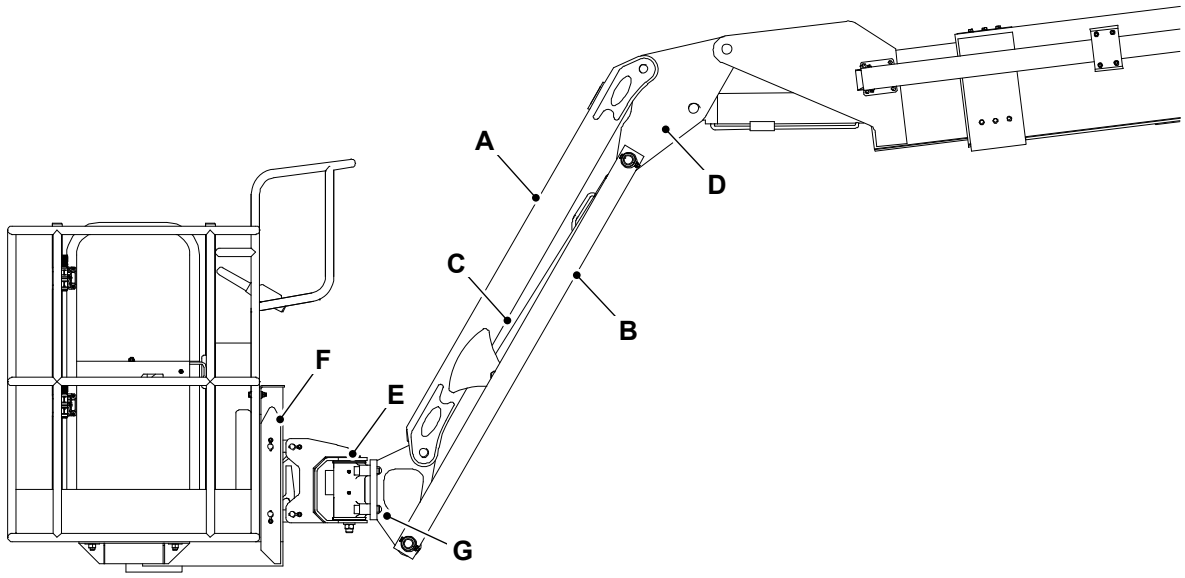
Introduction

These machines are installed with a jib.

The jib is an another articulation point for the platform to move up and down. The jib provides unequalled access up, over and around obstacles.

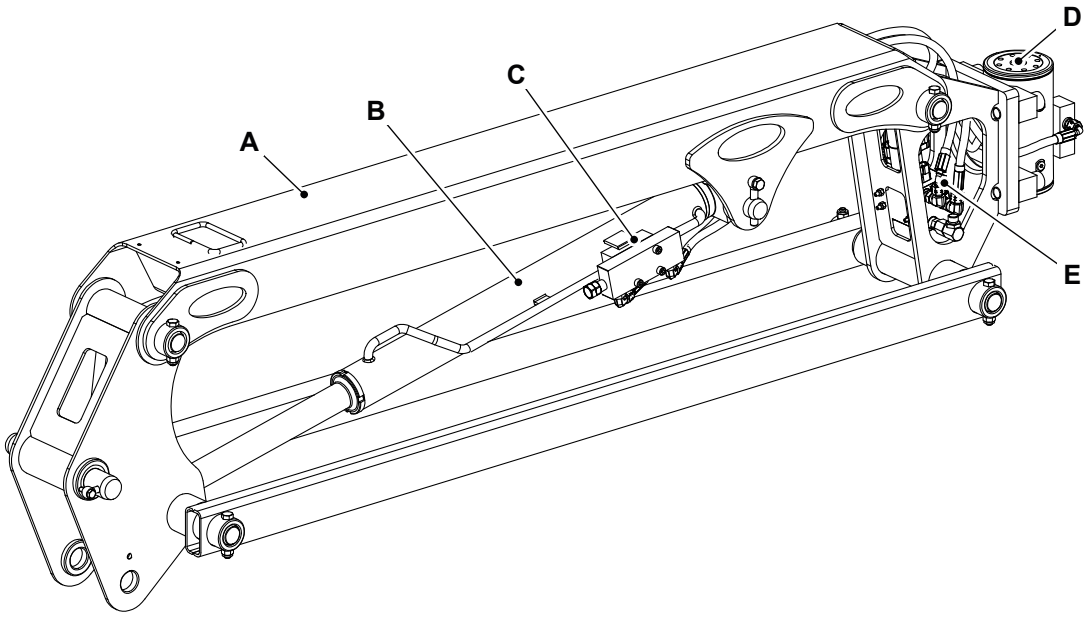
Component Identification

Figure 46.



A Jib lifting ram
B Jib lift cylinder
C Jib level arm
D Platform levelling knuckle
E Rotary actuator
F Platform carrier
G Jib knuckle

Figure 47.



A Jib lifting ram
B Jib lift cylinder
C Counter balance valve
D Rotary actuator
E Platform control valve

Check (Condition)

1. Check condition of the jib boom pivot pin for wear, scoring, tapering, ovality or other damage. If necessary, replace the pivot pin.
2. Check condition of the jib boom pivot pin attach points for scoring, tapering, ovality, or other damage. If necessary, replace the pivot pin.
3. Check condition of the inner diameter of jib boom pivot bearings for scoring, distortion, wear or other damage. If necessary, replace the damaged bearing.
4. Check condition of the jib lift cylinder attach pin for wear, scoring, tapering, ovality or other damage.
   4.1. Make sure that the pin surfaces are protected prior to installation. If necessary, replace the pivot pin.
5. Check condition of the inner diameter of rotary actuator attach point bearings for scoring, distortion, wear or other damage. If necessary, replace the damaged components.
6. Check condition of all the threaded components for damage such as stretching, thread deformation or twisting. If necessary, replace the damaged components.
7. Check condition of the structural components of the boom assembly for bending, cracking, separation of welds or other damage. Repair the boom sections as required.

Remove and Install

⚠ **CAUTION** This component is heavy. It must only be removed or handled using a suitable lifting method and device.

Notice: Do not allow dirt to enter the system. Before disconnecting any part of the system, thoroughly clean around the connection. When a component has been disconnected, always install protective caps and plugs to prevent dirt ingress.

Failure to follow these instructions will lead to dirt entering the system. Dirt in the system will seriously damage the systems components and could be expensive to repair.

Remove

1. Make the machine safe with the platform lowered.

   Refer to: PIL 01-03-27.

2. Remove the platform.

   Refer to: PIL 06-97-00.

3. Remove the rotary actuator.

   Refer to: PIL 30-80-00.

4. Use suitable lifting equipment to support the jib boom.

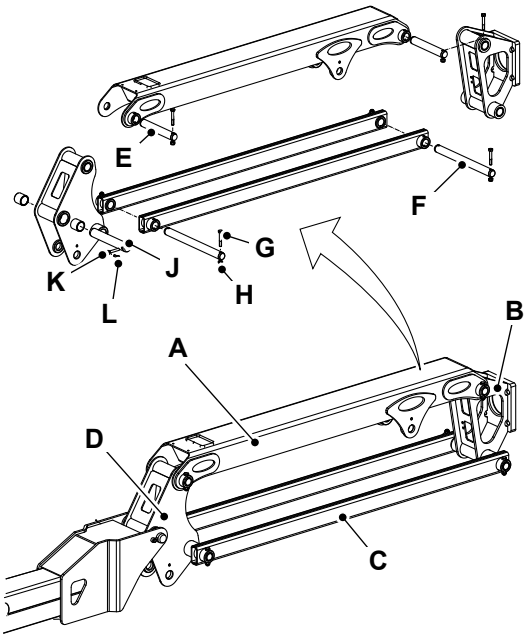
5. Remove the bolts (x6) and nuts (x6) from the jib extension arm and level arm pivot pin 1 and pivot pin 2.

   5.1. Use a suitable brass drift and hammer to remove the jib extension arm and level arm pivot pins from the front and rear jib knuckles.

6. Remove the set screw and lock pivot pin from the front jib knuckle pivot pin 3.

   6.1. Use a suitable brass drift and hammer to remove the front jib knuckle from inner telescopic boom

Figure 48.



A Jib extension arm
B Rear jib knuckle
C Jib level arm
D Front jib knuckle
E Pivot pin 1
F Pivot pin 2
G Bolt (x6)
H Nut (x6)
J Pivot pin 3
K Lock pivot pin
L Set screw

Install

1. The installation procedure is the opposite of the removal procedure.

Table 20. Torque Values

Item	Nm
H	53.5
L	22

93 - Emergency Lower System

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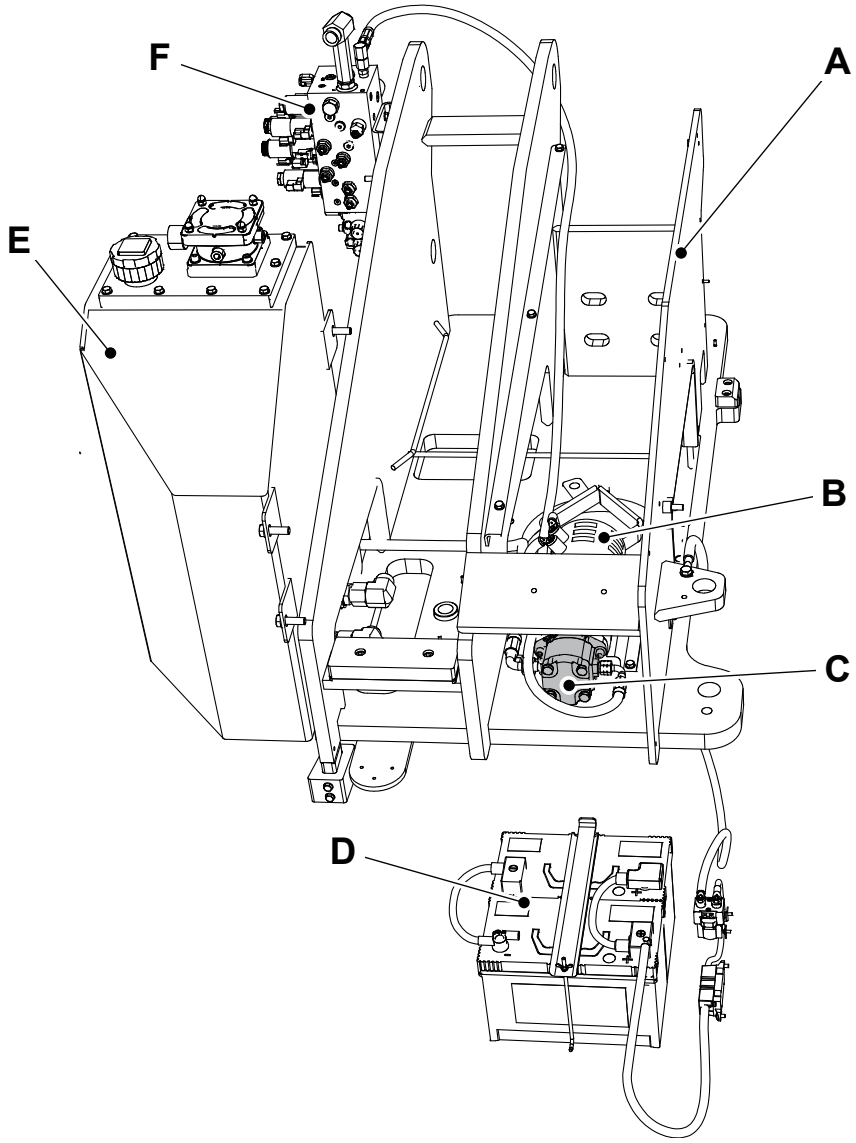
Introduction

In the event of no engine power available a hydraulic gear pump and electrical motor is used to lower the platform safely on the ground.

Component Identification

Figure 49.



A Turntable
B Electric motor
C Axillary pump
D Battery
E Hydraulic tank
F Main control valve

97 - Platform

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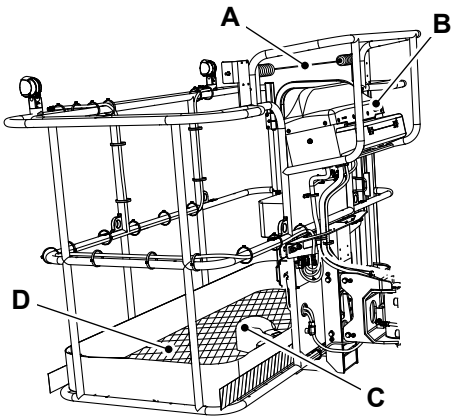
Introduction

The platform is mounting with platform carrier and Jib. The platform consists of the following parts:

- Platform floor.
- Foot pedal.
- Platform control panel.
- Secondary Guarding System.

Figure 50.



A Secondary Guarding System
B Platform control panel
C Foot pedal
D Platform floor

Health and Safety

⚠ **WARNING** Control lever/switch action may vary on machines, instructional labels near the levers/switches show by symbols, which levers/switches cause what actions. Before operating control levers/switches check the instructional label to make sure you select the desired action.

WARNING To operate the machine safely you must know the machine and have the skill to use it. You must abide by all relevant laws, health and safety regulations that apply to the country you are operating in. The operator's manual instructs you on the machine, its controls and its safe operation; it is not a training manual. Ensure that you receive the correct training before operating any machinery. Failing to do so will result in incorrect operation of the machine and you will be putting yourself and others at risk. In some markets, and for work on certain jobsites, you may be required to have been trained and assessed in accordance with an operator competence scheme. Make sure that you and your machine comply with relevant local laws and jobsite requirements – it is your responsibility.

WARNING Make sure it is clear overhead before raising the platform. Keep an adequate safe distance from all electrical power lines. Contact your local power company for safety procedures.

WARNING Notice boards or panels must not be installed on the platform because they will increase wind resistance.

WARNING Do not use the platform as a crane.

WARNING Do not extend the reach or height of the platform by the use of ladders or other equipment.

WARNING Do not use the platform when the wind speed exceeds the rated limit, stated in the operators manual.

WARNING Do not allow the machine to come in to contact with fixed objects, buildings etc.

WARNING Do not allow the machine to come in to contact with moving objects, vehicles, cranes etc.

WARNING Do not exceed the maximum rated load stated on the platform.

WARNING All operators must be adequately trained and authorised to use the machine.

WARNING All operators must make sure there is a restricted area under or around the platform to safeguard against falling objects injuring bystanders or colleagues.

WARNING All operators must use the correct safety harnesses when operating from the platform. Hard hats with chin straps must also be worn.

WARNING Do not operate the machine from the base controls with personnel in the platform, except when you need to lower the platform in an emergency using the procedure in the operators manual.

If the platform cannot be lowered by the use of the emergency controls, personnel must be removed using other means.

You must not work on the machine whilst personnel are in the platform.

Remove and Install

⚠ **CAUTION** This component is heavy. It must only be removed or handled using a suitable lifting method and device.

Remove

1. Make the machine safe with the platform lowered.

   Refer to: PIL 01-03-27.

2. Remove foot pedal.

3. Support the platform with suitable support equipment.

4. Disconnect the electrical connectors from the controller box.

   4.1. Put a label on the electrical connectors to help installation.

5. Remove the set screws (x4) and washers 1 (x4) of platform controller box.

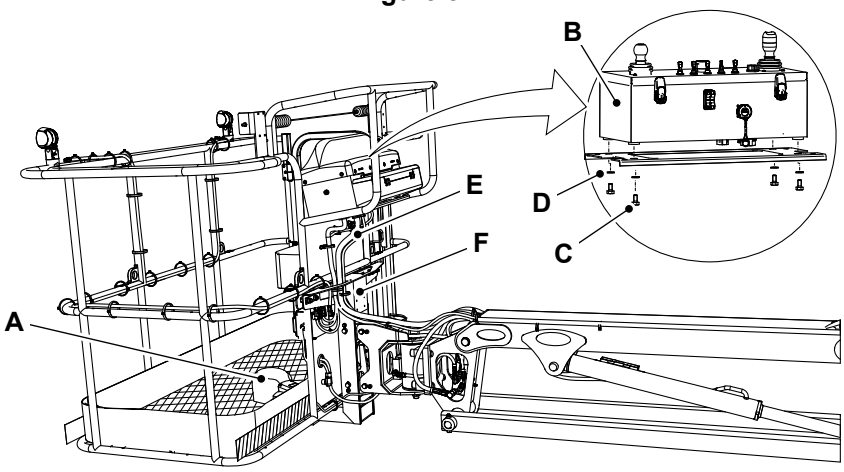
6. Remove platform controller box.

7. Remove the bolts (x4), washers 2 (x8) and locknut 1 (x4) from platform bracket.

8. Remove the locknut 2 (x4) and washers 3 (x4) from the platform.

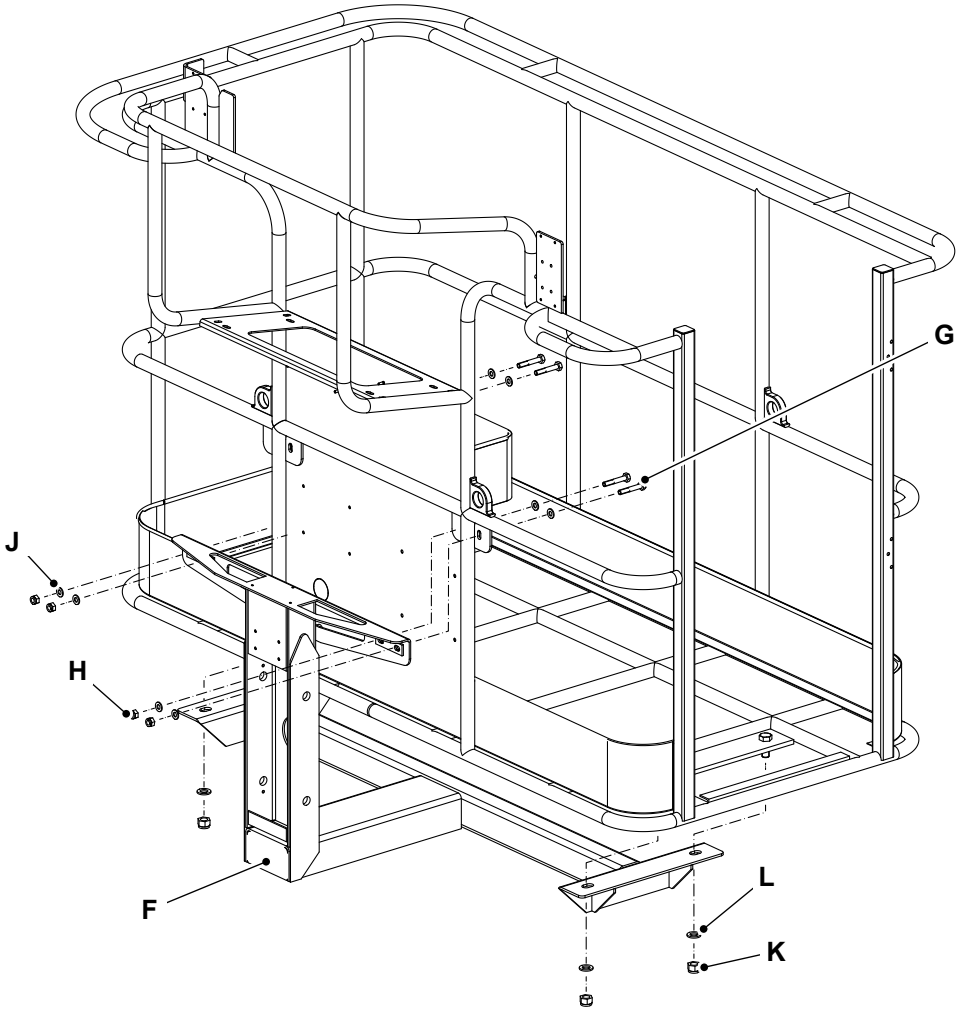
9. Remove the platform from the machine.

Figure 51.



A Foot pedal
B Platform control
C Set screw (x4)
D Washer1 (x4)
E Electric connectors
F Platform mounting

Figure 52.



F Platform mounting
G Bolts (x4)
H Locknut 1 (x4)
J Washer 2 (x8)
K Locknut 2 (x4)
L Washer 3 (x4)

Install

1. The installation procedure is the opposite of the removal procedure.
2. The ball of specific diameter should not pass through platform mesh.

   Dimension: 15mm

   2.1. Repair or replace the platform if more damage seen.

Table 21. Torque Values

Item	Nm
C	43
G	53.5
K	216

Notes:

15 - Engine

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15-21 Oil Filter
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Acronyms Glossary

ECM	Engine Control Module
PWM	Pulse Width Modulation
RPM	Revolutions Per Minute
TDC	Top Dead Centre
TMAP	Temperature Manifold Absolute Pressure

00 - Engine

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00 - General

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Introduction

This machine is installed with "Kohler KDI 1903 T4" engine. Maintenance information related to this engine is available via stand-alone documents on JCB Service Pro.
Refer to: servicepro.jcb.com.

Health and Safety

Hot Components

Touching hot surfaces can burn skin. The engine and machine components will be hot after the unit has been running. Allow the engine and components to cool before servicing the unit.

Turning the Engine

Do not try to turn the engine by pulling the fan or fan belt. This could cause injury or premature component failure.

Notice: *The engine and other components could be damaged by high pressure washing systems. Special precautions must be taken if the machine is to be washed using a high pressure system. Make sure that the alternator, starter motor and any other electrical components are shielded and not directly cleaned by the high pressure cleaning system. Do not aim the water jet directly at bearings, oil seals or the engine air induction system.*

WARNING! *To bleed the injectors you must turn the engine. When the engine is turning, there are parts rotating in the engine compartment. Before starting this job make sure that you have no loose clothing (cuffs, ties etc) which could get caught in rotating parts. When the engine is turning, keep clear of rotating parts.*

Notice: *Clean the engine before you start engine maintenance. Obey the correct procedures. Contamination of the fuel system will cause damage and possible failure of the engine.*

Notice: *Do not exceed the maximum level of engine oil in the sump. If the maximum is exceeded, the excess must be drained to the correct level. An excess of engine oil could cause the engine speed to increase rapidly without control.*

WARNING! *Hot oil and engine components can burn you. Make sure the engine and engine oil is cool before draining the engine oil. Used engine crankcase lubricants contain harmful contaminants. In laboratory tests it was shown that used engine oils can cause skin cancer.*

WARNING! *The engine has exposed rotating parts. Switch off the engine before working in the engine compartment. Do not use the machine with the engine cover open.*

Notice: *A drive belt that is loose can cause damage to itself and/or other engine parts.*

WARNING! *Do not open the high pressure fuel system with the engine running. Engine operation causes high fuel pressure. High pressure fuel spray can cause serious injury or death.*

CAUTION! *It is illegal to pollute drains, sewers or the ground. Clean up all spilt fluids and/or lubricants. Used fluids and/or lubricants, filters and contaminated materials must be disposed of in accordance with local regulations. Use authorised waste disposal sites.*

Technical Data

For: AJ48D [T4F] ..... Page 15-5
For: AJ48D [T0] ..... Page 15-5

(For: AJ48D [T4F])

Table 22.

Description	Data
Engine Type	KDI 1903 TCR
Emission compliance	US-EPA Tier 4 final, EU Stage IIIB
Maximum operating speed	2600 RPM (Revolutions Per Minute)
Power output	36kW
Weight (Dry)	233kg
Number of cylinders	3
Nominal bore size	88mm
Stroke	102mm
Cylinder arrangement	In line
Combustion Cycle	4-stroke
Firing order	1-3-2
Displacement	1.861L
Compression ratio	17: 1
Direction of rotation (viewed from flywheel end)	Counterclockwise
Valves	4 per cylinder
Tappets	Hydraulic
Lubricating oil pressure (Dependent on engine temperature and speed)	1–2.8bar (14.5–40.6psi)
Filter type	Screw-on canister
Pressure to open by-pass valve	2.5 ± 0.5bar (36.3 ± 7.3psi)
Oil pressure switch setting	0.8 ± 0.1bar (11.6 ± 1.5psi) falling
Oil pump[(1)]	Integral unit with relief valve
Combustion system	Common rail direct Injection
High pressure fuel pump	High pressure with electronically controlled fuel metering
Fuel tank capacity	59L
Alternator	100A

(1) The oil pump is a non-serviceable part

(For: AJ48D [T0])

Table 23.

Description	Data
Engine Type	KDI 1903 TCR
Emission compliance	De-Tier
Maximum operating speed	2600 RPM
Power output	36kW
Weight (Dry)	233kg
Number of cylinders	3
Nominal bore size	88mm
Stroke	102mm
Cylinder arrangement	In line

Description	Data
Combustion Cycle	4-stroke
Firing order	1-3-2
Displacement	1.861L
Compression ratio	17: 1
Direction of rotation (viewed from flywheel end)	Counterclockwise
Valves	4 per cylinder
Tappets	Hydraulic
Lubricating oil pressure (Dependent on engine temperature and speed)	1–2.8bar (14.5–40.6psi)
Filter type	Screw-on canister
Pressure to open by-pass valve	2.5 ± 0.5bar (36.3 ± 7.3psi)
Oil pressure switch setting	0.8 ± 0.1bar (11.6 ± 1.5psi) falling
Oil pump(1)	Integral unit with relief valve
Combustion system	Common rail direct Injection
High pressure fuel pump	High pressure with electronically controlled fuel metering
Fuel tank capacity	59L
Alternator	100A

(1) The oil pump is a non-serviceable part

Remove and Install

Lifting Equipment

You can be injured if you use incorrect or faulty lifting equipment. You must identify the weight of the item to be lifted then choose lifting equipment that is strong enough and suitable for the job. Make sure that lifting equipment is in good condition and complies with all local regulations.

The lifting equipment used must be an approved type and capable of lifting the engine safely. The recommended lifting equipment is shown. Use a spreader bar when lifting the engine. Never attempt to manually lift heavy components on your own. Always use lifting equipment, or obtain the help of an assistant. Inspect the lifting brackets for signs of damage. The brackets must be correctly torqued to the crankcase. Make sure the lifting equipment does not damage any of the engine dressing and the rocker cover.

There will be some component differences depending on the machine variant. Before attempting to remove the engine ensure that all the necessary components have either been removed, or safely disconnected from the engine.

Before Removal

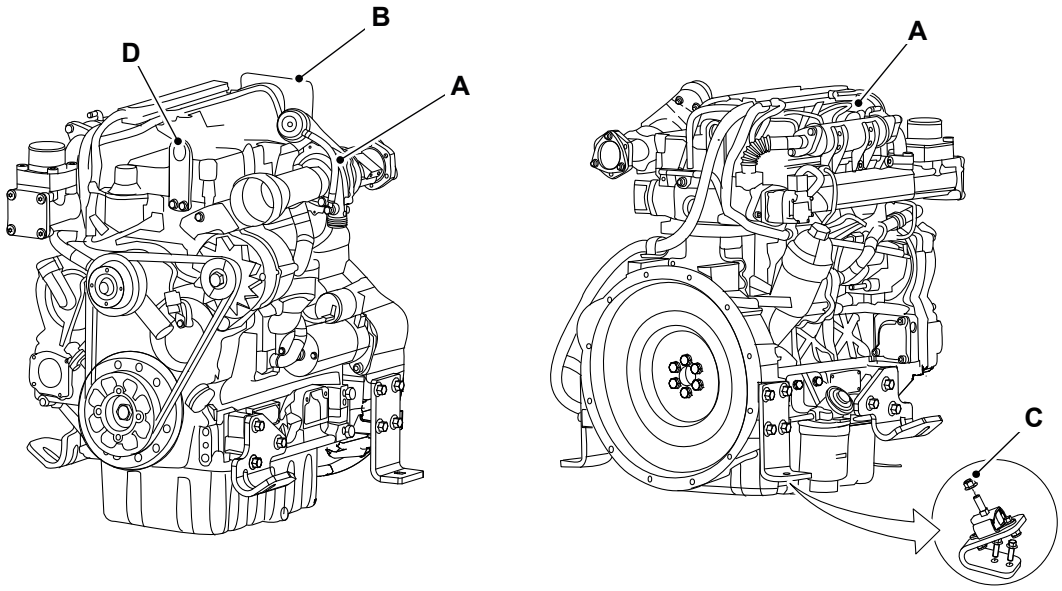
1. Make sure that the engine is safe to work on. If the engine has been running, let it cool before you start the service work.
2. Position the machine on firm level ground. Make the machine safe.
3. Remove the engine cover.
4. Unbolt the engine tray and install the locking pin.

Remove

1. Disconnect and remove the battery.
2. Drain the engine oil.
3. Drain the engine cooling system.
4. Remove the cooling pack.
5. Discharge the hydraulic pressure.
6. Drain the hydraulic tank. Disconnect and plug the hydraulic pipes. Label the hoses to help installation.
7. Disconnect the exhaust system.
8. Label the cab heater hoses at the engine. Release the hose clips and remove the hoses.
9. Disconnect the wiring connections from the starter motor.
10. Disconnect the wiring connections from the alternator.
11. Disconnect the wiring connections from the engine sensors and actuators.
12. Disconnect the fuel supply line at the fuel lift pump and the spill line at the fuel injection pump. Cap all hoses and ports to prevent ingress of dirt.
13. Disconnect the electrical connectors at the engine harness.
14. Uncouple the electrical harness at the ECM (Engine Control Module) machine side connector. Important: DO NOT touch the connector pins on the ECM or harness connectors. Cover the connectors to prevent contamination.
15. Ensure that all relevant harnesses and hoses are unclipped from the engine and tied out of the way.
16. Disconnect and plug the hoses at the hydraulic pump.
17. Remove the hydraulic pump.

    Refer to: PIL 30-12-00.
18. Attach slings to the engine lifting eyes.

Figure 53.



A Engine
B Exhaust support bracket
C Nut (4)
D Lifting eye

19. Remove the nuts (x4) from the rubber mount in the centre of the bracket.
20. Withdraw the engine in a level attitude until it is clear of the chassis. Raise the engine to lift it clear of the machine.
21. Lower the engine into a suitable stand that is capable of supporting the weight of the engine.

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Fill the cooling system with the correct mix of coolant fluid.
3. Fill and Check the hydraulic fluid level.
4. Fill and Check the engine oil level.
5. On completion, check the hydraulic and cooling system for leakage and levels.
6. Check the function of the drive and hydraulic services.

Table 24. Torque Values

Item	Nm
C	74

18 - Engine Belt

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Introduction

(For: AJ48D)

The crankshaft pulley is used to drive the coolant pump through a drive belt. In addition to the coolant pump the drive belt also drives the alternator. The belt is maintained at a constant tension by the alternator. To achieve the necessary belt/pulley contact area the belt is routed around idler wheels as required. The configuration varies depending on the accessories installed they include:

- Alternator
- Cooling fan
- Coolant pump

Health and Safety

Turning the Engine

Do not try to turn the engine by pulling the fan or fan belt. This could cause injury or premature component failure.

WARNING! *The engine has exposed rotating parts. Switch off the engine before working in the engine compartment. Do not use the machine with the engine cover open.*

Notice: *A drive belt that is loose can cause damage to itself and/or other engine parts.*

03 - Front End Accessory Drive (FEAD) Belt

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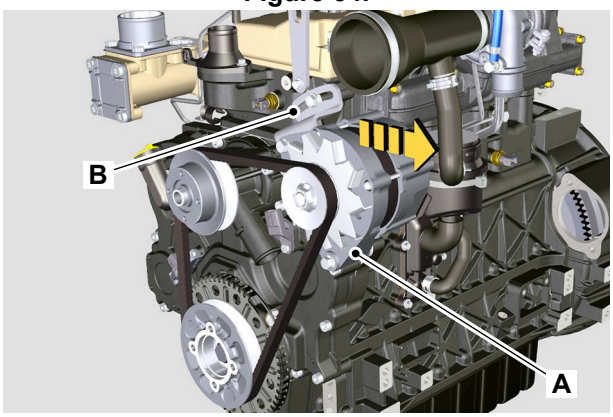
Introduction

(For: AJ48D)

Original Belt Configuration

The alternator adjusting lever makes sure that the front end accessory drive belt (FEAD) is kept at the correct tension.

Figure 54.

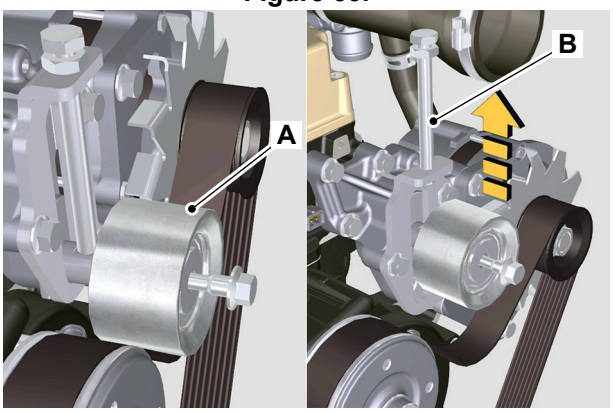


A Alternator
B Adjusting lever

Alternate Belt Configuration

A tensioning screw, which adjusts the tightening pulley travel, makes sure that the front end accessory drive belt (FEAD) is kept at the correct tension.

Figure 55.



A Tightening pulley
B Tensioning screw

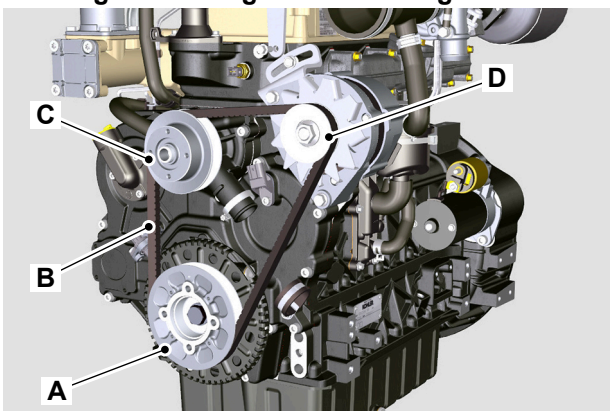
Health and Safety

⚠ **Notice:** A drive belt that is loose can cause damage to itself and/or other engine parts.

Component Identification

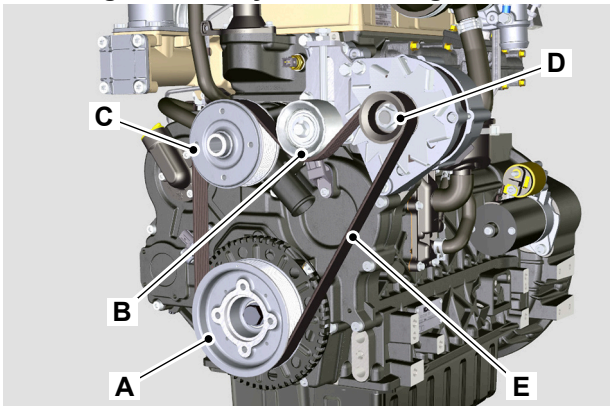
(For: AJ48D)

Figure 56. Original Belt Configuration



A Crankshaft drive pulley
B Drive belt
C Coolant pump drive pulley
D Alternator drive pulley

Figure 57. Poly-V Belt Configuration



A Crankshaft drive pulley
B Tensioner pulley
C Coolant pump drive pulley
D Alternator drive pulley
E Poly-V belt

Check (Condition)

At the recommended service interval, visually inspect the drive belt for damage.

1. Make the machine safe.

   Refer to: PIL 01-03-27.

2. Stop the engine and let it cool down.

3. Replace the drive belt if it has cracks or if it is frayed or has pieces of material missing.

Adjust

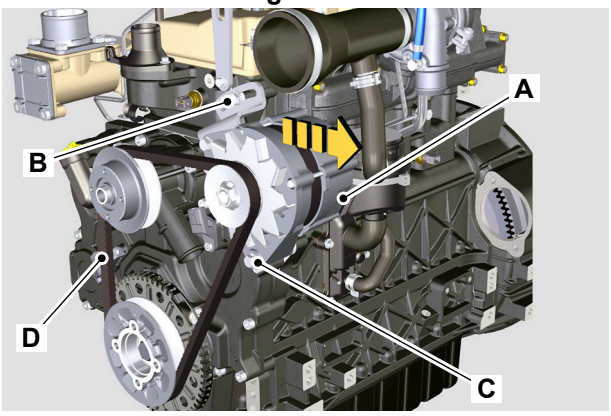
(For: AJ48D)

Original Belt Configuration

The belt must always be replaced every time it is removed, even if it has not reached the scheduled hours for replacement.

1. Pull the alternator in the direction of the arrow.

Figure 58.



A Alternator
B Top mounting bolt
C Bottom mounting bolt
D Drive belt

2. Tighten the top mounting bolt to the correct torque value.

   Torque: 25N·m

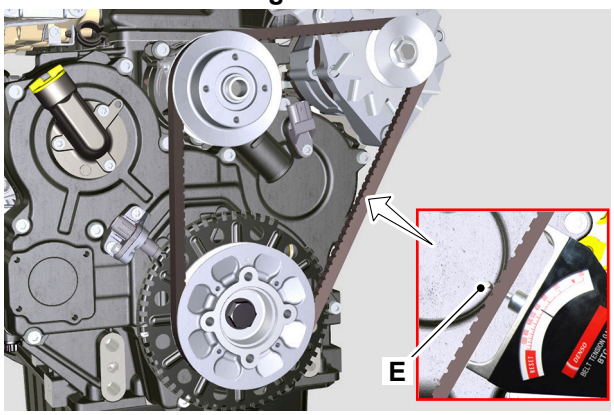
3. Tighten the bottom mounting bolt to the correct torque value.

   Torque: 40N·m

4. While tensioning the alternator, first install the top mounting screw and then the bottom mounting screw.

5. Use a belt tension tool (DENSO BTG-2) to measure the tension of the belt at the point shown.

Figure 59.



E Tension measuring point

6. The tension of the belt should between the specified values.

   Weight/Force: 350–450N

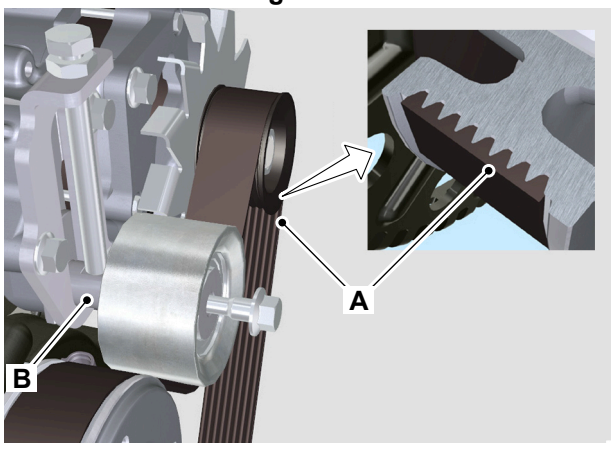
7. If the tension values do not match the specified, tighten the screws, then repeat the steps 1 to 6.

Alternate Belt Configuration

The belt must always be replaced every time it is removed, even if it has not reached the scheduled hours for replacement.

1. Make sure that the ribs of the belt are engaged correctly into the grooves of the pulleys.

Figure 60.



A Drive belt
B Pulley pin

2. Make sure that the pulley pin is at the bottom of the guide groove.

3. Tighten the screw, that attaches the pulley, to the correct torque value.

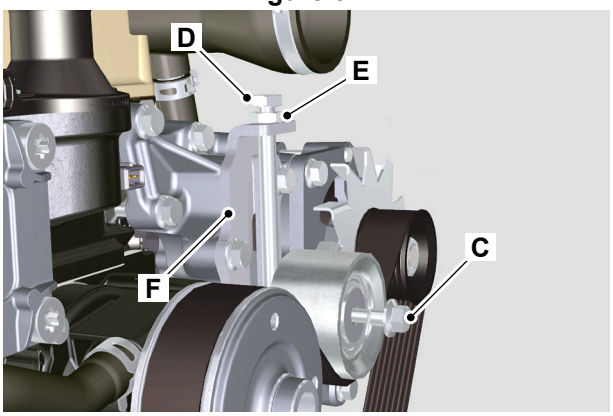
   Torque: 45N·m

4. Hold the tensioning screw with an Allen key.

5. Tighten the nut on the plate to secure the tightening screw.

   Torque: 45N·m

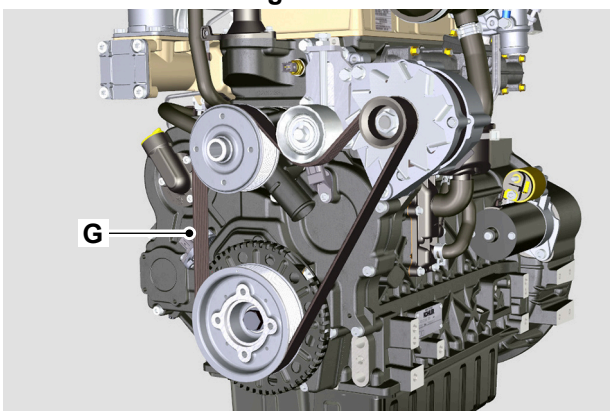
Figure 61.



C Screw
D Tensioning screw
E Nut
F Plate

6. Measure the tension of the belt at the point shown.

Figure 62.



G Tension measuring point

7. The tension of the belt should between the specified values.

   Frequency: 149–196Hz

8. Run the engine for the specified duration.

   Duration: 15–20min

9. Repeat the step 6 to 7.

10. The Poly-v drive belt is not adjustable. If the tension value is not within the specified range replace the drive belt.

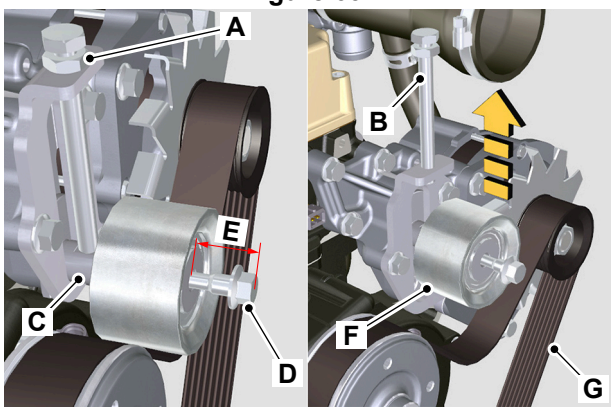
Remove and Install

(For: AJ48D)

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Disconnect the battery.
   Refer to: PIL 33-03-00.
3. Get access to the drive belt.
4. Loosen the nut and tighten the screw until it touches the pulley shaft. Refer to Figure 63.
5. Loosen the bolt that attaches the pulley to the pulley shaft, up to the specified distance. Refer to Figure 63.
   Distance: 32mm
6. Loosen the screw, the belt tensioner pulley will move up. Refer to Figure 63.
   6.1. If the pulley will not move, pull the belt tensioner pulley up.
7. Remove the drive belt. Refer to Figure 63.

Figure 63.

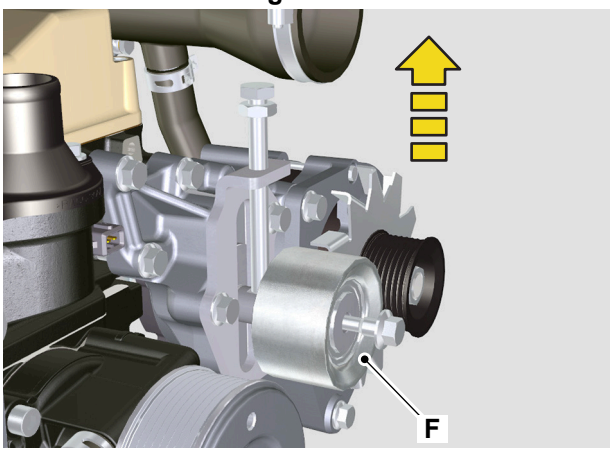


A Nut
B Screw
C Pulley shaft
D Bolt
E 32mm
F Tensioner pulley
G Existing drive belt

Install

1. Pull the belt tensioner pulley up. Refer to Figure 64.

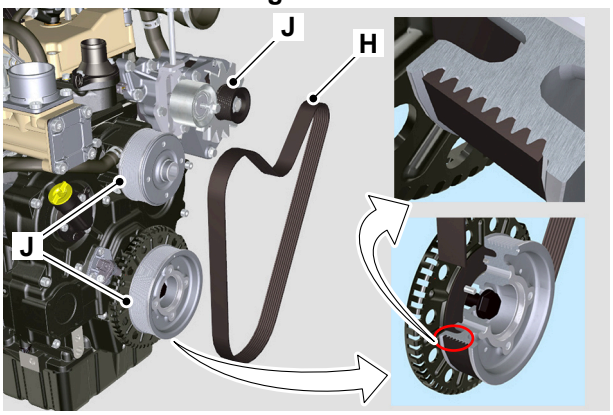
Figure 64.



F Tensioner pulley

2. Insert the new drive belt on the pulleys. Refer to Figure 65.

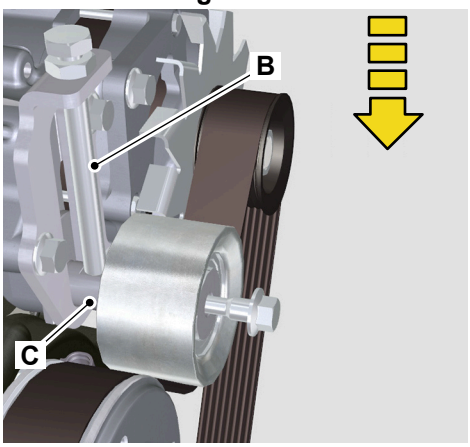
Figure 65.



H New drive belt
J Pulleys

3. Make sure that the ribs of the drive belt are engaged correctly into the grooves of the pulleys.
4. Tighten the screw until the pulley shaft reaches the bottom of the guide groove. Refer to Figure 66.

Figure 66.



B Screw
C Pulley shaft

5. Tension the drive belt.
6. Tighten the pulley bolt to the correct specified torque value.

   Torque: 45N·m
7. Tighten the nut.
8. Connect the battery.
9. Close the engine cover.
10. Check the belt tension after the engine operation for the specified time.

    Duration: 15min

21 - Tensioner

Remove and Install

(For: AJ48D)

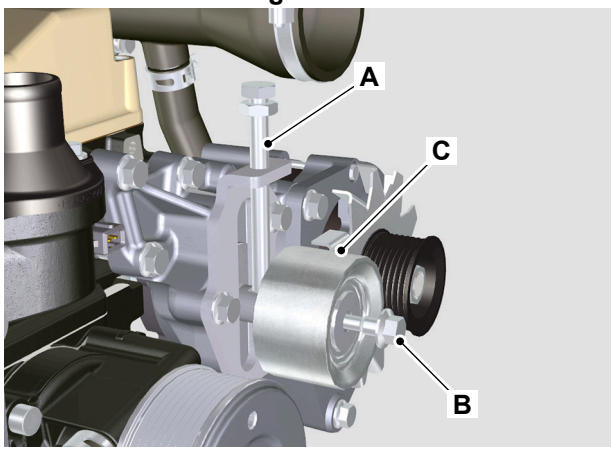
This procedure is applicable for machines installed with Poly-V drive belt.

Important: The drive belt must always be replaced every time it is removed, even if it has not reached the scheduled hours for replacement.

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Remove the drive belt.
3. Remove the tensioning screw.
4. Remove the screw that secures the tightening pulley.
5. Remove the tightening pulley.

Figure 67.



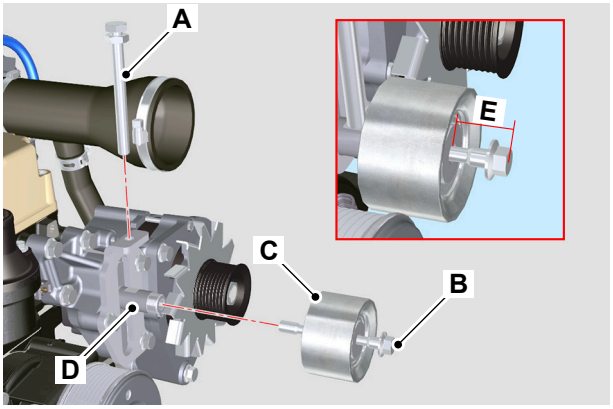
A Tensioning screw
B Screw
C Tightening pulley

Install

1. Insert the screw in the tightening pulley.
2. Manually tighten the screw on to the pulley pin up to the stop; Loosen the screw again by one turn.
3. The screw must be out by the specified distance from the surface of the tightening pulley.

   Distance: 32mm
4. Install the drive belt.
5. Install the tightening screw on to the plate, up to the stop on the pulley pin.
6. Tension the drive belt.

Figure 68.



A Tensioning screw
B Screw
C Tightening pulley
D Pulley pin
E 32mm

21 - Oil Filter

Contents **Page No.**

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00 - General

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Health and Safety 15-22
Technical Data 15-22
Component Identification 15-23
Check (Level) 15-24
Remove and Install 15-24

Introduction

The oil filter is a spin on type which screws on to the filter head. The oil filter and cooler are incorporated in a housing that is bolted to the side of the crankcase.

The housing allows transfer of lubricating oil from the crankcase to the oil cooler and the oil filter head.

Health and Safety

Oil

Oil is toxic. If you swallow any oil, do not induce vomiting, seek medical advice. Used engine oil contains harmful contaminants which can cause skin cancer. Do not handle used engine oil more than necessary. Always use barrier cream or wear gloves to prevent skin contact. Wash skin contaminated with oil thoroughly in warm soapy water. Do not use petrol, diesel fuel or paraffin to clean your skin.

CAUTION! *It is illegal to pollute drains, sewers or the ground. Clean up all spilt fluids and/or lubricants. Used fluids and/or lubricants, filters and contaminated materials must be disposed of in accordance with local regulations. Use authorised waste disposal sites.*

CAUTION! *Oil will gush from the hole when the drain plug is removed. Keep to one side when you remove the plug.*

CAUTION! *The oil filter canister will contain some oil which could spill out when you remove the canister.*

Technical Data

(For: AJ48D)

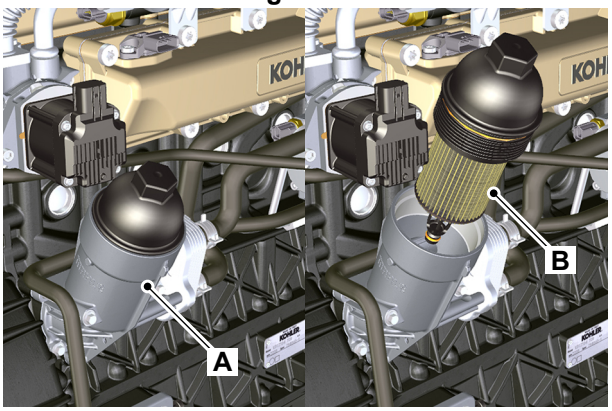
Table 25.

Maximum operating pressure	4bar (58.0psi)
Max flow rate	3.17L/min

Component Identification

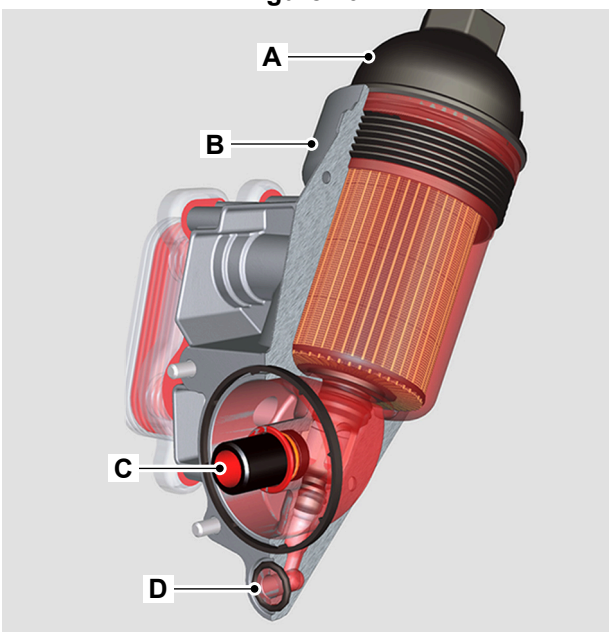
(For: AJ48D)

Figure 69.



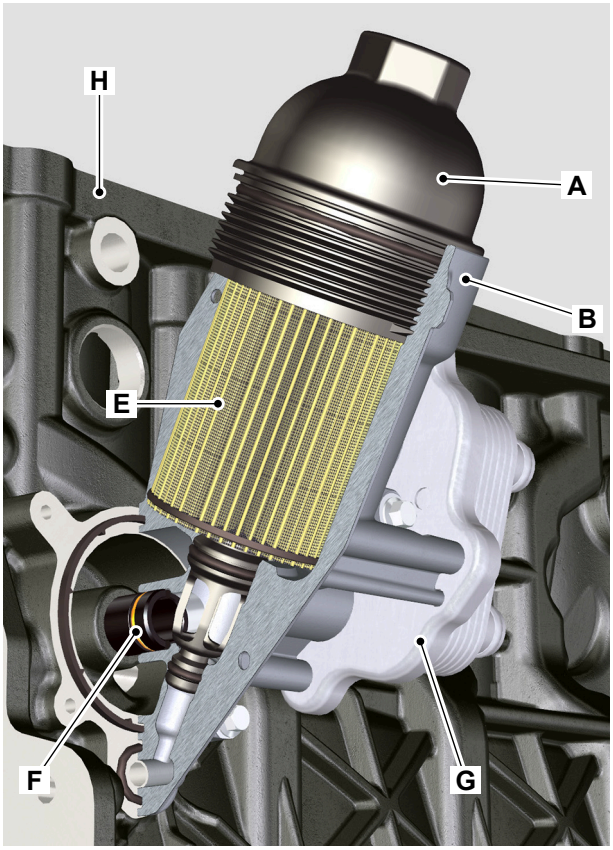
A Oil Filter
B Element

Figure 70.



A Cartridge holder cover
B Oil filter support
C Oil returning into the circuit
D Oil returning to the crankcase

Figure 71.



A Cartridge holder cover
B Oil filter support
E Oil filter cartridge
F Outgoing fitting from filter
G Water/oil heat exchanger
H Crankcase

Check (Level)

(For: AJ48D)

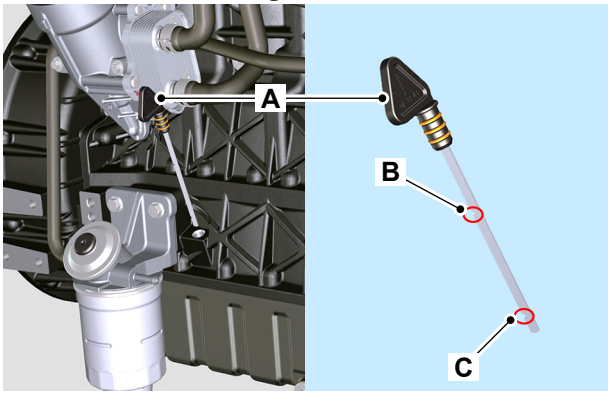
Engine oil and oil filter replacement must be completed in accordance with the service schedules. Failure to replace the oil and filter at the recommended interval could cause serious engine failure.

1. Make the machine safe.

   Refer to: PIL 01-03-27.

2. Park the machine on a hard level surface for accurate measurement of the oil level.
3. Get access to the engine.
4. Check that the oil level is between the two marks on the dipstick.

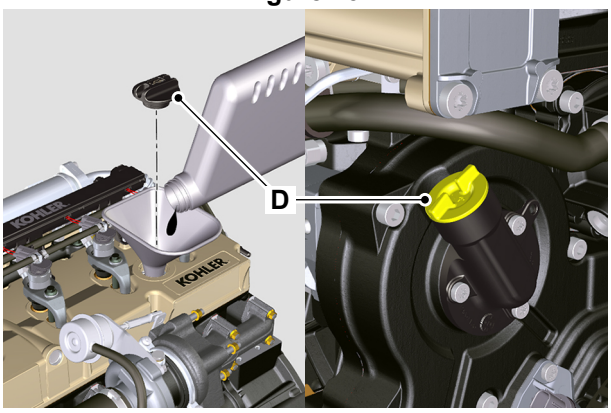
Figure 72.



A Dipstick
B Maximum level mark
C Minimum level mark

5. If necessary, add recommended oil through one of the filler points.

Figure 73.



D Oil filler caps

Remove and Install

(For: AJ48D)

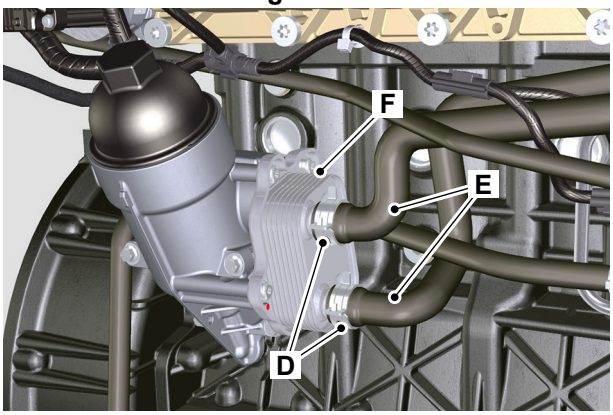
Before Removal

1. Drain the engine oil.

Remove and Install

1. Remove the clamps and remove the pipes from the oil cooler unit.

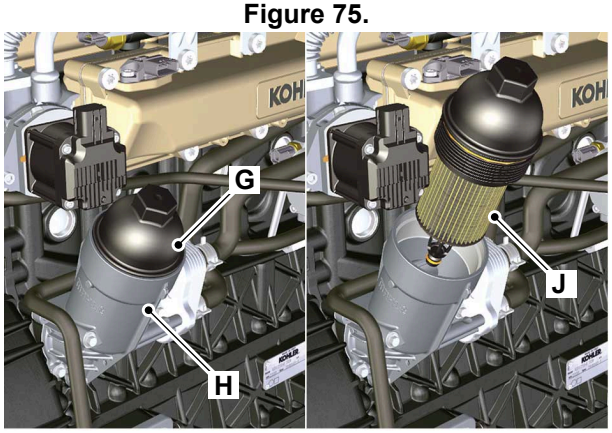
Figure 74.



D Clamps
E Pipes
F Oil cooler

2. Use a suitable container to recover any residual oil.
3. Loosen the element holder cap.

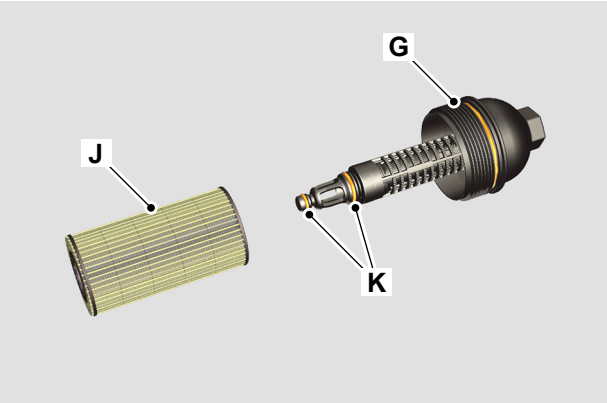
Figure 75.



G Element holder cap
H Oil filter support
J Element

4. Remove the cap and the oil filter element from the oil filter support.
5. Remove the cartridge from the cap and discard.

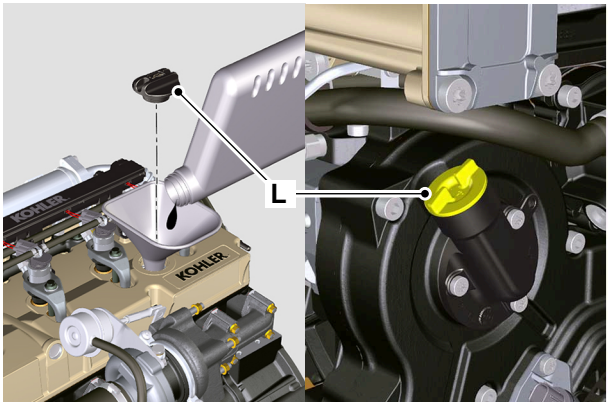
Figure 76.



G Element holder cap
J Element
K Seal

6. Remove and replace the seals.
7. Apply clean oil on the seals.
8. Put the element on the cap.
9. Install the cap on the oil filter support.
10. Tighten the cap to the correct torque value.
11. Install the pipes on the support.
12. Secure the pipes with the clamps.
13. Through one of the filler points, fill the engine with the recommended oil to the MAX mark on the dipstick.

Figure 77.



L Oil filler caps

14. Wipe off any spilt oil, install the filler cap and make sure it is secure.
15. Operate the engine, until the oil pressure low warning light has extinguished.
16. Check for oil leakage.
17. When the oil has cooled, check the oil level again, and if necessary top up with clean engine oil.

Table 26. Torque Values

Item	Nm
B	35
G	25

24 - Air Filter

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00 - General

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Remove and Install 15-30

Introduction

Engine performance and durability will be severely affected if the quality of the air intake is poor.

A dirty and blocked air filter will reduce the amount of air entering the combustion chamber which can cause engine misfiring, black smoke and low output power.

A dirty and blocked air filter can also lead to abrasion of the cylinder bores and valves (referred to as dusting). This will cause excessive oil consumption, black smoke, low output power and a reduced engine life.

This is a dry-type air filter with a replaceable paper filter cartridge.

Health and Safety

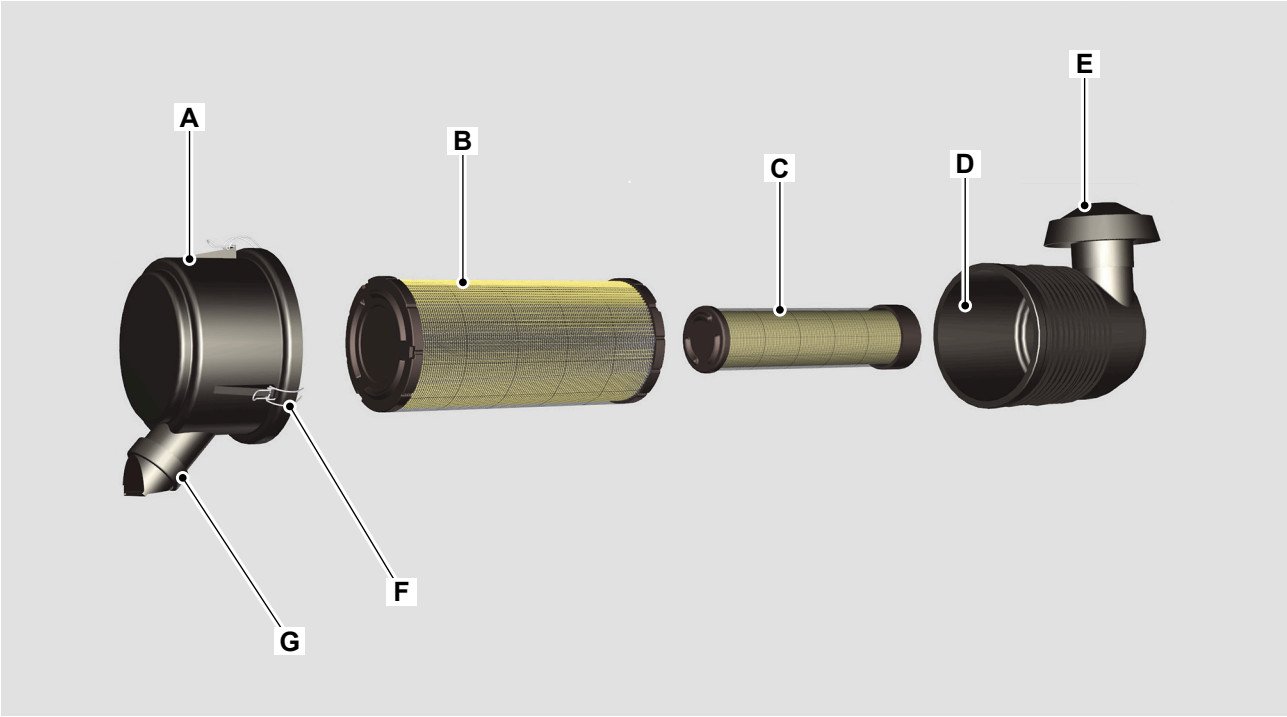
⚠ **Notice:** Do not run the engine when the element has been removed.

Notice: The outer element must be renewed immediately if the warning light on the instrument panel illuminates.

Component Identification

(For: AJ48D)

Figure 78.



A Filter cover
B Air filter cartridge
C Air filter safety cartridge
D Filter support
E Pre-filter cap
F Filter cover hook
G Dust exhaust valve

Check (Condition)

The air filter element (s) should be changed at the recommended service interval, refer to the Maintenance Schedules.
Refer to: PIL 78-24.

Check all the hose connections for loose installations and damaged hose clamps, look specifically for splits or cracks in the hoses. Pay particular attention to the connections on the air intake to turbo compressor and on the crossover tube.

Renew any damaged components.

In addition, most air filter housings will be installed with a vacuum switch. The switch will detect if there is a restriction on the air intake, and activate warning indicators such as an audible alarm and/or a visual indicator.

Remove and Install

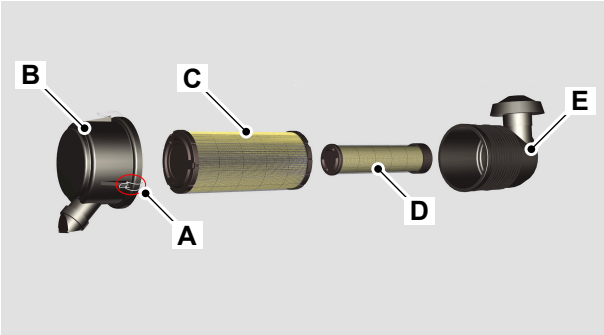
(For: AJ48D)

Remove

The appearance of the air cleaner installed may differ slightly on your machine.

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Open the engine compartment cover.
   Refer to: PIL 06-06-06.
3. Release the two hooks and remove the cover from the filter body.
4. Remove the outer and safety cartridge.

Figure 79.



A Hook
B Cover
C Outer cartridge
D Safety cartridge
E Filter body

Install

1. The safety cartridge must always be replaced if it is dirty or damaged.
2. Put the safety cartridge inside the outer cartridge.
3. Put both the cartridges inside the filter body.
4. Install the cover on the body with the hooks.

09 - Dust Valve

Clean

(For: AJ48D)

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Do not run the machine with the dust valve removed.
3. Open the engine compartment cover.
   Refer to: Open and Close (PIL 06-06-06).
4. Check the dust valve is not blocked.
5. Inspect the rubber flaps for cuts and nicks and check that the rubber has not perished. Replace if necessary.
6. Close the engine cover.

Figure 80.

A Dust valve

84 - Sensor

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15-84-06 Camshaft Position 15-41
15-84-17 Temperature and Manifold Air Pressure (TMAP) 15-46
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15-84-27 Fuel Rail Pressure 15-57
15-84-33 Coolant Temperature 15-59

00 - General

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Introduction

The engine sensors continually send signals to the ECM (Engine Control Module) to help the ECM to control the smooth running of the engine and related components.

The ECM processes signals from the sensors continually and its response will be based on an evaluation of the combination of sensor signals.

After removal from the engine, protect the sensors from knocks, dust and water ingress and any high temperature sources.

The sensors are not serviceable, therefore they must be replaced in the event of damage.

Technical Data

(For: AJ48D)

Table 27.

Crankshaft Position Sensor	
Type	Hall effect
Air gap value	0.2mm (0.008in) and 1.2mm (0.047in)

Table 28.

Camshaft Position Sensor	
Type	Hall effect
Air gap value	0.2mm (0.008in) and 1.2mm (0.047in)

Table 29.

Coolant Temperature Sender		
Type	Temperature dependant resistance	
Tightening torque	20N·m max	
Temperature Vs Resistance Table		
Temperature °C (°F)	Rm min K Ω	Rm max K Ω
-40 (-39.9)	38,313	52,926
0 (32.0)	5,227	6,623
140 (283.8)	67	76

Table 30.

Inlet Manifold Air Pressure and Temperature Sensor (TMAP)	
Fixing screw tightening torque	6N·m max
Temperature Sensor	
Type	Temperature dependant resistor

Table 31.

Rail Pressure Sensor	
Type	The rail pressure sensor is integral with the common rail

Table 32.

Fuel Temperature Sensor	
Type	The fuel temperature sensor is integral with the high pressure fuel pump

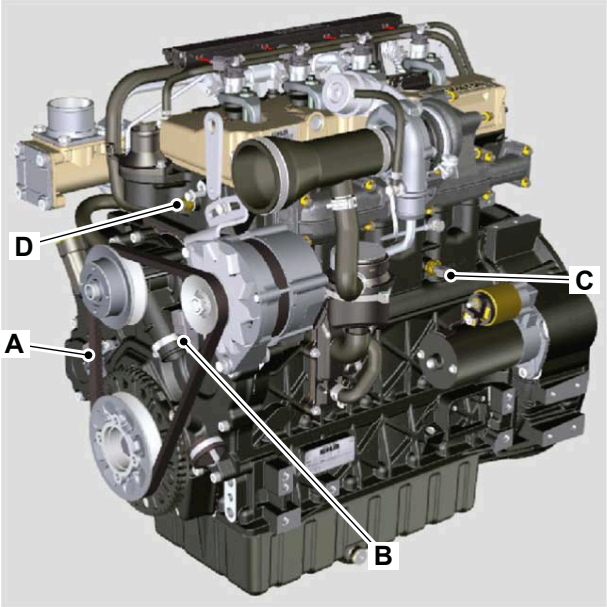
Table 33.

Oil Pressure Switch	
Set pressure	0.8 ± 0.1bar (11.6 ± 1.5psi)
Switch mode	Normally closed
Tightening torque	35N·m max

Component Identification

(For: AJ48D)

Figure 81.

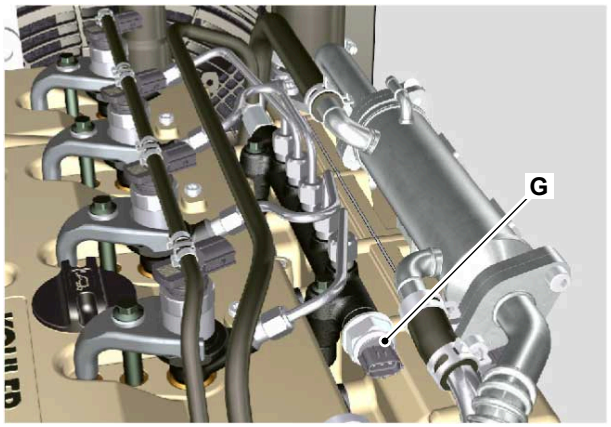


A Crankshaft position sensor
B Camshaft position sensor
C Oil pressure sensor
D Coolant temperature sensor

Figure 82.

E TMAP (Temperature Manifold Absolute Pressure) sensor
F Fuel temperature sensor

Figure 83.



G Fuel rail pressure sensor

03 - Crankshaft Position

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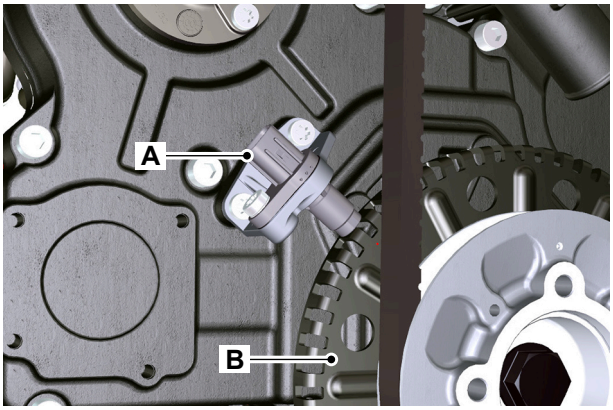
Remove and Install 15-39

Introduction

(For: AJ48D)

The crankshaft position sensor is a device used to monitor the position or rotational speed of the crankshaft. This information is used by the ECM (Engine Control Module) to control the ignition system timing and other engine parameters.

Figure 84.



A Crankshaft position sensor
B Phonic wheel

Operation

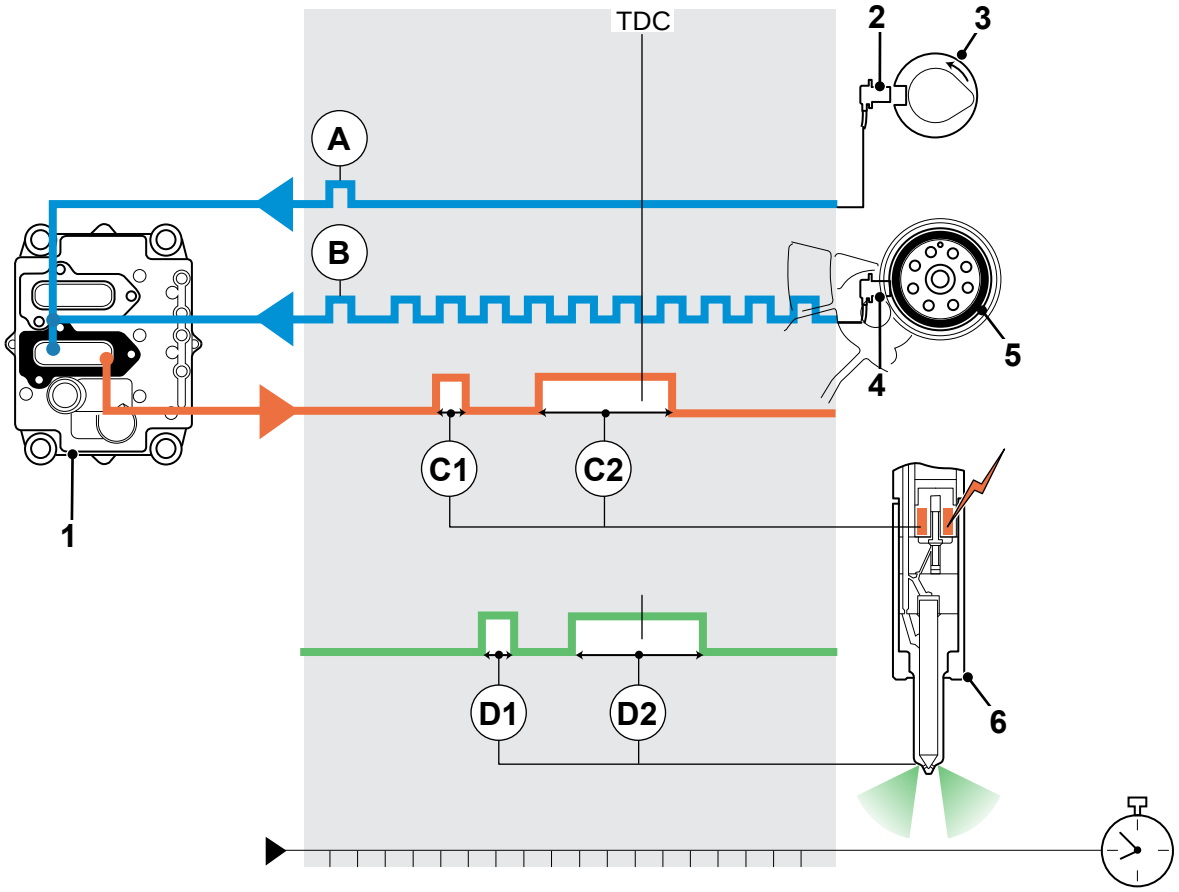
(For: AJ48D)

The crankshaft position sensor is installed on the timing gear case. The sensor reads the signal from the phonic wheel installed on the engine pulley.

The sensor sends an analogue signal to the ECM (Engine Control Module). The sensor produces a 5V square wave signal with Hall effect when the motor is rotating.

This data, together with the signal from the sensor, allows the ECM to control the fuel injection with respect to the TDC (Top Dead Centre) of the piston.

Figure 85.



1	ECM	**2**	Camshaft position sensor
3	Camshaft phonic wheel	**4**	Crankshaft position sensor
5	Crankshaft phonic wheel	**6**	Fuel injector
A	Camshaft sensor signal	**B**	Crankshaft position sensor signal
C1-C2	Current pulse-injector solenoid coil	**D1-D2**	Fuel Injection
TDC	TDC		

Check (Operation)

(For: AJ48D)

Carefully inspect the sensor. If it is found to be defective, replace the sensor.

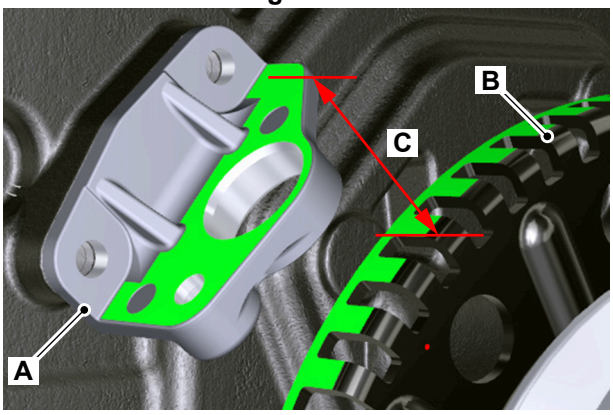
Adjust

(For: AJ48D)

Adjust the crankshaft position sensor as follows:

1. Measure the distance between the top surface of the bracket and the external diameter of the phonic wheel.

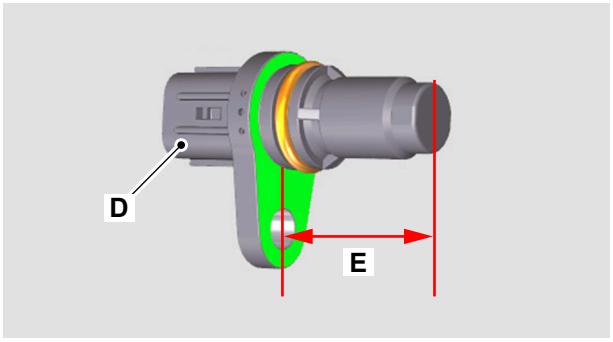
Figure 86.



A Bracket
B Phonic wheel
C Measurement 1

2. Measure the distance between the surfaces of the sensor as shown.

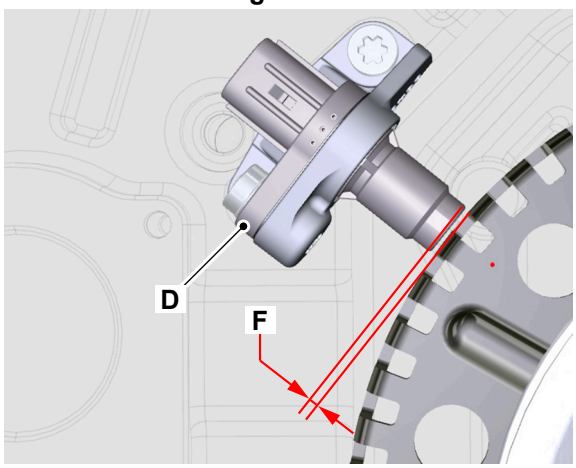
Figure 87.



D Sensor
E Measurement 2

3. The difference between the two measurements gives the air gap value.

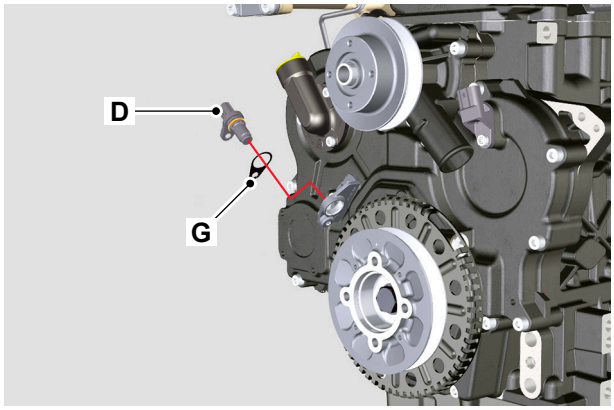
Figure 88.



D Sensor
F Air gap

4. The air gap value should be between 0.2mm (0.008in) and 1.2mm (0.047in).
5. If required insert one or two spacers based on the air gap value calculated.

Figure 89.



D Sensor
G Spacer

6. The spacers have a calibrated thickness of 0.2mm (0.008in).

Remove and Install

(For: AJ48D)

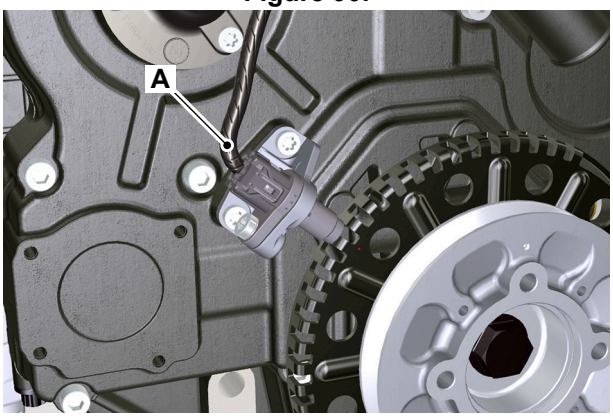
Before Removal

1. Make sure that the engine is safe to work on. If the engine has been running, let it cool before you start the service work.
2. Clean the sensor and the adjacent area of the timing gear case.

Remove

1. Get access to the crankshaft position sensor.
2. Disconnect the electrical connector from the sensor.

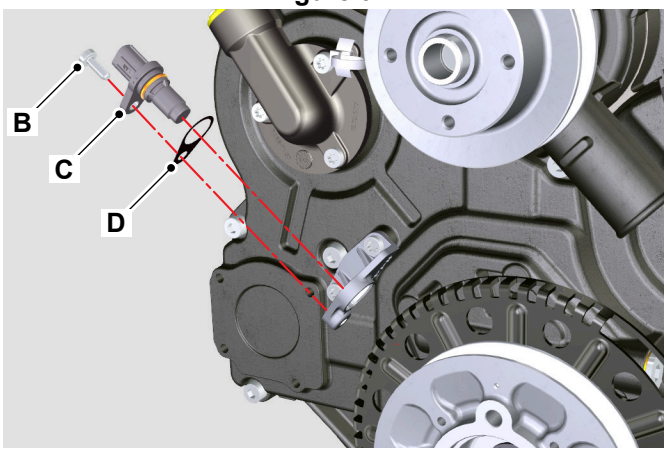
Figure 90.



A Electrical connector

3. Remove the screw, the sensor, and the spacer.

Figure 91.



B Screw
C Sensor
D Spacer

The crankshaft position sensor is a non-serviceable item. If the sensor is defective it must be replaced.

Install

1. Installation is the opposite of the removal sequence.
2. Make sure you adjust the sensor air gap before the final installation.

   Refer to: Adjust (PIL 15-84-03).
3. Tighten the screw to the correct torque value.

Table 34. Torque Values

Item	Nm
B	8

06 - Camshaft Position

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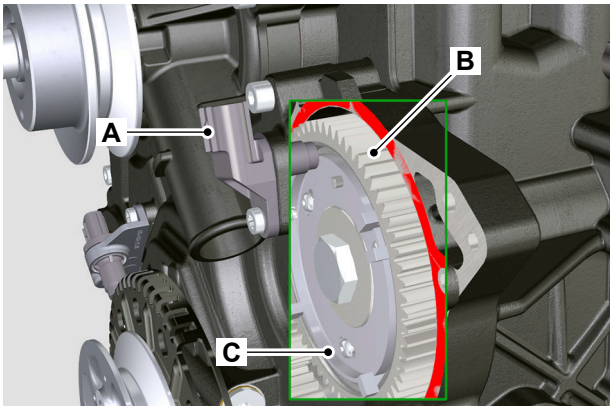
Introduction

(For: AJ48D)

The camshaft position sensor is a device that detects the passing of a gap on the camshaft phonic wheel. It sends a signal to the ECM (Engine Control Module) which stroke number piston is on so that the ECM knows which cylinder to inject the fuel into.

Figure 92.



A Camshaft position sensor
B Camshaft gear
C Phonic wheel

Operation

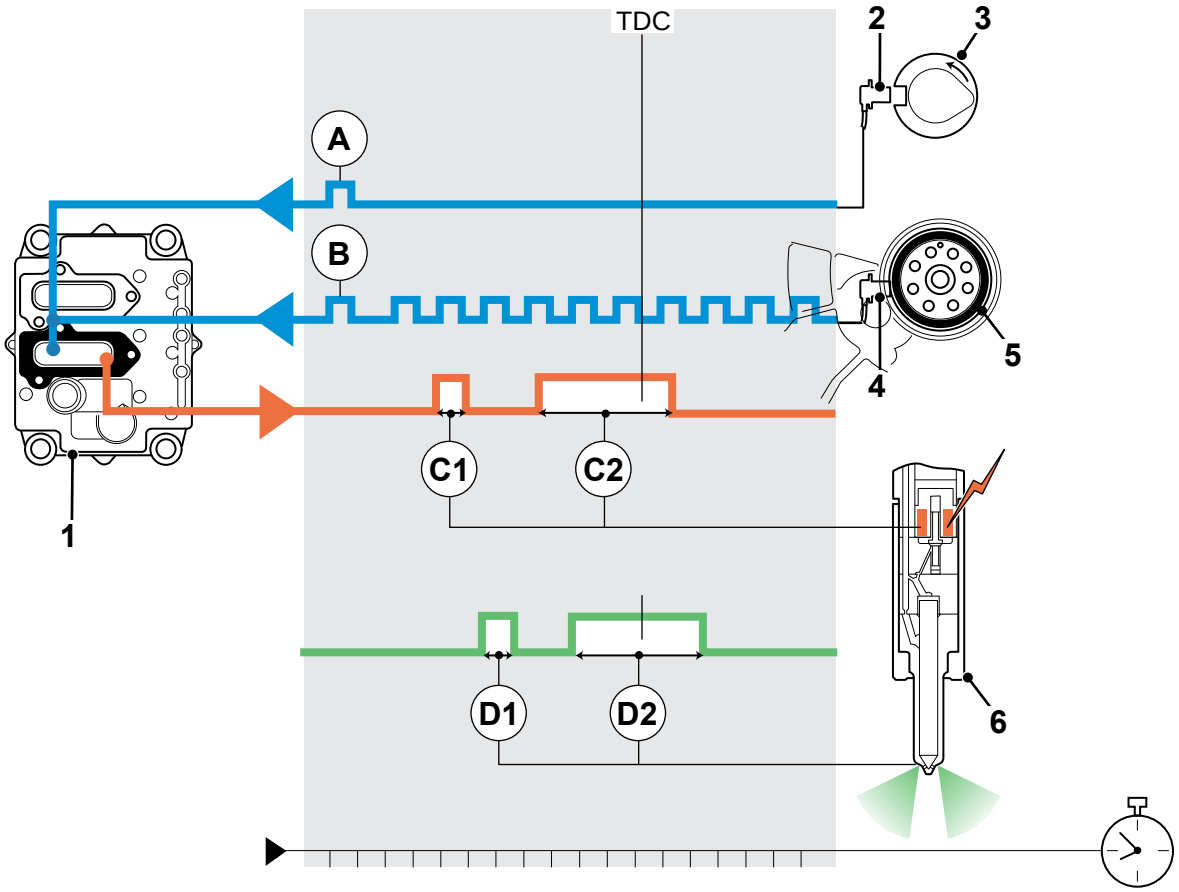
(For: AJ48D)

The camshaft position sensor is installed on the timing gear case. The purpose of the camshaft position sensor is to identify the position of the camshaft with respect to the engine crankshaft and consequently the position of the pistons.

The signal is read through the phonic wheel phased on the camshaft.

The ECM (Engine Control Module) will select the correct cylinder for fuel injection.

Figure 93.



1	ECM
2	Camshaft position sensor
3	Camshaft phonic wheel
4	Crankshaft position sensor
5	Crankshaft phonic wheel
6	Fuel injector
A	Camshaft sensor signal
B	Crankshaft position sensor signal
C1-C2	Current pulse - injector solenoid coil
D1-D2	Fuel Injection
TDC	TDC (Top Dead Centre)

Check (Operation)

(For: AJ48D)

1. Carefully inspect the sensor. If it is found to be defective, replace the sensor.
2. Inspect the sealing O-ring, if it is defective, replace it.

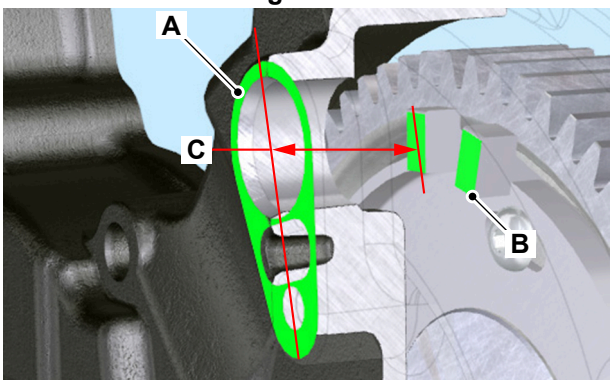
Adjust

(For: AJ48D)

Adjust the camshaft position sensor as follows:

1. Measure the distance between the top surface of the timing gear case and the tooth surface on the phonic wheel.

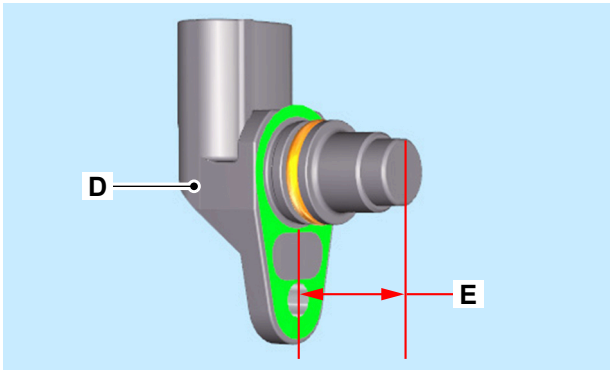
Figure 94.



A Timing gear case
B Tooth surface
C Measurement 1

2. Measure the distance between the surfaces of the sensor as shown.

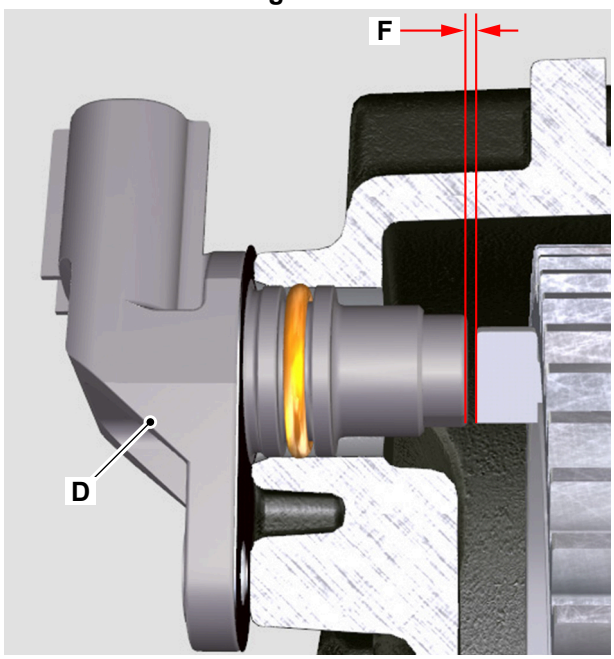
Figure 95.



D Sensor
E Measurement 2

3. The difference between the two measurements gives the air gap value.

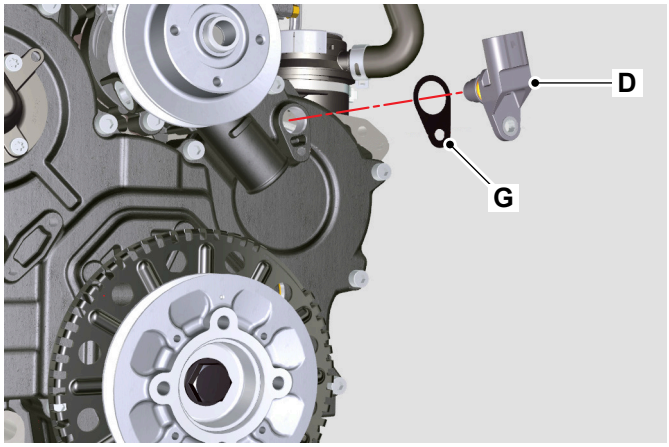
Figure 96.



D Sensor
F Air gap

4. The air gap value should be between 0.2mm (0.008in) and 1.2mm (0.047in).
5. If required insert one or two spacers based on the air gap value calculated.

Figure 97.



D Sensor
G Spacer

6. The spacers have a calibrated thickness of 0.2mm (0.008in).

Remove and Install

(For: AJ48D)

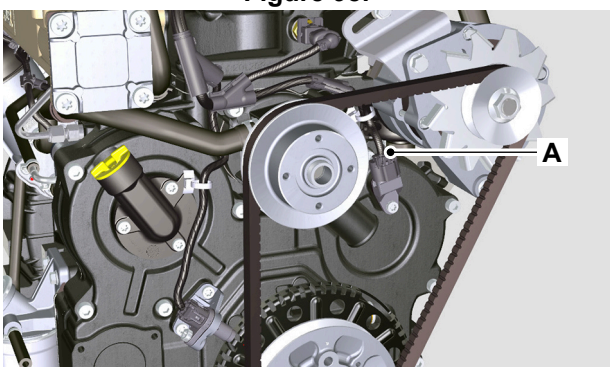
Before Removal

1. Make sure that the engine is safe to work on. If the engine has been running, let it cool before you start the service work.
2. Clean the sensor and the adjacent area of the engine block.

Remove

1. Get access to the camshaft position sensor.
2. Disconnect the electrical connector from the sensor.

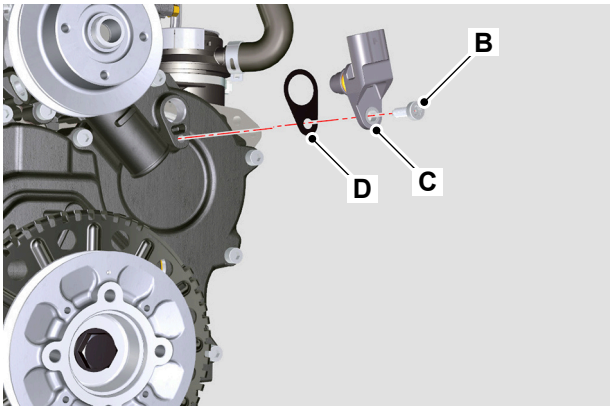
Figure 98.



A Electrical connector

3. Remove the screw, the sensor, and the spacer.

Figure 99.

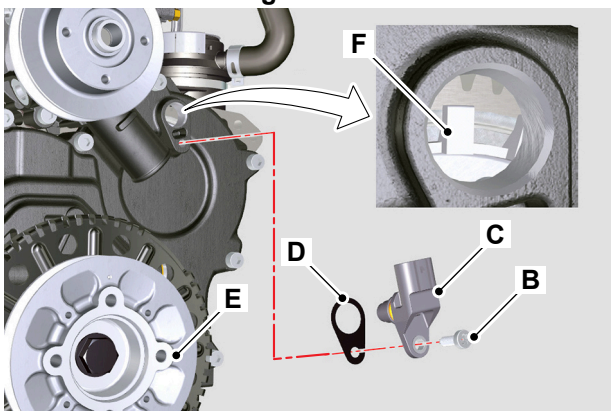


B Screw
C Sensor
D Spacer

The camshaft position sensor is a non-serviceable item. If the sensor is defective it must be replaced.

Install

Figure 100.



B Screw
C Sensor
D Spacer
E Crankshaft
F Phonic wheel tooth

1. Rotate the crankshaft until a tooth on the phonic wheel, which is installed on the camshaft, is visible from the timing case hole.
2. Adjust the camshaft position sensor air gap.
3. Install the required quantity of spacers on the sensor.
4. Attach the sensor onto the timing case with the screw.
5. Tighten the screw to the correct torque value.

Table 35. Torque Values

Item	Nm
B	8

17 - Temperature and Manifold Air Pressure (TMAP)

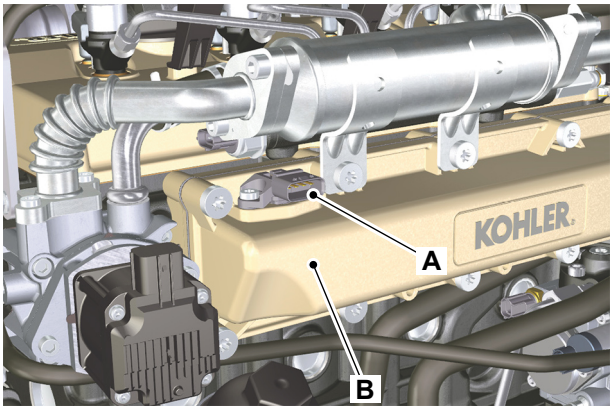
Introduction 15-46
Operation 15-47
Check (Condition) 15-47
Remove and Install 15-48

Introduction

(For: AJ48D)

The TMAP (Temperature Manifold Absolute Pressure) sensor is mounted in a port on top of the inlet manifold. It measures the inlet manifold boost air pressure and temperature. The sensor incorporates a piezo resistive element and resistor.

Figure 101.



A TMAP sensor
B Intake manifold

Operation

(For: AJ48D)

The TMAP (Temperature Manifold Absolute Pressure) sensor measures the inlet manifold boost air pressure and temperature. The sensor produces an analogue signal voltage proportional to air pressure.

Check (Condition)

(For: AJ48D)

1. Remove oil and sludge contamination from the sensor.
2. Carefully inspect the sensor. If it is defective, replace it.

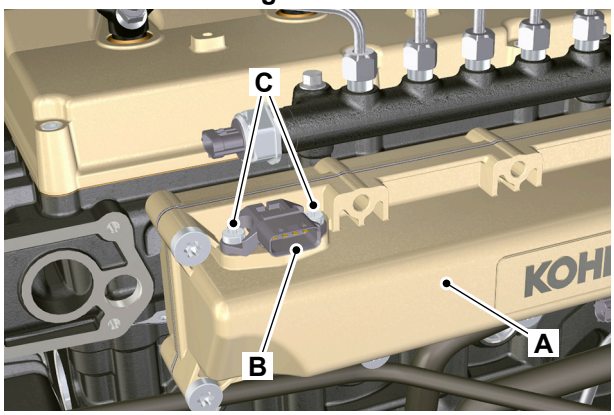
Remove and Install

(For: AJ48D)

Before Removal

1. Make sure that the engine is safe to work on. If the engine has been running, let it cool before you start the service work.
2. Clean the sensor and the adjacent area of the inlet manifold.

Figure 102.



A Inlet manifold
B TMAP (Temperature Manifold Absolute Pressure) sensor
C Screws

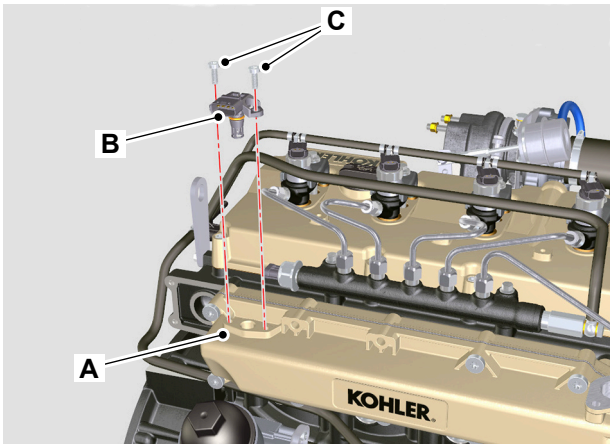
Remove

1. Get access to the engine.
2. Disconnect the electrical connector from the sensor.
3. Remove the screws.
4. Remove the TMAP sensor.

The TMAP sensor is a non-serviceable item. If the sensor is defective, it must be replaced.

Install

Figure 103.



A Inlet manifold
B TMAP sensor
C Screws

1. Installation is the reversal of the removal procedure.
2. Carefully push the sensor into its location bore in the inlet manifold. Do not use too much force.
3. Tighten the screws to the correct torque value.

Table 36. Torque Values

Item	Nm
C	6

21 - Engine Oil Pressure

Introduction 15-49
Technical Data 15-50
Component Identification 15-50
Operation 15-51
Remove and Install 15-51

Introduction

(For: AJ48D)

The engine oil pressure sensor is a device to alert the ECM (Engine Control Module) if the pressure inside the engine is outside the set limits.

The sensor is mounted on the engine crankcase.

Technical Data

(For: AJ48D)

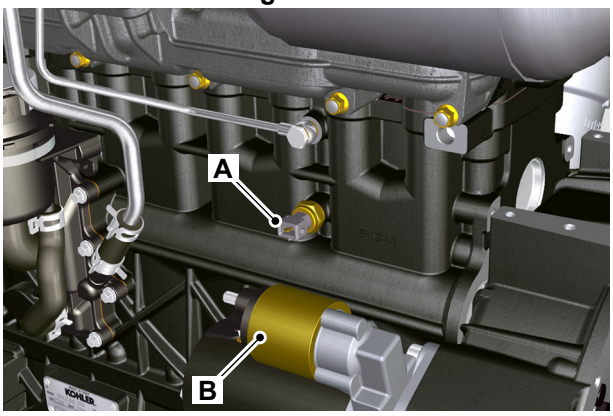
Table 37. Technical Data

Intervention pressure (MIN.)	0.8 ± 0.1bar (11.6 ± 1.5psi)

Component Identification

(For: AJ48D)

Figure 104.



A Engine oil pressure sensor
B Starter motor

Operation

(For: AJ48D)

The oil pressure sensor is Normally Closed. The sensor is calibrated.
Refer to: Technical Data (PIL 15-84-21).

When the oil pressure is low, the sensor closes the electrical circuit and the warning lamp is switched ON.

Remove and Install

(For: AJ48D)

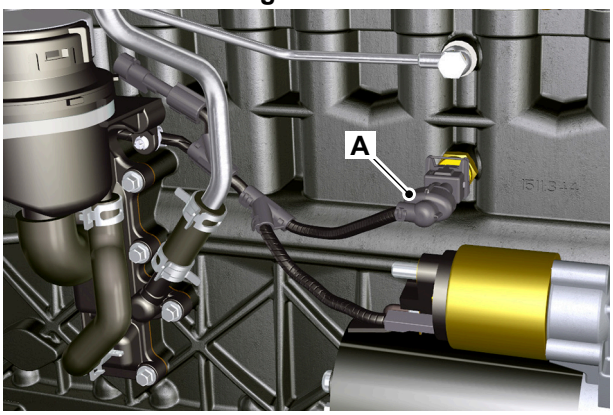
Before Removal

1. Make sure that the engine is safe to work on. If the engine has been running, let it cool before you start the service work.

Remove

1. Get access to the oil pressure semsor.
2. Disconnect the electrical connector from the engine oil pressure sensor.

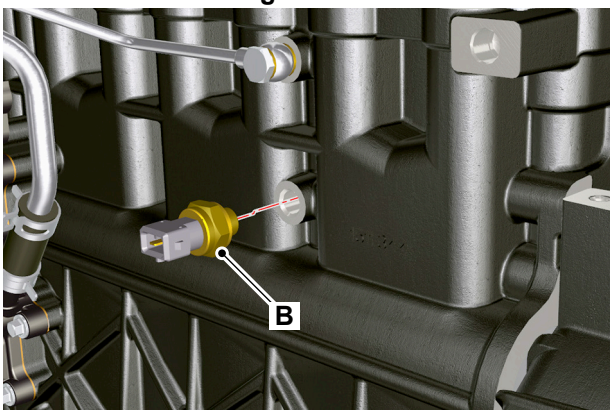
Figure 105.



A Electrical connector

3. Use a deep socket to remove the sensor from the oil cooler housing.

Figure 106.



B Oil pressure sensor

4. Put a cap on the open port to prevent loss of fluid and ingress of dirt.

The engine oil pressure sensor is a non-serviceable item. If the sensor is faulty or damaged it must be renewed.

Install

1. Replacement is the reversal of the removal procedure.
2. Tighten the engine oil pressure sensor to the correct torque value.

Table 38. Torque Values

Item	Nm
B	35

24 - Fuel Temperature

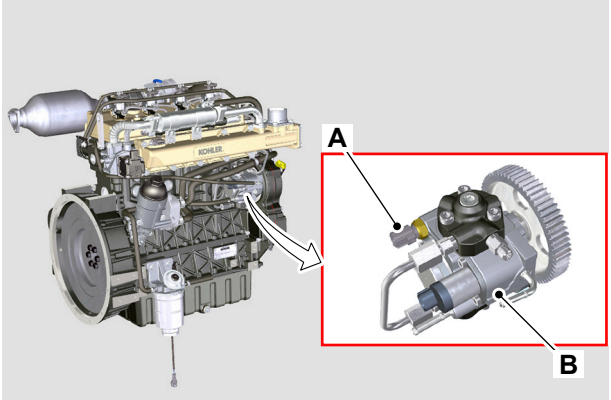
Introduction 15-53
Operation 15-54
Remove and Install 15-54

Introduction

(For: AJ48D)

The fuel temperature sensor is an integral part of the fuel injection high pressure pump.

Figure 107.



A Fuel temperature sensor
B Fuel pump

Operation

(For: AJ48D)

The fuel temperature sensor detects the fuel temperature as it enters the high pressure fuel injection pump. The ECM (Engine Control Module) processes the analogue signal sent by the sensor to determine the fuel temperature. The ECM responds and adjusts the fuel pressure.

Remove and Install

(For: AJ48D)

This part is a non-serviceable component, if it is defective, replace the fuel injection high pressure pump.

26 - Fuel Pressure

Introduction 15-55
Operation 15-56
Remove and Install 15-56

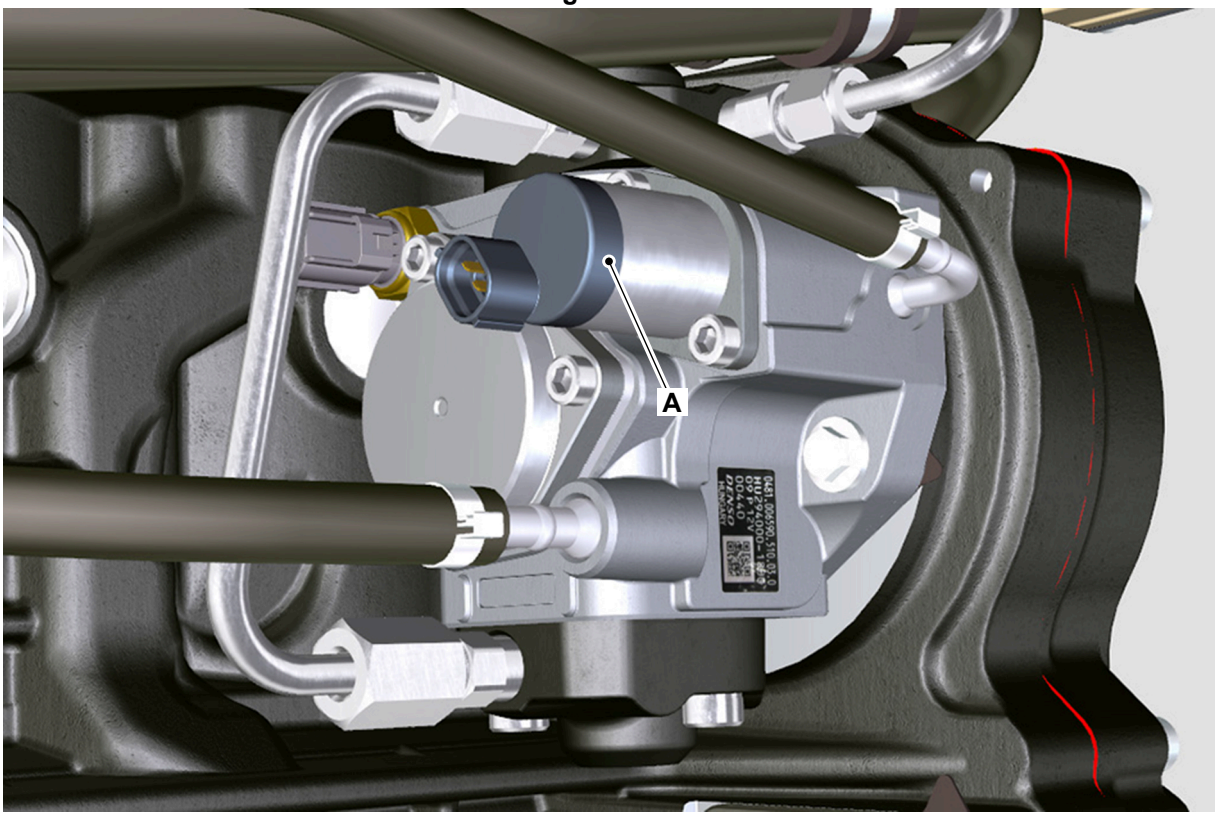
Introduction

(For: AJ48D)

Introduction

The fuel pressure sensor is an integral part of the high pressure pump.

Figure 108.



A Fuel pressure sensor

Operation

(For: AJ48D)

Operation

The fuel pressure sensor monitors the fuel pressure in the inlet port of the high pressure pump and it is controlled by the ECM (Engine Control Module) via PWM (Pulse Width Modulation).

The digital signal varies the valve opening in proportion to the amount of fuel injected into the fuel injection pump and consequently manages the excess fuel to be sent back to the fuel tank.

Remove and Install

(For: AJ48D)

Remove and Install

It is not possible to perform any maintenance on the fuel pressure sensor, as it is an integral part of the pump unit. Never remove the fuel pressure sensor from the pump.

If it is defective, replace the high pressure pump.

27 - Fuel Rail Pressure

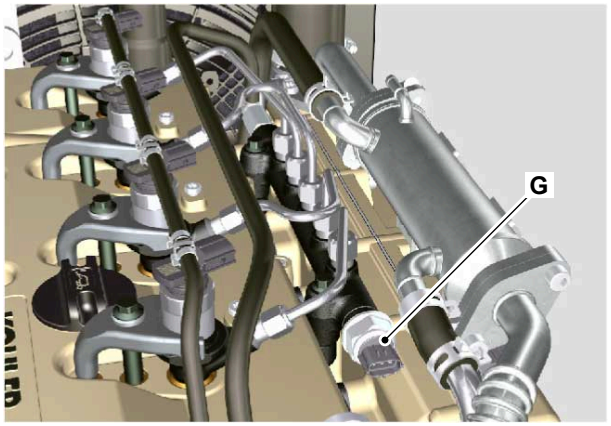
Introduction 15-57
Operation 15-58
Remove and Install 15-58

Introduction

(For: AJ48D)

The fuel rail pressure sensor is an integral part of the common fuel rail assembly.

Figure 109.



G Fuel rail pressure sensor

Operation

(For: AJ48D)

The fuel pressure sensor measures the pressure of the fuel in the fuel rail. The signal sent to the ECM (Engine Control Module) is analogue. The voltage and resistance detected by the ECM are proportional to the fuel pressure.

Remove and Install

(For: AJ48D)

It is not possible to perform any maintenance on the fuel pressure sensor, as it is an integral part of the rail unit. Never remove the fuel pressure sensor from the rail.

If it is defective, replace the complete common rail assembly.

33 - Coolant Temperature

Introduction 15-59
Technical Data 15-60
Component Identification 15-60
Operation 15-61
Check (Operation) 15-61
Remove and Install 15-62

Introduction

(For: AJ48D)

The coolant temperature sensor is a device used to measure the coolant temperature inside the engine. The sensor is installed on the cylinder head.

Technical Data

(For: AJ48D)

Table 39.

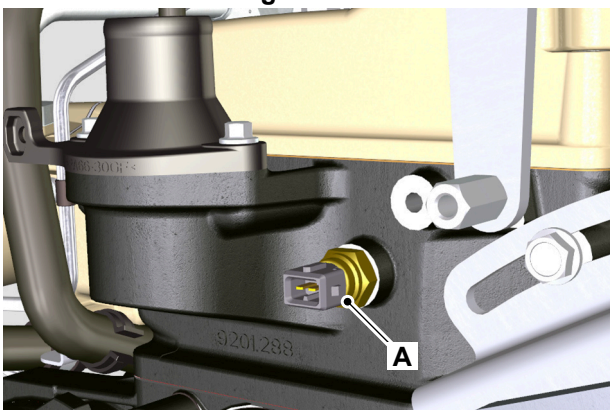
Temperature	Resistance
-40°C (-39.9°F)	38,313–52,926Ω
-10°C (14.0°F)	7,800–8,800Ω
0°C (32.0°F)	5,227–6,623Ω
15°C (59.0°F)	2,900–3,100Ω
25°C (77.0°F)	2,062–2,180Ω
80°C (175.9°F)	250–348Ω
110°C (229.8°F)(1)	142Ω
140°C (283.8°F)	67–76Ω

(1) 110°C (229.8°F) is the upper threshold temperature limit. If coolant temperature reaches to this value, Engine ECU activates the fault P0217.

Component Identification

(For: AJ48D)

Figure 110.



A Coolant temperature sensor

Operation

(For: AJ48D)

The sensor is used by the ECM (Engine Control Module) to control the high temperature indicator light signal and to control the electric fan of the coolant radiator.

The high temperature indicator light is switched ON at temperatures between 106–108°C (222.7–226.2°F).

Check (Operation)

The operational check of the coolant temperature sensor must be done when the engine is running.

1. Use a suitable digital multimeter to measure the resistance of the coolant temperature sensor.
2. When the temperature of the coolant is less than the specified, disconnect the wire connector from the coolant temperature sensor.

   Temperature: 50°C (121.9°F)
3. Place one lead of the multimeter on the connector of the coolant temperature sensor. Place the other lead of the multimeter on a ground for the coolant temperature sensor.
4. Measure the resistance. Make sure that the resistance is within the specified limit.

   Resistance: 54 ± 2Ω
5. Repeat the step 3 and 4 when the temperature of the coolant is approximately specified.

   Temperature: 120°C (247.8°F)
6. Measure the resistance. Make sure that the resistance is not less than the specified value.

   Resistance: 15Ω
7. If the resistance through the coolant temperature sensor is not within the given resistances, replace the coolant temperature sensor.

Remove and Install

(For: AJ48D)

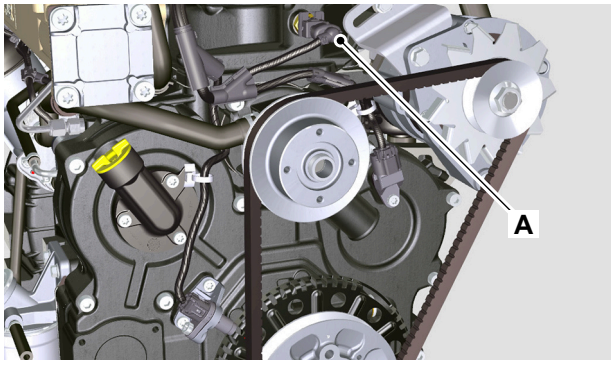
Before Removal

1. Make sure that the engine is safe to work on. If the engine has been running, let it cool before you start the service work.
2. Drain the coolant from the engine.

Remove

1. Get access to the coolant temperature sensor.
2. Disconnect the electrical connector from the sensor.

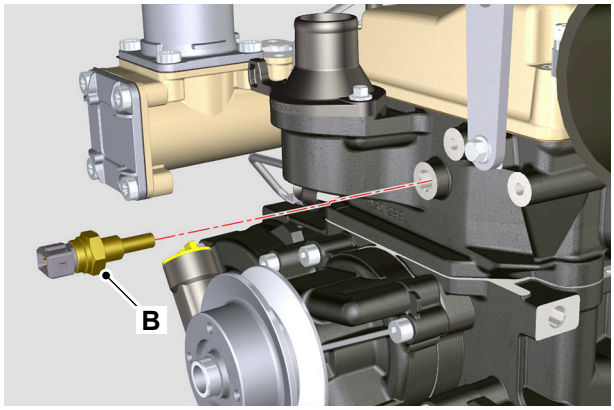
Figure 111.



A Electrical connector

3. Remove the sensor from the cylinder head.

Figure 112.



B Coolant temperature sensor

4. Put a cap on the open port to prevent loss of fluid and ingress of dirt.

The coolant temperature sensor unit is a non-serviceable item. If the sensor is faulty or damaged it must be replaced.

Install

1. Installation is the opposite of the removal procedure.
2. Tighten the coolant temperature sensor to the correct torque value.
3. Fill the cooling system with the recommended coolant mixture.
4. Start the engine and check for coolant leaks.

Table 40. Torque Values

Item	Nm
B	20

18 - Fuel and Exhaust System

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18-12 Water Separator
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18-24 Exhaust
18-24-00 General 18-33
18-39 Fuel Cooler
18-39-00 General 18-39

Acronyms Glossary

DEF	Diesel Exhaust Fluid
DOC	Diesel Oxidation Catalyst
ECM	Engine Control Module
EGR	Exhaust Gas Recirculation
HPV	High Pressure Valve
IMV	Inlet Metering Valve
NOx	Nitrogen Oxide
SCR	Selective Catalytic Reduction

00 - Fuel and Exhaust System

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00 - General

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Check (Leaks) 18-12
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Introduction

Maintenance information for some components pertaining to the fuel system is contained within the Manufacturer's engine manual and is available as a stand-alone document on JCB Service Pro.
Refer to: servicepro.jcb.com.

Health and Safety

Fuel

Fuel is flammable, keep naked flames away from the fuel system. Stop the engine immediately if a fuel leak is suspected. Do not smoke while refuelling or working on the fuel system. Do not refuel with the engine running. Completely wipe off any spilt fuel which could cause a fire. There could be a fire and injury if you do not follow these precautions.

Fluid Under Pressure

Fine jets of fluid at high pressure can penetrate the skin. Keep face and hands well clear of fluid under pressure and wear personal protective equipment. Hold a piece of cardboard close to suspected leaks and then examine the cardboard for signs of fluid. If fluid penetrates your skin, get medical help immediately.

WARNING! *Do not open the high pressure fuel system with the engine running. Engine operation causes high fuel pressure. High pressure fuel spray can cause serious injury or death.*

Notice: *Do not allow dirt to enter the fuel system. Before disconnecting any part of the fuel system, thoroughly clean around the connection. When a component has been disconnected, for example a fuel pipe, always install protective caps and plugs to prevent dirt ingress. Failure to follow these instructions will lead to dirt entering the fuel system. Dirt in the fuel system will seriously damage the fuel injection equipment and could be expensive to repair.*

Notice: *The high pressure fuel system is extremely susceptible to damage if it is contaminated. Always clean the engine using the correct procedures before carrying out maintenance. Contamination of the fuel system can cause catastrophic failure of the engine.*

Notice: *Running the engine with air in the system could damage the fuel injection pump. After maintenance, the system must be bled to remove any air.*

Notice: *Clean the engine before you start engine maintenance. Obey the correct procedures. Contamination of the fuel system will cause damage and possible failure of the engine.*

CAUTION! *It is illegal to pollute drains, sewers or the ground. Clean up all spilt fluids and/or lubricants. Used fluids and/or lubricants, filters and contaminated materials must be disposed of in accordance with local regulations. Use authorised waste disposal sites.*

Technical Data

(For: AJ48D)

Table 41. Fuel System Data

High pressure pump type	Denso HP3
Direction of rotation from flywheel side	Anti-clockwise
Fuel lift pump type (if installed)	Electrically operated
Maximum pressure at injection pump inlet	0.22bar (3.2psi)
Injector information	Electronically controlled solenoid actuated injectors. Each injector is marked with a unique calibration code.

Table 42. Fuel Filter

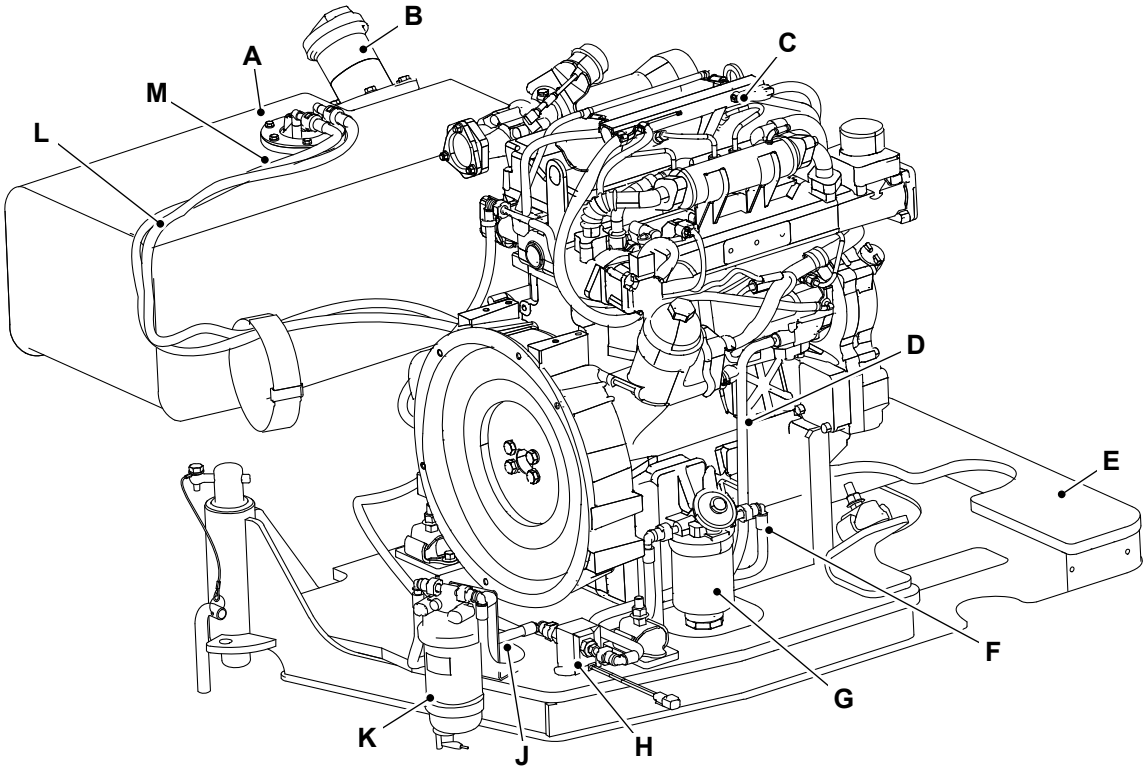
Description	Value
Filtering surface	0.23m²
Degree of filtration	5µm
Max operating pressure	2bar (29.0psi)
Max flow rate	3.17L/min

Component Identification

For: AJ48D [T4F] ..... Page 18-5
For: AJ48D [T0] ..... Page 18-6

(For: AJ48D [T4F])

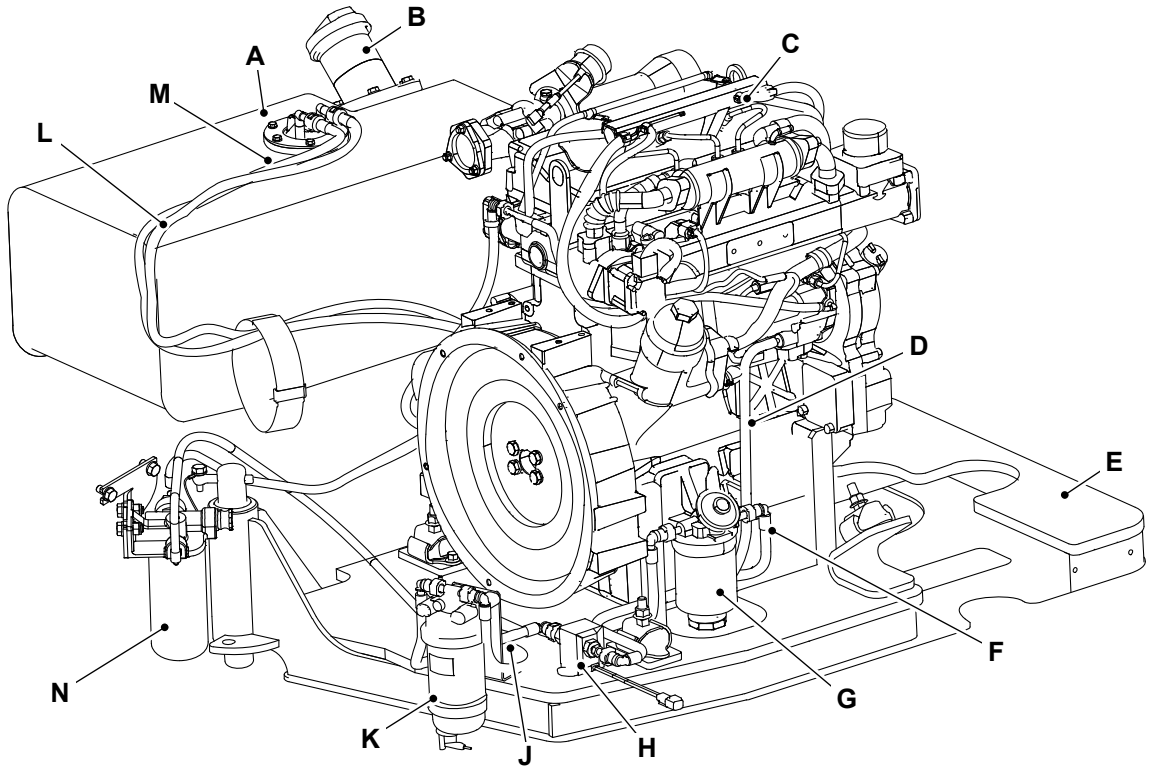
Figure 113.



A Fuel tank
B Fuel tank filler
C Engine
D Hose- secondary fuel filter to FIP
E Engine base panel
F Hose- fuel pump to secondary fuel filter
G Secondary fuel filter
H Fuel pump
J Hose- primary fuel filter to fuel pump
K Primary fuel filter
L Hose- overflow return
M Hose- fuel tank to primary fuel filter

(For: AJ48D [T0])

Figure 114.



A Fuel tank
B Fuel tank filler
C Engine
D Hose- secondary fuel filter to FIP
E Engine base panel
F Hose- fuel pump to secondary fuel filter
G Secondary fuel filter
H Fuel pump
J Hose- primary fuel filter to fuel pump
K Primary fuel filter
L Hose- overflow return
M Hose- fuel tank to primary fuel filter
N Lubricity filter

Operation

(For: AJ48D)

The fuel system is central to the performance and efficiency of the engine, distributing an accurate amount of fuel to each cylinder at exactly the right time.

Fuel is drawn from the fuel tank by the electric lift pump integral via the pre-filter/water separator. (The fuel lift pump is integral with the pre-filter/water separator assembly.)

Fuel is pressurised at low pressure by the electric lift pump and passes through an engine mounted fuel filter on its way to the inlet on the high pressure pump.

Important: Use of the correct fuel grade, together with effective filtration and decontamination of the fuel is essential. The high pressure pump, injectors and engine can be damaged beyond repair by contaminated fuel or use of incorrect fuel.

The high pressure fuel injection pump is a rotary type and is gear driven by the engine. The pump consists of two sections, the transfer pump and high pressure pump. Fuel is first pressurised to about 6bar (87.0psi) by the transfer pump. A constant pressure is maintained regardless of engine speed by the regulating valve.

Fuel is transferred to the high pressure pump via the IMV (Inlet Metering Valve). The metering valve controls the amount of fuel transferred depending on the engine operating parameters (throttle position, coolant temperature etc.). The metering valve is controlled by the ECM (Engine Control Module).

Some fuel flows through the pump at all times to provide internal lubrication and cooling. This fuel bleeds back to tank via the bleed-off fuel lines.

Pressurised fuel from the high pressure pump passes into the common fuel rail. The high pressure pump is capable of pressurising the fuel in the rail up to 2,000bar (29,007.5psi). The ECM controlled IMV is used to control the amount, and therefore pressure of the fuel in the common rail.

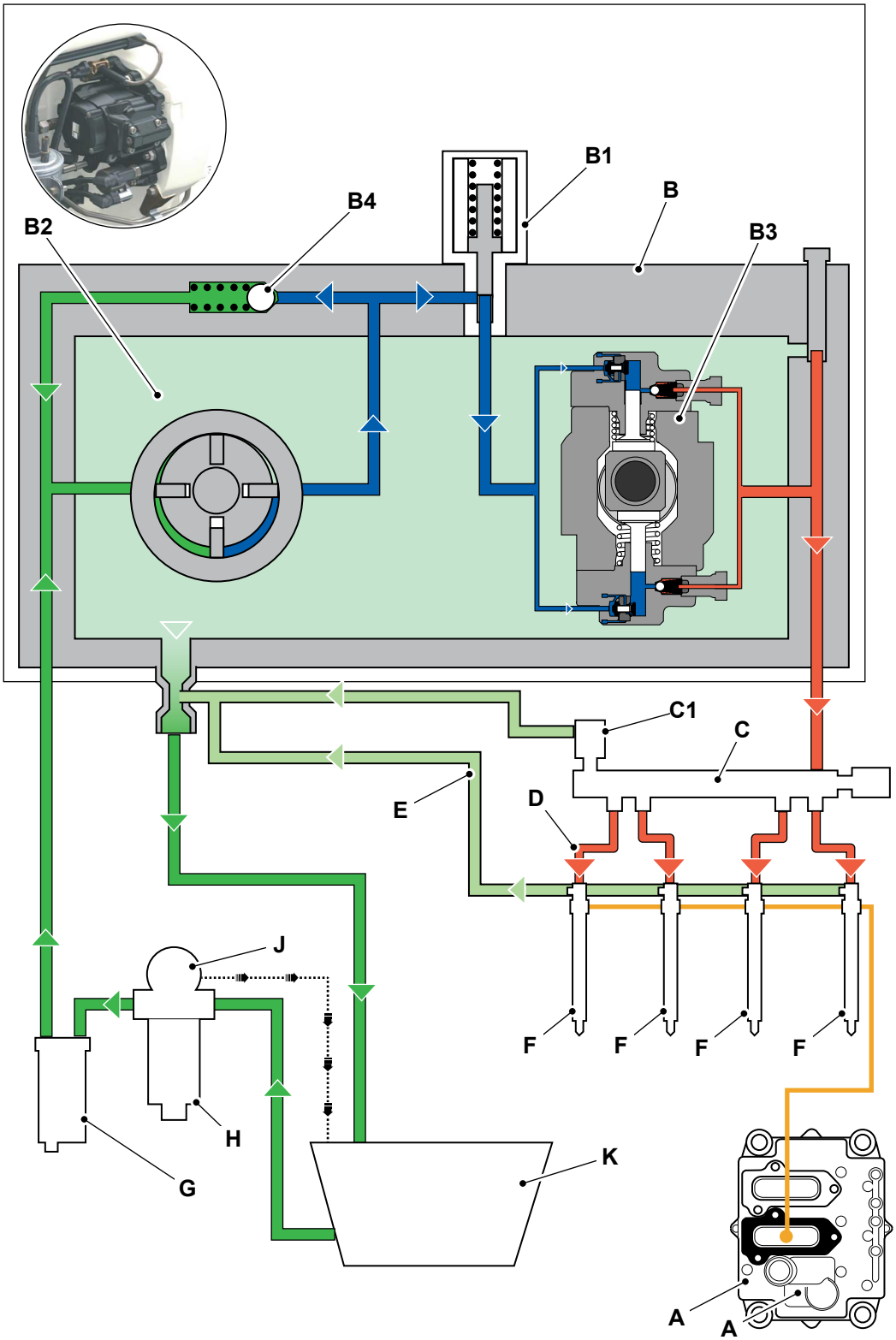
In some operating conditions the inlet metering valve is not able to reduce the rail pressure quickly enough (if the operator goes from full throttle to no throttle suddenly for example). In these circumstances the rail pressure is dumped to the bleed off line using the ECM controlled electric HPV (High Pressure Valve).

High pressure fuel pipes connect the injectors to the common fuel rail. The injectors are electrically controlled and incorporate a small solenoid valve.

Injection timing is determined by the ECM. Electrical data from several sensors is continually monitored and processed by the ECM to determine when, how much and to which cylinder fuel must be injected.

The injectors inject fuel in response to a supply of electrical current from the ECM. So precise is the control that several injections of fuel occur during each firing stroke for maximum efficiency and minimum emissions. During fuel injection some fuel bleeds off the injectors and back to tank via bleed off lines.

Figure 115.



A ECM
B1 IMV
B Fuel high pressure pump
B2 Fuel high pressure pump (transfer section)

B3 Fuel high pressure pump (high pressure section)
B4 Pressure regulating valve (transfer section)
C Common fuel rail
C1 HPV
D High pressure fuel lines
E Bleed off fuel lines
F Fuel injectors
G Fuel filter
H Pre-filter/water separator
J Electric fuel lift pump
K Fuel tank

Table 43. Colour code key

Colour	Component
Green	Tank pressure
Blue	Transfer pressure
Red	Injection rail pressure
Yellow	Electrical connections -ECM - injectors
Light Green	Pump internal pressure, injector bleed-off

Clean

Cleanliness Requirements

Important: Additional cleaning must be carried out prior to working on the high pressure fuel system. It is extremely important the high pressure fuel components and the adjacent parts of the engine are meticulously cleaned before any components are removed. Refer to: Effects of Contamination.

Before starting work on the high pressure fuel system, make sure that the working environment is suitable. Refer to: Maintenance Environment, Common Rail Fuel Injection.

1. Obey all fuel system health and safety information.
2. Clean the machine, prior to completing any maintenance work.
3. Clean the engine.
4. Remove the hoses, electrical harnesses and ancillaries to improve access and expose any remaining trapped dirt close to the relevant high pressure components.
5. Wash away any remaining dirt or debris and then dry the area using a compressed air jet. When the area is dry use a soft clean brush to remove sand or grit particles that remain.

Effects of Contamination

While the requirement for a good level of cleanliness is well known and common practice, the introduction of high pressure common rail fuel injection necessitates working to new levels of cleanliness.

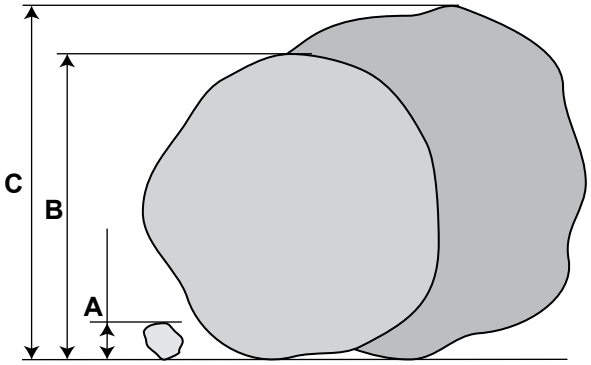
Once inside the system, fuel circuit contaminants greatly affect the performance and life of the fuel injection equipment. For example, contaminants in the fuel pump will develop internal wear to cause internal leakage and hence lower discharges. Use of poor quality fuels and poor maintenance could also lead to contaminants entering the fuel injectors. There is a possibility of catastrophic equipment failure if debris should prevent the injectors from fully closing. The main contaminants can be classified as follows:

- Solid Particles - sand, fibres, metallic particles, welding scale, sealing materials and wear particles etc.
- Liquid - usually water and incompatible oils and greases.
- Gases - Air, sulphur dioxide etc. which can create corrosive compounds if dissolved in the fluid.

These contaminants can appear during manufacture, assembly, operation and maintenance.

The fuel filter is rated at 5 micron = 0.005mm (0.0002in). Listed are a few typical comparisons of micron size:

Figure 116.



A 8 microns
B 70 microns
C 100 microns

- Red Blood Cell = 8 microns (0.008mm, 0.000315in).
- Human Hair = 70 microns (0.07mm, 0.00275in).
- Grain of Salt = 100 microns (0.1mm, 0.00394in).
- The smallest particle visible to the naked eye is 40 microns (0.00157in) approximately.

The fuel filter must be changed in accordance with the applicable service schedule and procedures. The water in fuel sensor must be maintained to make sure of correct operation at all times.

The potential for engine damage due to fuel contamination is much greater when using common rail injection technology than with mechanical injection systems. This is because common rail requires components with smaller manufacturing tolerances, especially the fuel injectors. In addition, common rail operates at much higher fuel pressures, over five times that of mechanical systems.

Similar pressures are used by commercial water jet cutting machines to cut metal. Fortunately clean diesel fuel has lubricating qualities that prevents erosion of components but it is obvious that contaminated fuel will cause serious damage at such high pressures.

Maintenance Environment, Common Rail Fuel Injection

Depending on circumstances engine maintenance may be required in various working environments. Obviously procedures are best carried out in a

dedicated workshop equipped with a suitable clean room, but in practice this is not always possible.

Maintenance procedures requiring removal or replacement of fuel system components, particularly high pressure components, require special precautions to make the working environment suitable, reducing the risk of contamination to an absolute minimum.

Use the following guidelines to make sure you reduce the chances of fuel system contamination when working in different environments:

Worksite - Open to weather

This repair site is not an acceptable location. Only in extreme circumstances should a machine be repaired on an open site. Use the guidelines below:

- Clean the engine. If the machine is on hard standing, clean away the material washed from the engine.
- Place suitable clean boards on the ground around the machine.
- Erect clean plastic sheeting to shelter the engine from wind and rain.
- Wear a new disposable environmental type suit when working on the fuel system. If the suit becomes contaminated with mud, move away from the engine and change into a new suit.
- Use clean latex gloves (non-powdered).
- Before you start work make sure that all the required replacement parts and tools are on site. Make sure that the replacement parts are still sealed inside their packaging.
- Put caps on all exposed ports and orifices immediately. Do not leave them open.
- High pressure fuel pipes MUST BE RENEWED if any pipe joint is loosened or disconnected. DO NOT re-use the original pipe.

Worksite - Closed to weather from above

This repair site is the least acceptable condition, if possible move the machine to a more suitable environment. Use the guidelines below:

- Clean the engine. Clean the floor of all material washed from the engine.
- Place suitable clean boards on the ground around the machine.
- Erect clean plastic sheeting to shelter the engine from the wind and the possibility of debris such as dirt and dust falling from above.
- Wear a new disposable environmental type suit when working on the fuel system. If it becomes contaminated with mud, move away from the engine and change into a new suit.
- Use clean latex gloves (non-powdered).
- Before you start work make sure that all the required replacement parts and tools are on site. Make sure that the replacement parts are still sealed inside their packaging.
- Put caps on all exposed ports and orifices immediately. Do not leave them open.
- High pressure fuel pipes MUST BE RENEWED if any pipe joint is loosened or disconnected. DO NOT re-use the original pipe.

Vehicle Maintenance Workshop

Unless the workshop has a dedicated `sealable clean room' work bay, precautions must still be taken.

- Clean the engine. Clean the engine in the dedicated area and then move it to the workshop.
- Clean the floor area around the machine.
- Erect clean plastic sheeting to shelter the engine from any wind and the possibility of debris such as dirt and dust falling from above.
- Make sure that workshop doors to the outside are kept closed. A gust of wind through an open door will easily blow sand particles into the air.
- Make sure your work wear is clean, non-flocking and lint free. If in doubt wear a new disposable environmental type suit.
- Use clean latex gloves (non-powdered).
- Before you start work make sure that all the required replacement parts and tools are on site. Make sure that the replacement parts are still sealed inside their packaging.
- Put caps on all exposed ports and orifices immediately. Do not leave them open.
- High pressure fuel pipes MUST BE RENEWED if any pipe joint is loosened or disconnected. DO NOT re-use the original pipe.

Check (Leaks)

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Open the engine compartment cover.
   Refer to: Open and Close (PIL 06-06-06).
3. Check the engine compartment, fuel pipes and the area below for leaks.
4. Start the engine.
5. While the engine is running, check the engine compartment, fuel lines and the area below for leaks.
6. If necessary, repair or replace any damaged components.

Bleed

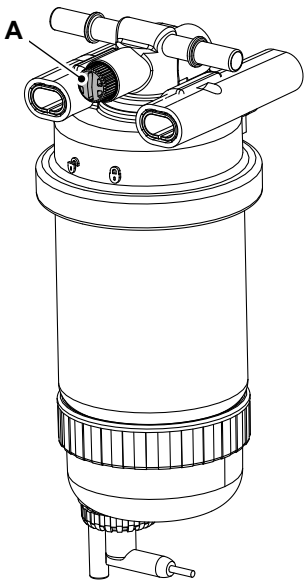
(For: AJ48D)

⚠ **Notice:** Do not allow dirt to enter the system. Before disconnecting any part of the system, thoroughly clean around the connection. When a component has been disconnected, always install protective caps and plugs to prevent dirt ingress.

Failure to follow these instructions will lead to dirt entering the system. Dirt in the system will seriously damage the systems components and could be expensive to repair.

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Open the rear access cover.
   Refer to: PIL 06-06.
3. Loosen the bleed screw on the fuel filter.
4. Turn on the ignition until fuel with no air flows freely from the valve, then close the bleed screw.
5. Start the engine and check for smooth running.
6. If the engine continues to run roughly, again bleed the fuel system.

Figure 117.



A Bleed screw

03 - Tank

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00 - General

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Remove and Install 18-16

Introduction

The fuel tank is a safe container for storing flammable fluids, from here the fuel is pumped into the engine.

There can be condensation in a partially filled fuel tank. Therefore, you must fill the fuel tank after you operate the engine.

Drain the water and sediment from any fuel storage tank at the recommended service intervals.

Remove and Install

Remove

1. Make the machine safe with the boom arm lowered.

   Refer to: PIL 01-03-27.

2. Put a label on the fuel pipes to help installation.

   2.1. Disconnect the fuel sensor plug connection.

   2.2. Plug all the open ports and hoses to prevent contamination.

3. Remove the feed and return fuel lines.

4. Place a container of suitable size beneath the machine.

   4.1. Remove the drain plug.

5. Remove the fastener and bracket.

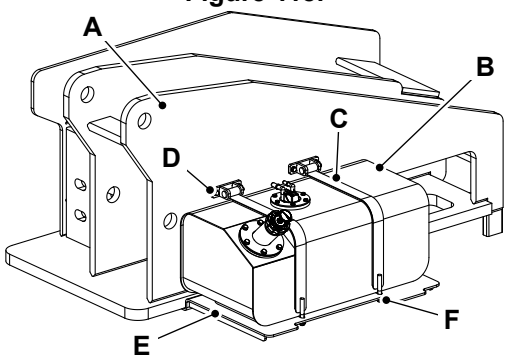
6. Remove the nuts (x2) from base plate.

7. Unscrew the fastening set screw (x2) of the fixing strap on the fuel tank.

   7.1. Remove the fixing strap (x2) from the fuel tank.

8. Remove the fuel tank away from the machine.

Figure 118.



A Turntable
B Fuel tank
C Strap (x2)
D Set screw (x2)
E Base plate
F Nut (x2)

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.

2. Bleed the fuel system.

   Refer to: Bleed (PIL 18-00-00).

3. Check the fuel pipes for leaks.

   Refer to: Check (Leaks) (PIL 18-00-00).

4. Tighten the set screw and nuts to the correct torque value.

Table 44. Torque Values

Item	Nm
D	22
F	89.5

09 - Filter

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18-09-00 General 18-19
18-09-15 Lubricity Filter 18-21

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00 - General

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Drain and Fill 18-20
Remove and Install 18-20

Introduction

The fuel filter consists of a paper element folded in such a way as to give a very large surface area. It is most important that the fuel filter is changed regularly in accordance with the machine service schedule. Use only the correct specification filters.

Drain and Fill

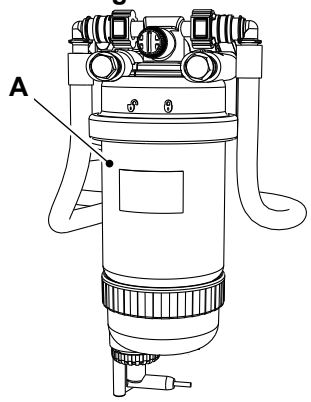
(For: AJ48D)

1. Obey all fuel system health and safety information.

   Refer to: Health and Safety (PIL 18-00-00).

2. Drain off any water in the fuel filter element and the water separator by turning the tap.

Figure 119.



A Fuel filter

Remove and Install

(For: AJ48D)

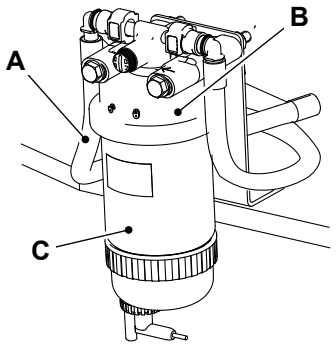
Obey all fuel system health and safety information. Refer to: PIL 01-03-27.

Make sure that you keep a suitable container to collect the fuel from the cartridge, when you remove the water in fuel sensor from the cartridge.

Remove

1. Make sure that the engine is safe to work on. If the engine has been running, let it cool before you start the service work.
2. Get access to the filter.
3. Clean around the filter cover and housing.
4. Loosen the drain nut and allow the water/ fuel to drain into a suitable container.
5. Remove the filter and O-ring.

Figure 120.



A Fuel pipe
B Filter housing
C Cartridge

6. If required, remove the water in fuel sensor.
7. With strap wrench remove the cartridge from the filter housing.

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Install a new O-ring into filter housing and lubricate with clean fuel.
3. Bleed the fuel system.

   Refer to: Bleed (PIL 18-00-00).

15 - Lubricity Filter

Remove and Install

(For: AJ48D [T0])

Special Tools

Description	Part No.	Qty.
Final fuel filter removal tool - engine mounted (430 Engine)	320/A7126	1

Hot Components

Touching hot surfaces can burn skin. The engine will be hot after the unit has been running. Allow the engine to cool before servicing the unit.

Notice: *Do not allow dirt to enter the fuel system. Before disconnecting any part of the fuel system, thoroughly clean around the connection. When a component has been disconnected, for example a fuel pipe, always install protective caps and plugs to prevent dirt ingress. Failure to follow these instructions will lead to dirt entering the fuel system. Dirt in the fuel system will seriously damage the fuel injection equipment and could be expensive to repair.*

Remove

1. Make the machine safe.

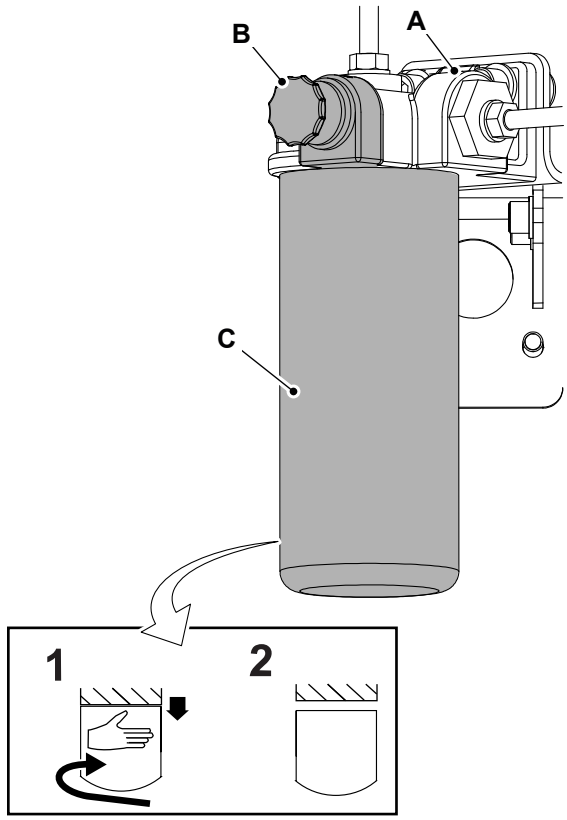
   Refer to: PIL 01-03.

2. Access the lubricity fuel filter.
3. Put the container below the filter to collect leakage fuel.
4. With help of a filter wrench loosen the filter cartridge.

   Special Tool: Final fuel filter removal tool - engine mounted (430 Engine) (Qty.: 1)

5. Remove the cartridge with hands.

Figure 121.



A Filter head
B Hand pump
C Filter cartridge

Install

1. The installation procedure is opposite of the removal procedure. Additionally make sure following steps:
2. Apply clean engine oil to the new fuel filter gasket.
3. Do not fill new filter cartridge with fuel, possibility of contamination of fuel system.
4. Operate the hand pump on filter head, before starting the engine.
5. Dispose of the collected fuel according to local regulations.

12 - Water Separator

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18-12-00 General 18-23
18-12-04 Water in Fuel Sensor 18-25

00 - General

Introduction 18-23
Drain and Fill 18-24
Remove and Install 18-24

Introduction

The water separator is designed to separate water and dirt from the fuel using a special chemically treated paper filter element. A bowl installed in the bottom of the trap collects the water removed from the fuel.

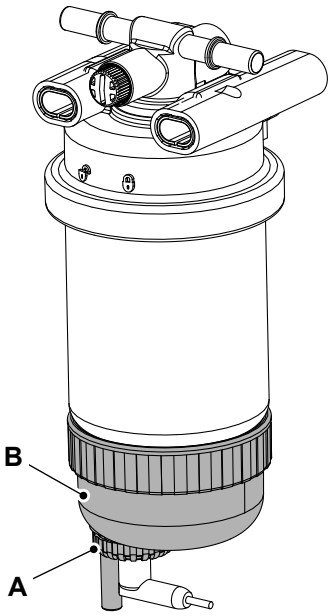
The bowl is installed with an electric probe which senses when the water is above a preset level. The probe enables a suitable alarm/indicator device. Water can be drained off by means of the drain screw installed in the base of the bowl. It is essential that the water trap is drained regularly. Water must be drained immediately if the probe signals an alarm.

Drain and Fill

Drain

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Get access to the water separator.
3. Examine the water separator bowl for sediment. Refer to Figure 122.
   3.1. If there is water but no sediment, open the tap to drain the water.
   3.2. If there is any sediment in the bowl, replace the fuel filter element.

Figure 122. Water Separator



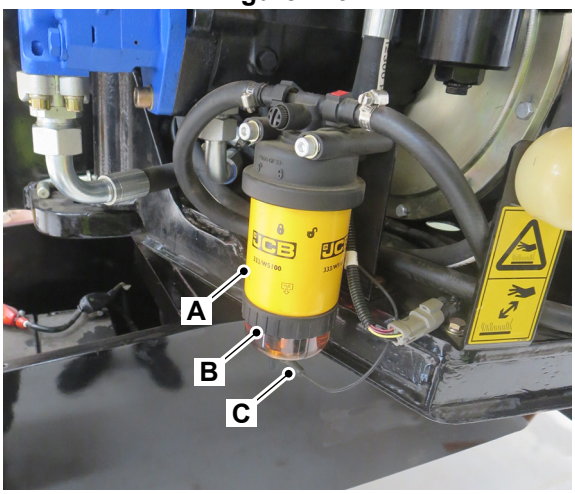
A Tap
B Bowl

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Open the engine compartment cover.
   Refer to: PIL 06-06-06.
3. Drain the water separator.
   Refer to: Drain and Fill (PIL 18-12-00).
4. Remove the water in fuel sensor.
   Refer to: Remove and Install (PIL 18-12-04).
5. Remove the filter cap.
6. Remove the filter element.
7. Be careful, the filter will be full of fuel.
8. Remove and discard the O-ring.

Figure 123.



A Water separator
B Filter cap
C Water in fuel sensor

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Fill the filter element with clean fuel.

04 - Water in Fuel Sensor

Introduction 18-25
Remove and Install 18-26

Introduction

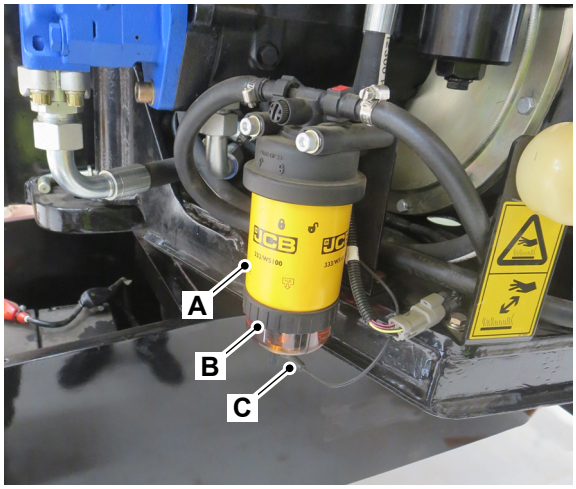
The water in fuel sensor is installed in the fuel filter water bowl. A warning light will illuminate in the instrument panel to indicate that water has accumulated in the fuel filter water bowl and must be drained.

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Remove the ignition key.
3. Open the engine compartment cover.
   Refer to: PIL 06-06-06.
4. Disconnect the electrical connections.
5. Remove the sensor fixing screw.
6. Remove the sensor.

Figure 124.



A Water separator
B Filter cap
C Water in fuel sensor

Install

1. The installation procedure is the opposite of the removal procedure.

21 - Fuel Pump

Contents **Page No.**

18-21-00 General 18-29

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00 - General

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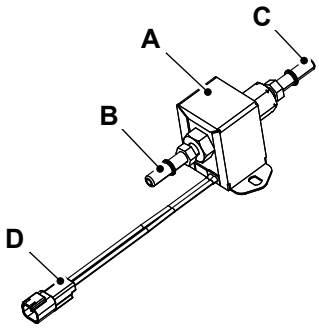
Component Identification 18-30
Remove and Install 18-30

Introduction

The fuel lift pumps function is to raise the level of fuel up through the system into the fuel injection system.

Component Identification

Figure 125.



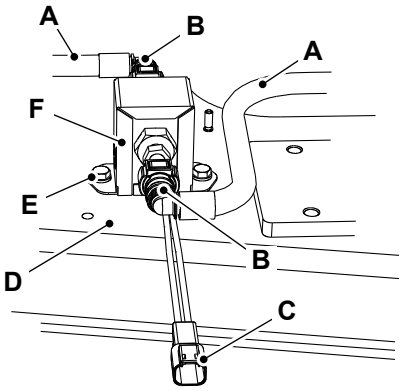
A Fuel pump
B Hose (Outlet)
C Hose (Inlet)
D Electrical connection

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03.
2. Open the engine compartment cover.
   Refer to: PIL 06-06-06.
3. Turn the fuel supply to the OFF position.
4. Disconnect the electrical connector from the fuel pump.
5. Plug all the open ports and hoses to prevent contamination.
6. Loosen the clamps and disconnect the hoses.
7. Put a label on the hoses to help installation.
8. Remove the set screw (x2) and remove the fuel pump.

Figure 126.



A Hoses
B Clamps
C Electrical connector
D Engine base panel
E Set screw (x2)
F Fuel pump

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Make sure that the fuel pump is clean and free from damage.
3. Bleed the fuel system.
   Refer to: Bleed (PIL 18-00-00).
4. Tighten the setscrew to the correct torque value.
   Refer to: PIL 72-03.

24 - Exhaust

Contents **Page No.**

18-24-00 General 18-33

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Health and Safety 18-34
Check (Condition) 18-34
Remove and Install 18-35

Introduction

The exhaust system is used to guide exhaust gases away from the controlled combustion inside the engine by means of an exhaust pipe. Depending on the machine design, the exhaust gas may flow through the following components:

- Cylinder head and exhaust manifold.
- Turbocharger to increase the engine power (if installed).
- A catalytic converter or EGR (Exhaust Gas Recirculation) system to reduce air pollution (if installed).
- SCR (Selective Catalytic Reduction) (if installed). In SCR system exhaust gases pass through the DEF (Diesel Exhaust Fluid) injection chamber to lower the NOx (Nitrogen Oxide) concentration in the exhaust gases.
- A silencer or muffler to reduce noise (if installed).

The exhaust pipe carries the toxic and noxious gases away from the users of the machine. Note machines or generators that work indoors can quickly fill an enclosed space with carbon monoxide or other poisonous exhaust gases if they are not properly vented to the outdoors.

Health and Safety

Exhaust Gases

Machine exhaust gases can harm and possibly kill you or bystanders if they are inhaled. Do not operate the machine in closed spaces without making sure there is good ventilation. If possible, install an exhaust extractor. If you begin to feel drowsy, stop the machine at once and get into fresh air.

Sparks

Explosions and fire can be caused by sparks from the exhaust or the electrical system. Do not use the machine in closed areas where there is flammable material, vapour or dust.

Hazardous Atmospheres

This machine is designed for use in normal outdoor atmospheric conditions. It must not be used in an enclosed area without adequate ventilation. Do not use the machine in a potentially explosive atmosphere, i.e. combustible vapours, gas or dust, without first consulting your JCB dealer.

Hot Components

Touching hot surfaces can burn skin. The engine and machine components will be hot after the unit has been running. Allow the engine and components to cool before servicing the unit.

WARNING! *The engine has exposed rotating parts. Switch off the engine before working in the engine compartment. Do not use the machine with the engine cover open.*

Check (Condition)

Excessive smoke from the exhaust stack combined with a complaint of low power could be as a result of:

- Dirt or dust (unfiltered air) ingested directly into the engine, resulting in damage to the cylinder bores and/or turbocharger (if installed). There will also be a possible increase in oil consumption.
- Air leaks from the air hose connections.
- Exhaust manifold leaks.
- Dirty or partially blocked air filter.

Remove and Install

For: AJ48D [T4F] ..... Page 18-35
For: AJ48D [T0] ..... Page 18-36

(For: AJ48D [T4F])

⚠ **CAUTION** The exhaust pipe becomes extremely hot when the engine is running and will remain so for some time after the engine is stopped. If you touch the hot pipe you could be severely burned.

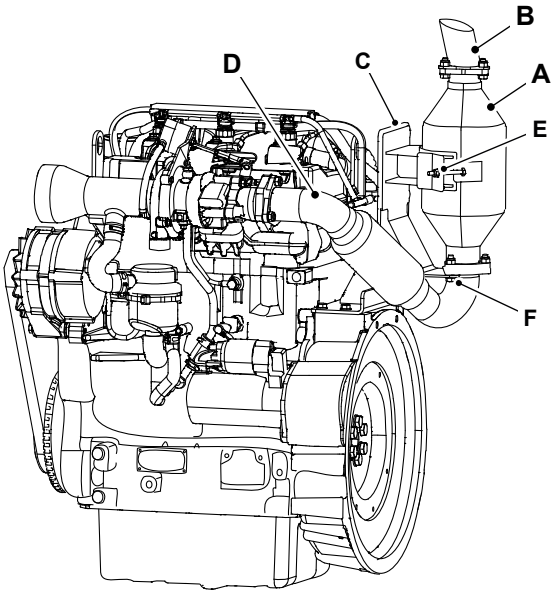
CAUTION This component is heavy. It must only be removed or handled using a suitable lifting method and device.

Remove

1. Make the machine safe.

   Refer to: PIL 01-03-27.
2. Make sure that the engine is safe to work on. If the engine has been running, let it cool before you start the service work.
3. Get access to the exhaust system.
4. Remove the exhaust flex joint from the engine.
5. Remove the setscrew (x2) and loosen locknut (x2).
6. Pull out the DOC (Diesel Oxidation Catalyst) and remove the exhaust system.

Figure 127.



A DOC thermal blanket
B Exhaust pipe
C Exhaust support bracket
D Exhaust flex joint
E Locknut (x2)
F Setscrew (x2)

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Heat insulation over exhaust pipe is not damaged.
3. Tighten the fasteners to the correct torque value.

Table 45. Torque Values

Item	Nm
E	22

(For: AJ48D [T0])

⚠ **CAUTION** The exhaust pipe becomes extremely hot when the engine is running and will remain so for some time after the engine is stopped. If you touch the hot pipe you could be severely burned.

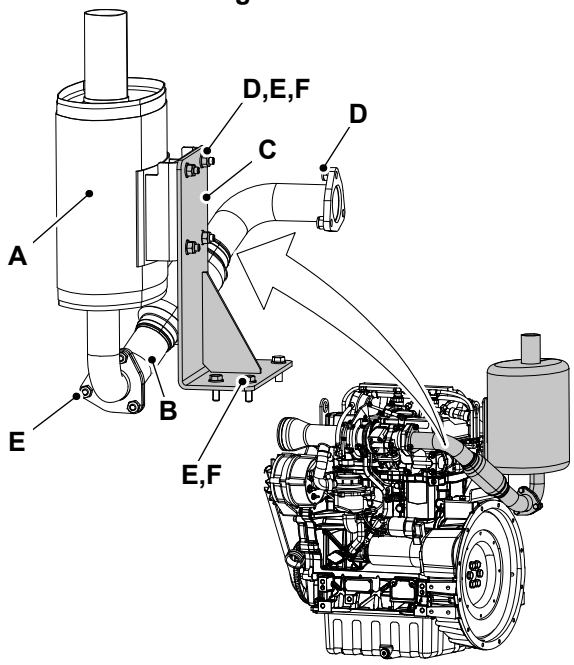
CAUTION This component is heavy. It must only be removed or handled using a suitable lifting method and device.

Remove

1. Make the machine safe.

   Refer to: PIL 01-03-27.
2. Get access to the exhaust system.
3. Remove the lock nut (x3) and disconnect exhaust pipe with flex joint from engine.
4. Remove the setscrew (x3) those attach exhaust pipe with muffler.
5. Remove lock nut (x4) and washer (x4) that hold muffler with support bracket.
6. Remove setscrew (x4) and washer (x4) those attach support bracket with engine.

Figure 128.



A Exhaust muffler
B Exhaust pipe with flexible joint
C Exhaust support bracket
D Locknut (x7)
E Setscrew (x11)
F Washer (x8)

Install

1. The installation procedure is opposite of the removal procedure. Additionally make sure the below steps:
2. All set screws are tighten to correct torque value.

   Torque: 22N·m
3. Gaskets are fitted at both the ends of exhaust pipe with flexible joint.
4. Heat insulation over exhaust pipe is not damaged.
5. After the exhaust system is installed, start the engine and make sure no leakage of exhaust gas from joints.

39 - Fuel Cooler

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00 - General

Remove and Install

Hot Components

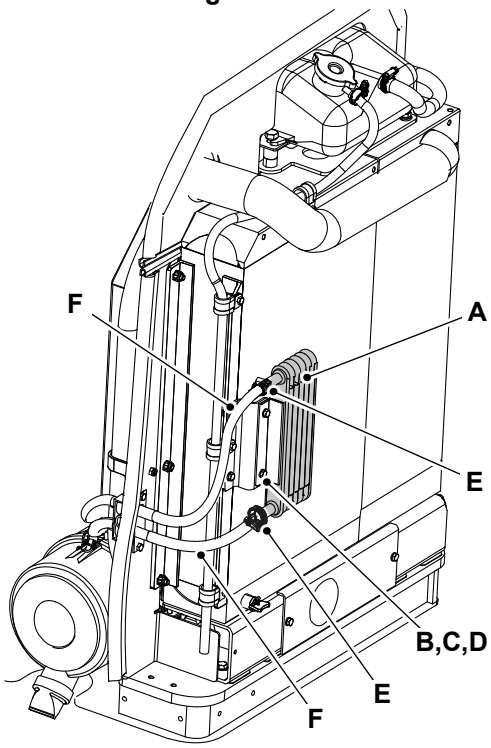
Touching hot surfaces can burn skin. The engine will be hot after the unit has been running. Allow the engine to cool before servicing the unit.

Optional

Remove

1. Make the machine safe.
   Refer to: PIL 01-03.
2. Access the fuel cooler.
3. Put labels on the hoses for identification to help installation.
4. Arrange suitable container to collect spilling fuel if any.
5. Loosen worm clamp (x2) and disconnect fuel hose (x2) from fuel cooler.
6. Plug the open ends of hoses and open ports of the oil cooler.
7. Remove set screw (x2), plain washer (x4) and locknut (x2).

Figure 129.



A Fuel cooler
B Set screw (x2)
C Plain washer (4)
D Locknut (x2)
E Worm clamp (x2)
F Fuel hose (x2)

Install

1. The installation procedure is opposite of the removal procedure. Additionally make sure following step.
2. Dispose of collected fuel according to local regulations.

Table 46. Torque Values

Item	Description	Nm
B	Set screw (x2)	12
E	Worm clamp (x2)	2

Notes:

21 - Cooling System

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Acronyms Glossary

CAC	Charge Air Cooler

00 - Cooling System

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Technical Data 21-4
Component Identification 21-5
Fault-Finding 21-6
Check (Level) 21-8
Remove and Install 21-9

Introduction

During the working cycle of the engine a great deal of heat is generated. It is important that the engine is kept at its normal operating temperature to achieve maximum efficiency. It is the function of the cooling system to allow the engine to reach this temperature quickly and then maintain it.

Maintenance information for some components pertaining to the cooling system is contained within the Manufacturer's engine manual and is available as a stand-alone document on JCB Service Pro.
Refer to: servicepro.jcb.com.

Health and Safety

⚠ **CAUTION** The cooling system is pressurised when the coolant is hot. When you remove the cap, hot coolant can spray out and burn you. Make sure that the engine is cool before you work on the cooling system.

CAUTION Antifreeze can be harmful. Obey the manufacturer's instructions when handling full strength or diluted antifreeze.

Technical Data

(For: AJ48D)

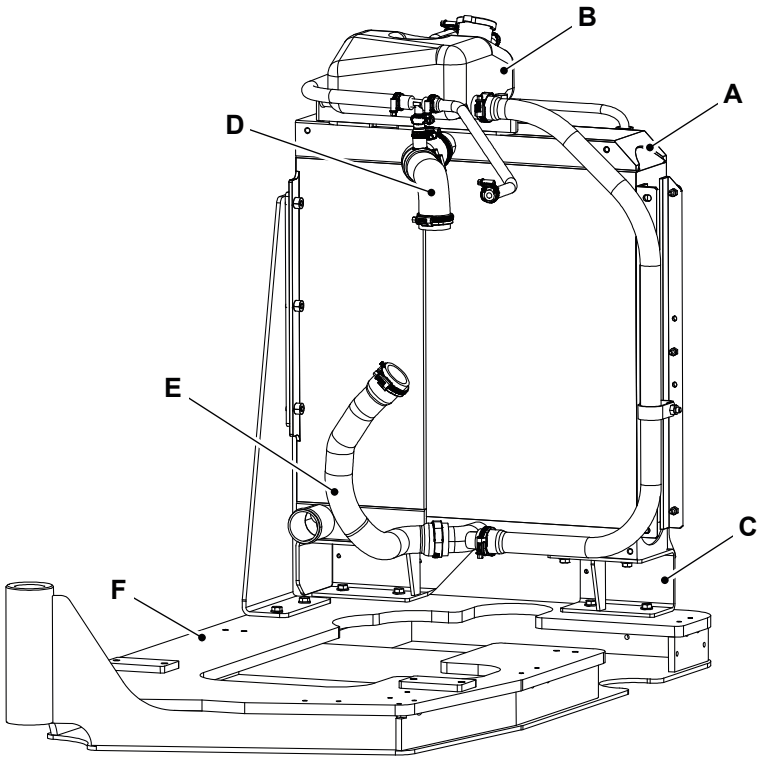
Table 47.

Thermostat	Wax element with by-pass blanking
Thermostat operating temperature:	79°C (174.1°F)
Stroke at 91°C (195.7°F)	7.5mm
Liquid recirculation (from 0.3bar (4.4psi)	0.15L/min
Water pump flow rate	75L/min

Component Identification

(For: AJ48D)

Figure 130.



A Cooling pack (radiator + CAC (Charge Air Cooler))
B Expansion tank
C Cooling system mounting
D Hose - from thermostat
E Hose - engine inlet
F Engine base

Fault-Finding

Fault

Coolant - Loss.	Table 48.	Page 21-6
Coolant - Over Temperature.	Table 49.	Page 21-6
Coolant - Under Temperature.	Table 50.	Page 21-7
Coolant - Contaminated.	Table 51.	Page 21-7

Table 48. Coolant - Loss.

Cause	Remedy
Incorrect coolant level.	Check the level.
Coolant leaking from engine radiator or cab heater.	Visually inspect the radiator heater, hoses and connection to locate the leak.
External engine coolant leak.	Visually inspect the engine and components for seal, gasket hose connection leaks. Make sure all hose clips are in good condition and torqued to the recommended figure. Make sure all spring band clamps are in good condition and apply sufficient pressure to the hoses.
Overheating or compression gases leaking, resulting in loss through the radiator overflow.	See Also: Table 49. Coolant - Over Temperature.
Lubricating oil cooler leak.	Check/replace the oil cooler. Check for coolant in the oil.
Cylinder head gasket leak.	Check/replace the head gasket.
Cylinder head cracked or porous.	Check/replace the cylinder head.
Crankcase coolant passages leaking.	Check/replace the crankcase.

Table 49. Coolant - Over Temperature.

Cause	Remedy
Incorrect coolant level (low).	Check the level. See Also: Table 48. Coolant - Loss.
External radiator matrix blocked with dirt or chaff.	Clean exterior or radiator matrix.
Air flow to the radiator inadequate or restricted.	Check/repair fan shroud, anti-recirculation sealing, shutters, fan sensors, fan speeds as required.
Coolant pump or fan drive belts loose.	Check/correct belt tension.
Radiator hose collapsed, restricted or leaking.	Check/replace hose.
Oil level overfilled.	Check oil level.
Cooling system pressure cap incorrect or faulty.	Replace cap with the correct rating for the system.
Over concentration of anti-freeze.	Remove part of the coolant from cooling system and replace with water.
Temperature sensor gauge faulty.	Verify that the gauge and temperature sensor are accurate.
Thermostat faulty, incorrect or missing.	Check/replace the thermostat.
Air or combustion gases in the cooling system.	Make sure the fill rate is not exceeded and the correct vented thermostat is installed. If aeration continued, check for a compression leak through the head gasket.
Coolant pump faulty.	Check/replace the coolant pump.

Cause	Remedy
Vent line from engine and/or radiator blocked or incorrectly routed (sudden overheating).	Check routing and operation or vent line.
Leak between the top tank and the auxiliary tank (sudden overheating).	Check for coolant leakage between radiator auxiliary tank and radiator top tank.
Cooling passages in radiator, cylinder head, head gasket or crankcase blocked.	Flush the system and fill with clean coolant.

Table 50. Coolant - Under Temperature.

Cause	Remedy
Air flow across the radiator excessive.	Check/repair fan shroud, anti-recirculation sealing, shutters, fan sensors, fan speeds as required.
Temperature sensor gauge faulty.	Check the electronic fault codes. Verify that the gauge and temperature sensor are accurate.
Thermostat faulty, (open - not sealing).	Check/replace the thermostat.
Coolant not flowing by temperature sensor.	Check/clean coolant passages. A total coolant loss may result in the gauge showing low temperature initially. In which case, check the level.

Table 51. Coolant - Contaminated.

Cause	Remedy
Coolant rusty, operation without correct mixture of antifreeze and water.	Drain and flush the cooling system. Fill with correct mixture of antifreeze and water. Review the coolant change interval.
Engine oil cooler, or cooler housing allowing cross contamination of coolant with engine oil.	Remove the oil cooler assembly and check relevant sealing elements for damage.
Lubricating oil leaks from lubricating oil cooler, head gasket, head and crankcase.	See Also: Table 48. Coolant - Loss.

Check (Level)

(For: AJ48D)

⚠ **CAUTION** The cooling system is pressurised when the coolant is hot. When you remove the cap, hot coolant can spray out and burn you. Make sure that the engine is cool before you work on the cooling system.

1. Make the machine safe.

   Refer to: PIL 01-03-27.

2. Make sure that the engine is safe to work on. If the engine has been running, let it cool before you start the service work.

3. Open the engine compartment cover.

   Refer to: PIL 06-06-06.

4. Get access to the expansion tank.

5. Check the level of coolant in the radiator and in the expansion tank.

6. If necessary, fill the cooling system with correct coolant.

Remove and Install

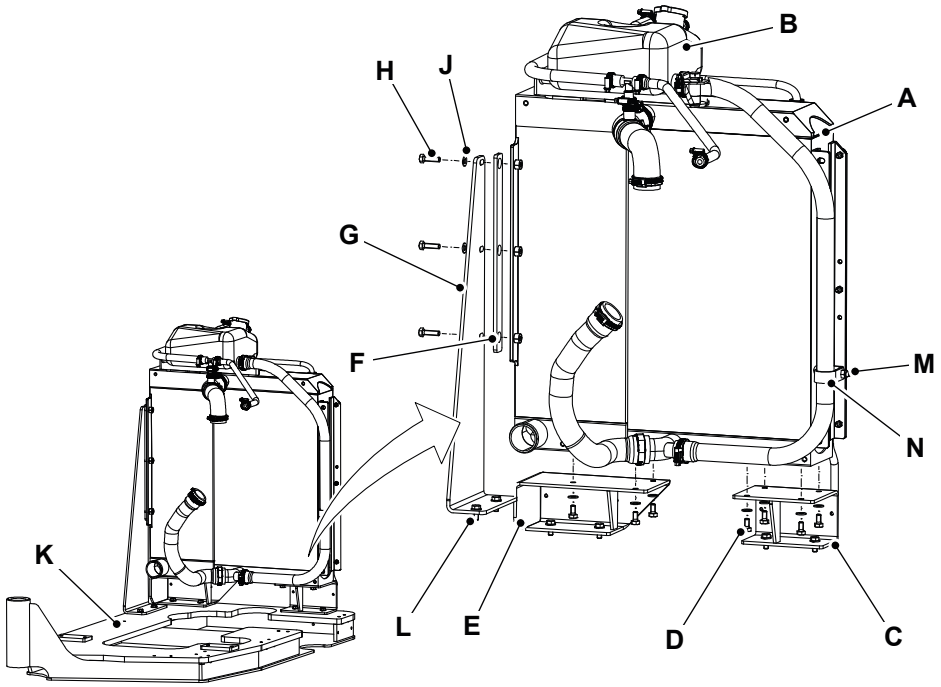
(For: AJ48D)

⚠ **CAUTION** The cooling system is pressurised when the coolant is hot. When you remove the cap, hot coolant can spray out and burn you. Make sure that the engine is cool before you work on the cooling system.

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Make sure that the engine is safe to work on. If the engine has been running, let it cool before you start the service work.
3. Get access to the engine.
4. Drain the cooling system.
   Refer to: Introduction (PIL 21-00-00).
5. Put a label on the hoses to help installation.
6. Mark the position of the clamps to help installation.
7. Loosen the screws and remove the clamps from all the hoses.
8. Disconnect the hoses.
9. Remove the setscrew 1 (x7), setscrew 2 (x7) and washer from the cooling system mounting.
10. Remove the reservoir draw plate from the cooling system.
    10.1. Remove the setscrew 2 (x3) and plain washer (x3).
11. Remove the cooling system from engine base.
12. Remove the radiator hose.
    12.1. Remove the locknut, spacer and p clip bracket.

Figure 131.



A Cooling system
B Expansion tank
C Cooling system mounting - right hand
D Setscrew 1
E Cooling system mounting - left hand
F Foam seal
G Reservoir draw plate
H Setscrew 2
J Washer (x16)
K Engine base

L Setscrew 3
M P clip bracket
N Locknut
P Spacer (not shown)

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Tighten the hoses, clamps and fasteners to the correct torque value.
3. Fill the cooling system with the correct coolant.

Table 52. Torque Values

Item	Nm
D	12.7
L	22
N	28
H	12.7

03 - Cooling Pack

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21-03-21 Guard 21-17

12 - Hydraulic Oil Cooler

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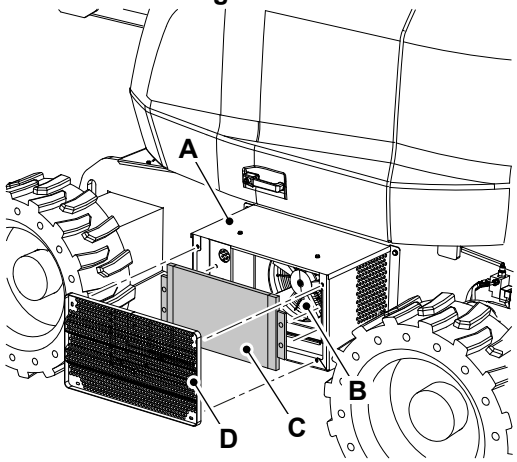
Operation 21-14
Remove and Install 21-15

Component Identification

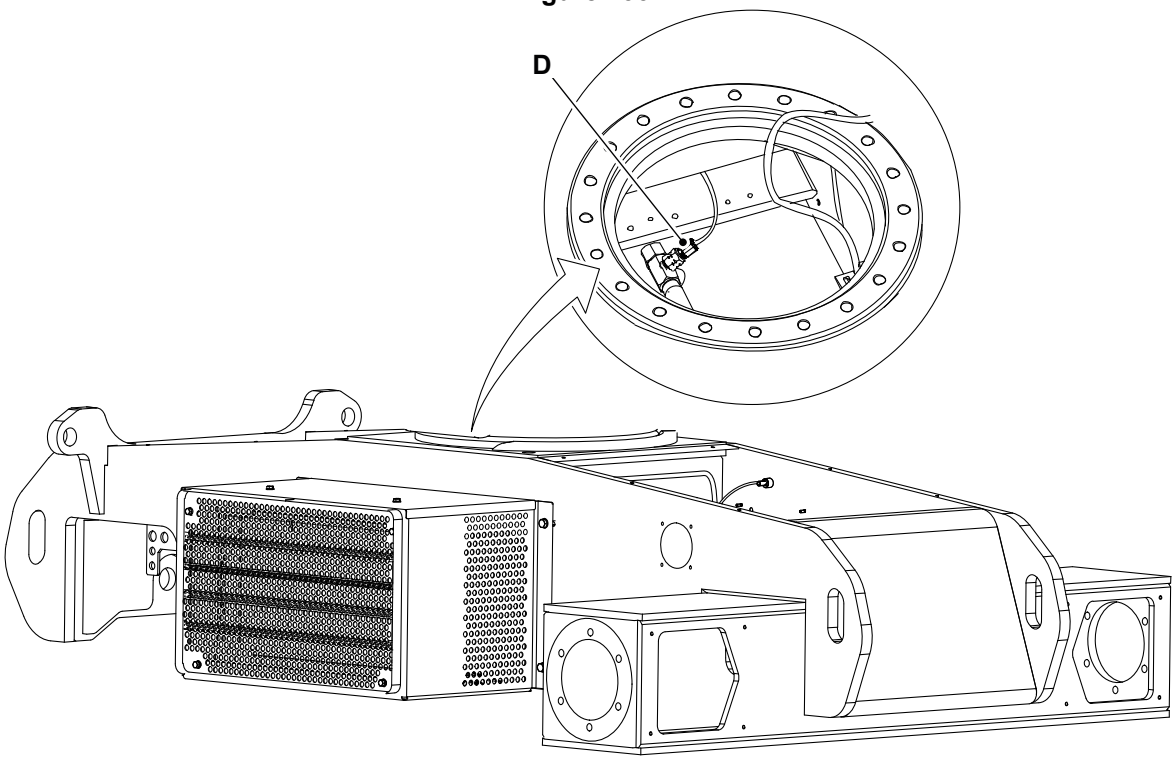
(Optional)

Figure 132.



A Casing
B Fan
C Cooler
D Grill

Figure 133.



D Hydraulic oil temperature sensor

Operation

(Optional)

Heat contamination reduces oil viscosity, which in turn reduces the fluid’s ability to lubricate components which can result in excess wear and failure of relatively moving/rotating components.

Heated oil causes excess wear on seals, surfaces, and other components, which can cause particulate buildup, damage components, and shorten the system's life span.

Heat contamination also changes the chemical properties of hydraulic oil.

Hydraulic oil cooler, also called heat exchanger, use ambient air to cool oil in hydraulic systems.

Oil cooler is a coil structure through which hot oil is passed, externally powered fan pushes ambient air over coil surface, and thus cools hydraulic fluid.

Remove and Install

Hydraulic Oil Temperature

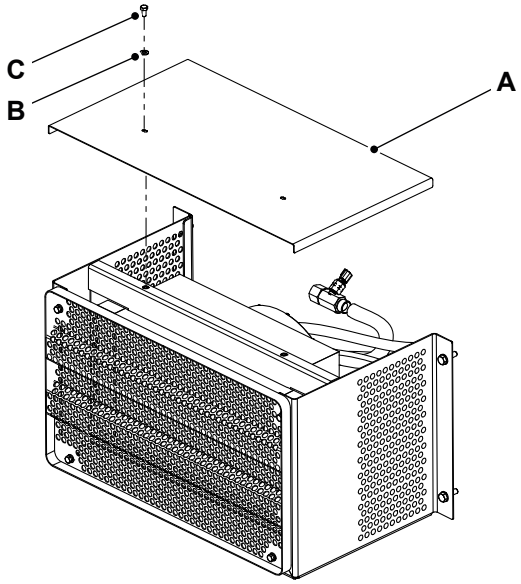
The temperature of the hydraulic oil will be high soon after stopping the machine. Wait until it cools (less than 40 °C (104 °F)) before beginning maintenance.

(Optional)

Remove

1. Make the machine safe.
   Refer to: PIL 01-03.
2. Remove set screw1 (x2), plain washer (x2) and then remove top cover.

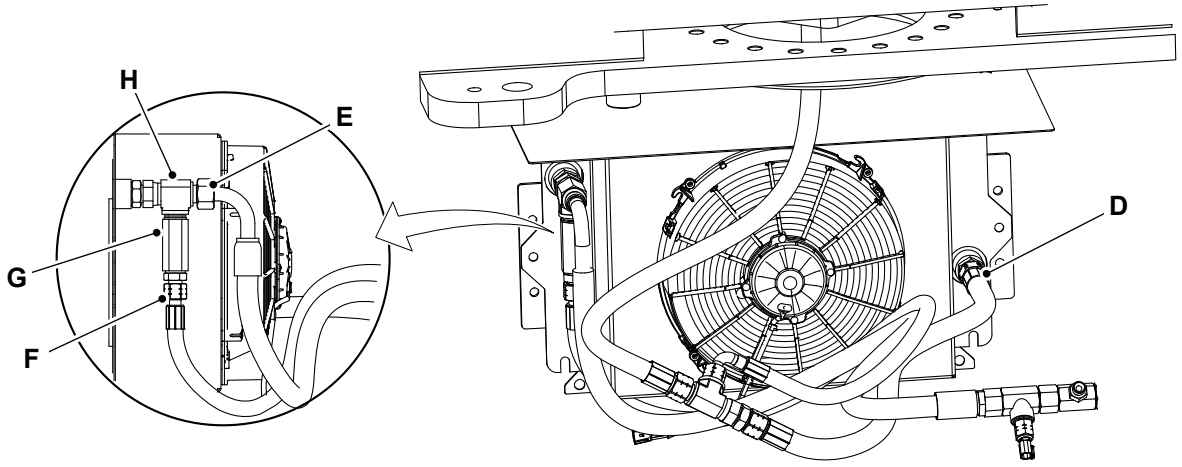
Figure 134.



A Top cover
B Plain washer (x2)
C Set screw1 (x2)

3. Put labels on hydraulic hoses for identification to help installation.
4. Arrange suitable container to collect spilling oil if any.
5. Disconnect hose1, hose2 and hose3 from the oil cooler.

Figure 135.

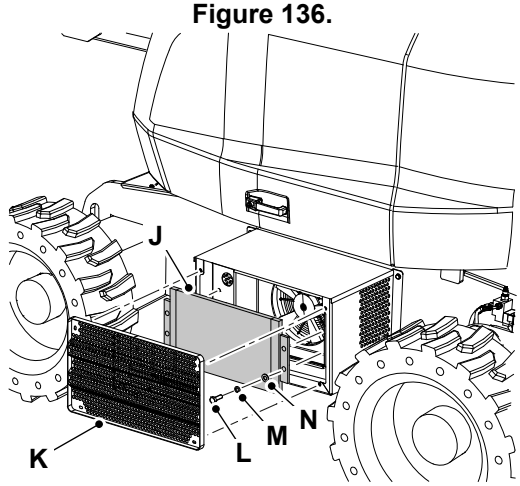


D Hose1
E Hose2
F Hose3
G Bypass check valve
H 3-way adapter

6. Plug open ends of the hoses.

7. Remove the bypass check valve. Refer to Figure 135.
8. Remove the 3-way adapter. Refer to Figure 135.
9. Remove the grill before oil cooler.
   Refer to: Remove and Install (PIL 21-03-21).
10. Remove set screw2 (x4), spring washer (x4) and plain washer (x4) from the oil cooler.

Figure 136.



J Hydraulic oil cooler
K Grill
L Set screw2 (x4)
M Spring washer (x4)
N Plain washer (x4)

11. Plug open ends of the oil cooler.

Install

1. The installation procedure is opposite of the removal procedure. Additionally do the following steps.
2. Make sure no cross connections of the hoses.
3. Dispose of collected oil according to local regulations.

Table 53. Torque Values

Item	Description	Nm
C	Set screw1 (x2)	22
D	Hose1	90 ± 5
F	Hose3	60 ± 5
G	Bypass check valve	90 ± 5
L	Set screw2 (x4)	22

21 - Guard

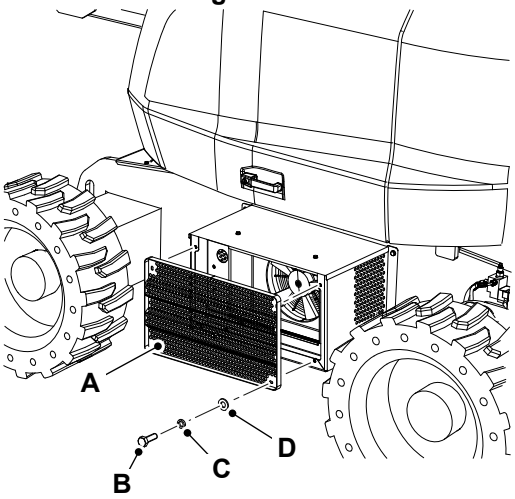
Remove and Install

(Optional)

Remove

1. Make the machine safe.
   Refer to: PIL 01-03.
2. Access the hydraulic oil cooler casing.
3. Remove set screw (x4), spring washer (x4) and plain washer (x4) with grill.

Figure 137.



A Grill
B Set screw (x4)
C Spring washer (x4)
D Plain washer (x4)

Install

1. The installation procedure is opposite of the removal procedure. Additionally do the following steps.
2. Tighten the set screw (x4) with correct torque value.

   Torque: 22N·m

Notes:

24 - Brake System

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Acronyms Glossary

ARV	Auxiliary Relief Valve

18 - Park Brake

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Check (Pressure) 24-9

Introduction

The brakes are installed on the front and rear wheels of the machine and they are integral parts of the hub.

The brakes installed on the machine are park brake only, there are no service brakes installed.

The hydrostatic drive system accelerates and decelerates the machine.

The park break will release during travel time, when park solenoid valve signalled to open. The pressure from the transmission circuit causes the brakes to release.

Health and Safety

Working Under the Machine

Make the machine safe. Make sure the park brake is engaged and machine is fully isolated. Remove the machine key switch, disconnect the battery. Use blocks to prevent unintentional movement of the wheels.

Springs

Always wear personal protective equipment when dismantling assemblies containing components under pressure from springs. This will protect against eye injury from components accidentally flying out.

WARNING! *Before working on the brake system, make sure that the machine is on solid level ground. Put blocks on all wheels to prevent the machine rolling.*

WARNING! *Before testing the park brake make sure the area around the machine is clear of people.*

WARNING! *Do not use a machine with a faulty park brake.*

WARNING! *Do not use the machine with any part of its brake system disconnected or inoperative. When the test has been completed, make sure all brake system components are installed and the system is operating correctly.*

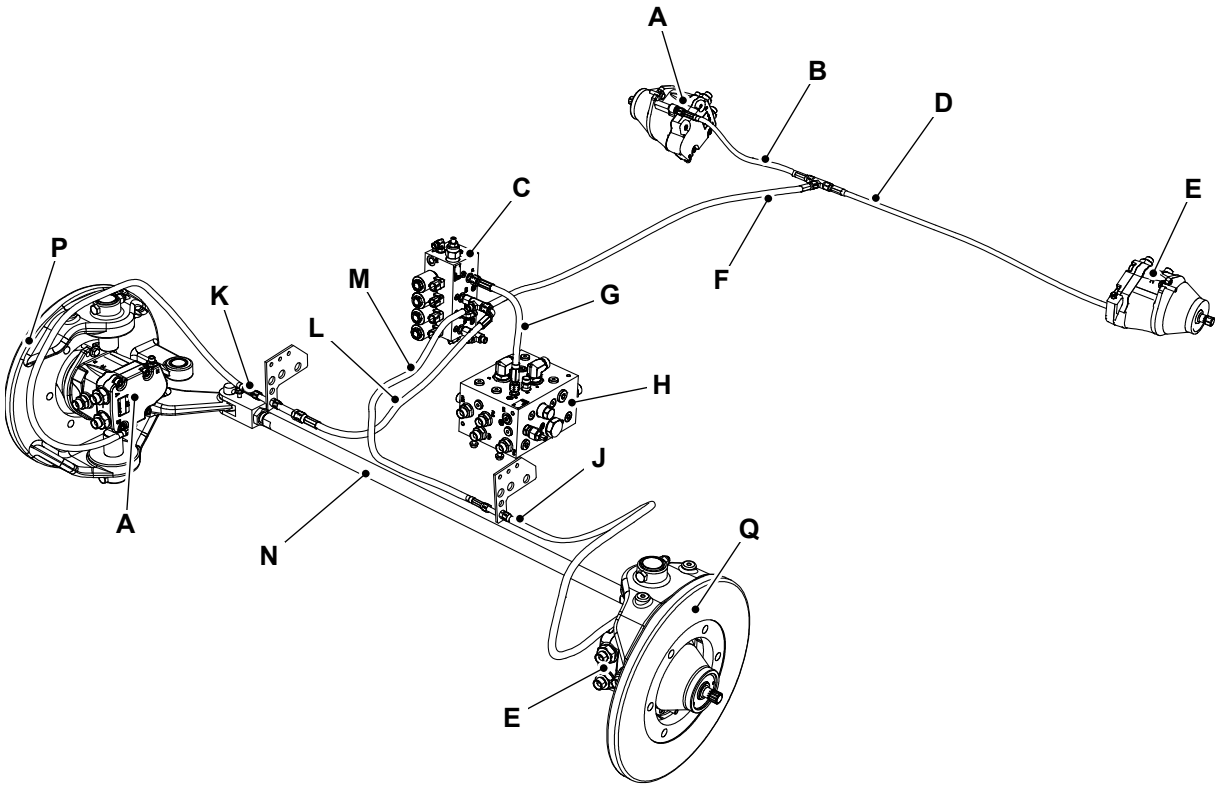
Technical Data

Table 54. Brake control valve

Description	Data
Flow rating	11L/min
System operating pressure	280bar (4,061.1psi)
ARV (Auxiliary Relief Valve)- brake circuit	35bar (507.6psi)
Temperature	-20–100°C (-4.0–211.9°F)
Voltage	12 -1.2/+3V
Current	Maximum 1.67A
	Normal 1.04A
Power	20W

Component Identification

Figure 138.



A Left side drive motor

B Hose- brake release to left hand side motor (Blue colour band)

C Brake valve

D Hose- brake release to right hand side motor (Blue colour band)

E Right side drive motor

F Hose- brake valve to brake release (Blue colour band)

G Hose- brake valve to transmission valve (Orange colour band)

H Transmission valve

J Hose- adaptor bulkhead to both side motors

K Adaptor bulkhead

L Hose- brake valve to left adaptor bulkhead (Yellow colour band)

M Hose- brake valve to right adaptor bulkhead (Green colour band)

N Steering linkage

P Torque hub right side

Q Torque hub left side

Operation

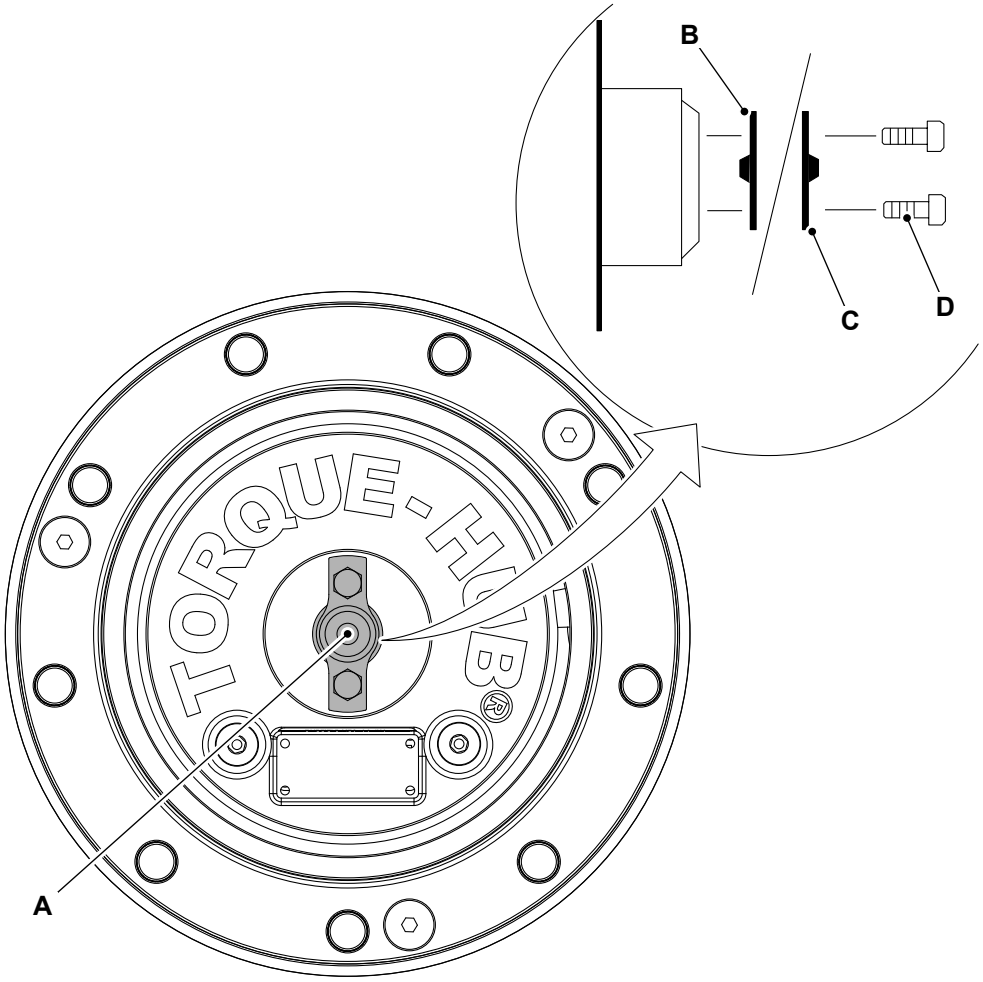
Manual Brake Deactivation

Manual brake deactivation is required when there is machine failure and machine needs to be towed to the safe maintenance site. Do not tow machine for a distance more than 200m. Before towing make sure that the oil level in the hub is appropriate.

Do not keep the brake deactivated for a duration more than 0.5h

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Remove the screw (x2).
3. Remove the disengage cap from the hub.
4. Flip the disengage cap and install to the hub.
5. Tighten the screw (x2)
6. Do the steps 1 to 5 to other hubs.
7. After towing operation install the disengage cap in its original position on all four hubs.

Figure 139.



A Disengage cap
B Disengage cap (brake disengaged position)
C Disengage cap (brake engaged position)
D Screw (x2)

Fault-Finding

Fault

Brake slips	Table 55.	Page 24-8
Brake drags or runs hot	Table 56.	Page 24-8
Brake not releasing	Table 57.	Page 24-8

Table 55. Brake slips

Cause	Remedy
Excessive pressure in the hydraulic system	Check the filters, hose size, restrictions in other hydraulic components.
Oil in the brake (If designed for dry use)	Replace oil seal in the brake. Check motor seal and piston seals. Check and clean the internal components. If necessary, replace the damaged components.
Disc plates worn	Check the disc thickness.
Springs broken or have taken a permanent set	Check the release pressure. If necessary, replace the spring.

Table 56. Brake drags or runs hot

Cause	Remedy
Low actuation pressure	Connect the pressure gauge to the bleed port and check pressure with system ON.
Bearing failure	Replace the bearing.

Table 57. Brake not releasing

Cause	Remedy
Stuck or clogged valve	Connect the pressure gauge to the bleed port and check pressure with system ON. If necessary, replace the inoperative line or component.
Damaged O-rings	Replace the O-rings.
Discs frozen	Replace the disc.

Check (Pressure)

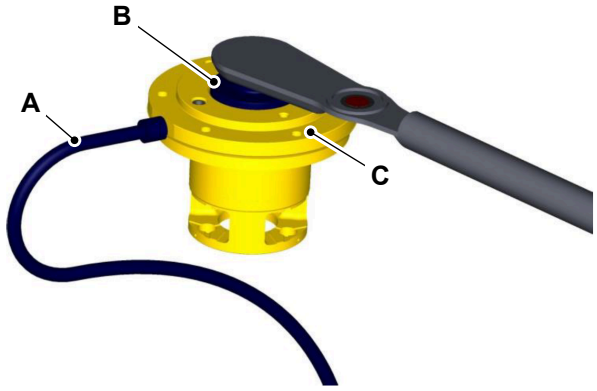
⚠ **WARNING** Before testing the park brake make sure the area around the machine is clear of people.

1. Make the machine safe.
   Refer to: PIL 01-03.
2. Install a hydraulic hand pump with pressure gauge into the brake port.
3. Place the suitable tool into input coupling.
4. Try to rotate the tool and keep increasing the pressure at the same time, until the brake releases.
   4.1. Make a note that the brake is released when the rotation is possible.
5. Make a note of the brake release pressure. Refer to Table 58.
   5.1. If the brake pressure is not within specified limit, contact your JCB dealer.
6. Increase the pressure to maximum and hold the pressure for specified time. Refer to Table 58.
   Duration: 1min
7. If brake loses pressure, contact your JCB dealer.
8. Roll check the unit for one revolution by rotating the tool.
9. Discharge the pressure.
10. Make a note of the pressure at which the brake locks up.
11. Clean the excess fluid from around brake port and install the pipe plug.

Table 58.

Description	Number of Spring	Initial Release Pressure	Full Release Pressure	Maximum Pressure	Torque Rating
Brake	14	7.24bar (105.0psi)	19.37bar (280.9psi)	68.95bar (1,000.0psi)	120N·m

Figure 140.



A Pressure gauge pipe
B Tool
C Spindle

Notes:

25 - Steering System

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Acronyms Glossary

2WS	Two Wheel Steer

00 - Steering System

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Introduction

The steering is controlled by the hydraulic system and the boom pump through the main control valve. There are two double acting single end steering cylinder rams
Refer to: PIL 30-15-34. installed on the front drive wheels.

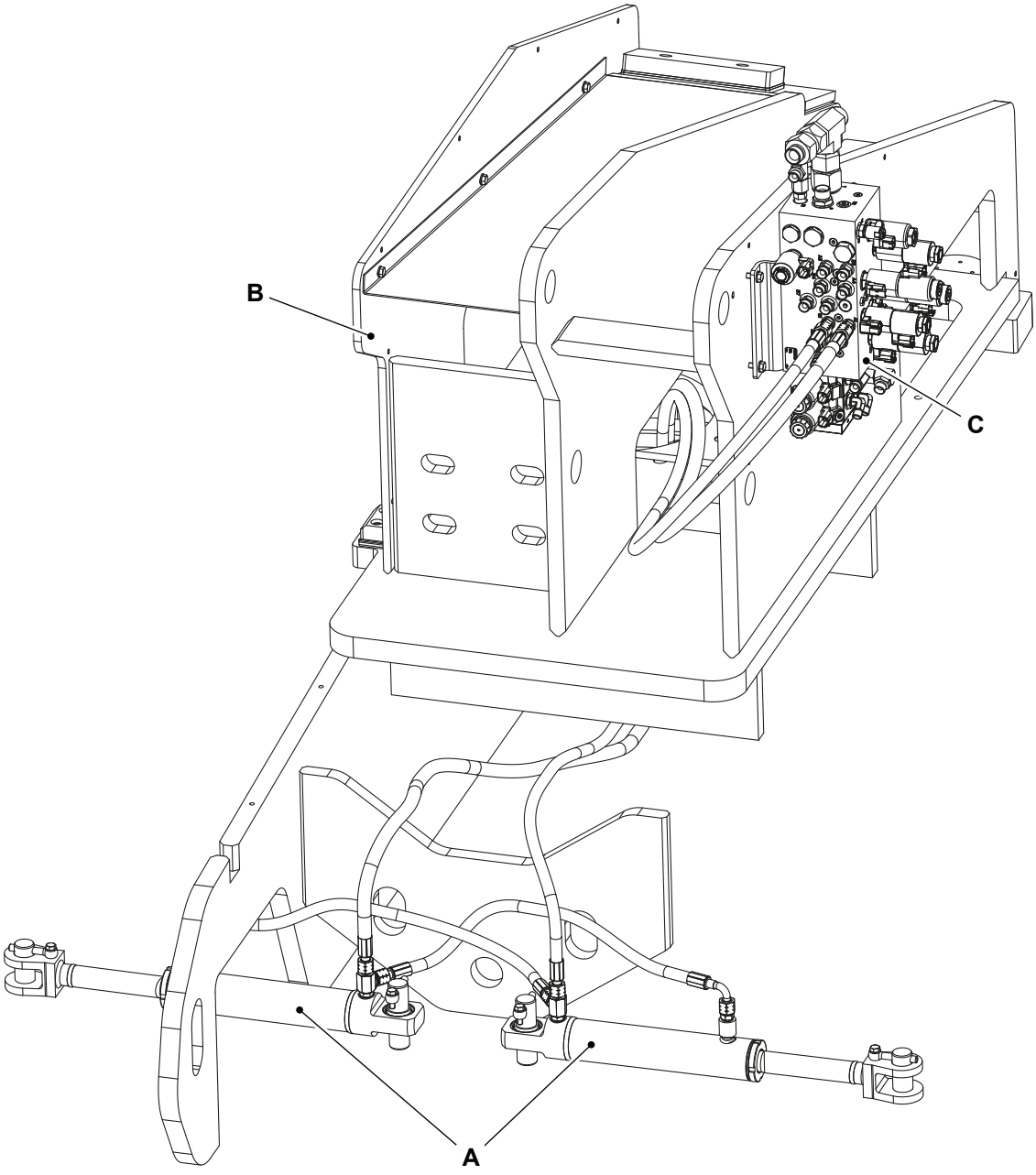
Technical Data

Table 59.

Description	Data
Type	2WS (Two Wheel Steer)
Inner wheel turning radius	2.7m
Outer wheel turning radius	4.7m

Component Identification

Figure 141.



A Steering ram
B Turntable
C Main control valve

33 - Link Arm

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00 - General

Remove and Install

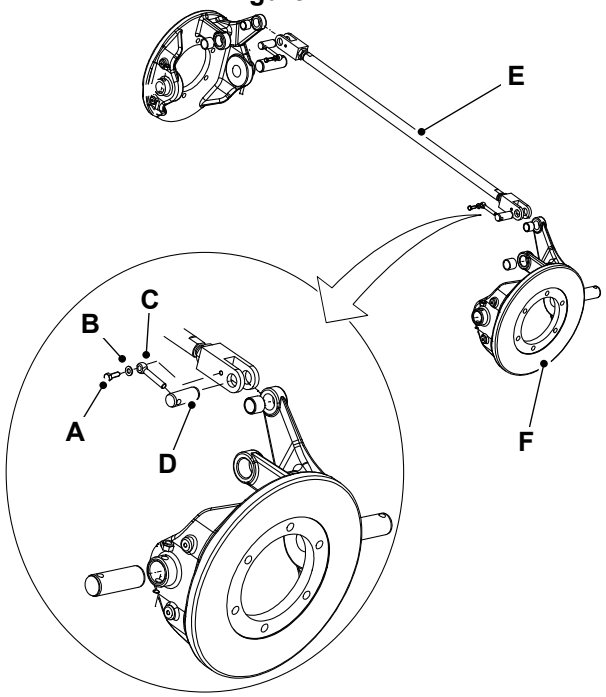
Remove

1. Make the machine safe with the platform lowered.

   Refer to: PIL 01-03-27.

2. Remove the bolt (x2) and washer (x2) from the pin (x2).
3. Remove the pin (x2).
4. Remove the pivot pin (x2) from the steering link rod.
5. Remove the steering link rod from the wheel hub.

Figure 142.



A Bolt
B Washer
C Pin
D Pivot pin
E Steering link rod
F Steering knuckle

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Tighten the bolt to the correct torque value.

Table 60. Torque Values

Item	Nm
A	22

27 - Driveline

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Acronyms Glossary

ARV	Auxiliary Relief Valve

00 - Driveline

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Introduction

The driveline system installed on this machine is an electrically operated and a hydraulically driven system. It consists of the following components:

- Axle oscillation system.
  Refer to: PIL 27-20-01.
- Hub.
  Refer to: PIL 27-27-00.
- Wheel.
  Refer to: PIL 27-29-00.
- Wheel drive motor.
  Refer to: PIL 27-32-00.

Drive Orientation System

The drive orientation system is intended to indicate the operator conditions that could make the direction of movement of the chassis different than the direction of movement of the drive/steer control handle. The system indicates to the operator the need to match the yellow and white directional arrows on the platform control panel to the arrows on the chassis. The system uses a limit switch mounted on the underside of the turntable, an indicator light and an acknowledgment switch on the platform display panel.

The limit switch trips roughly when the boom is swung past a rear tire. When the turntable is in the normal drive position with the boom between the rear tires, no indications or interlocks are made. When the machine is actively driving and the turntable is swung past the switch point, the system is ignored until drive/steer functions will be disabled. The operator must engage the drive orientation system is enabled, the DOS indicator will be illuminated continuously and a 3s enable timer will be started and will continue for 3s after the end the last drive/steer command. If the timer expires, the DOS override switch must be re-engaged to enable drive/steer.

Technical Data

Table 61. Drive Motor

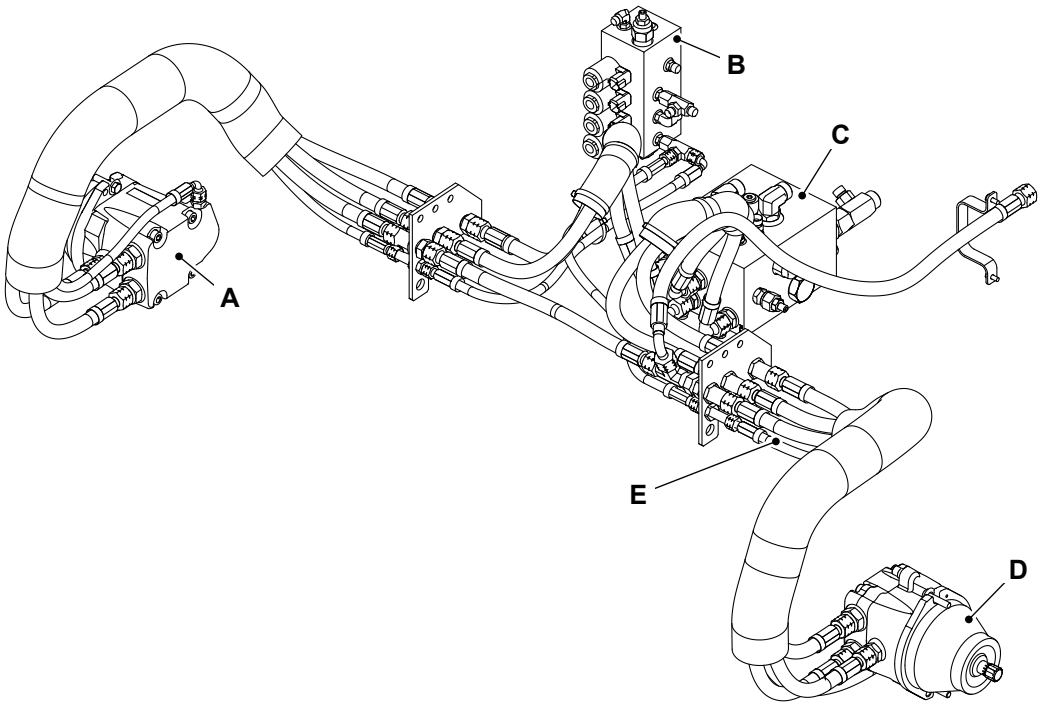
Description	Data
Motor type	Axial piston motor - variable displacement
Maximum working pressure	350bar (5,076.3psi)
Maximum displacement	30 cc/rev
Minimum displacement	11.34 cc/rev
Maximum flow at 30 cc/rev	118.3L/min
Rotation direction	Bi-directional
Shaft torque	226N·m

Table 62. Hub/Wheel gearbox

Description	Data
Gearbox ratio	57.49:1
Continuous output torque	3,390N·m
Intermediate output torque	6,780bar (98,335.6psi)
Oil quantity	0.68L
Brake initial minimum release pressure	7.24bar (105.0psi)
Brake full release pressure	19.37bar (280.9psi)
Maximum operating pressure	68.95bar (1,000.0psi)

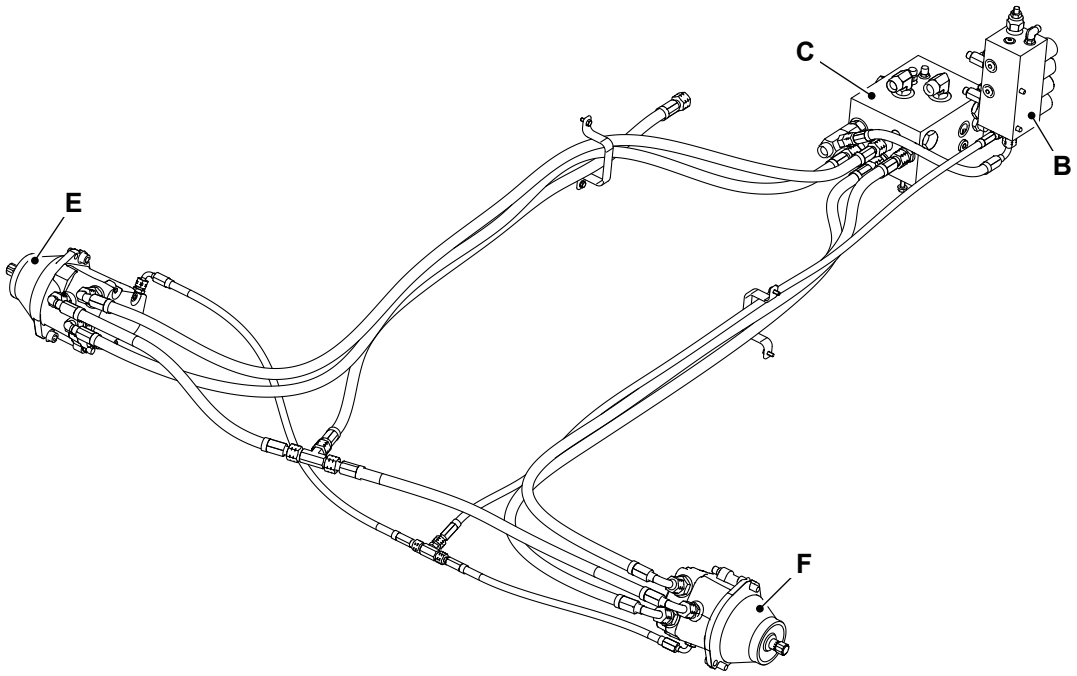
Component Identification

Figure 143. Front Drive Circuit



A Front drive motor - right side
B Brake control valve
C Transmission control valve
D Front drive motor - left side
E Drive circuit hoses

Figure 144. Rear Drive Circuit



B Brake control valve
C Transmission control valve
E Rear drive motor - left side
F Rear drive motor - right side

20 - Axle(s)

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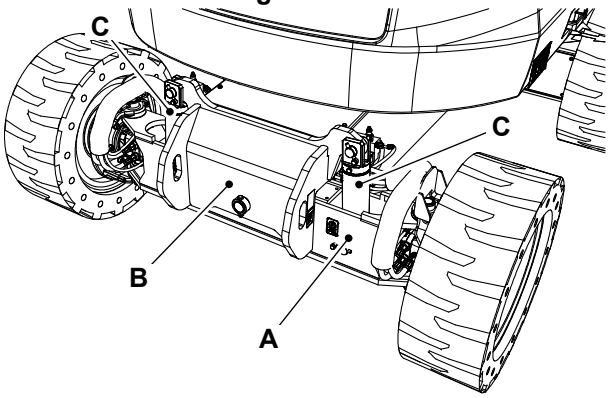
Introduction

The axles on this machine are structural components connecting the wheels to the chassis. The front axle is an oscillating axle. The rear axle is fixed to the chassis.

Component Identification

Figure 145.



A Front axle
B Chassis
C Oscillation cylinder ram (x2)

Remove and Install

Working Under the Machine

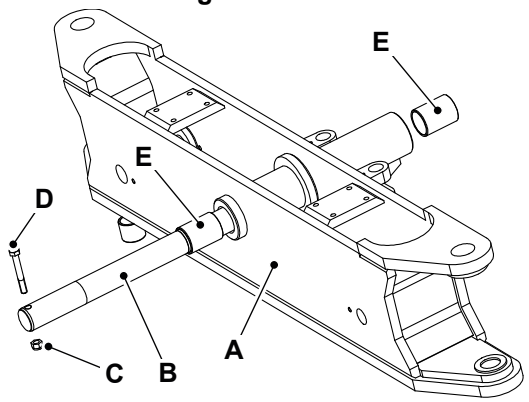
Make the machine safe before getting beneath it. Make sure that any attachments on the machine are correctly attached. Engage the park brake, remove the ignition key, disconnect the battery. If the machine has wheels use blocks to prevent unintentional movement.

CAUTION! *This component is heavy. It must only be removed or handled using a suitable lifting method and device.*

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
   Refer to: Discharge and Pressurise (PIL 30-00-00).
3. Disconnect the hydraulic hoses from the wheel drive motor.
4. Put a label on the hoses to help installation.
5. Plug all the open ports and hoses to prevent contamination.
6. Use suitable lifting equipment to lift the machine, then use a stand to support its axle.
7. Remove the wheel.
   Refer to: Remove and Install (PIL 27-29-00).
8. Remove the hub assembly.
   Refer to: Remove and Install (PIL 27-27-00).
9. Remove the wheel motor assembly.
   Refer to: Remove and Install (PIL 27-32-00).
10. Remove the oscillation axle ram.
    Refer to: Remove and Install (PIL 30-15-67).
11. Remove the bolt and lock nut from the from axle.
12. Remove the pivot pin and lubricating bush (x2) from the from axle.
13. Use the suitable lifting equipment, remove the axle from the machine.

Figure 146.



A Front axle
B Pivot pin
C Bolt
D Lock nut
E Lubricating bush (x2)

Remove

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Tighten the locknut to the correct torque value.

   Torque: 89.5N·m

01 - Axle Oscillation

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Introduction

The axle oscillation system allows the front axle to oscillate under certain conditions. The system consists of two oscillating axle rams, two pilot operated oscillating axle balance valves, and one solenoid operated flow control valve on the brake control valve.

The oscillating axle rams are installed on each end of the front axle and the two pilot operated oscillating axle balance valves are directly mounted to each ram. The pilot operated oscillating axle balance valve pilot lines are pressurised by the solenoid operated flow control valve on the brake control valve to enable the rams to move.

Component Identification

(For: AJ48D)

Figure 147.

A Front axle
B Oscillation lockout cylinder rams (x2)
C Pilot controlled ARV (Auxiliary Relief Valve)

Operation

The axle oscillation system enables the oscillating axle to be locked or unlocked according to boom position and drive requirements.

The oscillating axle system works in two ways:

1. It allows the axle to oscillate during travel on uneven ground with the platform in the standard travel position.
2. It creates increased stability by locking the axle so it cannot pivot when the boom is rotated away from the standard travel position, or when the booms are raised or extended out of the stowed position.

The front axle is attached to the frame by a pivot pin, which allows all four wheels to remain in contact with the ground when traveling on rough terrain. The axle oscillation system also incorporates two hydraulic cylinders connected between the frame and the axle.

The hydraulic cylinders permit axle oscillation when the boom is in the transport position and drive is commanded. The hydraulic cylinders will lock and hold the axle when drive is not commanded or when the boom is outside the transport position.

The cylinders unlock when pilot pressure is applied to the oscillating axle balance valves and lock when pilot pressure is removed. Pilot pressure is available from the transmission circuit and is controlled by a solenoid operated valve mounted on the brake control valve in the chassis. To ensure the oscillating axle system is functioning correctly, a pressure transducer is mounted between the brake control valve and the balance valves.

Oscillating Axle Lockout Test

Note: Lockout system test must be performed quarterly, any time a system component is replaced or when improper system operation is suspected.

Note: Make sure that the boom is fully retracted, lowered and centered between rear wheels prior to beginning lockout cylinder test.

1. Place a specified height block with ascension ramp in front of left front wheel.

   Dimension: 150mm

2. From platform control console, start engine.
3. Place the drive control lever to the forward and drive machine up ascension ramp until left front wheel is on the top of block.

   3.1. The oscillating axle should pivot so that the remaining 3 wheels remain in contact with the ground.

4. Activate swing control lever and position boom over right side of machine or raise the main boom enough to get it out of the transport position.
5. Place drive control lever to reverse and drive machine off of block and ramp.
6. Check the left front or higher rear wheel remains elevated in position off of ground.
7. Carefully return boom to stowed position (centered between rear wheels if swung or fully lowered if raised) when boom reaches stowed position, locknut cylinders should release and allow wheel to rest on ground, it may be necessary to activate drive to release cylinders.
8. Place a specified height block with ascension ramp in front of right front wheel.

   Dimension: 150mm

9. Place the drive control lever to the forward and drive machine up ascension ramp until right front wheel is on the top of block.

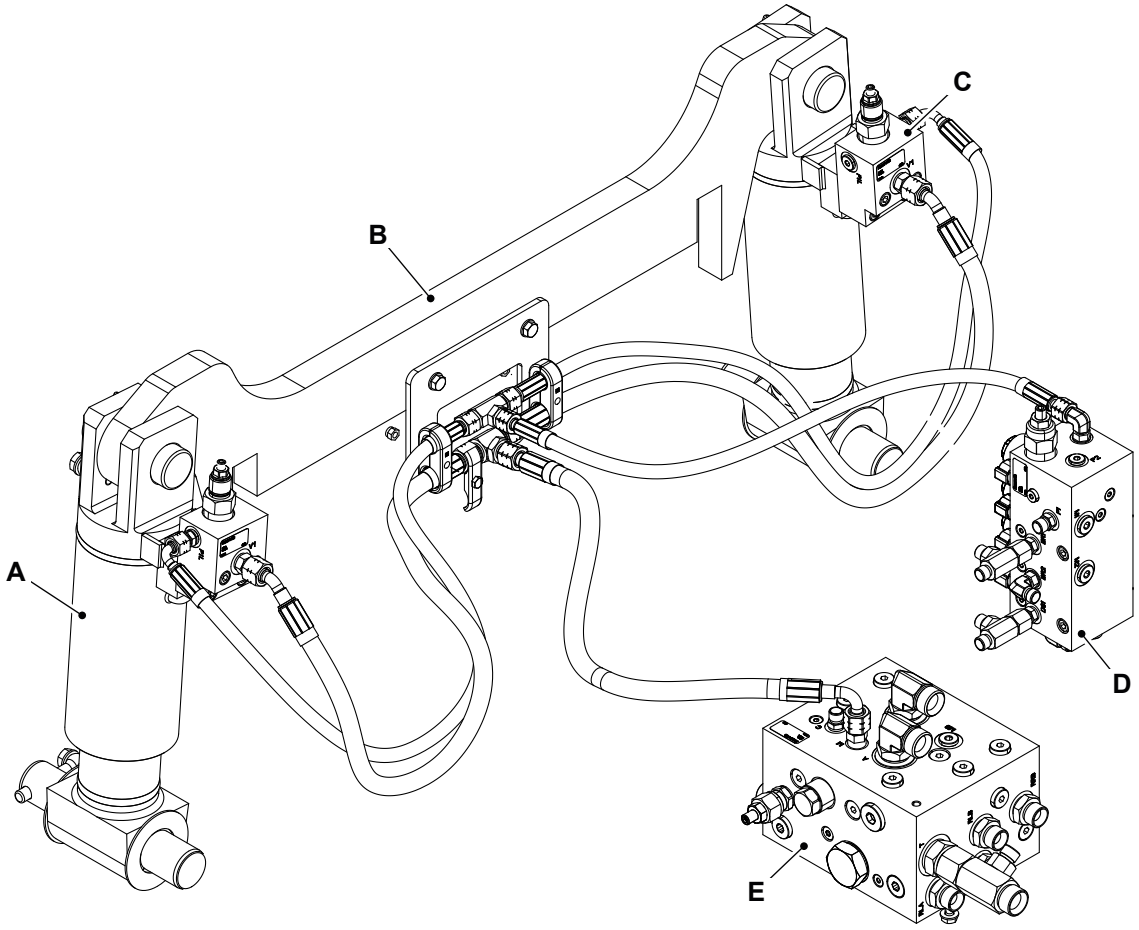
   9.1. The oscillating axle should pivot so that the remaining 3 wheels remain in contact with the ground.

10. Do the steps 4 and 7 to check the opposite side of the oscillating axle.
11. If lockout cylinders do not function properly, correct the malfunction prior to any further operation.

Diagram

(For: AJ48D)

Figure 148.



A Oscillation ram
B Chassis
C Counter balance valve
D Brake control valve
E Transmission control valve

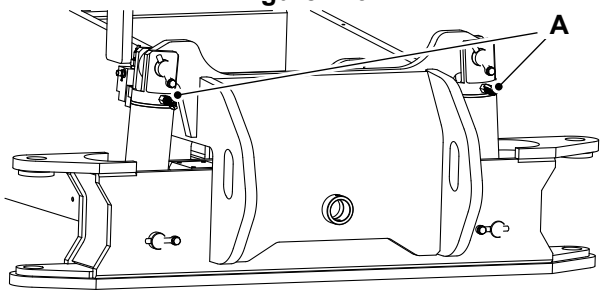
Bleed

(For: AJ48D)

1. Start the engine.
2. Position the turntable to the normal stowed position.
3. Attach clear tubing to bleed point nipple.
4. Position a small bucket/bottle in front of the axle oscillation ram bleed point and insert clear tubing.
5. Using a wrench to loosen the bleed point.
6. Bleed air from the top of axle oscillation ram. Collect hydraulic oil until a steady unbroken stream of hydraulic oil is viewed.
7. Tighten the bleed point adaptor to specified torque value while stream of hydraulic oil is running.

   Torque: 35–39N·m

Figure 149.



A Bleed point

27 - Hub

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Check (Leaks) 27-22
Check (Level) 27-22
Remove and Install 27-23

Introduction

The hub is the part of the axle where the wheel is mounted and where the axle shaft (if installed) passes through.

Some hubs are not driven and rotate due to motion of the machine and some driven hubs may also have reduction gearing installed.

The hub may also be designed to allow steering of the wheels and/or incorporate brakes.

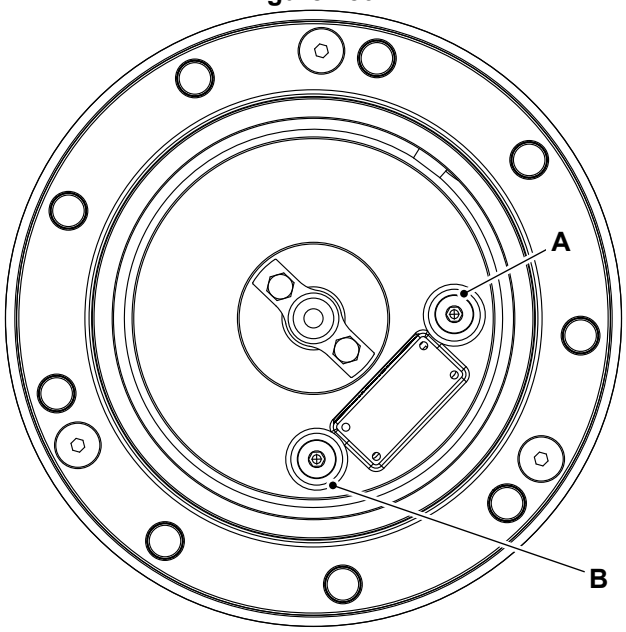
Drain and Fill

Make sure that you change the hub oil after correct intervals.
Refer to: PIL 78-24-06.

Drain

1. Make the machine safe.
   Refer to: PIL 01-03.
2. Park the machine on level ground.
3. Turn the wheel manually to move one plug to the vertical position and other to horizontal position.
4. Remove both the plugs.
5. Allow the oil to drain.
6. Make a note that, there will be a certain amount of residual oil that cannot be drained from the gearbox due to the internal configuration of the gearbox.

Figure 150.

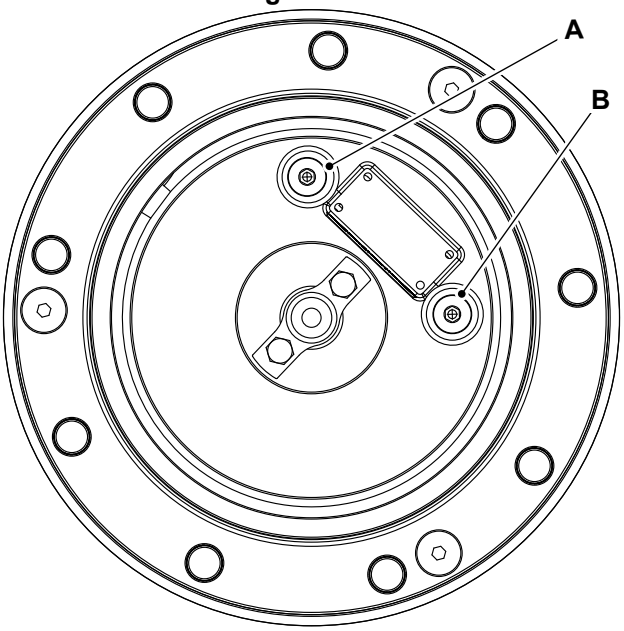


A Oil level plug (horizontal position)
B Oil level plug (vertical position)

Fill

1. Fill the hubs with the correct axle oil through the plug in top vertical position.
   1.1. When gearbox is half filled, the oil will start spilling from the plug in horizontal position.

Figure 151.



A Oil level plug (vertical position)
B Oil level plug (horizontal position)

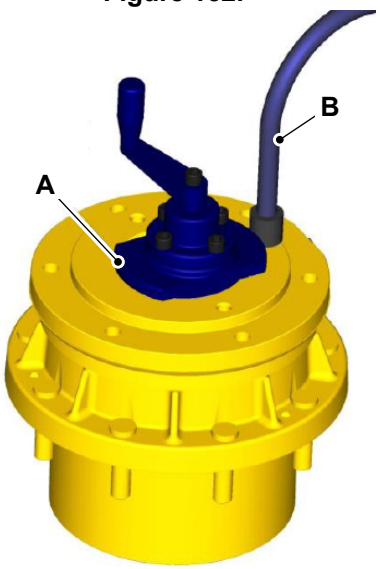
2. Clean and install both the cover pipe plugs.

Check (Condition)

The purpose of the roll test is to determine if the unit's gears are rotating consistently, easily and properly. If more drag is felt in the gears only at certain points, then the gears are not rolling consistently and easily and should be examined for improper installation or defects.

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Remove the gearbox from the machine.
3. Place it on a suitable workbench and install the roll test tool (Dana spicer part number T195650).
4. Rotate the gearbox both clockwise and counterclockwise the same number of turns as the ratio of the unit.
5. It should be able to rotate the gears in the unit applying constant force to the roll checker.
   5.1. If more drag is felt in the gears only at certain points, then the gears are not rolling consistently and easily and should be examined for improper installation or defects.
6. The brake must be released before performing the roll test.
   Refer to: Check (Leaks) (PIL 27-27-00).

Figure 152.



A Tool
B Pressure gauge pipe

Some gear packages roll with more difficulty than others. Do not be concerned if the gears in the unit seem to roll hard as long as they roll with consistency.

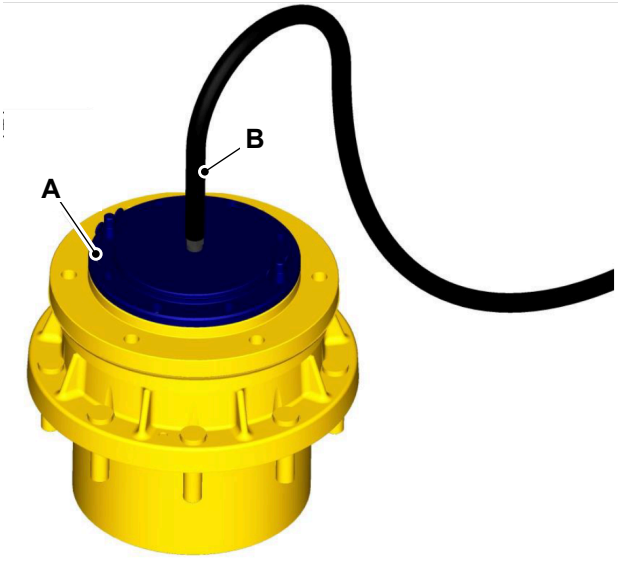
The gearbox ratio is the same number as the last three numbers on the ID tag.

Check (Leaks)

The purpose of the leak test is to make sure that the unit is air tight.

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Connect a suitable pressure gauge to the unit.
3. Pressurise the hub assembly to the specified pressure.
   Pressure: 0.69bar (10.0psi)
4. Wait for the specified duration.
   Duration: 20min
5. Check the reading on the pressure gauge.
   5.1. Make sure that the pressure in the hub assembly does not decrease.
6. If the pressure in the hub assembly decreases, do the following steps.
   6.1. Apply a solution of soap and water on to the pipe plug, main seal, O-rings and gasket.
   6.2. Check for signs of air bubbles.
   6.3. Replace the damaged parts.

Figure 153.



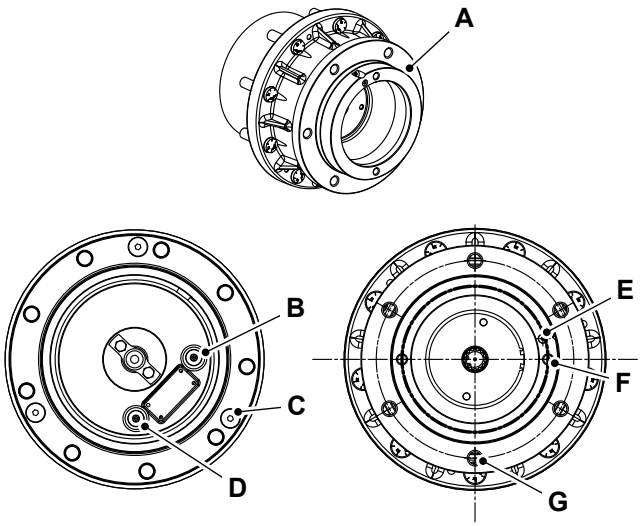
A Blanking plate
B Pressure gauge pipe

Check (Level)

⚠ **Notice:** Never operate the machine with the low hub oil level, otherwise severe damage to the hub internal components can occur.

1. Make the machine safe.
   Refer to: PIL 01-03.
2. Drive the machine to rotate the hub until side plugs are located one in vertical and other in horizontal position.
3. Make sure that the oil level mark on the hub is horizontal.
4. Remove the oil plug and check oil level.
5. Make sure that the oil is in level with the bottom of the oil plug hole. If necessary, top up with the correct axle oil.
6. Clean, apply pipe thread sealant and install the oil plug.
7. Repeat this procedure for each torque hub.

Figure 154.



A Gearbox wheel
B Oil plug (Horizontal position)
C Shipping cap screw
D Oil plug (vertical position)
E Brake port
F Motor mounting holes
G Spindle mounting holes

Remove and Install

Working Under the Machine

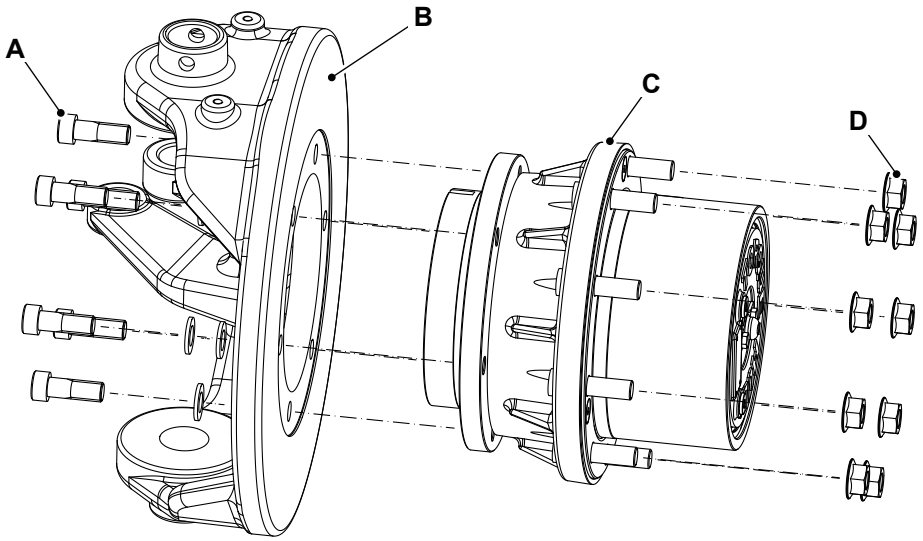
Make the machine safe. Make sure the park brake is engaged and machine is fully isolated. Remove the machine key switch, disconnect the battery. Use blocks to prevent unintentional movement of the wheels.

CAUTION! *This component is heavy. It must only be removed or handled using a suitable lifting method and device.*

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
   Refer to: Discharge and Pressurise (PIL 30-00-00).
3. If necessary, remove the wheel drive motor.
   Refer to: Remove and Install (PIL 27-32-00).
4. Disconnect the hydraulic hoses from the brake assembly.
5. Put a label on the hoses to help installation.
6. Remove and discard the O-rings.
7. Plug all the open ports and hoses to prevent contamination.
8. Place a jack under the hub assembly to support.
9. Remove the applicable wheel nut (x9) and remove the wheel from the machine.
   Refer to: Remove and Install (PIL 27-29-00).
10. Remove the capscrew (x6) and washer (x6).
11. Remove the hub assembly from the machine.

Figure 155.

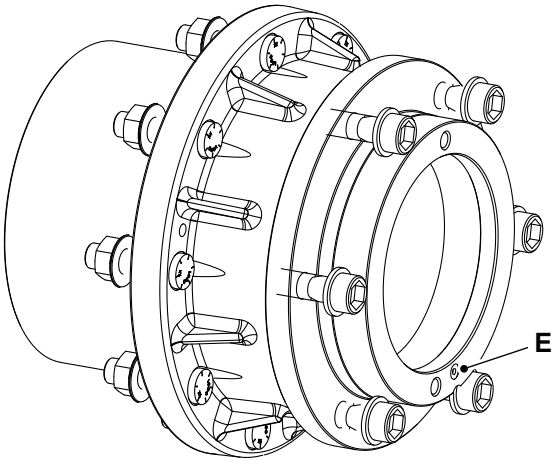


A Capscrew (x6)
B Steering knuckle
C Torque hub
D Wheel nut (x9)

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Align the brake port of the hub assembly to the brake port of the wheel drive motor.

Figure 156.



E Brake port

3. Tighten the capscrew (x6) and wheel nut (x9) to the correct torque value.

Table 63. Torque Values

Item	Nm
A	250
D	210

29 - Wheel

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Introduction

On new machines, and whenever a wheel has been removed, check the wheel nut torques every two hours until they stay correct. Every day, before starting work, check that the wheel nuts are tight. Tighten the wheel nuts (in a diagonal sequence) to the correct torque value, refer to Remove and Install.

Health and Safety

⚠ **WARNING** If, for whatever reason, a wheel stud is renewed, all the studs for that wheel must be changed as a set, since the remaining studs may have been damaged.

WARNING Wheels and tyres are heavy. Take care when lifting or moving them. Store with care to ensure that they cannot fall and cause injury. Use suitable lifting equipment if necessary.

WARNING Do not install pneumatic tyres on a wheel made for a solid tyre. Do not install a solid tyre on a wheel made for a pneumatic tyre. If you are unsure of the correct specification for your machine, contact your local JCB dealer or a trained specialist.

This machine has only been stability tested with solid-filled tyres. If semi-solid or inflated tyres are used the machine could be potentially unstable. Do not use tyres other than solid-filled tyres.

Remove and Install

⚠ **CAUTION** You can be injured if you use incorrect or faulty lifting equipment. You must identify the weight of the item to be lifted then choose lifting equipment that is strong enough and suitable for the job. Make sure that lifting equipment is in good condition and complies with all local regulations.

Important: The wheel and tyre assembly is heavy. Get the help of another person to remove and replace a wheel.

Check and tighten the wheel nuts. Follow the intervals in the Maintenance Schedules.
Refer to: PIL 78-24-03.

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Put chocks against the wheels.
3. Loosen the nuts in the sequence shown on the wheel to be exchanged. Refer to Figure 157.
4. Use suitable lifting equipment to lift the machine, then use a stand to support its axle.
5. Remove the nuts in the sequence shown from the wheel.
6. Move the wheel away from the machine.

Figure 157.

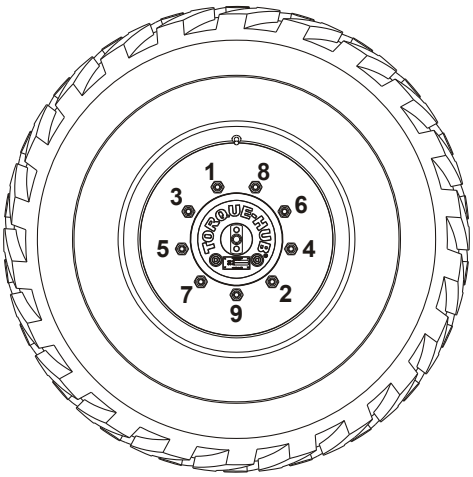
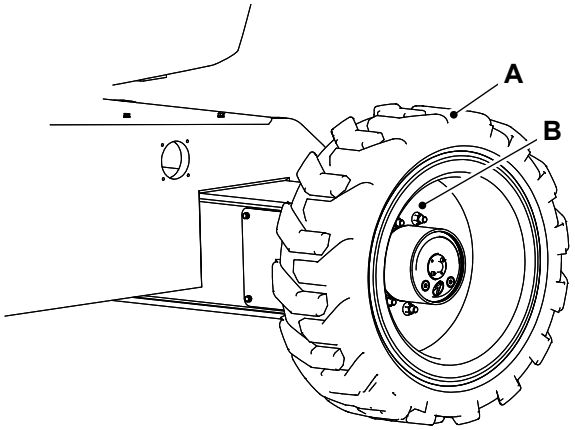


Figure 158.



A Wheel
B Wheel nut

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Tighten the nuts by hand.
   2.1. Do not use lubricant on threads on nuts.
3. Tighten the nuts to the correct torque value in the sequence shown. Refer to Figure 157.
   Torque: 210N·m

32 - Wheel Drive Motor

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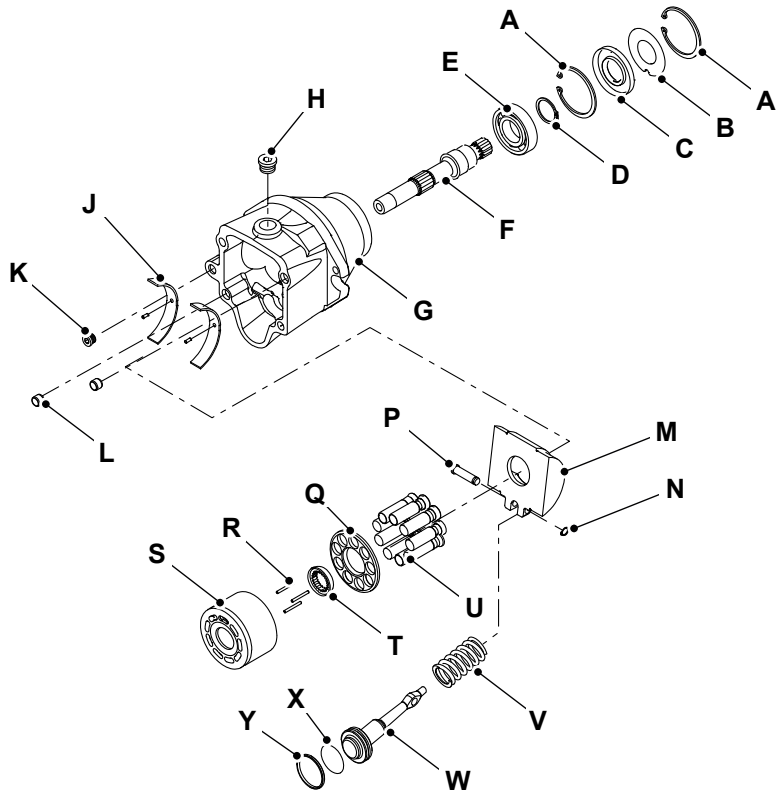
Introduction

The wheel drive motors installed on each wheel of this machine are variable displacement axle piston motors with an integral servo piston.

Component Identification

Figure 159.



A Retaining ring 1
B Seal support washer
C Lip seal
D Retaining ring 2
E Ball bearing
F Shaft
G Motor housing
H Plug assembly 1
J Journal bearing kit
K Plug assembly 2
L Pin 1
M Swashplate
N Retaining ring 3
P Pin 2
Q Slipper retainer
R Slipper hold down pin
S Cylinder block assembly
T Slipper retainer guide
U Piston assembly
V Spring
W Servo piston
X O-ring
Y Piston ring

Operation

The integral servo piston controls the motor displacement.

The motor is spring biased to maximum displacement and hydraulically shifted to minimum displacement. The minimum and maximum displacement of the motor can be set with fixed internal stops. The large diameter servo piston allows smooth acceleration and deceleration with relatively large circuit orifices.

Fault-Finding

Fault		
Unusual noises	Table 64.	Page 27-34
No or insufficient pressure	Table 65.	Page 27-34
Pressure/flow fluctuations	Table 66.	Page 27-34
Rotational speed or torque not achieved	Table 67.	Page 27-34
Oil heating	Table 68.	Page 27-35

Table 64. Unusual noises

Cause	Remedy
Insufficient bleeding of the hydraulic system.	Axial piston unit, suction line for the hydraulic pump and filling the reservoir.
	Completely air bleed axial piston unit and hydraulic system.
	Check correct installation position.
Output speed too high	Adjust the speed to the correct value.
Improper mounting of the axial piston unit.	Check the mounting of the axial piston unit. Tighten the fasteners to the correct torque value.
Attachment parts not installed correctly.	Install the attachment parts correctly. Tighten the fasteners to the correct torque value.
Mechanical damage to the motor.	Install new motor.

Table 65. No or insufficient pressure

Cause	Remedy
Insufficient bleeding of the hydraulic system.	Completely air bleed axial piston unit, suction line for the hydraulic pump and fill the reservoir with the correct hydraulic fluid.
Mechanical output drive is faulty.	Investigate and repair as necessary.
Drive power too low.	Investigate and repair as necessary.
Control device or controller of the axial piston unit faulty.	Investigate and repair as necessary.
Control of the control device faulty.	Investigate and repair as necessary.
Motor is worn.	Install new motor.
Drive unit defective.	Investigate and repair as necessary.

Table 66. Pressure/flow fluctuations

Cause	Remedy
Hydraulic system not or insufficiently air bled.	Completely air bleed the axial piston unit, suction line for the hydraulic pump and filling the reservoir with the correct hydraulic fluid.
	Check correct installation position.
Unstable control signal.	Investigate and repair as necessary.
Control device or controller faulty.	Investigate and repair as necessary.

Table 67. Rotational speed or torque not achieved

Cause	Remedy
Insufficient flow at hydraulic pump.	Check the function of the hydraulic pump.
Minimum or maximum displacement set incorrectly.	Investigate and repair as necessary.
Control of the control device faulty.	Check the control.
Pilot pressure or control pressure not sufficient.	Check pilot pressure or control pressure. Investigate and repair as necessary.

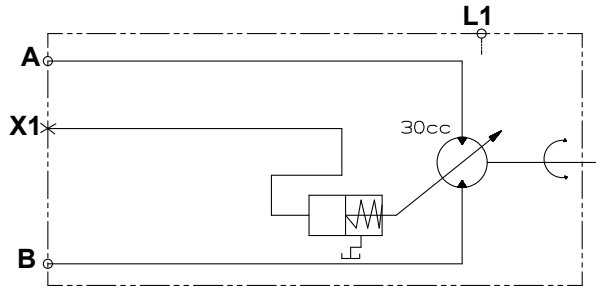
Cause	Remedy
Control device or controller of the axial piston motor faulty.	Investigate and repair as necessary.
Hydraulic fluid not in optimum viscosity range.	Change the oil for one with the correct viscosity.
Motor is worn.	Install new motor.
Wrong direction of rotation.	Check function of the hydraulic pump. Make sure the connections are correct. Refer to (PIL 27-32).

Table 68. Oil heating

Cause	Remedy
Excessive inlet temperature at the motor.	Check the functioning of the cooler and repair if necessary.
	Check the hydraulic fluid level and top up if necessary.
Pressure control valve faulty.	Investigate and repair as necessary.
Output speed too high.	Investigate and repair as necessary.
Flushing valve faulty.	Investigate and repair as necessary.
Motor is worn.	Install new motor.

Diagram

Figure 160.



A System port
B System port
X1 Control port
L1 Drain port

Remove and Install

Working Under the Machine

Make the machine safe. Make sure the park brake is engaged and machine is fully isolated. Remove the machine key switch, disconnect the battery. Use blocks to prevent unintentional movement of the wheels.

CAUTION! *This component is heavy. It must only be removed or handled using a suitable lifting method and device.*

Remove

1. Make the machine safe.

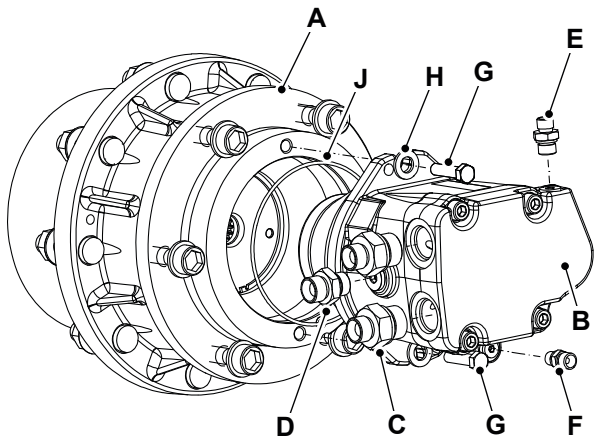
   Refer to: PIL 01-03-27.

2. Discharge the hydraulic pressure.

   Refer to: Discharge and Pressurise (PIL 30-00-00).

3. Disconnect the hydraulic hoses from the wheel drive motor.
4. Put a label on the hoses to help installation.
5. Plug all the open ports and hoses to prevent contamination.
6. Support the wheel drive motor with a suitable stand.
7. Remove the adaptors.
8. Remove the bolt (x2) and washer (x2).
9. Remove and discard the O-ring.
10. Remove the wheel drive motor from the brake assembly and hub.

Figure 161.



A Hub/wheel gearbox
B Wheel drive motor
C Adaptor 1
D Adaptor 2
E Adaptor 3
F Adaptor 4
G Bolt
H Washer
J O-ring

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Make sure that the brake port of the hydraulic motor is aligned with the brake port of the hub.
3. Tighten the fasteners to the correct torque value.

Table 69. Torque Values

Item	Nm
C	170–187
D	70–77
E	35–39
F	20–22
G	65

Disassemble and Assemble

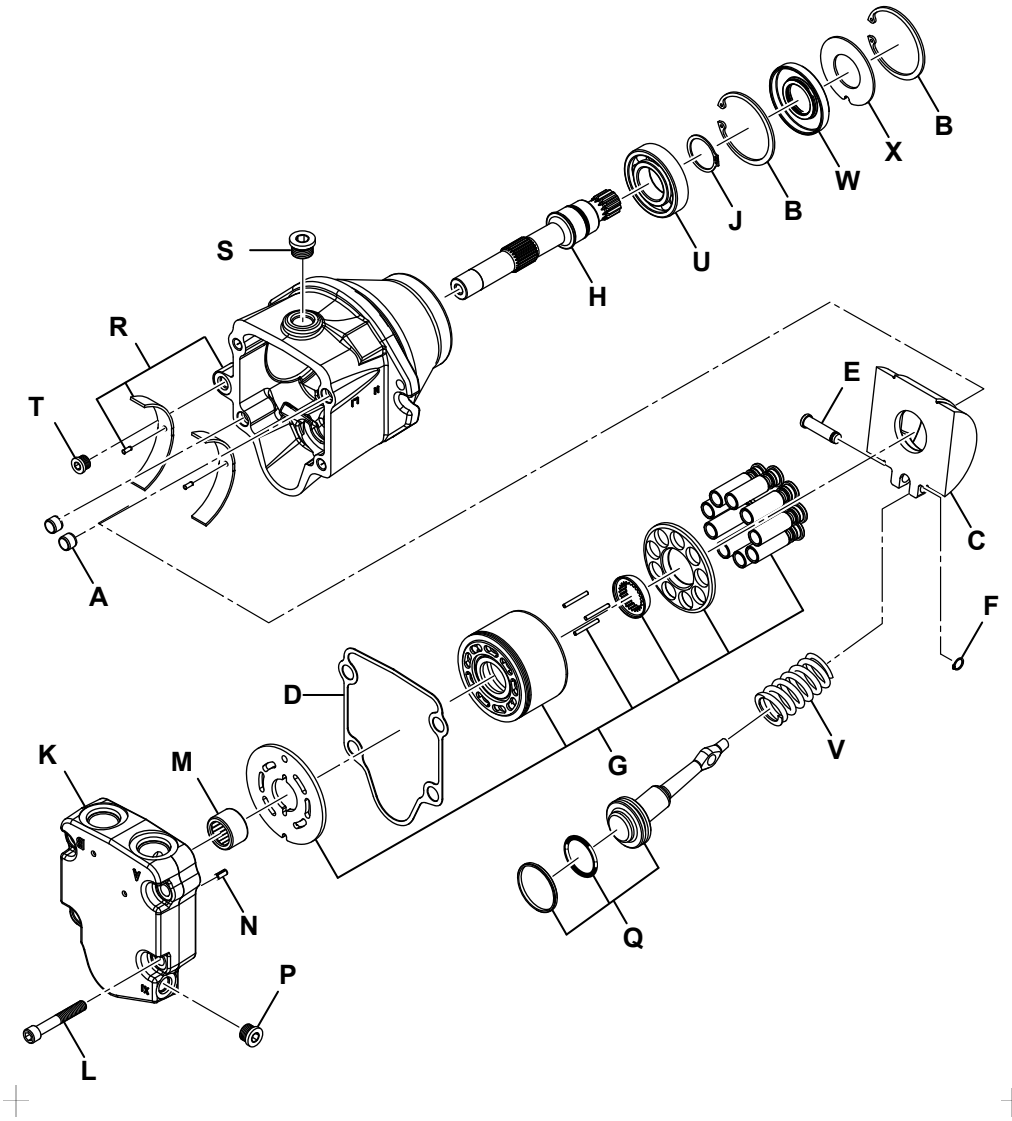
Disassemble

1. Remove the slew motor from the machine.
   Refer to: Remove and Install (PIL 27-32-00).

2. Disassemble the wheel drive motor.

   2.1. Use the alphabetical sequence shown on the illustration as a guide to disassembly. Refer to Figure 162.

Figure 162.



Assemble

1. The assembly procedure is the opposite of the disassembly procedure.

46 - Output Shaft Seal

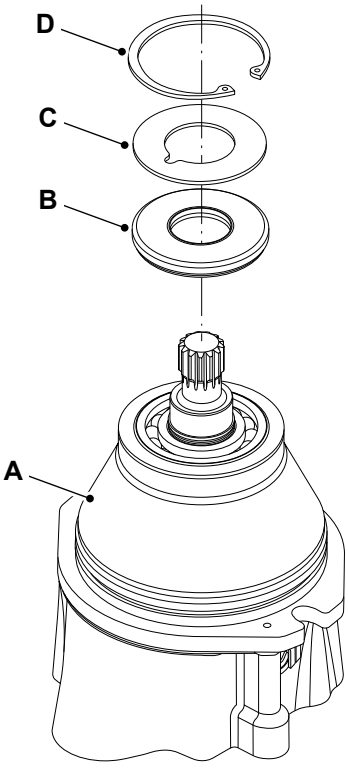
Remove and Install

Remove

Remove the output shaft seal if there is excessive leakage from the motor.

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Remove the wheel motor.
   Refer to: PIL 27-32-00.
3. Remove the retaining ring 1.
4. Remove the seal support washer.
5. Remove and discard the lip seal.
   5.1. To avoid damage to the shaft, install a large metal screw into the chuck of a slide hammer. Drive the screw into the seal surface and use the slide hammer to pull out the seal.

Figure 163.



A Motor housing
B Lip seal
C Seal support washer
D Retaining ring 1

Install

1. Check the condition of the output shaft and seal bore for rust, wear and contamination.
2. Cover the output shaft splines with an installation sleeve to protect the lip seal.
3. Install a new lip seal. Make sure that the cup side of the lip seal faces the motor.
4. Press the lip seal into the housing until it bottoms out. Press evenly to avoid binding and damaging the seal.
5. Install the seal support washer.
6. Install the retaining ring 1.
7. Remove the installation sleeve.

33 - Tyre

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Introduction

Tyres provide a flexible cushion that absorb shocks, while keeping the wheel in close contact with the ground.

Tyre materials are usually synthetic rubber, natural rubber, fabric and wire, along with other compound chemicals. They consist of a tread and a body. The tread provides traction while the body ensures support.

Make sure that the tyres are kept in good condition.

Health and Safety

⚠ **WARNING** Wheels and tyres are heavy. Take care when lifting or moving them. Store with care to ensure that they cannot fall and cause injury. Use suitable lifting equipment if necessary.

WARNING Running tyres outside recommended guidelines may result in failure of the tyres which at high speeds may endanger life.

WARNING Do not install pneumatic tyres on a wheel made for a solid tyre. Do not install a solid tyre on a wheel made for a pneumatic tyre. If you are unsure of the correct specification for your machine, contact your local JCB dealer or a trained specialist.

WARNING When ordering tyres, you must specify not only the tyre size but also the speed designation. The correct tyres for the machine are shown in the Operator's Manual. On no account should you use tyres of other designations without first gaining approval from the machine manufacturer.

This machine has been tested for stability with solid tyres only. If the semi-solid or inflated tyres are used, the machine could be potentially unstable. Do not use any tyres other than JCB recommended solid tyres. Refer to:
Refer to: Technical Data (PIL 27-33-00).

Technical Data

Table 70.

Tyre Size (Description)	Type	Width over Tyre	Tyre Width	Off
33 X 12 - 20/7.5 (SR02H)	Solid tyre	2,260mm	305mm	56r
33 X 12 D610 on 24 X 10 Wheel	Foam fill tyre	2,259.8mm	304.8mm	56r
33 X 12 D610 on 24 X 10 Wheel little foot	Turf tyre	2,250.9mm	295.9mm	56r
33 X 15.50 - 16.5 on 16.5 X 12 Wheel (Interim)	Turf tyre	2,425.4mm	391.2mm	95.

30 - Hydraulic System

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Acronyms Glossary

ARV	Auxiliary Relief Valve
DC	Direct Current
EDC	Electronic Displacement Control
HPRV	High Pressure Relief Valve
MRV	Main Relief Valve
PRV	Pressure Relief Valve
PWM	Pulse Width Modulation
QRC	Quick Release Coupling
RPM	Revolutions Per Minute
SPP	Service Parts Pro

Notes:

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Introduction

The hydraulic system is a power transmission system that uses the force of flowing liquids to transmit power to specific components in a machine.

To help you trace specific hydraulic problems to a faulty unit (valve, actuator, ram etc.), refer to Fault finding.
Refer to: PIL 30-00-00.

Once you have traced the faulty unit, refer to the relevant section for removal, disassembly and checking instructions.

To help identify circuits, valves, rams etc. mentioned in the fault finding procedures. Refer to the hydraulic schematic diagrams.
Refer to: PIL 30-00-50.

- Before you begin fault finding, read the Health and Safety Information.
  Refer to: PIL 30-00-00.
- Make simple checks before you remove or disassemble a major component.
- Make sure that the hydraulic fluid is at the correct working temperature 50°C (121.9°F).
- Whatever the fault, check the condition of the hydraulic fluid. Drain and replace if necessary. Refer to Hydraulic fluid quality in this procedure and Hydraulic System - Clean.
  Refer to: PIL 30-00-00.
- Make sure you remove ALL contamination and if possible identify its origin. It may be part of a component from elsewhere in the circuit.

Hydraulic Fluid Quality

This machine uses a large volume of fluid in the hydraulic system for power transmission, equipment lubrication, rust prevention and sealing. According to a survey conducted by a pump manufacturer, seventy per cent of the causes of problems in hydraulic equipment were attributable to inadequate maintenance of the quality of the hydraulic fluid. Therefore, it is obvious that control of the quality of the hydraulic fluid helps prevent hydraulic equipment problems and greatly improves safety and reliability. Furthermore from an economic angle it extends the life of the hydraulic fluid if quality is maintained.

Hydraulic Contamination

Once inside the system, hydraulic circuit contaminants greatly affect the performance and life of hydraulic equipment. For example, contaminants in a hydraulic pump develop internal wear to cause internal leakage and hence lower discharges. Wear particles generated will circulate with the hydraulic fluid to cause further deterioration in the performance of this and other equipment. Contaminants also

enter principal sliding sections of the equipment causing temporary malfunction, scuffing, sticking and leakage and can lead to major problems. The main contaminants can be classified as follows:

1. Solid Particles - Sand, fibres, metallic particles, welding scale, sealing materials and wear particles etc.
2. Liquid - Usually water and incompatible oils and greases.
3. Gases - Air, sulphur dioxide etc. which can create corrosive compounds if dissolved in the fluid.

These contaminants can appear during manufacture, assembly and operation.

Health and Safety

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before connecting or removing any hydraulic hose, residual hydraulic pressure trapped in the service hose line must be vented. Make sure the hose service line has been vented before connecting or removing hoses. Make sure the machine cannot be started while the hoses are open.

WARNING! *Fine jets of fluid at high pressure can penetrate the skin. Keep face and hands well clear of pressurised fluid and wear protective glasses. If fluid penetrates your skin, get medical help immediately.*

WARNING! *Take care when disconnecting hydraulic hoses and fittings as the oil will be hot.*

WARNING! *Damaged hoses can cause fatal accidents. Examine the hoses regularly. Do not use the machine if a hose or hose fixture is damaged.*

Notice: *Using incorrect fluid could damage the system. See Fluids, Capacities and Lubricants for the correct fluid. The fluid can harm your skin. Wear rubber gloves. Cover cuts or grazes.*

Notice: *Do not allow dirt to enter the system. Before disconnecting any part of the system, thoroughly clean around the connection. When a component has been disconnected, always install protective caps and plugs to prevent dirt ingress. Failure to follow these instructions will lead to dirt entering the system. Dirt in the system will seriously damage the systems components and could be expensive to repair.*

CAUTION! *The temperature of the hydraulic oil will be high soon after stopping the machine. Wait until it cools before beginning maintenance.*

Notice: *Using incorrect fluid could damage the system. See Fluids, Capacities and Lubricants for the correct fluid. The fluid can harm your skin. Wear rubber gloves. Cover cuts or grazes.*

Technical Data

Table 71.

Description	Details	Data
Hydraulic system	Hydraulic system capacity	120L
	Hydraulic main system pressure	210bar (3,045.8psi)
	Hydraulic transmission pressure	280bar (4,061.1psi)
Hydraulic tank	Capacity	90L
Return line filter	Nominal flow	150L/min
	Temperature range	-30–106°C (-22.0–222.7°F)
	Maximum working pressure	10bar (145.0psi)
	Filter size	10 µ
	Beta ratio	200
	By pass valve pressure	3 +0.5 bar
High pressure filter	Nominal flow	63L/min
	Temperature range	-30–100°C (-22.0–211.9°F)
	Maximum working pressure	400bar (5,801.5psi)
	Filter size	5 µ
	Beta ratio	200
	By pass valve pressure	7 +/-0.5 bar
Medium pressure filter	Nominal flow	44L/min
	Temperature range	-30–100°C (-22.0–211.9°F)
	Maximum working pressure	63bar (913.7psi)
	Filter size	10 µ
	Beta ratio	200
	By pass valve pressure	7 +/-0.5 bar
Auxiliary pump	Type	Gear pump
	Displacement	4 cc
	Speed range	500-3500 RPM (Revolutions Per Minute)
	Max continues pressure	250bar (3,625.9psi)
Slew motor	Continuous max torque	316N·m
	Type	Fixed displacement
	Capacity	130 cc
Standard oil viscosity		ISO 32 CST at 40°C (103.9°F)
Main control valve	Maximum working pressure	210bar (3,045.8psi)
	Maximum flow	30L
	Temperature range	-20–100°C (-4.0–211.9°F)
Platform control valve	Maximum working pressure	210bar (3,045.8psi)
	Maximum flow	11L
	Temperature range	-20–100°C (-4.0–211.9°F)
Brake valve	Maximum working pressure	280bar (4,061.1psi)
	Maximum flow	11L
	Temperature range	-20–100°C (-4.0–211.9°F)
Transmission valve	Maximum working pressure	350bar (5,076.3psi)
	Maximum flow	120L
	Temperature range	-20–100°C (-4.0–211.9°F)

Table 72. Pressure Specification

Description	Pressure
Steer left	138bar (2,001.5psi)
Steer right	138bar (2,001.5psi)
Drive forward	280bar (4,061.1psi)
Drive reverse	280bar (4,061.1psi)
Leveling rise	180bar (2,610.7psi)
Leveling lower	180bar (2,610.7psi)
Articulated boom raise	210bar (3,045.8psi)
Articulated boom lower	100bar (1,450.4psi)
Telescopic boom raise	210bar (3,045.8psi)
Telescopic boom lower	210bar (3,045.8psi)
Telescopic boom extend	145bar (2,103.0psi)
Telescopic boom retract	210bar (3,045.8psi)
Slew left	138bar (2,001.5psi)
Slew right	138bar (2,001.5psi)
Platform rotate left	210bar (3,045.8psi)
Platform rotate right	210bar (3,045.8psi)
Jib boom raise	210bar (3,045.8psi)
Jib boom lower	210bar (3,045.8psi)
Oscillating axles left hand side	200bar (2,900.8psi)
Oscillating axles right hand side	200bar (2,900.8psi)
Oscillating axles ON/ OFF	280bar (4,061.1psi)
Brakes front	35bar (507.6psi)
Brakes rear	35bar (507.6psi)
Drive motor speed	35bar (507.6psi)

Make a note that, these pressures are applicable for a hydraulic oil temperature of 40°C (103.9°F), and the values may vary per machine by +/-5% based on valve tolerances.

Operation

The hydraulic system performs all functions of these machines. The hydraulic system is divided into two groups.

- Boom/Steer functions
- Drive functions

A gear pump provides hydraulic power to move the active boom. When the engine is running, this pump supplies hydraulic fluid under pressure to the function valve, where the directional and flow control valves are located. In order to protect from over-pressurization of the boom/steer system, an relief valve is located in the main control valve.

A separate gear pump provides hydraulic power to move the active boom when the engine is not running. This is driven by an electric motor. This is for emergency use only, in the event that the engine is unable to start, or as a result of a safety function cut-out. This pump provides hydraulic oil to the same function valve as the main gear pump.

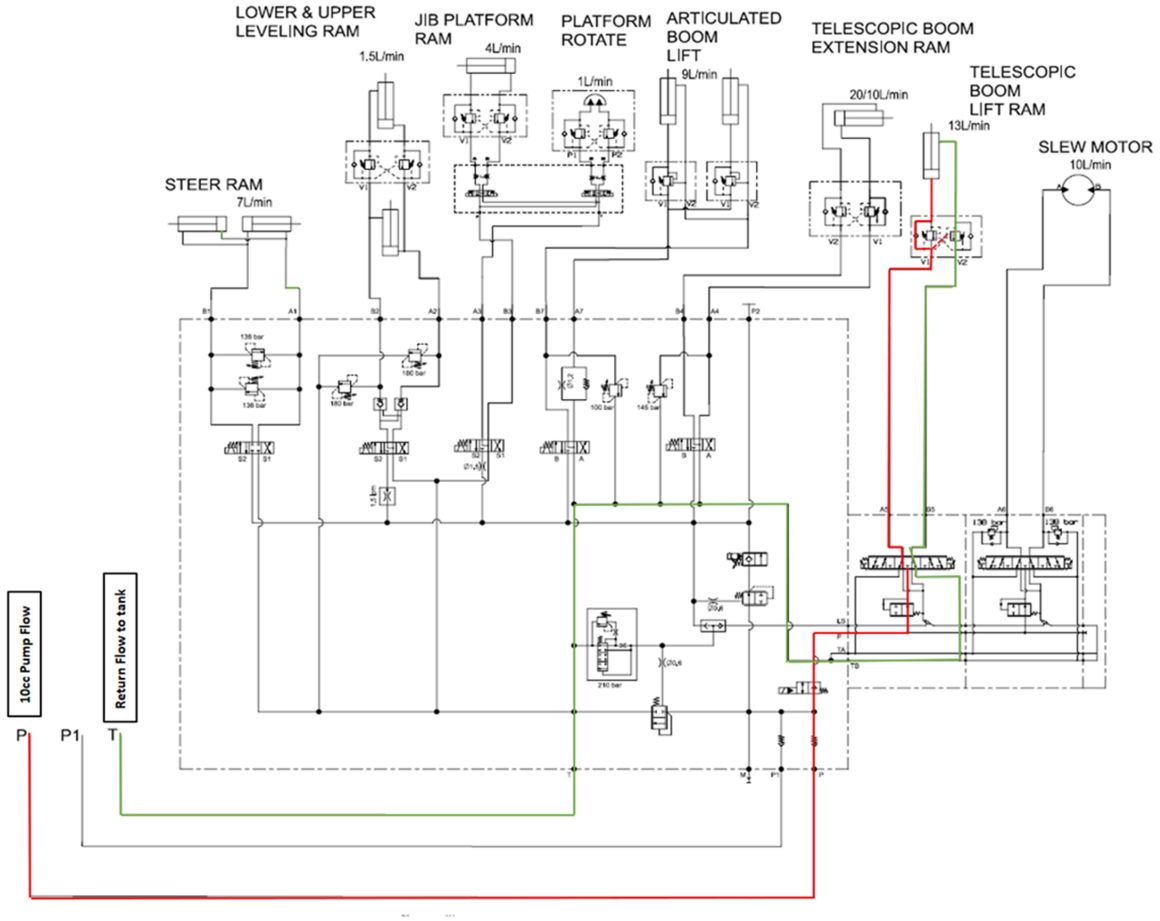
When the engine is running, separate bi-directional variable displacement piston pump powers the drive function. Two relief valves are used to prevent overload of the closed loop drive system.

The articulated boom lift, main boom lift, telescopic boom extend, platform levelling, jib cylinders, and platform rotary actuator incorporate counterbalance valves to prevent boom or platform movement in the event of a hydraulic line failure.

Main Boom Function

From the base control panel, select the base enable and operate the main boom function switch up/down. Or from the platform control panel, operate foot pedal and main boom joystick up/down. The main boom/slew spool shifts for main boom function. Main boon directional proportional to spool shifts for function up/down. Flow to cylinder to lift boom at speed commanded (controlled by MCV) is available. If platform mass exceeds lift limit, excess flow passes through relief valve to tank.

Figure 164.

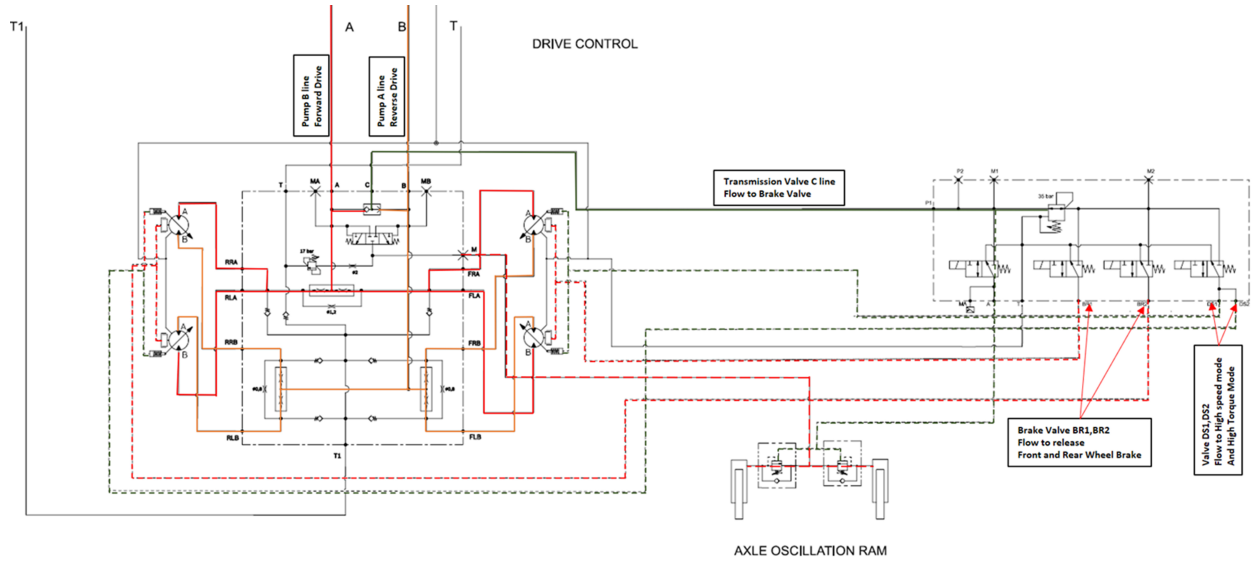


Travel Function

Select the platform controller and select travel function. Operate the foot pedal and joystick forward or backward. The travel pump forward or backward is energised and pump is driven at engine speed. Hydraulic flow passes through travel valve dividing equal flow to motors. Brake valve BR1 and BR2 solenoids are energised.

When the travel pump is energised in the forwards or backwards direction, pressure builds in the transmission valve block. When this pressure is sufficient, the brakes are released and the machine begins to move. If machine is in stowed and forward position is ON, then axle is unlocked. If machine stowed and forward position is in Off condition, then axle is locked. If machine is in high torque mode, high or low torque solution is de-energised and no pressure is built on wheel motor displacement (forward or backward) below 35bar (507.6psi) to maximum displacement at low speed or high torque. If machine is in low torque mode, high or low torque solenoid is energised and pressure is built on wheel motor displacement (forward or backward) to above 35bar (507.6psi) to reduce displacement at low speed or high torque.

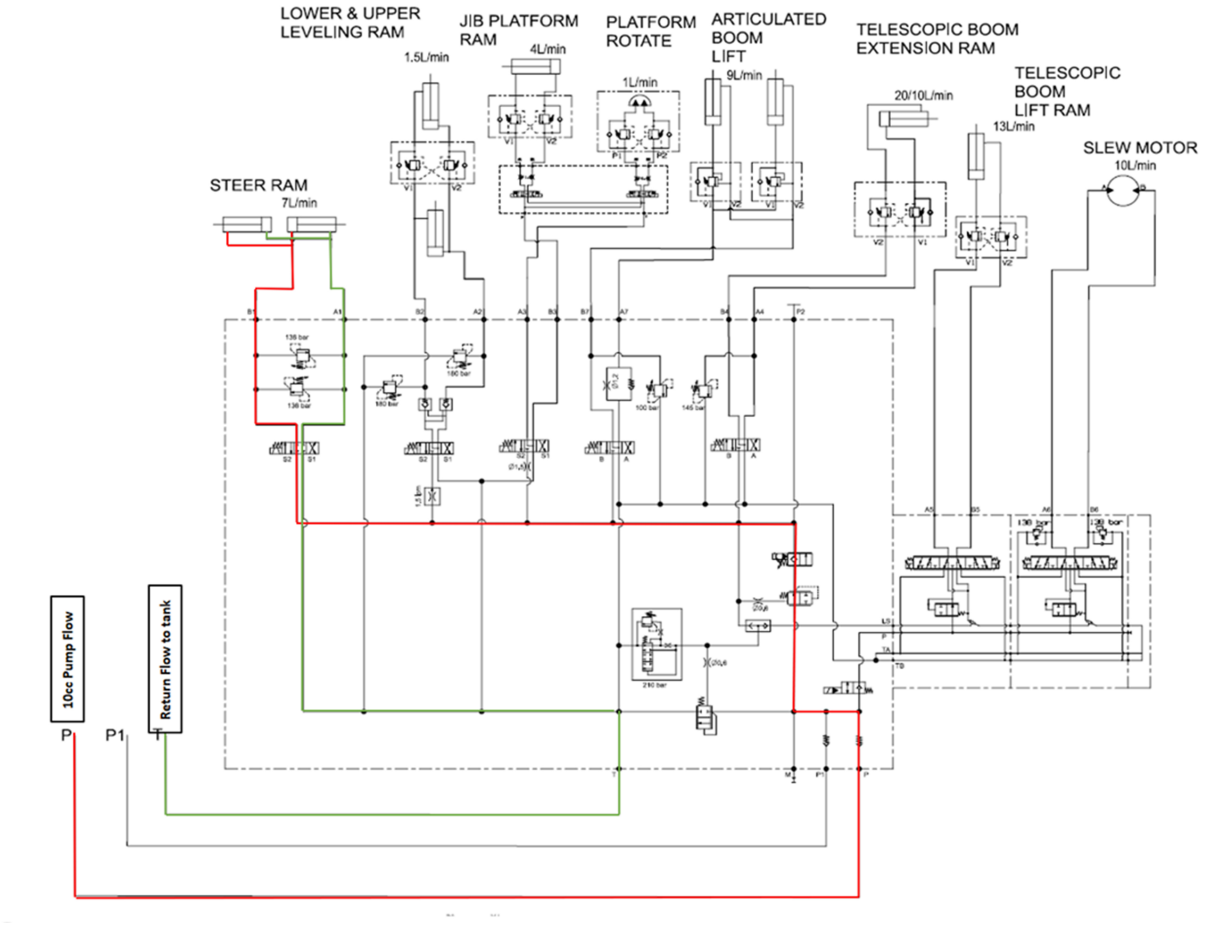
Figure 165.



Steer Function

Select platform controller and select travel function. Select steer function and operate foot pedal right or left. The boom pump is driven at engine speed. The steer spool shift across, hydraulic oil flows to steer cylinder. Flow to cylinder to steer the wheels at speed commanded (controlled by MCV “Public proportional Solenoid”) is available. The steer cylinder is driven in selected direction to turn the wheels. Brake valve BR1 solenoid (front) is energised. The steer wheel permitted to rotate due to surface friction. This can be in combination with travel function.

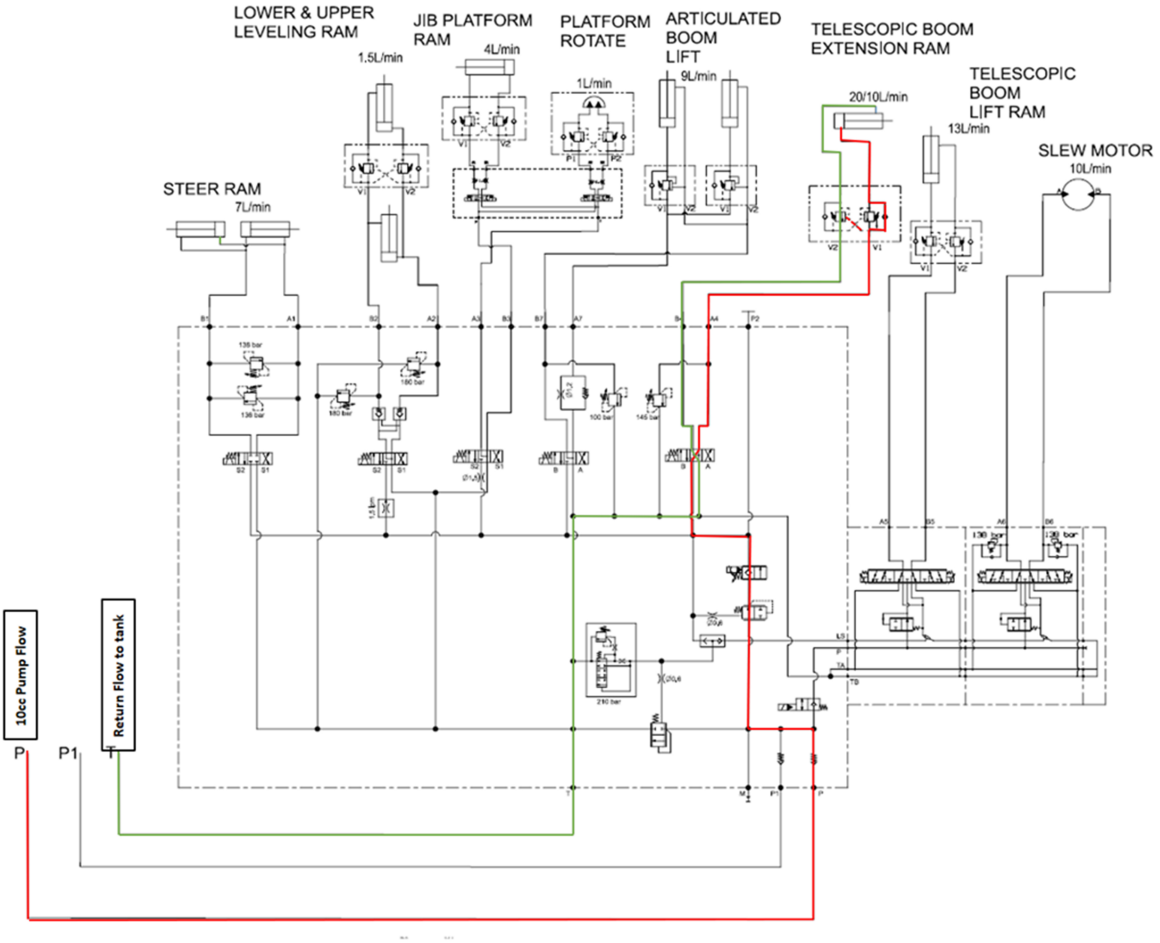
Figure 166.



Telescopic Boom Extension

From the base control panel, select the base enable and operate the telescopic boom function switch left/right. Or from the platform control panel, operate foot pedal and telescopic boom function switch up/down. The boom extension spool shifts for extend/retract. Flow to cylinder to extend boom at speed commanded (controlled by MCV) is available. If platform mass exceeds lift limit, excess flow passes to tank through the Main RV (retract) or the Teleboom Extend ARV (extend).

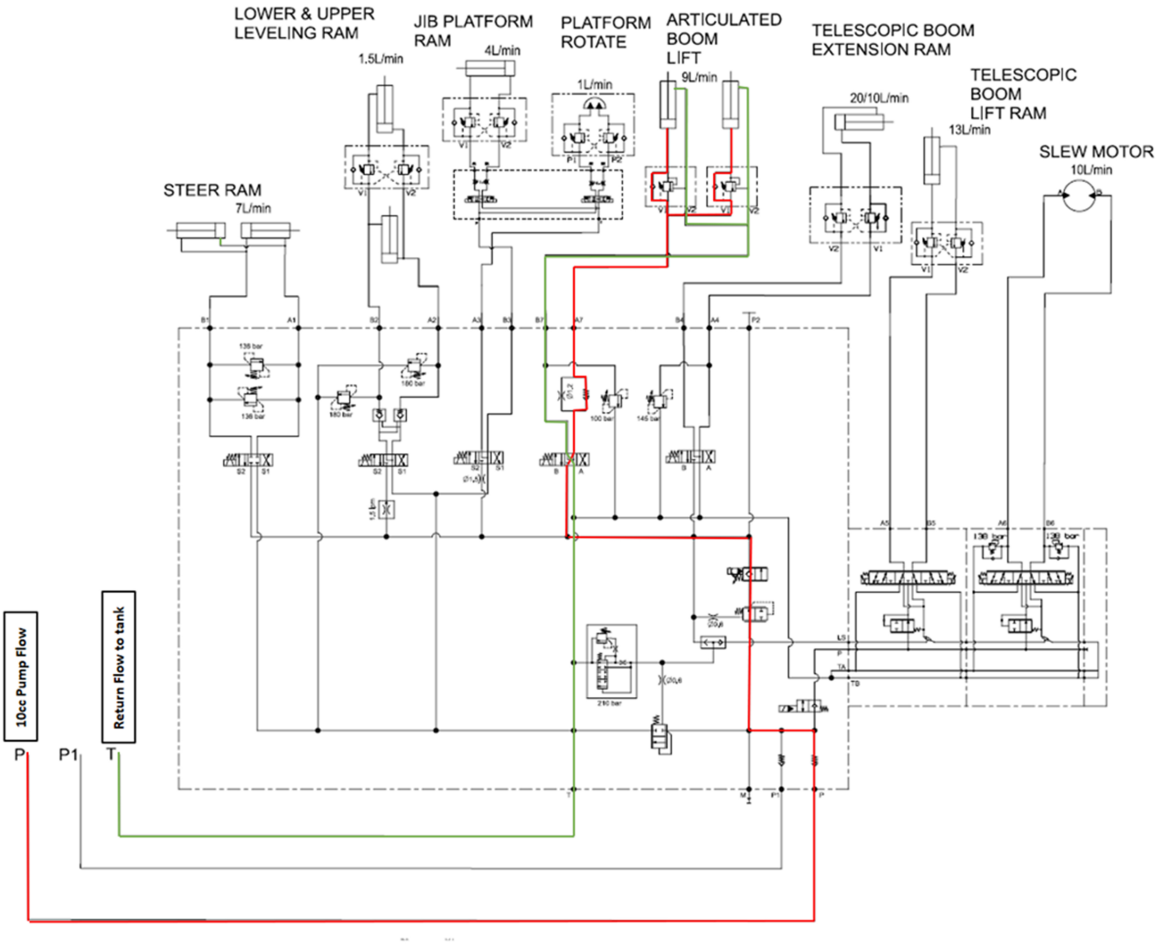
Figure 167.



Articulated Boom Lift

From the base control panel, select the base enable and operate the articulated boom function switch up/down. Or from the platform control panel, operate foot pedal and articulated boom function switch up/down. The articulated spool shifts for up/down function. Flow to cylinder to lift boom at speed commanded (controlled by MCV "Public Proportional Sol"). If platform mass exceeds lift limit, excess flow passes to tank through the Main RV (raise) or the Artic Boom Lower ARV (lower).

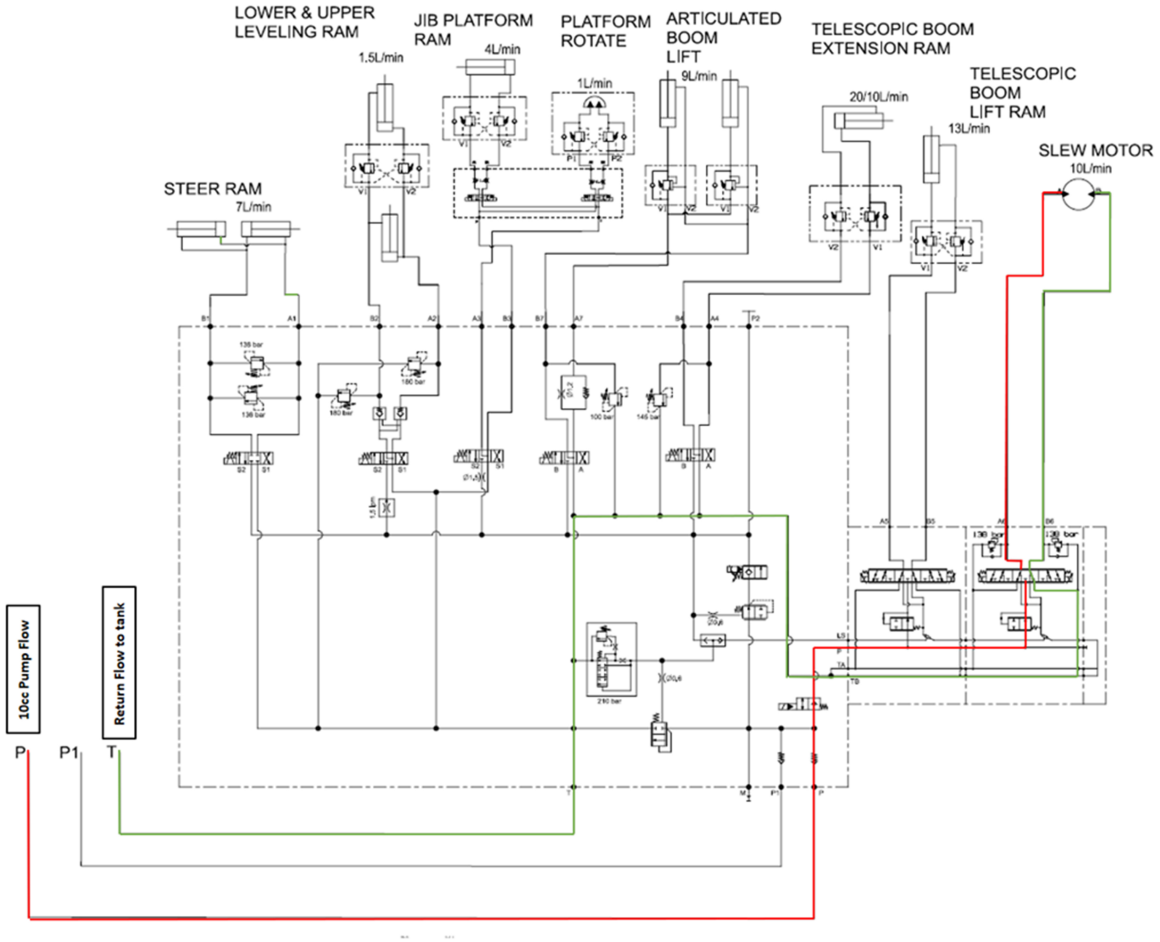
Figure 168.



Slew Rotation

From the base control panel, select the base enable and operate the slew function switch left/right. Or from the platform control panel, operate foot pedal and slew joystick left/right. Slew spool shifts for slew function. Slew direction proportional spool shifts for left/right function. Flow to motor to rotate turntable at speed commanded (controlled by MCV slew direction proportional solenoid). If turntable mass exceeds slew limit, excess flow passes to tank through the ARV (left/right). There is a 355 degree slew limit preventing continuous rotation of the turntable

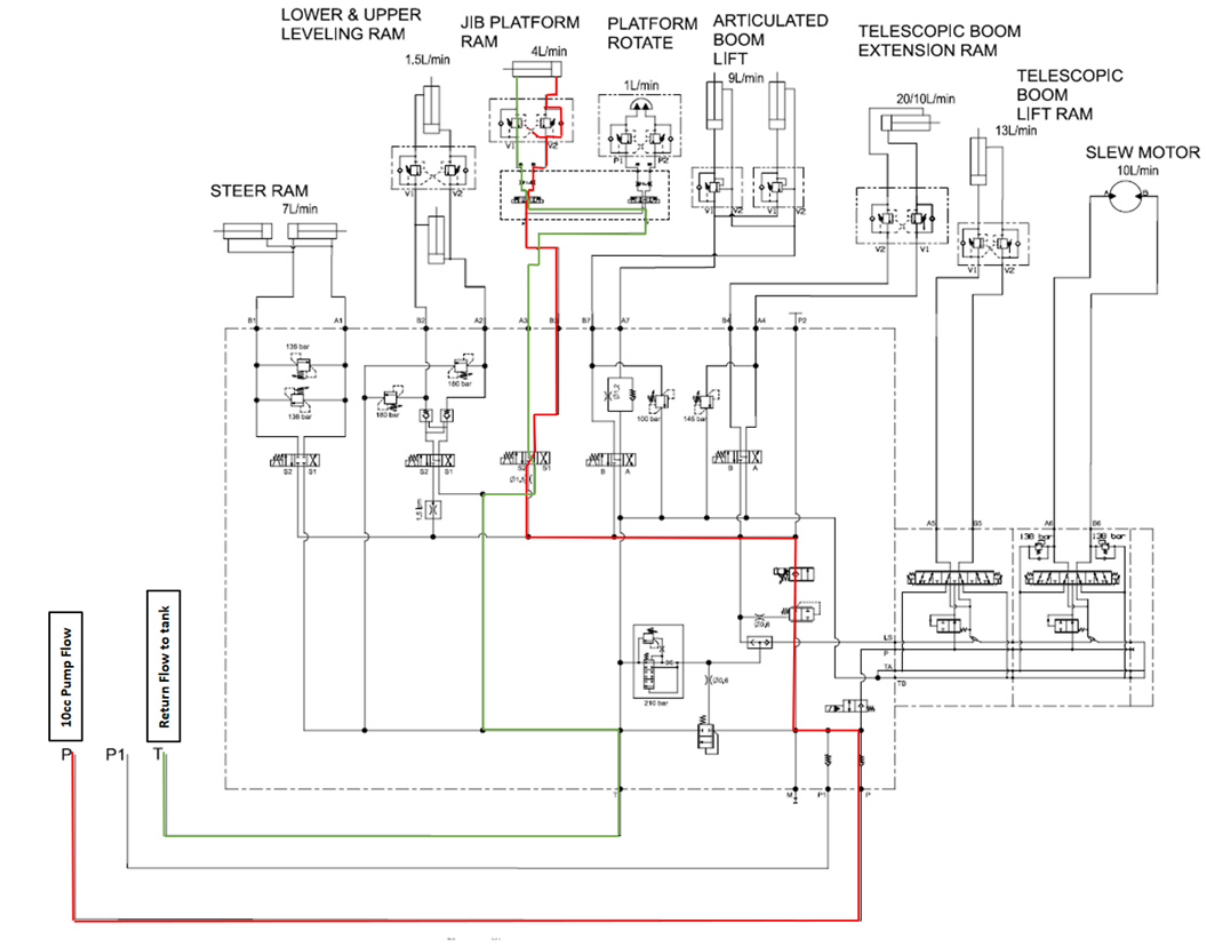
Figure 169.



Jib Lift

From the base control panel, select the base enable and operate the jib boom function switch up/down. Or from the platform control panel, operate foot pedal and jib boom function switch up/down. Platform select MCV spool shifts at S1 position for platform function. Platform control jib spool shifts from function jib up/down. Flow to cylinder to lift boom at speed commanded (controlled by MCV "Public Proportional Sol"). If platform mass exceeds lift limit, excess flow passes to tank through the Main RV (raise/lower)

Figure 170.



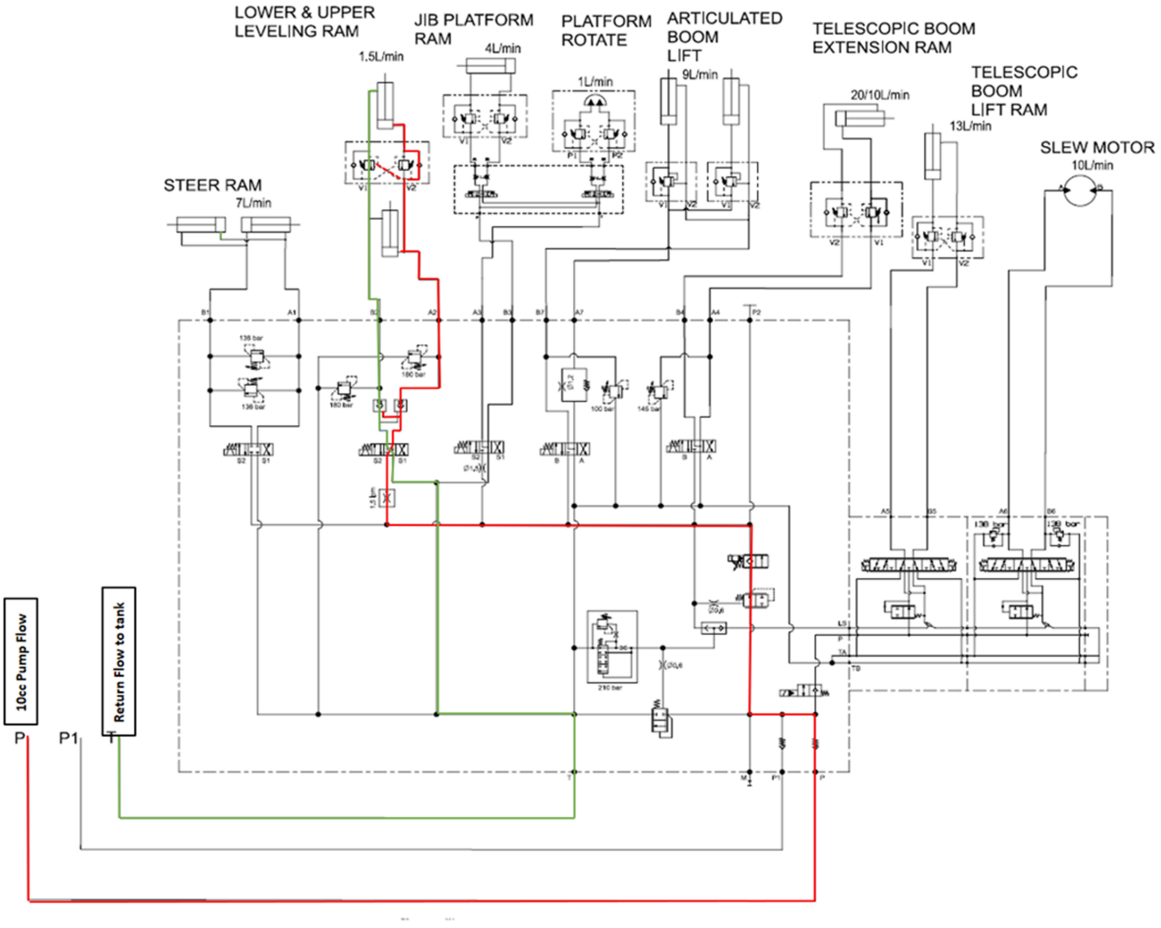
Platform Levelling

Platform levelling is an automatic function when the main boom is raising/lowering so that the platform remains at a constant angle relative to the chassis. It can also be a manual function to make adjustments to the angle of the platform.

For the automatic levelling function: When the main boom is raised/lowered, a master levelling cylinder is extended/retracted. This displaces oil into a slave levelling cylinder, which maintains the platform angle. When there is no manual adjustment of the platform level, the master and slave levelling cylinders are in a closed loop circuit.

For the manual levelling function: From the base control panel, select the base enable and operate the platform levelling function switch up/down. Or from the platform control panel, operate foot pedal and platform levelling function switch up/down. Platform level spool shifts for level up/down function. Flow to cylinder to change the platform level at speed commanded (controlled by MCV "Public Proportional Sol"). If platform mass exceeds lift limit, excess flow passes to tank through the Main RV (left/ right).

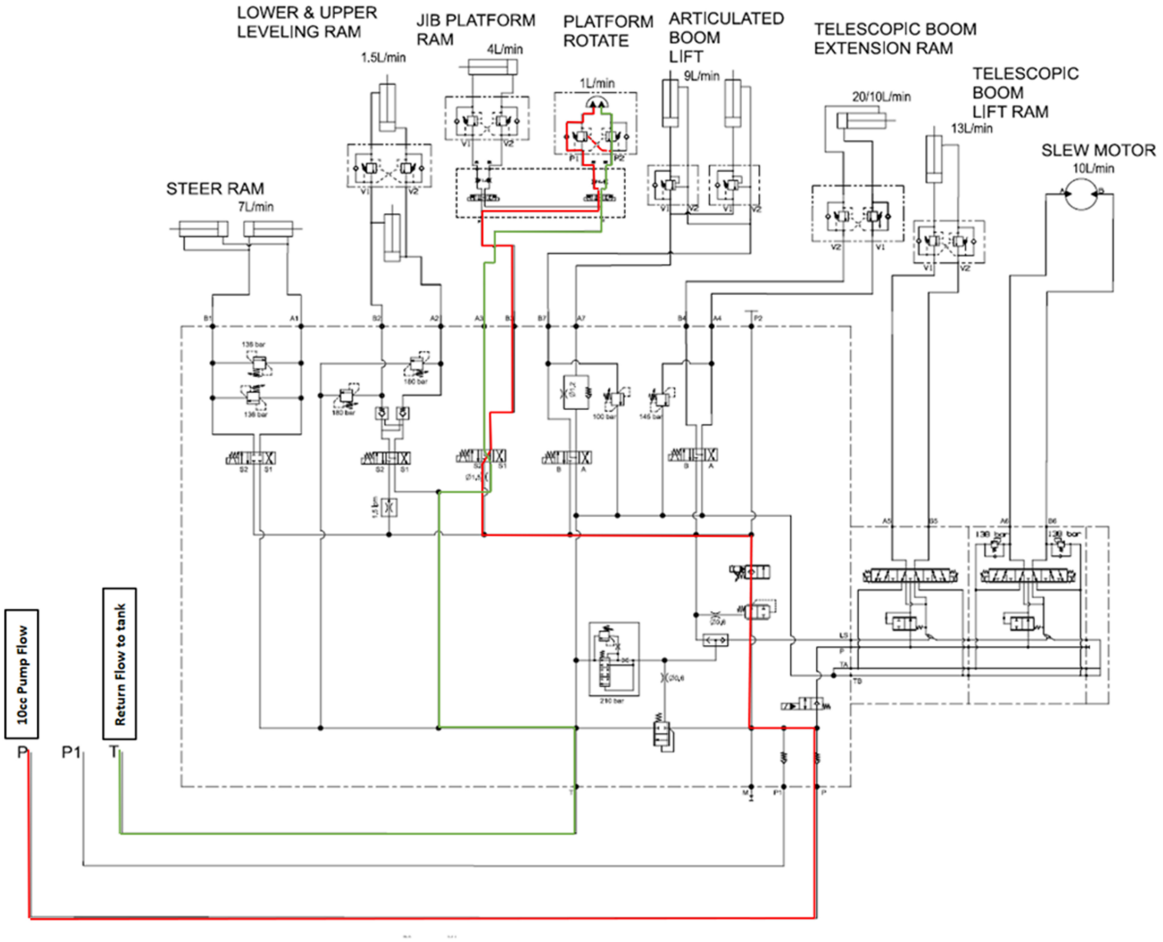
Figure 171.



Platform Rotation

From the base control panel, select the base enable and operate the platform rotate function switch left/right. Or from the Platform control panel, operate foot pedal and rotate function switch left/right. Platform select MCV spool shifts at S1 position for platform function. Platform control rotate spool shifts for platform rotate left/right function. Flow to rotatory actuator to rotate platform at speed commanded (controlled by MCV "Public Proportional Sol"). If platform mass exceeds lift limit, excess flow passes to tank through the Main RV (raise/lower).

Figure 172.


LOWER & UPPER LEVELING RAM
JIB PLATFORM RAM
PLATFORM ROTATE
ARTICULATED BOOM LIFT
TELESCOPIC BOOM EXTENSION RAM
TELESCOPIC BOOM LIFT RAM
SLEW MOTOR
STEER RAM
7L/min
1.5L/min
4L/min
1L/min
9L/min
20/10L/min
13L/min
10L/min
10cc Pump Flow
Return Flow to tank
P
P1
T

Fault-Finding

Fault		
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Table 73. Lack of power in all lifting functions

Cause	Remedy
Insufficient hydraulic fluid	Check for leaks and top up as required
Hydraulic leaks in system	Check hoses, replace as required
Main relief valve (MRV) setting incorrect	Check and adjust as required
Pump flow	Check pump flow, if necessary service or replace pump
Auxiliary relief valve (ARV) setting incorrect	Check and adjust as required
Damaged cylinder seals	Check cylinder seals and replace as required

Table 74. All hydraulic rams slow to operate

Cause	Remedy
MRV (Main Relief Valve) setting incorrect	Check and adjust as required
Pump flow	Check pump flow, if necessary service or replace pump
Piston rod bent	Replace piston rod, Check pressure setting of MRV, Check that associated pivot pins are adequately greased
Service pipe lines leaking, damaged, trapped or kinked	Check hoses and pipes, replace as required
Check ARV setting incorrect	Check and adjust as required

Table 75. One hydraulic service fails to operate

Cause	Remedy
Service pipe lines leaking, damaged, trapped or kinked	Check hoses and pipes, replace as required
Ram or pipe lines from ram leaking	Check and rectify as required
Valve spool not operating	Check for leaks, rectify as required. Make sure that spool lock-out is operating (check for faulty wiring, solenoid sticking, burr on spool, etc.). Make sure that associated load hold check valve is operating. On servo machines, check operation of joystick and feed hoses. On manual machines, check that control lever and associated linkage is operating the spool, rectify as required
Valve spool not moving fully from neutral to full selection	Spool movement should be 5.5 mm (0.22 in). On servo machines, check servo (charge) pressure. Check spool/ cartridge and replace as required

Cause	Remedy
Valve spool leaking	Rectify, check for contamination
Poor engine performance	Check engine performance
Electrical solenoid failure	Check solenoid is energised correctly. Replace solenoid or connections, if faulty

Table 76. Engine tends to stall when hydraulics are under load

Cause	Remedy
Main relief valve (MRV) setting incorrect	Check and adjust as required
Poor engine performance	Check engine performance
Pump failure	Check pump flow rate & pressures

Table 77. Valve spool sticking

Cause	Remedy
Hydraulic fluid contaminated	Clean tank strainer. If strainer badly clogged, drain and flush hydraulic system then fill with clean hydraulic fluid. Replace all hydraulic filters
Valve housing twisted during installation	Loosen retaining bolts and tighten to correct torque
Bent spool	Disassemble control valve. Renew spool as necessary
Spool return spring broken	Renew as necessary
Temperature distribution within control valve not uniform	Warm up entire system before using service

Table 78. Ram creep

Cause	Remedy
Valve spool not operating	Check for leaks, rectify as required. Make sure that spool lock-out is operating (check for faulty wiring, solenoid sticking, burr on spool, etc.). Make sure that associated load hold check valve is operating. On servo machines, check operation of joystick and feed hoses. On manual machines, check that control lever and associated linkage is operating the spool, rectify as required
Piston rod bent	Replace piston rod. Check pressure setting of MRV, Check that associated pivot pins are adequately greased
Piston seal damaged	Check piston seal. Replace if faulty.
ARV (Auxiliary Relief Valve) pressure setting incorrect	Check ARV pressures. Adjust pressure setting or replace ARV if faulty
Load holding valve failure	Check Load holding valve settings. Check for oil contamination. Replace valve if required. Flush oil and replace filters if contamination present

Table 79. Hydraulic oil becomes too hot

Cause	Remedy
Hydraulic filter clogged	Change hydraulic filter
Charge filter by-pass valve leaking	Check condition of hydraulic filter, Check operation of by-pass valve
Air in hydraulic system	Bleed System
Oil temperature abnormally high	Check for correct fluid. Check for blockage or kinked hoses and lines

Table 80. Boom judders when used while machine is moving

Cause	Remedy
Boom pump flow low	Check flow rate
Service pipe lines leaking, damaged, trapped or kinked	Check hoses and pipes, replace as required

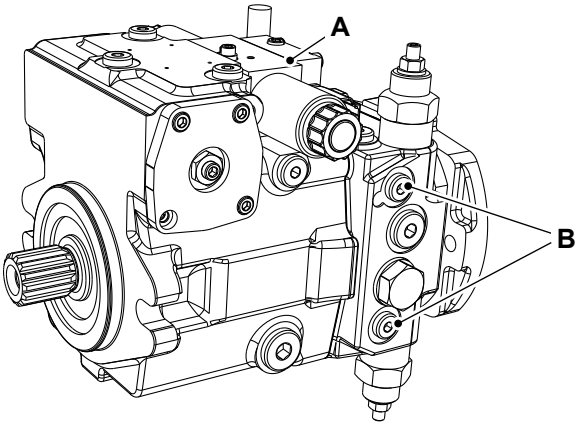
Discharge and Pressurise

Observe all the health and safety information.
Refer to: Health and Safety (PIL 30-00-00).

Discharge

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure for electrical and pilot operated services as follows:
   2.1. Turn the ignition key to the ON position. Do not start the engine.
   2.2. Lower and retract all of the booms until they are stowed on their respective rests or fully supported. Then release the controls. All pressure should dissipated.
   2.3. Turn the ignition key to the OFF position.
3. Make sure there is no pressure in the hydraulic drive system.
   3.1. Check the pressure at the test point on drive pump using a suitable pressure gauge.

Figure 173.

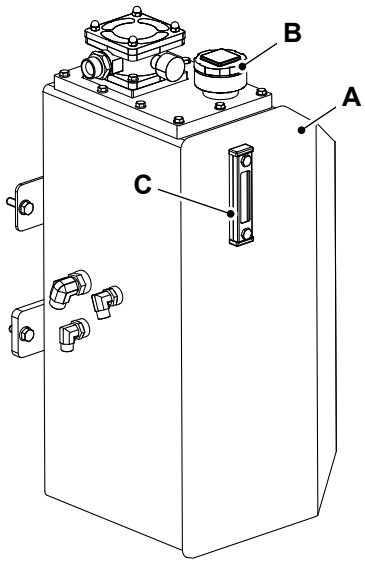


A Drive pump
B Test points

Drain and Fill

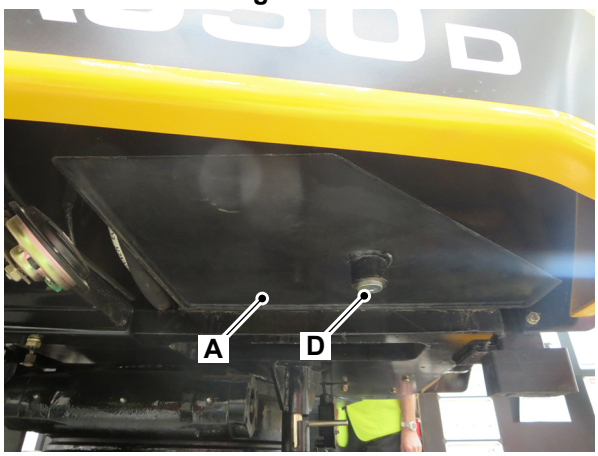
1. Make the machine safe with the platform lowered.
   Refer to: PIL 01-03-27.
2. Isolate the battery.
   Refer to: PIL 33-03-00.
3. Open the hydraulic compartment cover.
   Refer to: PIL 06-06-09.
4. Remove the filler cap from the hydraulic tank.
   4.1. Make sure that no foreign objects or contamination can enter the hydraulic tank.
5. Put a suitable container below the drain plug of the hydraulic tank.

Figure 174.



A Hydraulic tank
B Filler cap
C Check level plug

Figure 175.



A Hydraulic tank
D Drain plug

6. Remove the drain plug.
7. When the hydraulic tank is empty, check the drain plug.
   7.1. Clean the drain plug.
   7.2. Install the drain plug.
   7.3. If the drain plug is damaged, replace it.
8. Fill the hydraulic tank with clean fluid through the filler neck.
9. Check the hydraulic oil level.
   Refer to: Check (Level) (PIL 30-00-00).
10. Install the filler cap.

Clean

Special Tools

Description	Part No.	Qty.
Hydraulic Flushing Rig	892/01255	1

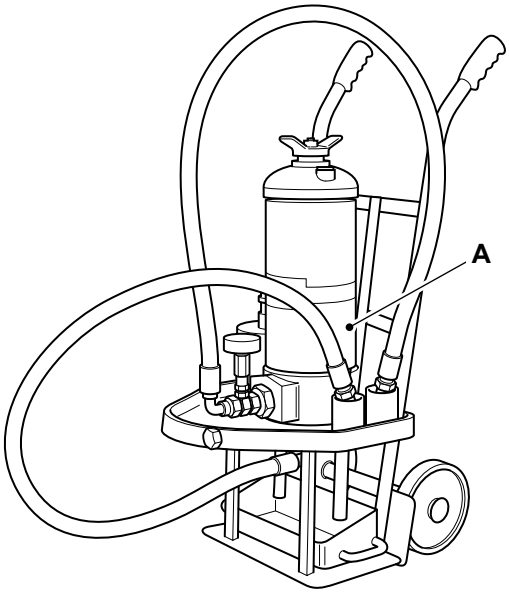
Cleaning Operation

The purpose of cleaning oil is to remove contaminants of all types and sludge by filtering hydraulic fluid through a cleaning unit. Follow the instructions in the Hydraulic flushing rig instruction manual.

Procedure

1. Connect the Hydraulic flushing rig in place of the hydraulic filter.
   Special Tool: Hydraulic Flushing Rig (Qty.: 1)
2. Run the system for sufficient time to pump all the hydraulic fluid through the unit.
3. Disconnect the cleaning unit and reconnect the filter.
4. Top up the system with clean hydraulic fluid as required.

Figure 176.



A Hydraulic flushing rig

Contaminant Standards

Dirt that damages your system is in many cases too small to be seen with the eye. The particle size is measured in microns (1 micron = 0.001 mm (0.0000394 in).

Listed below are a few typical comparisons:

- Red Blood Cell = 8 microns (0.008 mm, 0.000315 in)
- Human Hair = 70 microns (0.07 mm, 0.00275 in)
- Grain of Salt = 100 microns (0.1 mm, 0.00394 in)

The smallest particle visible to the naked eye is 40 microns (0.00157) approximately. Standards will often be quoted to ISO (International Standards Organisation) for which literature can be obtained.

Check (Leaks)

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Open the access covers as required.
   Refer to: PIL 06-06.
3. Check the areas around the hydraulic components and hoses for traces of hydraulic oil.
4. Check the chassis and undershield for any traces of hydraulic oil.
5. Check all the hoses, connectors and fittings for any leaks.
6. If a leak is found, do the following.
   6.1. Clean the area around the leaking component, hose or fittings.
   6.2. Tighten the connectors to the correct torque value.
   6.3. If the leak is still not correct, disassemble the component to replace the O-rings and seals as applicable.

Check (Level)

⚠ **Notice:** If the fluid is cloudy, then water or air has contaminated the system. This could damage the hydraulic pump. Contact your JCB dealer immediately.

1. Make the machine safe with the platform lowered.

   Refer to: PIL 01-03-27.

2. Make a note that the machine must be level when you check the fluid level to make sure that the measurement is correct.

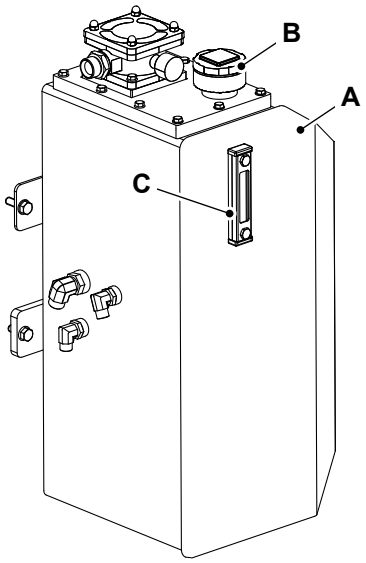
3. Make sure that the fluid is visible in the sight gauge.

4. Make sure that the fluid level is in between minimum and maximum mark.

5. If necessary, add the hydraulic fluid.

   Refer to: Drain and Fill (PIL 30-00-00).

Figure 177.



A Hydraulic tank
B Filler cap
C Level gauge with thermometer

49 - Schematic Symbols

Introduction 30-24
Diagram 30-25

Introduction

Complex hydraulic components and circuits can be described to the engineer by using graphical symbols. The tables illustrate and give a brief description for some of the more common symbols used.

There are many symbols in use and it would be impossible to include them all here. However it should be noted that most are only variations or refinements on the basic principles explained here. If more detailed information is required you are recommended to obtain a copy of BS2917 or IS01219.

Once familiar with the symbols, the engineer can use hydraulic circuit diagrams as an aid to fault finding. It will be possible to see the complete hydraulic circuit and decipher the relationship between hydraulic components.

Diagram

Table 81. General

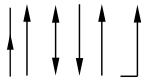
Symbol	Description
	Spring
	Flow restriction affected by viscosity
	Direction of flow
	Indication of rotation
	Indication of direction and paths of flow
	Variable control

Table 82. Cylinder Rams

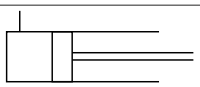
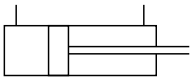
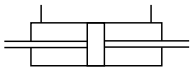
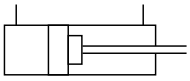
Symbol	Description
	Single acting
	Double acting
	Double ended
	Double acting with damping at rod area end

Table 83. Pumps and Motors

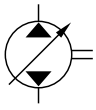
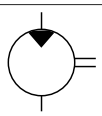
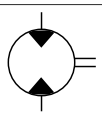
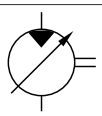
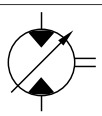
Symbol	Description
	Variable capacity pump two directions of flow
	Fixed capacity motor one direction of flow
	Fixed capacity motor two directions of flow
	Variable capacity motor one direction of flow
	Variable capacity motor two directions of flow

Table 84. Directional control valves

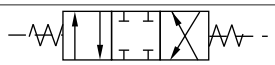
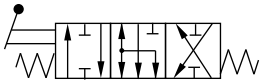
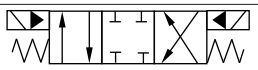
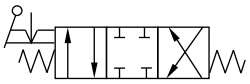
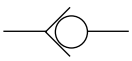
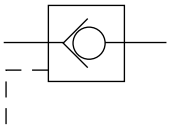
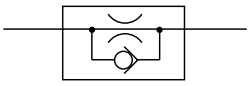
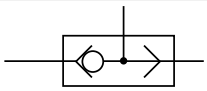
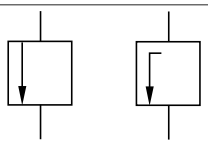
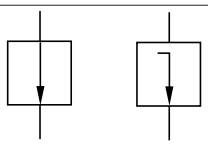
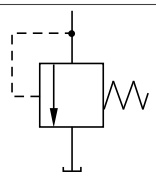
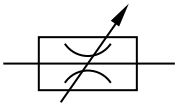
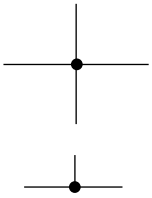
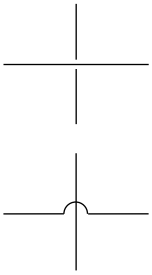
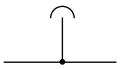
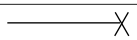
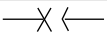
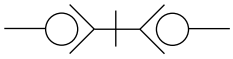
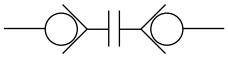
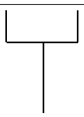
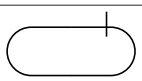
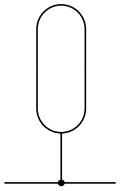
Symbol	Description
	Used to enclose several valves indicating they are supplied as one unit
	3-Position, 4-port spring centered pilot operated valve
	3-position, 6-port spring centered manually operated valve
	3-Position, 4-port spring centered solenoid & pilot pressure operated valve
	3-Position, 4-port spring centered detent hand operated valve
	Non-return valve
	Non-return valve with back pressure spring
	Pilot operated non-return valve
	One way restrictor
	High pressure selector (shuttle valve)
	Throttling orifice - normally closed
	Throttling orifice - normally open
	Relief valve
	Variable restrictor

Table 85. Energy Transmissions and Conditioning

Symbol	Description
	Working line, return or feed
	Pilot control
	Drain lines
	Flexible pipe
	Line junction
	Crossing lines
	Air bleed
	Line plugged, also pressure test point
	Line plugged with take-off line
	QRC (Quick Release Coupling) - connected
	QRC - disconnected
	Tank - return line above fluid level
	Tank - return line below fluid level
	Header tank
	Pressure sealed tank
	Accumulator

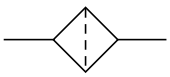
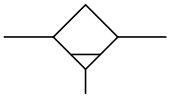
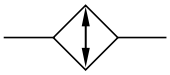
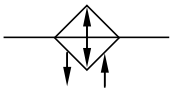
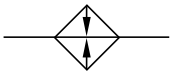
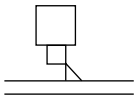
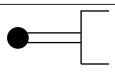
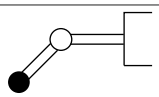
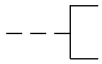
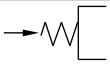
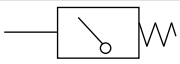
Symbol	Description
	Filter or strainer
	Water trap
	Cooler - with no indication of coolant flow
	Cooler - indicating direction of coolant flow
	Heater

Table 86. Control Mechanisms

Symbol	Description
	Rotating shaft - one direction
	Rotating shaft - two directions
	Detent
	Locking device
	Over centre device
	Simple linkage
	General control
	Push button operated
	Lever operated
	Pedal operated
	Stem operated
	Spring operated
	Roller operated
	Roller trip operated (one directional)
	Solenoid one winding
	Solenoid two windings

Symbol	Description
	Electric motor operated
	Internal pressure pilot operated
	External pressure pilot operated
	Pressure operated spring release
	Pilot operated by solenoid pilot valve
	Pilot operated by a solenoid or separate pilot valve
	Pressure gauge
	Pressure switch

50 - Schematic Circuit

Introduction 30-28
Diagram 30-29

Introduction

A schematic diagram is a simplified pictorial representation of the machines hydraulic circuit. It shows the components of the circuit as simplified hydraulic symbols, and the connections between the different components. The schematic diagram is used to troubleshoot problems and to make sure that all the connections have been made and that everything is present. Detailed schematics for individual systems are given in the relevant PIL section.

Diagram

Figure 178. 401/D7061 - 4 (Sheet 1 of 6)- Boom Circuit..... Page 30-31
Figure 179. 401/D7061 - 4 (Sheet 2 of 6)- Power Pack Circuit..... Page 30-35
Figure 180. 401/D7061 - 4 (Sheet 3 of 6)- Boom Circuit..... Page 30-39
Figure 181. 401/D7061 - 4 (Sheet 4 of 6)- Drive Control.....Page 30-43
Figure 182. 401/D7061 - 4 (Sheet 5 of 6)- Boom Circuit (Standard).....Page 30-47

Notes:

Page 30-32

**Figure 178. 401/D7061 - 4
(Sheet 1 of 6)- Boom Circuit**

Page 30-33

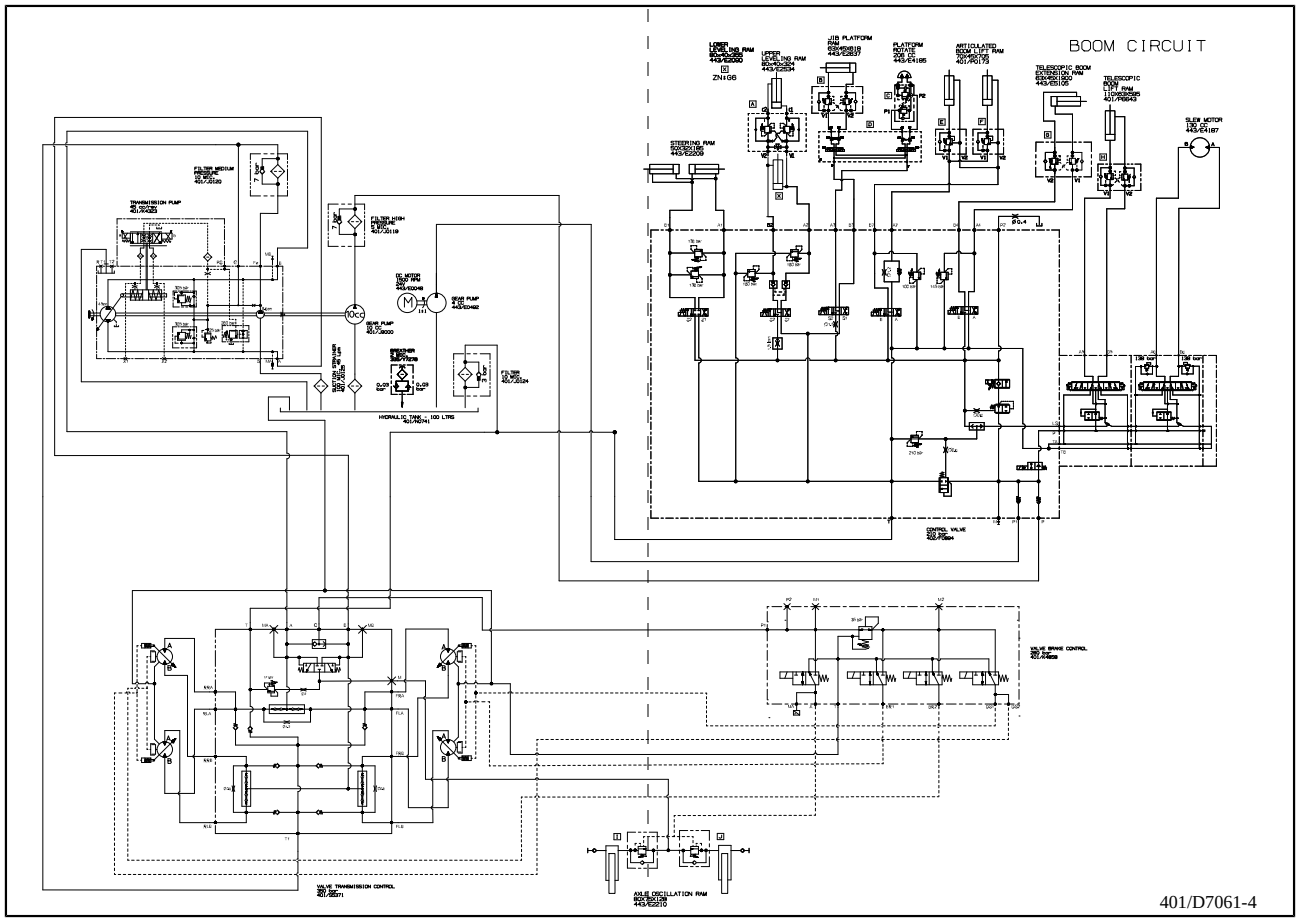
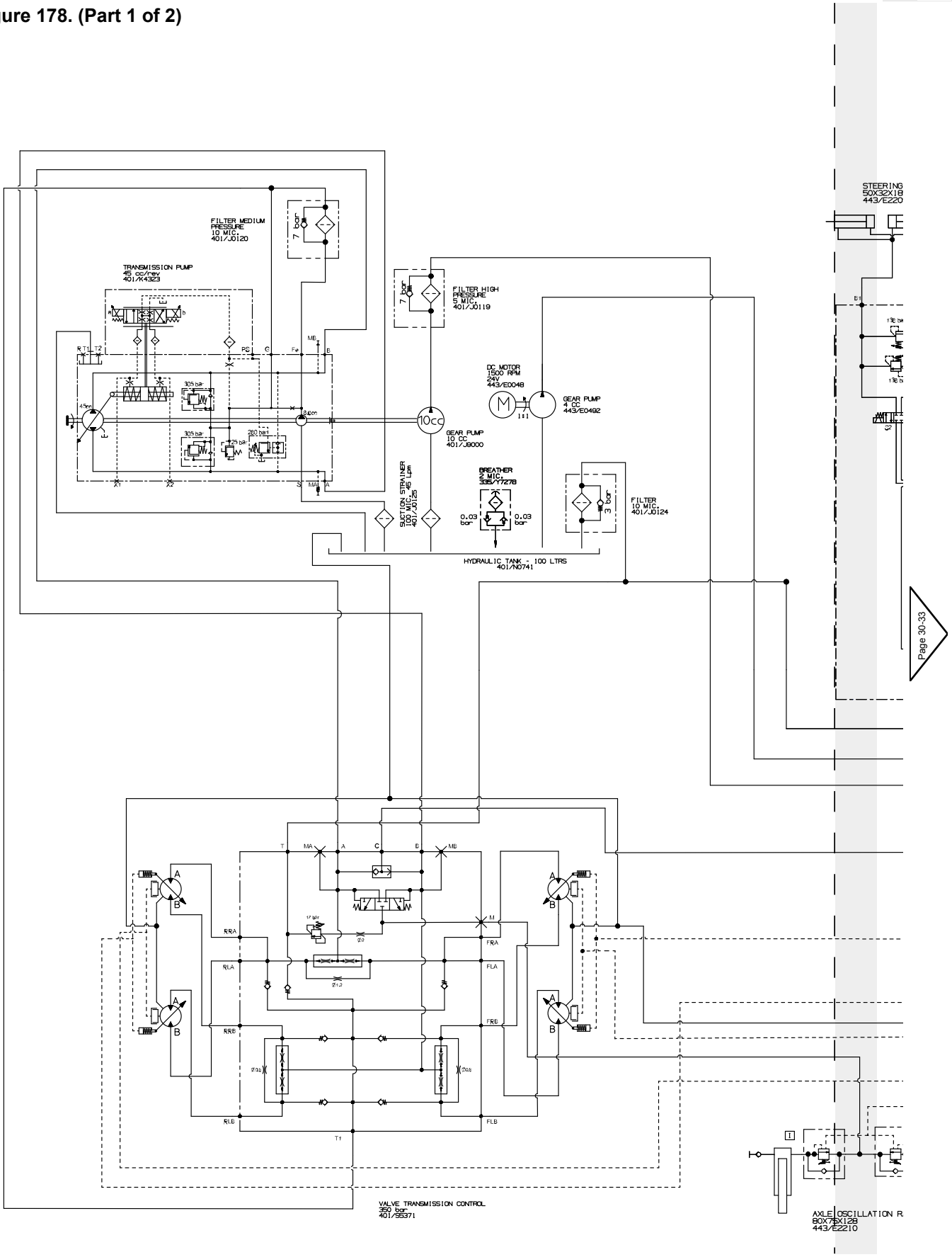


Figure 178. (Part 1 of 2)



jure 178. (Part 2 of 2)

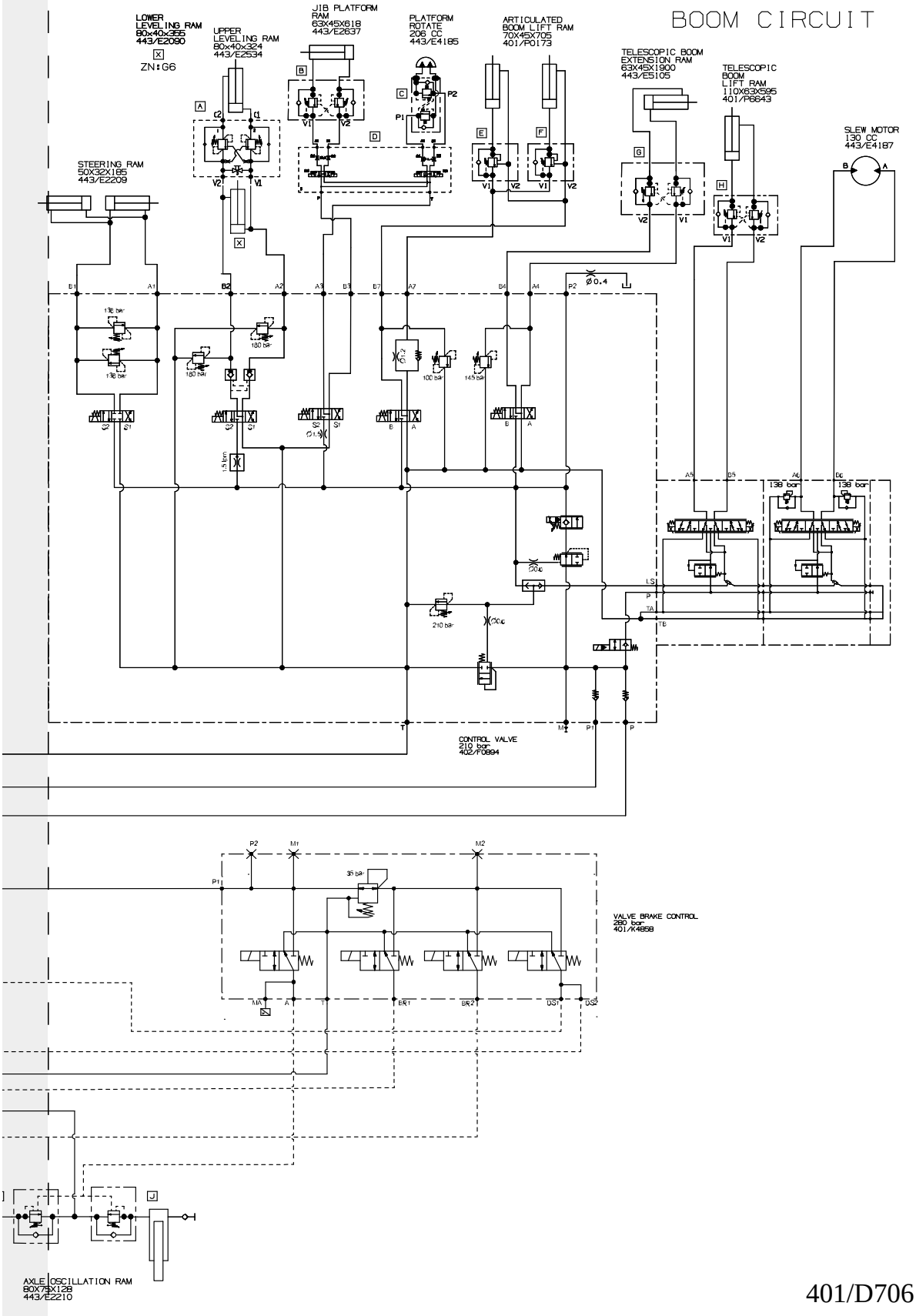


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Figure 179. 401/D7061 - 4 (Sheet 2 of 6)- Power Pack Circuit

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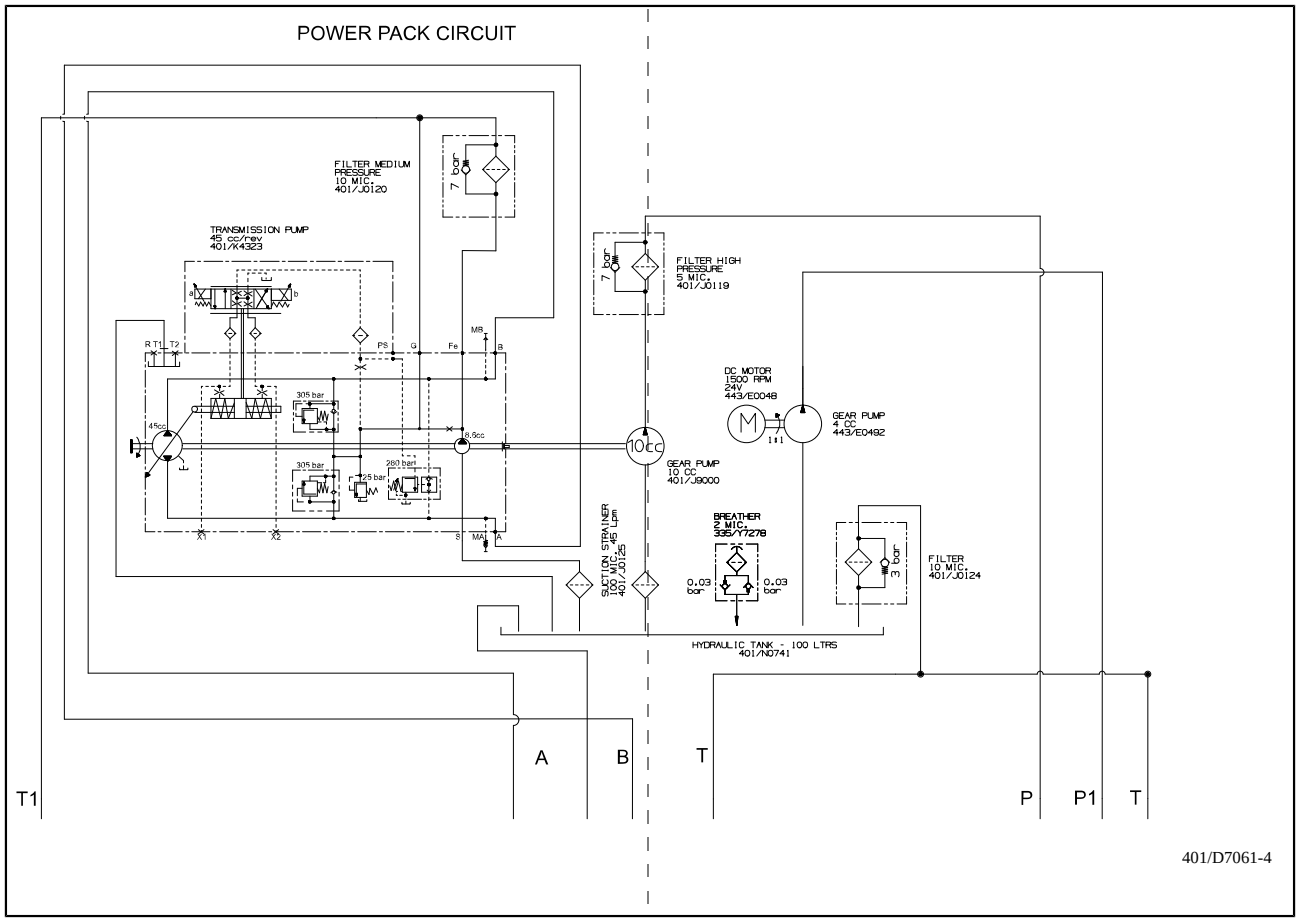

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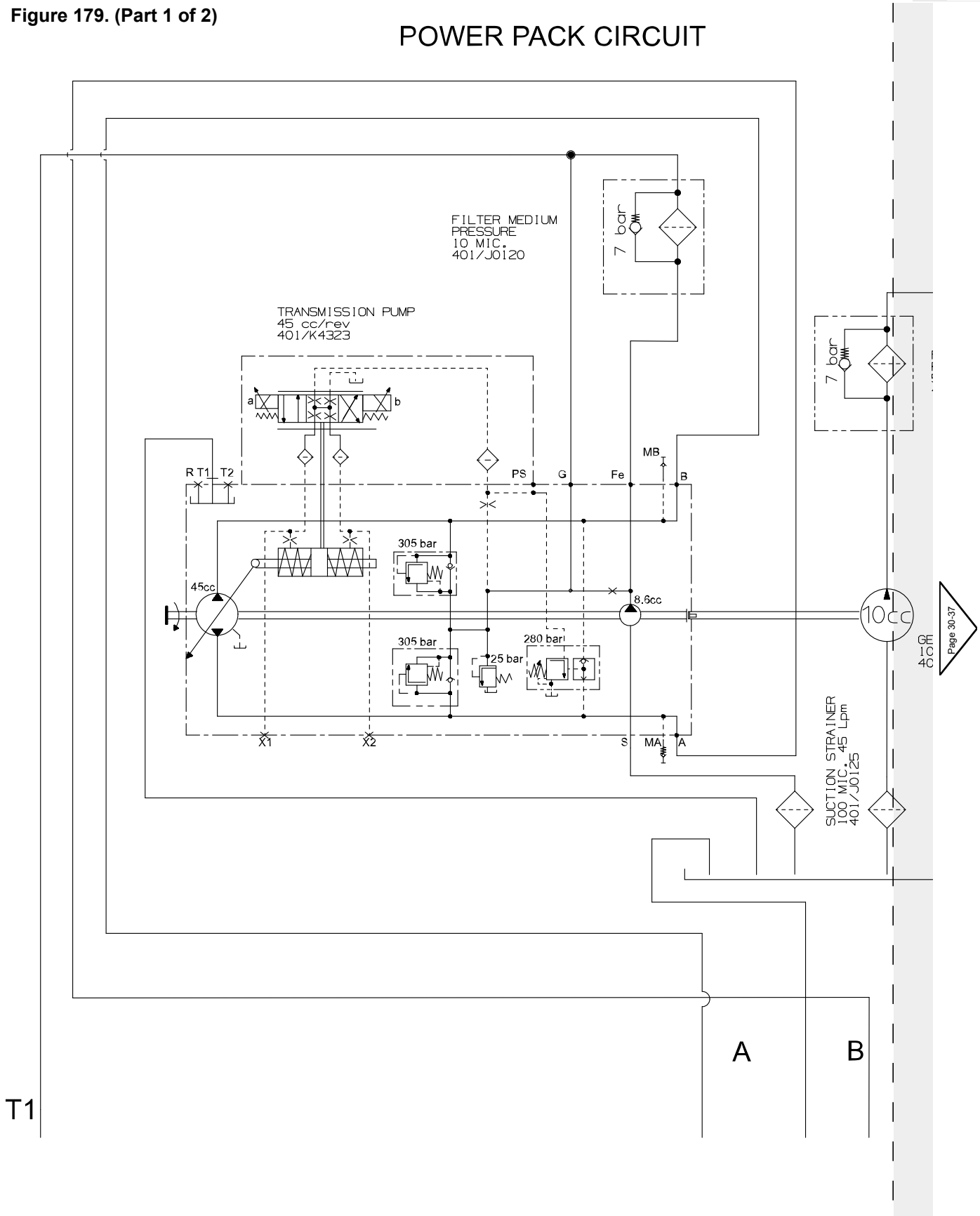
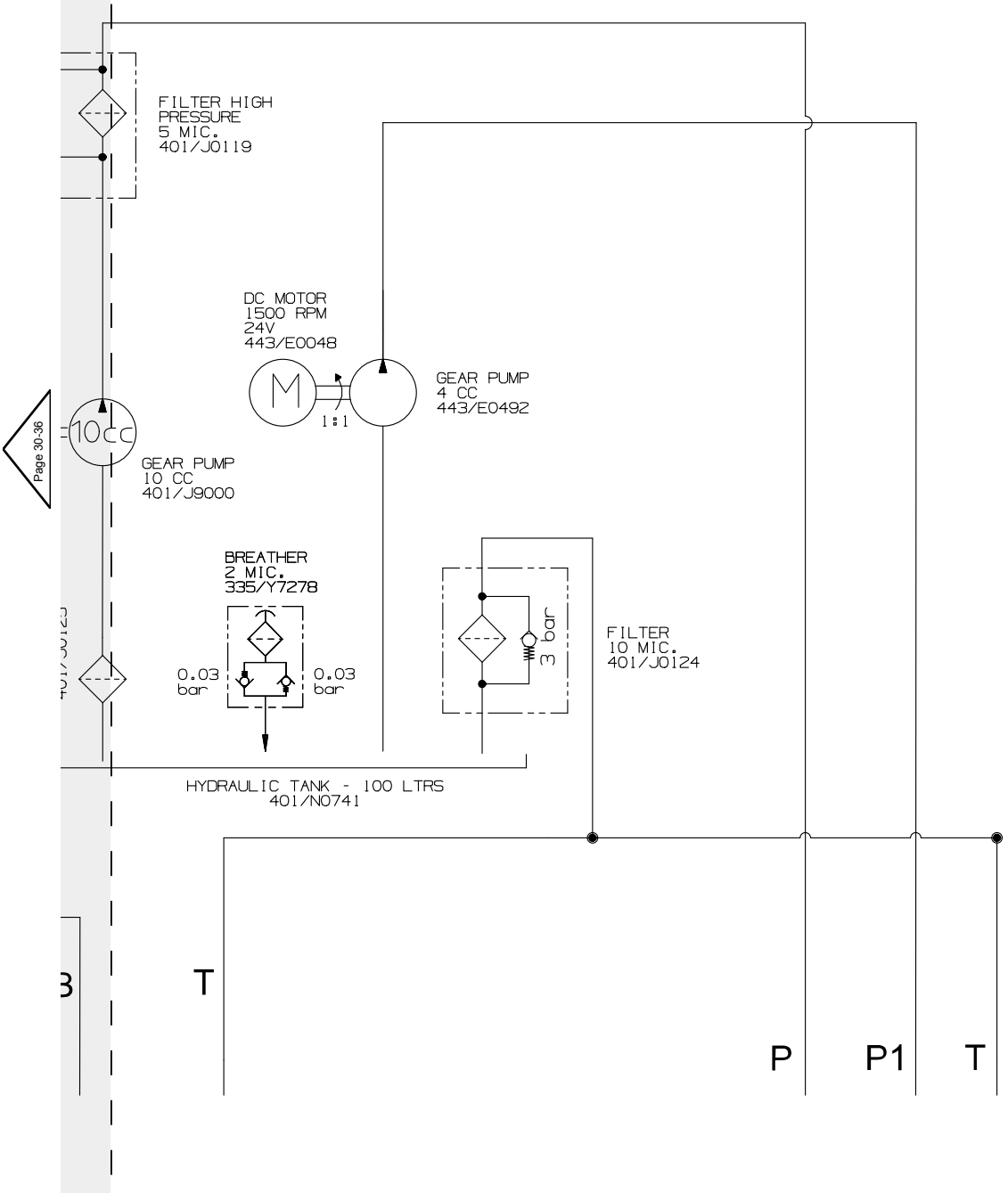
Figure 179. (Part 1 of 2)



gure 179. (Part 2 of 2)



401/D7061-4

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**Figure 180. 401/D7061 - 4
(Sheet 3 of 6)- Boom Circuit**

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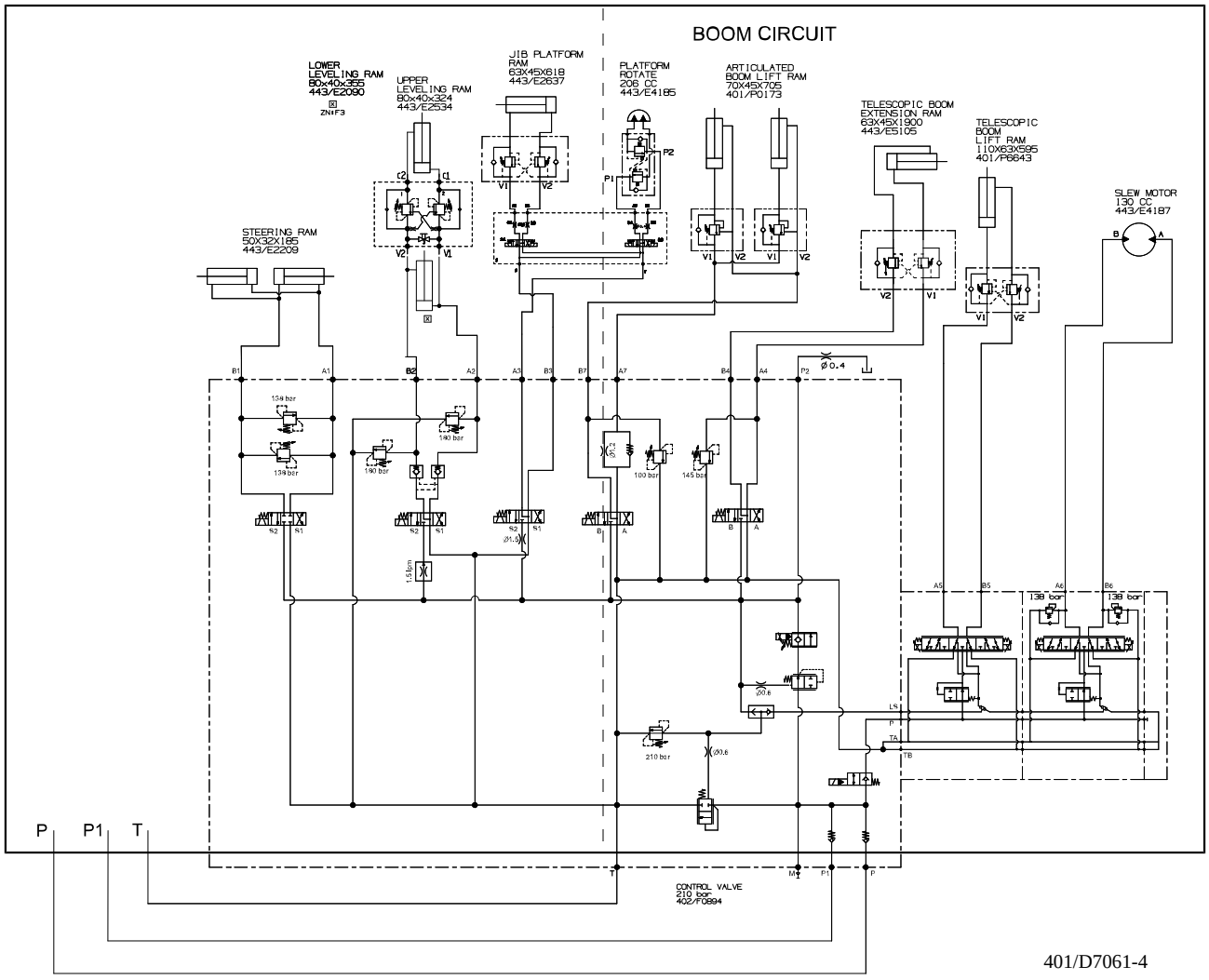

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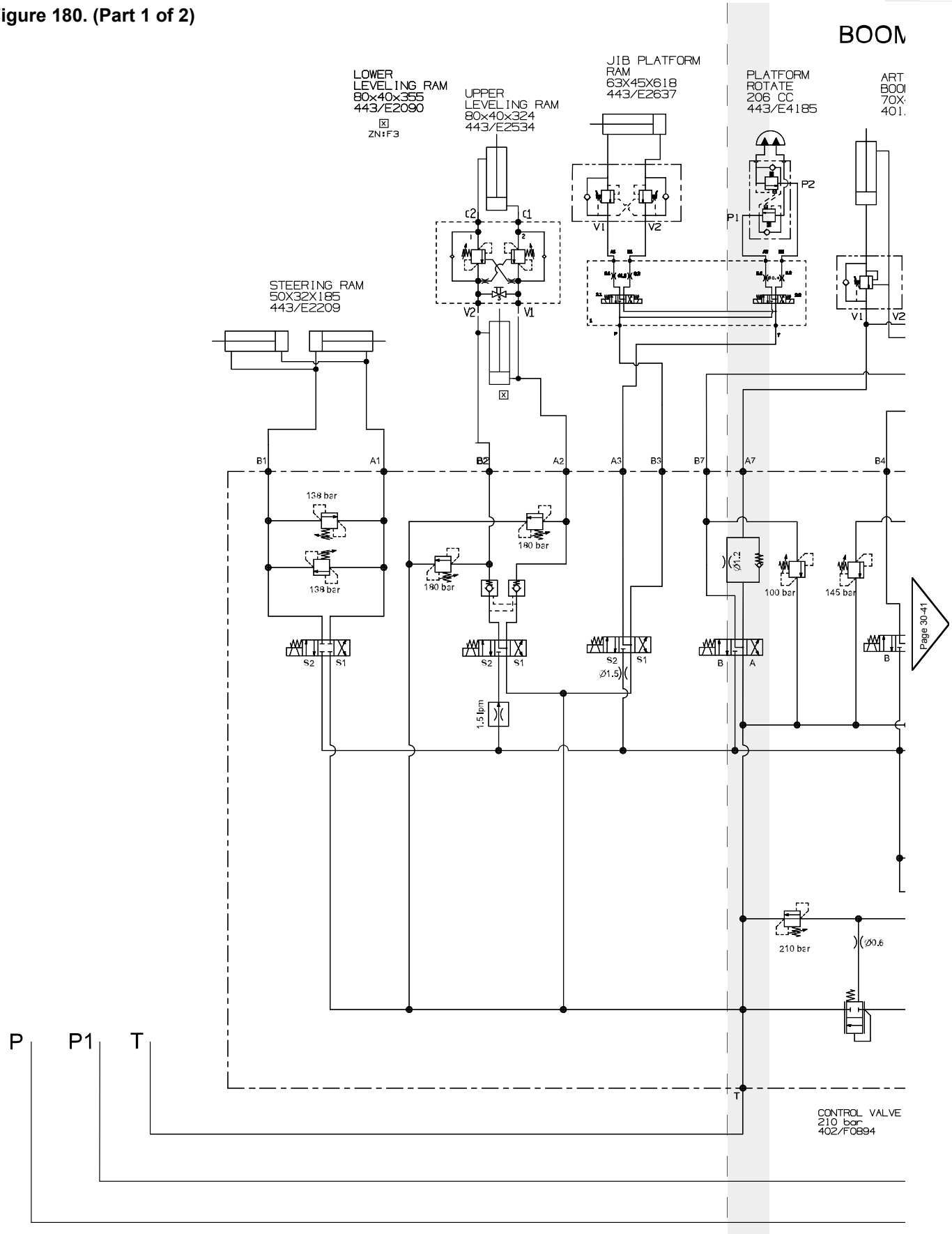
Figure 180. (Part 1 of 2)



jure 180. (Part 2 of 2)

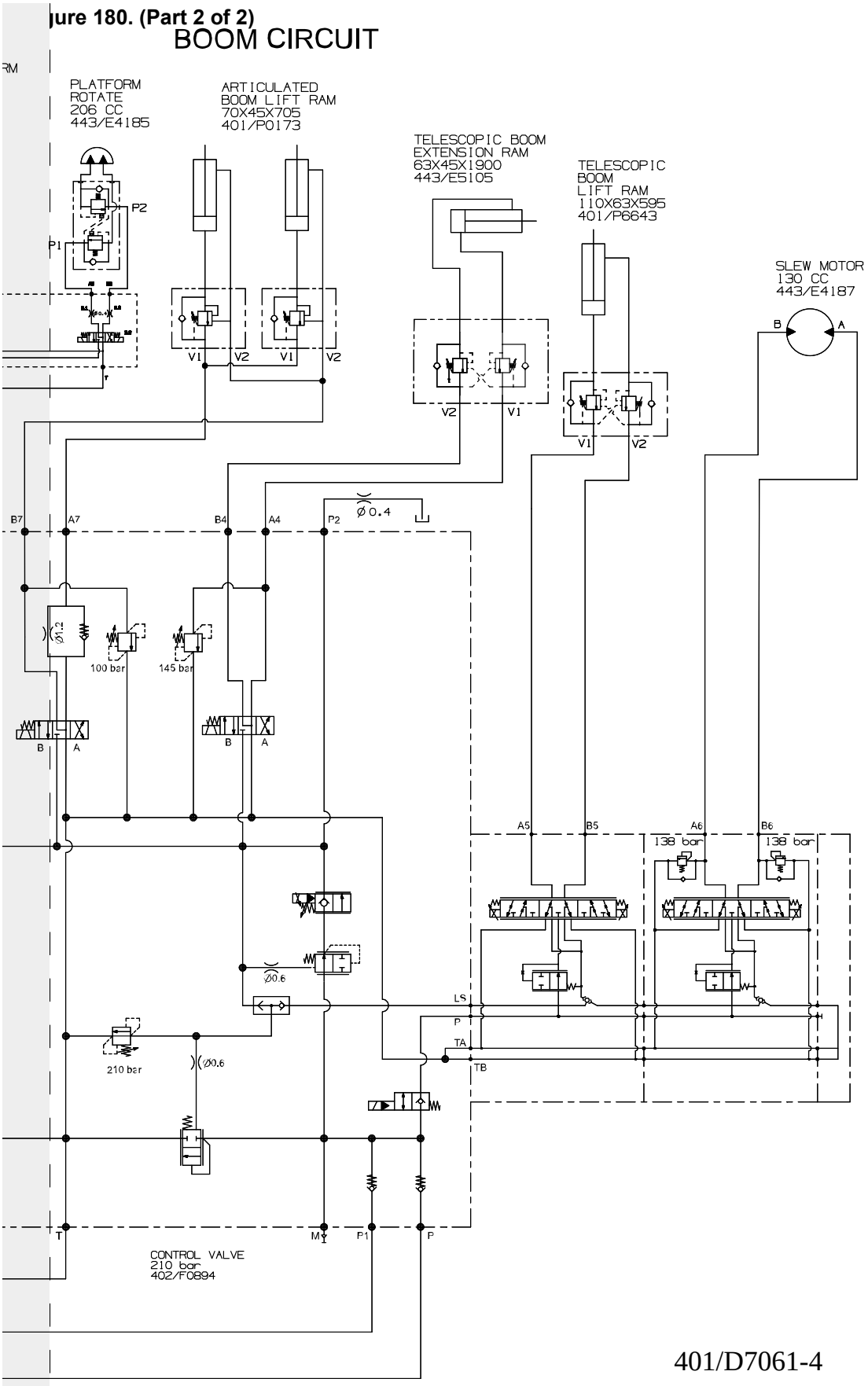


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**Figure 181. 401/D7061 - 4
(Sheet 4 of 6)- Drive Control**

Page 30-45

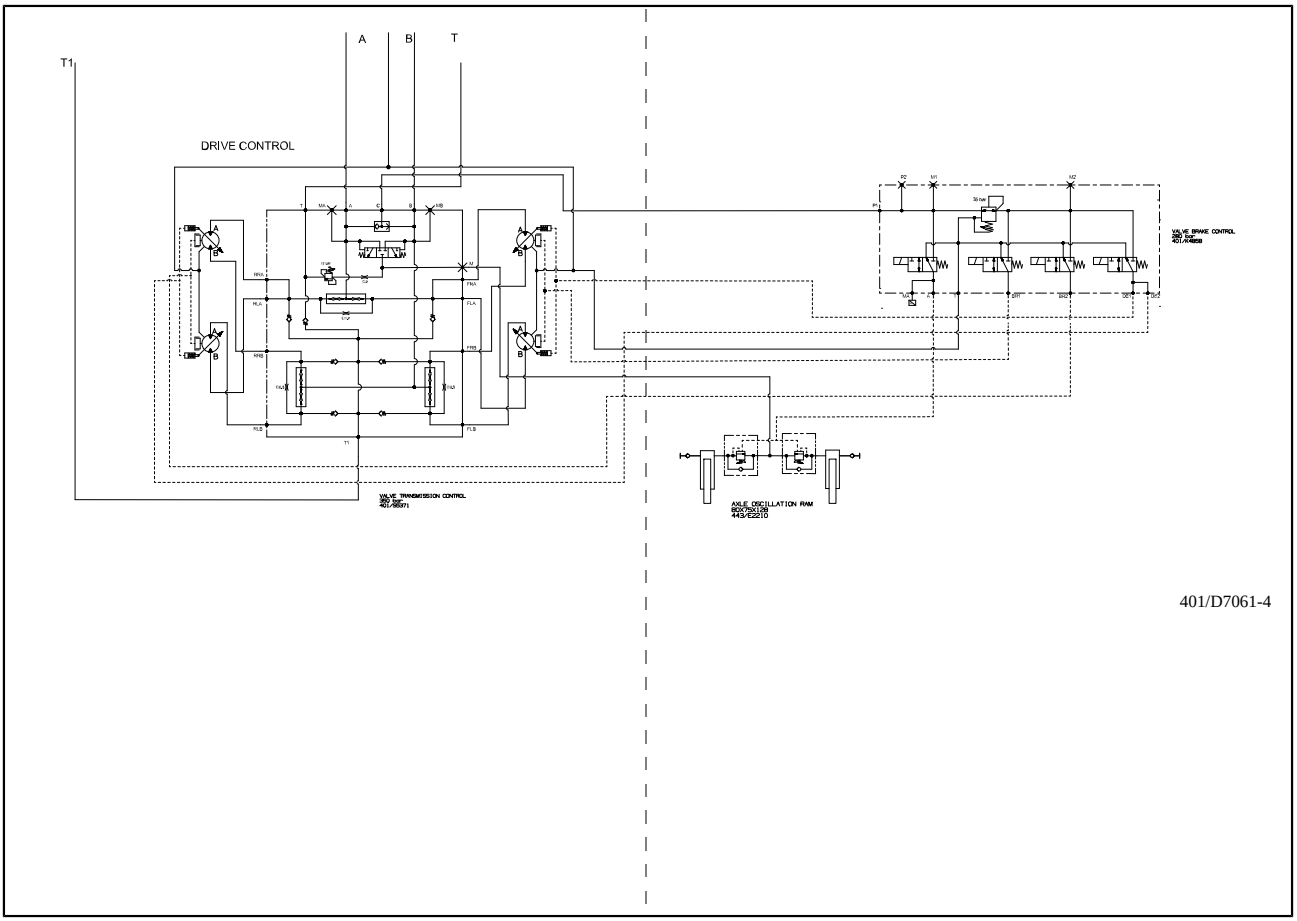

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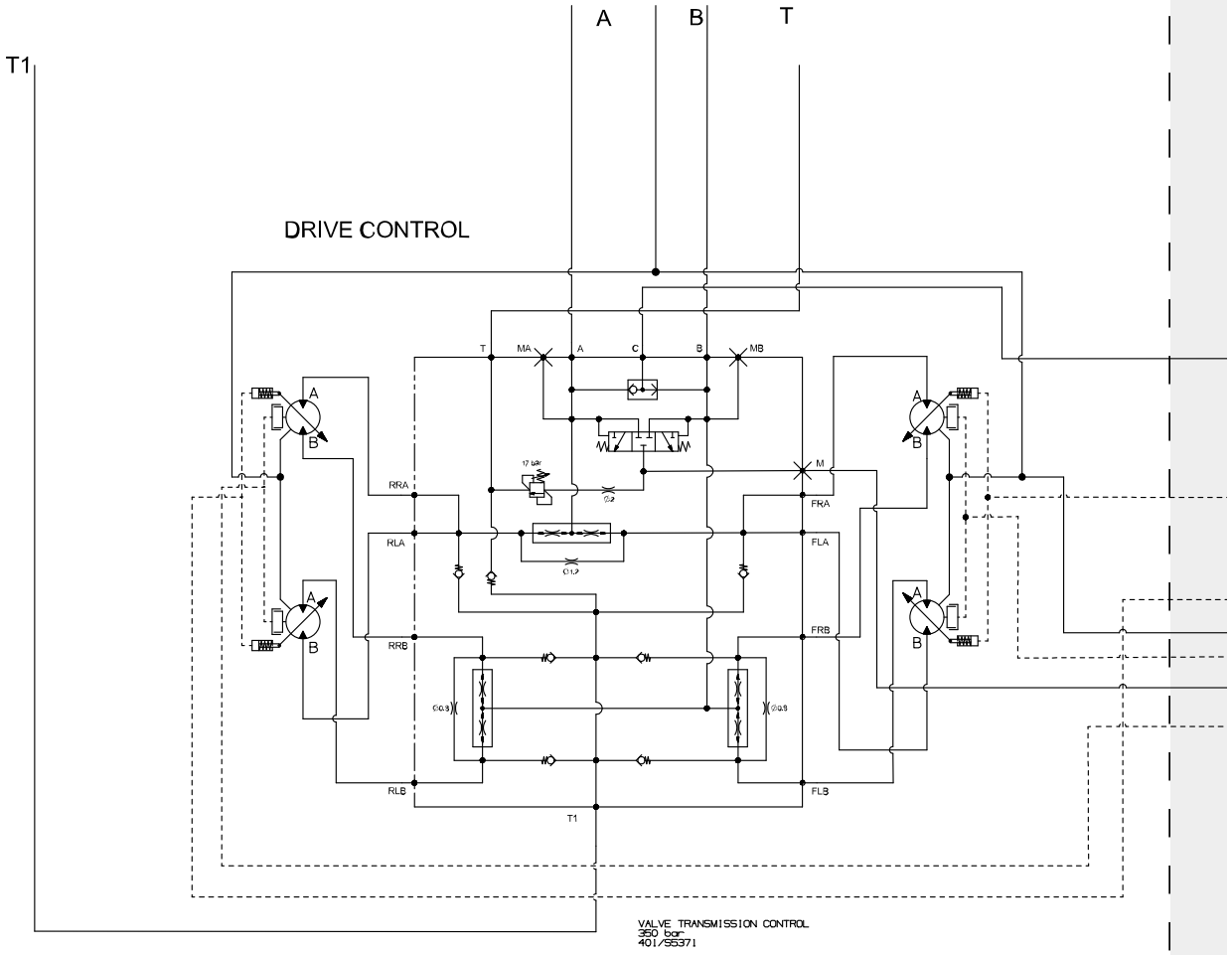
Figure 181. (Part 1 of 2)



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gure 181. (Part 2 of 2)

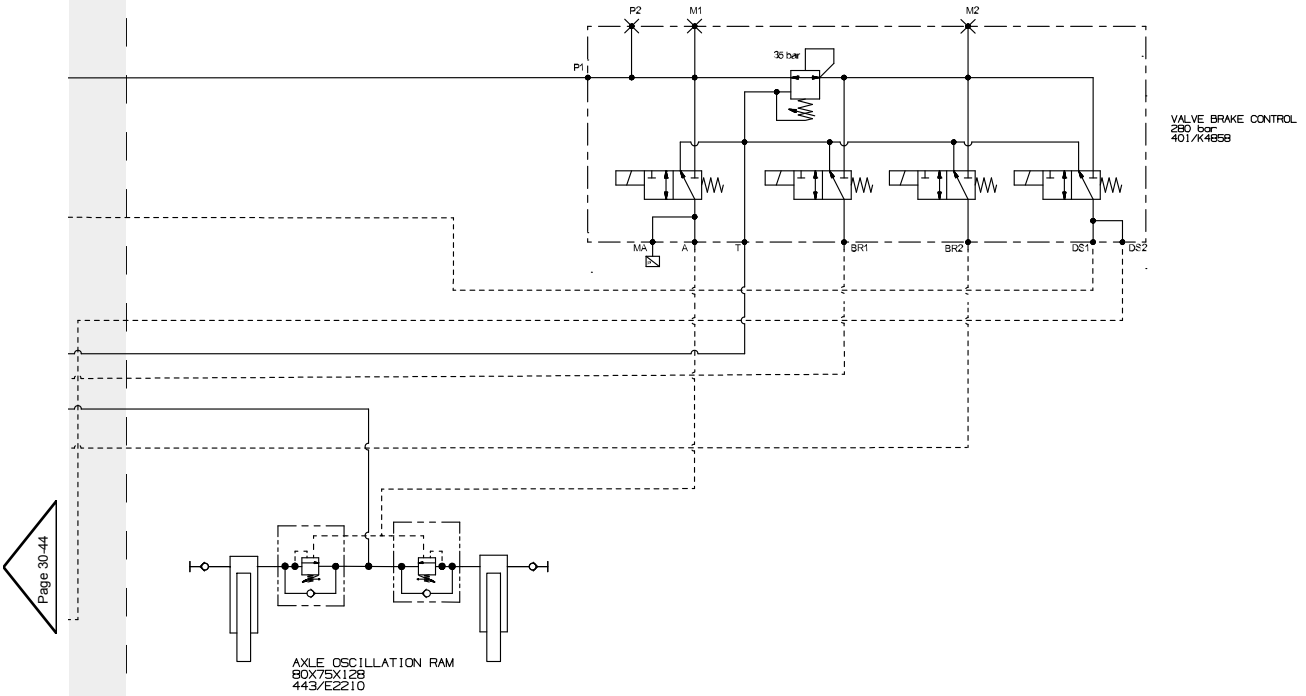

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Figure 182. 401/D7061 - 4 (Sheet 5 of 6)- Boom Circuit (Standard)

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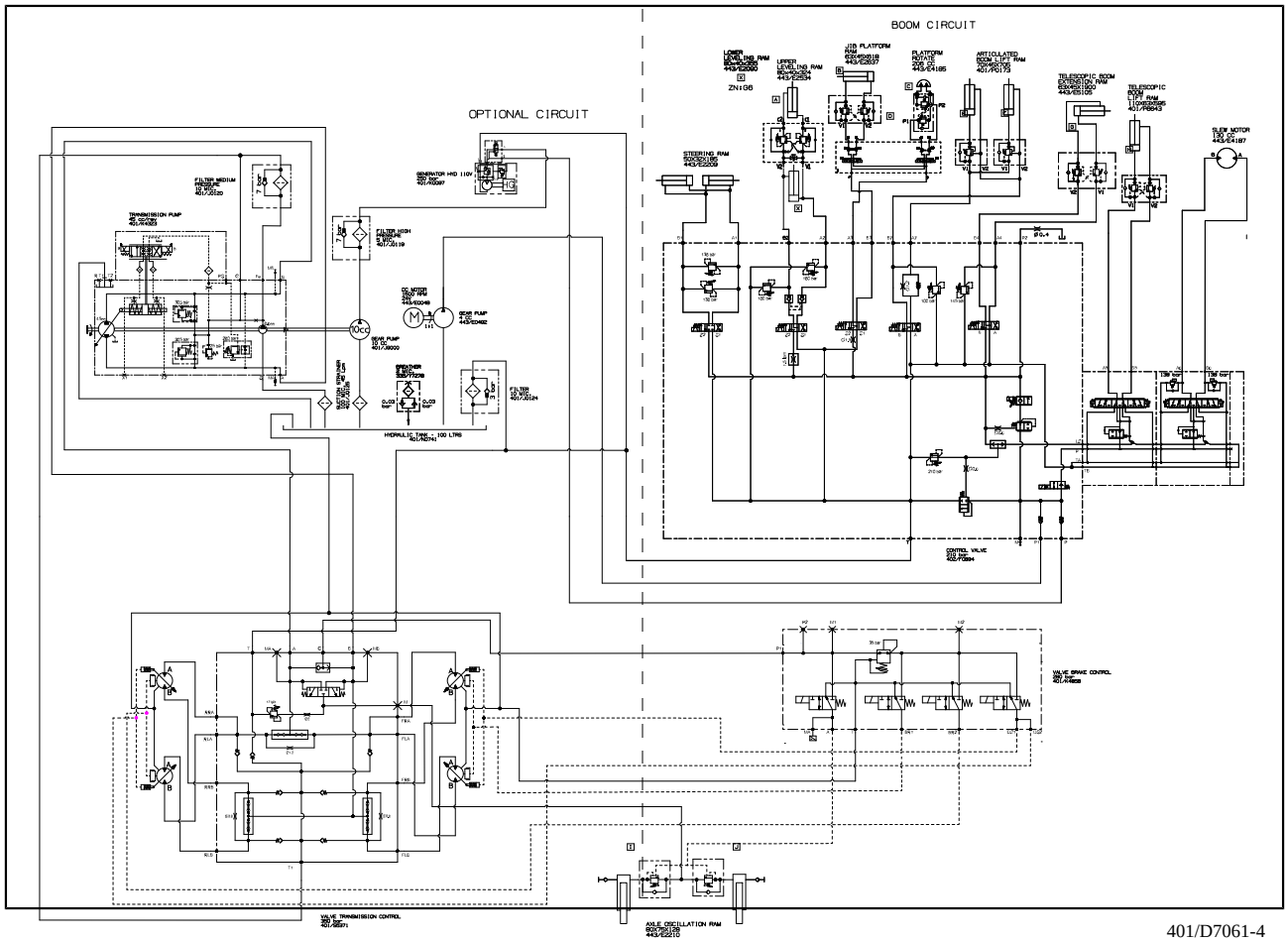
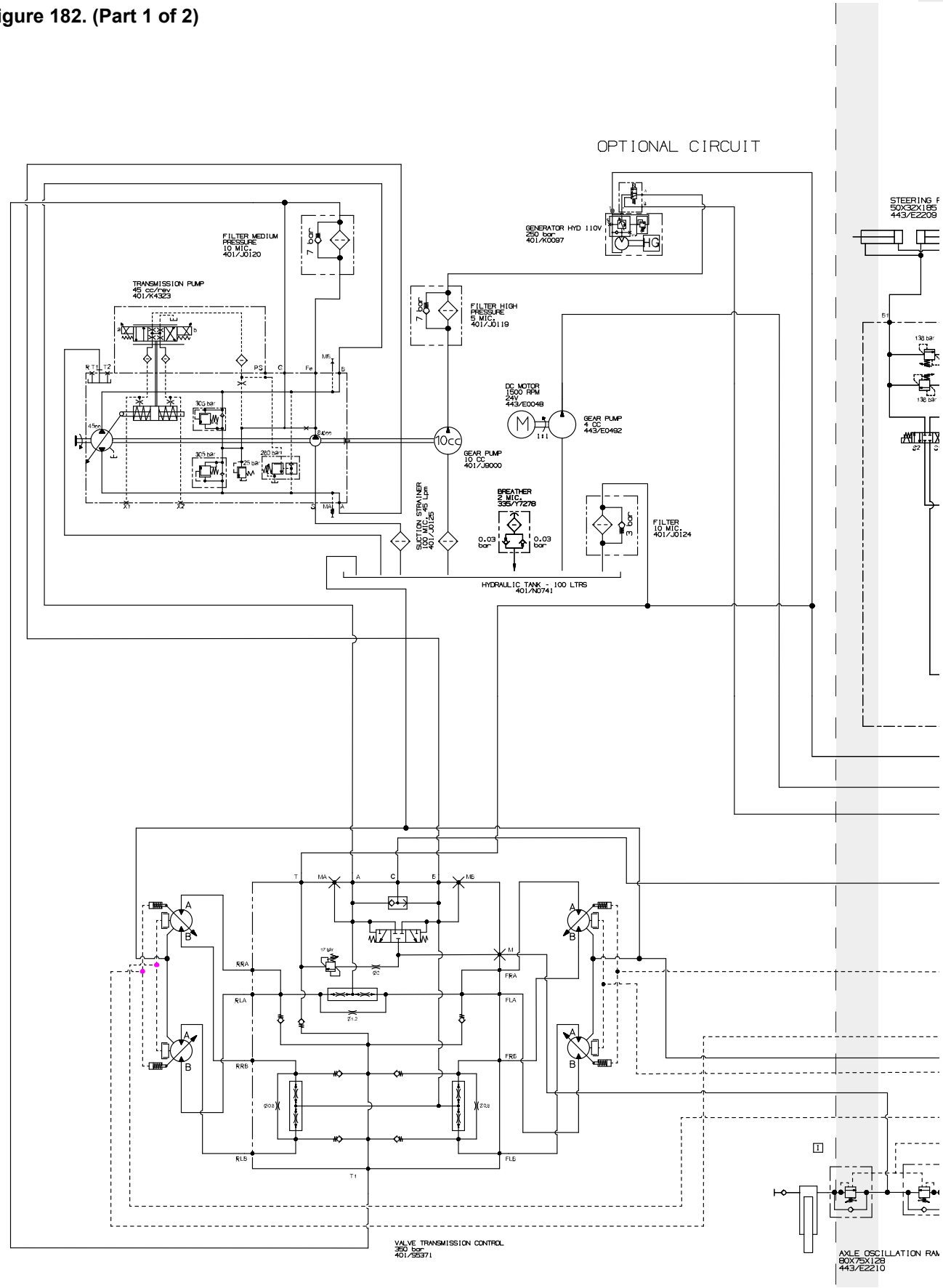
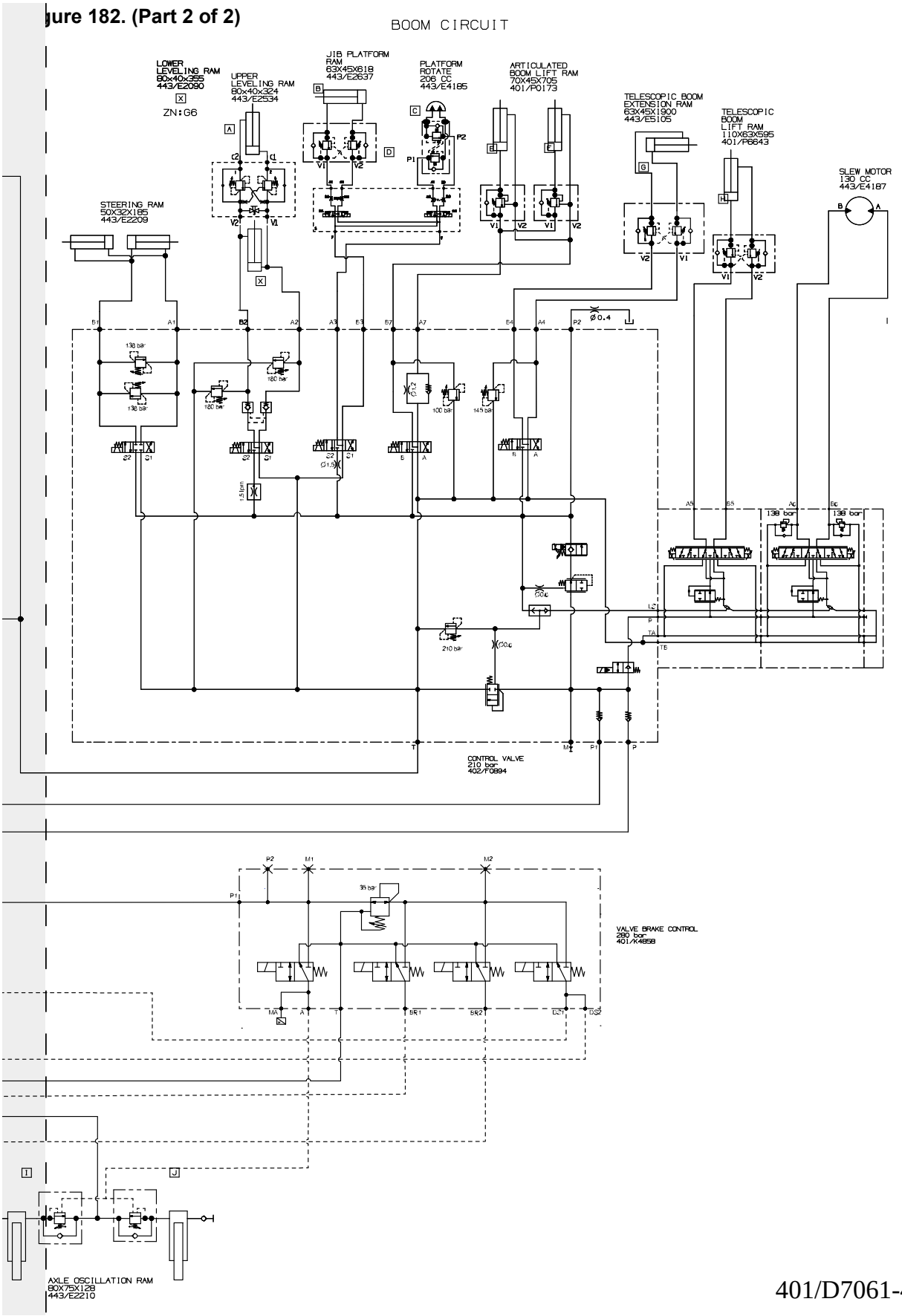


401/D7061-4

Figure 182. (Part 1 of 2)

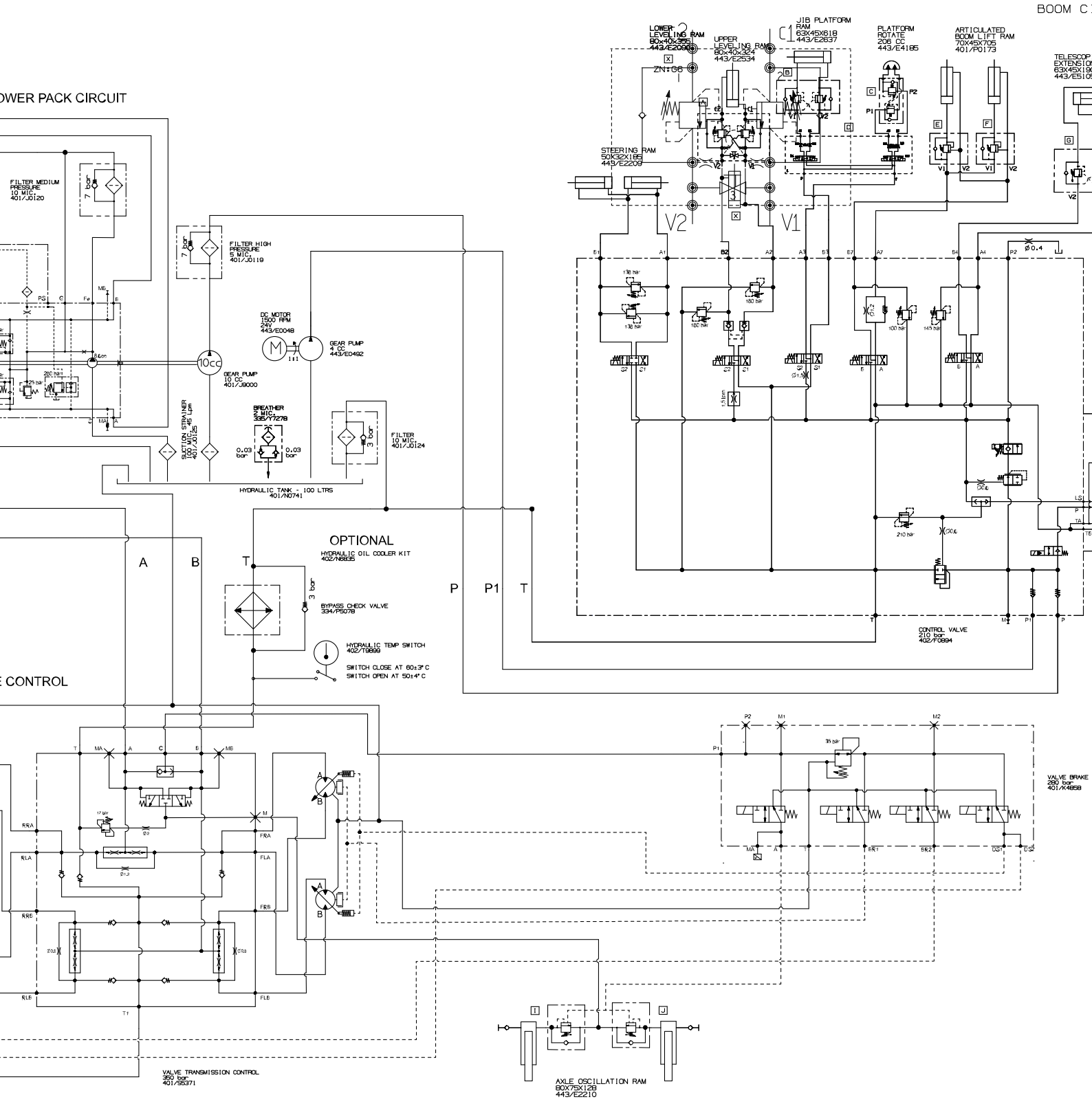


gure 182. (Part 2 of 2)



401/D7061-4

Figure 183. 401/D7061 - 4 (Sheet 6 of 6)- Boom Circuit with Hydraulic Oil Cooler (Optional)



03 - Tank

Contents **Page No.**

30-03-00 General 30-53
30-03-24 Breather 30-55

Notes:

00 - General

Introduction 30-53
Remove and Install 30-54

Introduction

The hydraulic tank holds excess hydraulic oil to accommodate volume changes due to the following.

- Cylinder ram extension and contraction.
- Temperature driven expansion and contraction.
- Hydraulic oil leaks.

The tank is also designed to aid in the separation of air from the fluid and it also acts as a heat accumulator to cover losses in the system when peak power is used.

The tank also houses filters or strainers that help to separate dirt and other particulates from the oil.

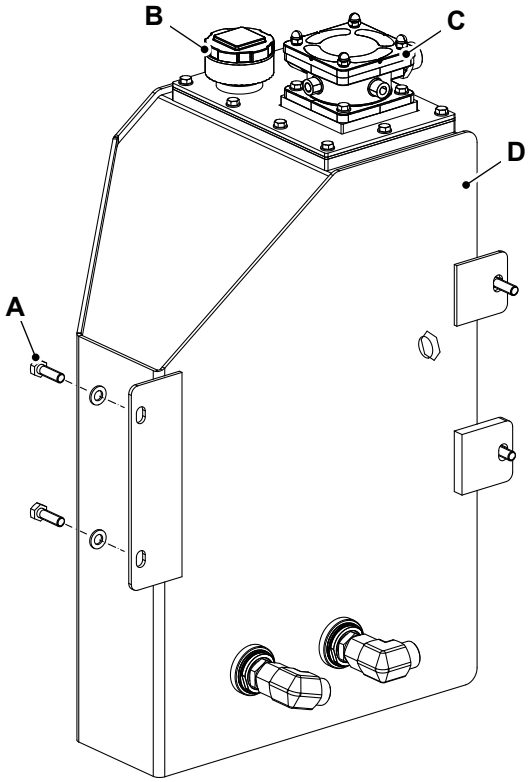
The cleanliness of this component is critical.
Refer to: Clean (PIL 30-00-00).

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Open the side turntable cover of the base control panel.
3. Place a container of suitable size beneath the machine.
   Volume: 100L
   3.1. Remove the oil drain plug and discharge all the oil into the container.
4. Put a label on the electrical wires of the horn to help installation.
   4.1. Disconnect the wires from the horn.
   4.2. Remove the bolts of the horn.
   4.3. Remove the horn from the machine.
5. Put a label on the hoses to help installation.
   5.1. Disconnect the oil suction hose attached to the cut-off valves of the hydraulic oil tank.
   5.2. Plug all the open ports and hoses to prevent contamination.
6. Put a label on the oil supply hoses to help installation.
   6.1. Disconnect the oil supply hoses for the auxiliary power unit.
   6.2. Plug all the open ports and hoses to prevent contamination.
7. Disconnect the hose from the hydraulic return filter.
   7.1. Plug all the open ports and hoses to prevent contamination.
8. Remove the setscrews (x4) of the hydraulic oil tank.
9. Support the hydraulic oil tank with suitable lifting equipment.
10. Remove the hydraulic oil tank away from the machine.

Figure 184.



A Setscrew (x4)
B Filler cap
C Hydraulic return filter
D Hydraulic oil tank

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Tighten the bolts to the correct torque value.
   Refer to: PIL 72-03-00.
3. Fill the tank with the correct, clean hydraulic oil through the filler neck.

24 - Breather

Introduction 30-55
Remove and Install 30-56

Introduction

The hydraulic tank breather allows air in and out of the tank. This smooths out the pressure fluctuations in the hydraulic tank as hydraulic fluid is rapidly drawn out from, or returned to the tank.

The breather also prevents contaminants like moisture and particles from entering the tank when air is drawn in. Contaminates can easily corrode, wear out or otherwise reduce the fluid performance of a hydraulic system.

When air is expelled from the tank the breather prevents hydraulic fluid spillage.

Remove and Install

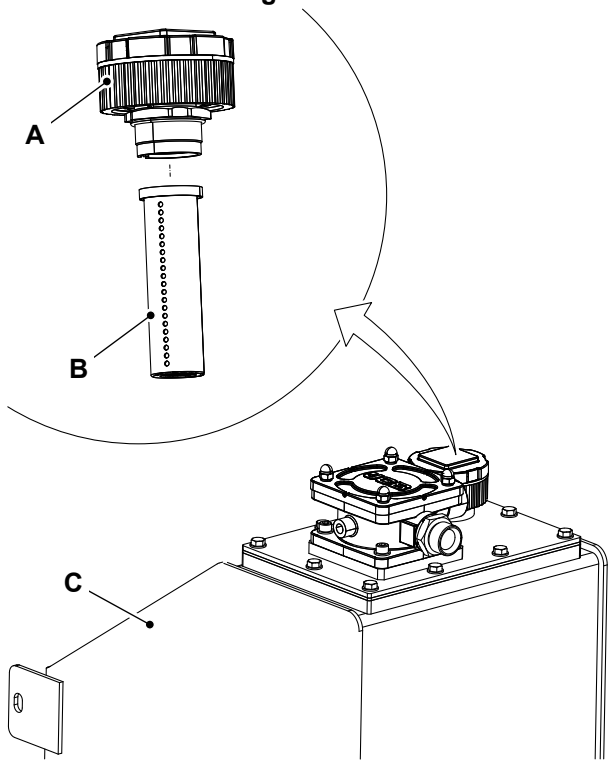
Special Tools

Description	Part No.	Qty.
Spanner	335/Y9489	1

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Get access to hydraulic tank.
   Refer to: PIL 06-06-09.
3. Use specified tool to remove the filler breather.
   Special Tool: Spanner (Qty.: 1)
4. If necessary, remove the strainer from the hydraulic tank.

Figure 185.



A Filler breather
B Strainer
C Hydraulic tank

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Tighten the filler breather to the correct torque value.
   Torque: 8–10N·m

04 - Filter

Contents **Page No.**

30-04-00 General 30-59
30-04-03 Main 30-60
30-04-09 Return Line 30-62

Notes:

00 - General

Introduction

Hydraulic filters are an important part of the machines hydraulic system. Metal particles are continually produced by mechanical components and need to be removed along with other contaminants.

The hydraulic filter assemblies are designed to filter all the contamination that is generated through use to the required level of cleanliness.

Filters are positioned in many different locations. Refer to the relevant hydraulic filter for the location and removal procedure.

The filters must be serviced to the requirements of the machine maintenance schedules. To ensure optimum performance and reliability it is important that the machine's hydraulic system is serviced periodically in accordance with the manufacturers requirements.

03 - Main

Introduction 30-60
Component Identification 30-61
Remove and Install 30-61

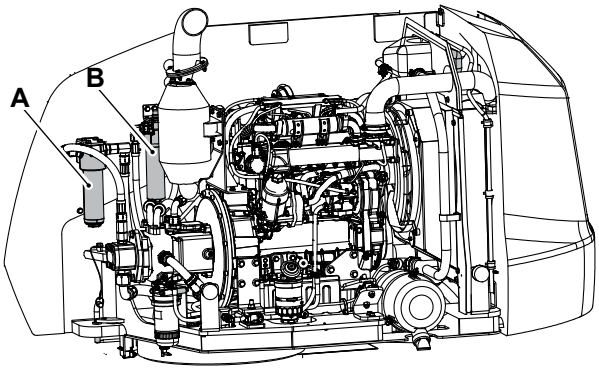
Introduction

This machine has two main hydraulic filters, one medium pressure filter of 10µ for the transmission drive circuit and the other high pressure filter of 5µ for the main valve block services.

Both the medium pressure filter and high pressure filter incorporates a bypass valve with 7bar (101.5psi) pressure capacity. If the filter becomes blocked, the bypass valve opens and allows fluid to bypass the filter. This prevents excessive back pressure which can damage the hydraulic system. The filter is not effective when the bypass valve is open.

Component Identification

Figure 186.



A High pressure filter
B Medium pressure filter

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Open the engine compartment cover.
   Refer to: PIL 06-06-06.
3. Place a suitable container under the hydraulic oil filter.
4. Remove the filter with an oil filter wrench.
5. Remove and discard the gasket.
6. Remove and discard the filter element.

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Tighten the filler breather to the correct torque value.
   Torque: 8–10N·m
3. Check the system for hydraulic leaks.
   Refer to: Check (Leaks) (PIL 30-00-00).

09 - Return Line

Introduction 30-62
Remove and Install 30-63

Introduction

This machine has one return line filter common for both drive circuit and service circuit, usually located in the main hydraulic return line close to, or inside the hydraulic tank.

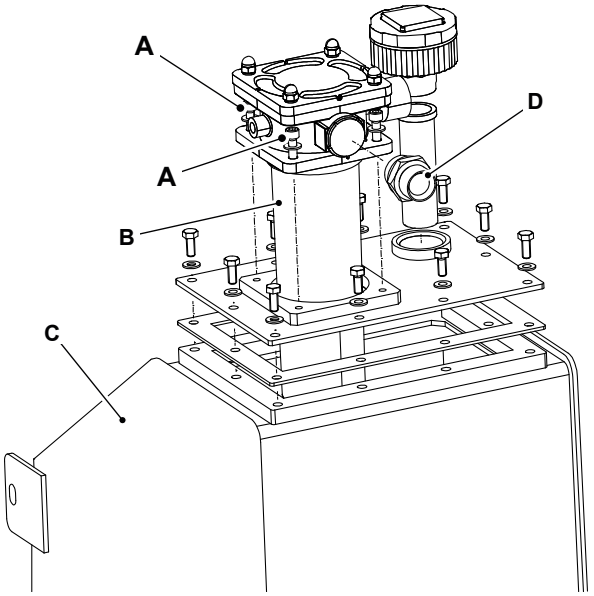
This filter incorporate a bypass valve with pressure 3bar (43.5psi). If the filter becomes blocked, the bypass valve opens and allows fluid to bypass the filter. This prevents excessive back pressure which can damage the hydraulic system. The filter is not effective when the bypass valve is open.

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
   Refer to: Discharge and Pressurise (PIL 30-00-00).
3. Get access to the hydraulic tank.
   Refer to: PIL 06-06-09.
4. Remove the capscrew (x4) and washer (x4).
5. Remove the return line filter from the hydraulic tank.

Figure 187.



A Capscrew (x4)
B Return line filter
C Hydraulic tank
D Clog indicator

Install

1. The installation procedure is the opposite of the removal procedure.
2. Tighten the filler breather to the correct torque value. Torque: TBC
   Torque: 8–10N·m

06 - Alternator Motor

Contents **Page No.**

30-06-00 General 30-65

00 - General

Introduction 30-65
Health and Safety 30-66
Component Identification 30-67
Fault-Finding 30-68
Clean 30-70
Check (Condition) 30-71
Adjust 30-72
Remove and Install 30-73

Introduction

These machines are installed with an alternator motor, also called a hydraulic generator.

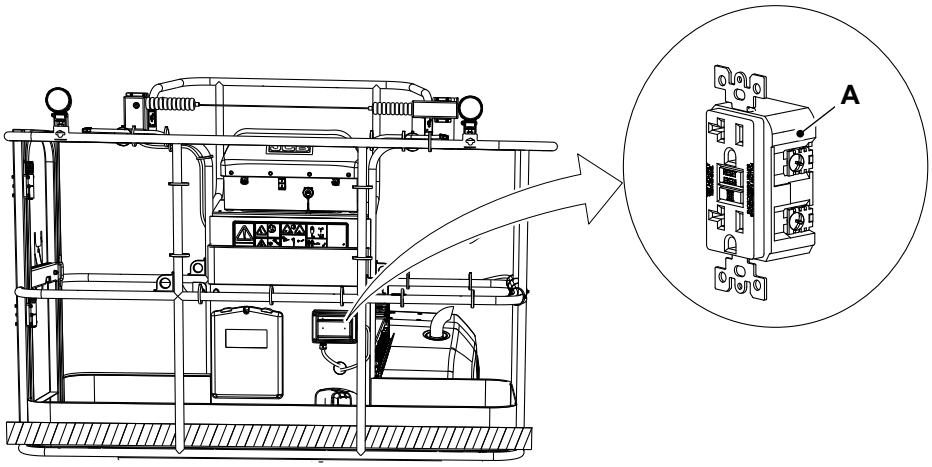
The alternator motors are compact and integrated all-in-one units. The alternator motor use a hydraulic power source to operate and produce electricity. These can be used to provide power to the platform when the machine is stationary. You must use equipment that is within the specified rated capacity of hydraulic generator. Refer to Table 87.

Table 87.

Description	Data
Rated output	110V, 60Hz
Rated Power	1,650W

The power plug is located at one end of the platform. Refer to Figure 188.

Figure 188.



For operation of hydraulic generator from platform refer to:
Refer to: Operation (PIL 30-06-00).

Health and Safety

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before connecting or removing any hydraulic hose, residual hydraulic pressure trapped in the service hose line must be vented. Make sure the hose service line has been vented before connecting or removing hoses. Make sure the machine cannot be started while the hoses are open.

WARNING! *Electric shock hazard. High voltage can cause serious injury or death. Make sure that all work is performed by qualified personnel. All cabling to the load must comply with the applicable laws and electrical standards.*

WARNING! *Suitable grounding of the product provides extra safety. The international electric code requires that the product is properly connected to an appropriate earth to help prevent electric shock. A suitable terminal is located on the generator for this purpose. For remote grounding connect a length of heavy gauge copper wire from the product terminal to a copper rod driven into the ground. Never operate electrical equipment with damaged or defective cables.*

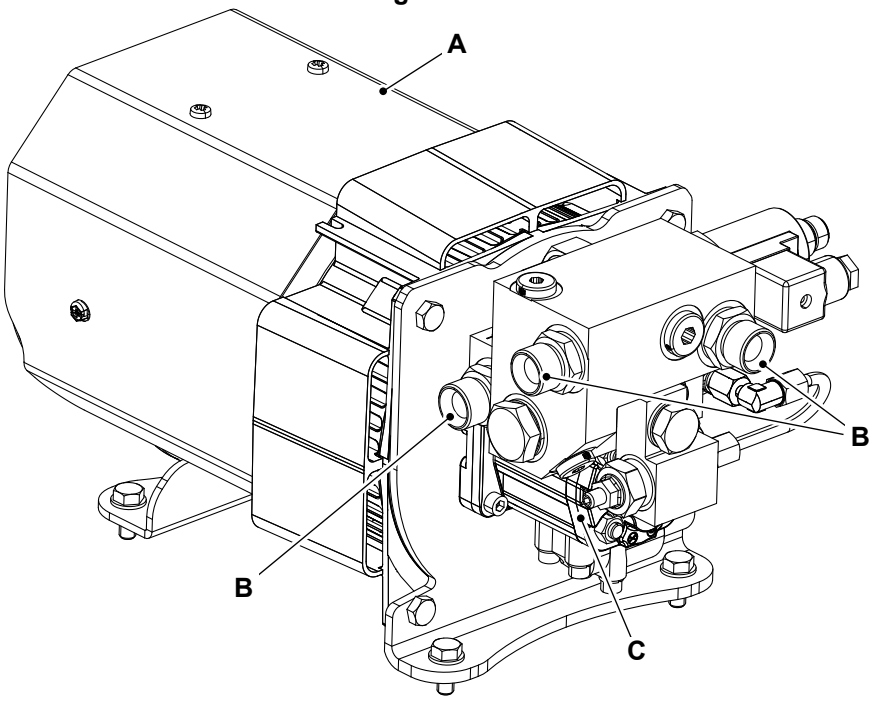
WARNING! *Stop and wait for at least 30 min for the electrical parts to completely discharge before you remove any covers, otherwise you could be electrocuted.*

CAUTION! *The temperature of the hydraulic oil will be high soon after stopping the machine. Wait until it cools before beginning maintenance.*

CAUTION! *To avoid burning, wear personal protective equipment when handling hot components. To protect your eyes, wear goggles when using a brush to clean components.*

Component Identification

Figure 189.



A Alternator
B Adaptor
C Hydraulic motor

Fault-Finding

Fault		
Low output voltage at no load	Table 88.	Page 30-68
Output voltage is less than	Table 89.	Page 30-68
Low output voltage and frequency at load	Table 90.	Page 30-68
Low frequency at no load	Table 91.	Page 30-68
High frequency at load	Table 92.	Page 30-68
Output voltage instability	Table 93.	Page 30-69
High hydraulic oil consumption	Table 94.	Page 30-69
High hydraulic pressure consumption	Table 95.	Page 30-69
A mild electrical shock from hydraulic motor	Table 96.	Page 30-69
Abnormal noise from the alternator motor	Table 97.	Page 30-69

Table 88. Low output voltage at no load

Cause	Remedy
Poor contact in electrical system	Check all internal contacts and wirings of the alternator motor.
	Check condition of the brush and slip rings. Clean them as required.

Table 89. Output voltage is less than

Cause	Remedy
Excitation rectifier failed	Check condition of the excitation rectifier. Replace as required.
Voltage regulator failed	Replace the capacitor.
Insufficient residual magnetism	Use an external battery of 12V DC (Direct Current) voltage for specified duration to magnetise the rotor. Duration: 1–2s

Table 90. Low output voltage and frequency at load

Cause	Remedy
Overloaded alternator motor	Reduce the load and check the current to make sure that the proper load is applied.

Table 91. Low frequency at no load

Cause	Remedy
Too low RPM (Revolutions Per Minute)	If the frequency is out of range, hydraulic system failure is concerned.
	Make sure that the hydraulic flow and pressure are sufficient. If necessary, adjust the RPM cartridge.
	Check the hydraulic motor for possible leakage. I necessary, replace the motor.

Table 92. High frequency at load

Cause	Remedy
Too high RPM	If the frequency is out of range, hydraulic system failure is concerned.
	Make sure that the hydraulic flow and pressure are sufficient. If necessary, adjust the RPM cartridge.

Table 93. Output voltage instability

Cause	Remedy
Unstable RPM	Check condition of the hydraulic components including automatic frequency control valve. Adjust them as required.
	Make sure that the hydraulic oil flow is constant.
	Make sure that the hydraulic oil flow and pressure are not excessive. Adjust them as required.
	Check the hydraulic motor for possible leakage. If necessary, replace the hydraulic motor.

Table 94. High hydraulic oil consumption

Cause	Remedy
Failure of axial sealing of hydraulic motor and alternator. External indication - hydraulic oil outflow from ventilation grids	Axial seal of hydraulic motor broken by reason of excessive pressure in return line. Rebuild the return line. Make a note that the maximum allowed pressure in return line is as specified. Pressure: 5bar (72.5psi)
	Replace the axial seal of hydraulic motor.
Oil leakage from the hydraulic motor	Check the condition of the hydraulic motor for wear. If necessary, replace it.

Table 95. High hydraulic pressure consumption

Cause	Remedy
Winding failed	Check condition of the stator winding for short circuit. If necessary, replace the alternator motor.

Table 96. A mild electrical shock from hydraulic motor

Cause	Remedy
Poor earthing	Make sure that the earth leads are properly connected.

Table 97. Abnormal noise from the alternator motor

Cause	Remedy
Bearing failed	Check condition of the bearings for wear and damages. Replace as required.
Fan broken	Check condition of the fan for wear and damages. Replace as required.

Clean

Compressed Air

Compressed air is dangerous. Wear personal protective equipment. Never point a compressed air jet at yourself or others.

The frequent cleaning of the alternator motor is critical for correct operation. Make sure that the alternator gets clean ventilation. Dusty conditions increase the wear of the components.

1. Remove the cover, side screen and diffuser.
2. Use compressed air to clean the fan, rotor, stator compartment and the alternator electrical component.
3. Clean the component thoroughly. Remove all dust, dirt, oil and grease deposits.
4. Check condition of all seals and gaskets. Replace them as required.
5. Install the cover, side screen and diffuser.

Check (Condition)

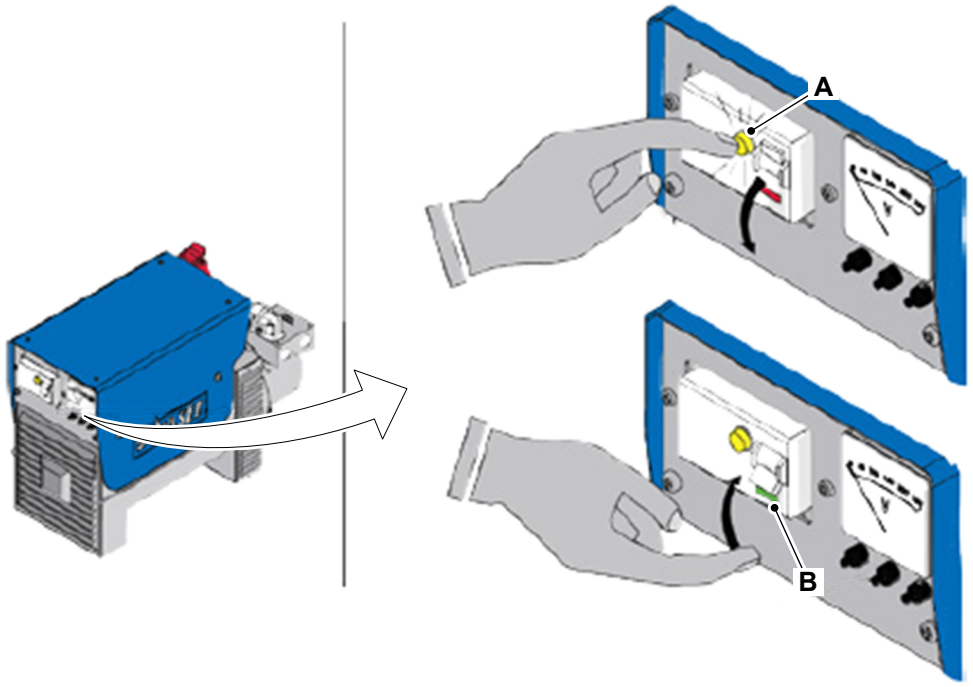
It is recommended to check the condition of the hydraulic alternator at least once a month.

Make a note of the following:

- The alternator safety device can only be tested when the hydraulic alternator is on.
- When the test button is pressed the switch must be released immediately.
- Do not use the hydraulic alternator with faulty safety equipment.
- If a fault condition trips the safety device, the fault has to be cleared before the switch can be set back up.
- Do not bypass or remove the safety device to clear the problem.

1. Push the test button to check the functionality of the device. If everything is in order, the switch releases.
2. Switch the reset switch back up to put the hydraulic alternator operational.

Figure 190.



A Test button

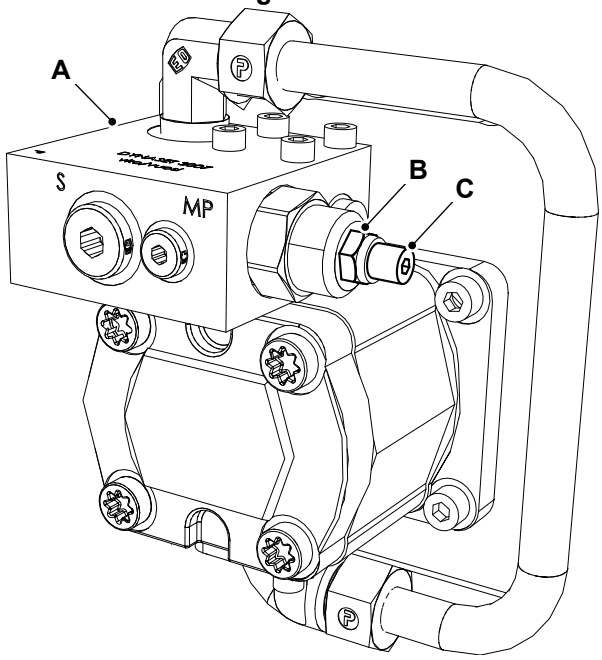
B Reset switch

Adjust

Do not adjust hydraulic alternator when any appliance is connected to it. When you adjust the hydraulic alternator, make sure that the hydraulic oil is at normal operating temperature.

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Start the hydraulic alternator.
3. Make sure that the hydraulic flow is at nominal level.
4. Use a suitable multimeter to measure the current frequency.
5. Switch the generator off before adjusting the settings. Loosen the locknut.

Figure 191.



A Cartridge valve
B Locknut
C Adjusting screw

6. Turn the adjustment screw to change the frequency accordingly.
   6.1. Do not make more than a quarter of a turn at a time.
   6.2. Make sure that the multimeter shows the required frequency reading.
7. Tighten the locknut to the correct torque value.

Table 98. Torque Values

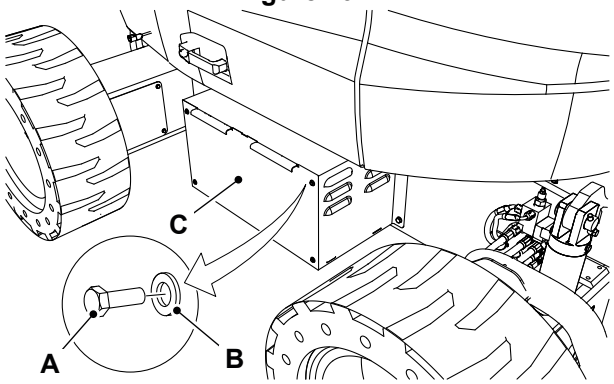
Item	Nm
B	10

Remove and Install

Remove

1. Make the machine safe.
2. Discharge the hydraulic pressure.
3. Remove the screw (x4) and washer (x4).
4. Remove the cover.

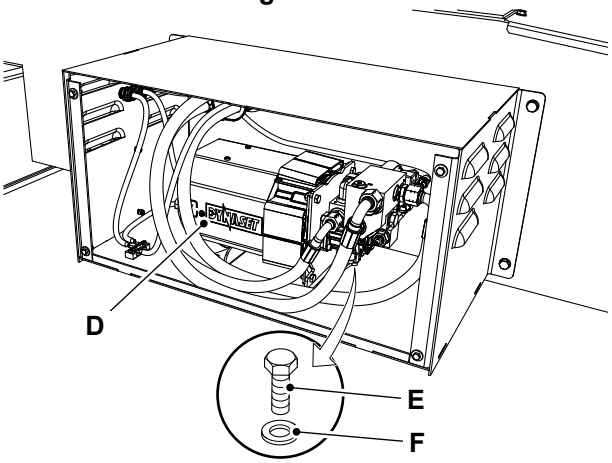
Figure 192.



A Screw (x4)
B Washer (x4)
C Cover

5. Put a label on the hydraulic hoses to help installation.
   5.1. Remove the hydraulic hoses from the hydraulic generator.
   5.2. Plug all the open ports and hoses to prevent contamination.
6. Disconnect the electrical connectors from hydraulic generator.
7. Remove the bolt (x4) and washer (x4).
8. Carefully lift and remove the hydraulic generator from the machine.

Figure 193.



D Hydraulic generator
E Bolt (x4)
F Washer (x4)

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Tighten the bolt (x4) to the correct torque value.

Table 99. Torque Values

Item	Nm
E	22

11 - Gear Pump

Contents **Page No.**

30-11-00 General 30-75

00 - General

Introduction 30-75
Check (Condition) 30-76
Remove and Install 30-77

Introduction

There are two gear pumps on the machine. One is mounted to the transmission pump. The other is mounted on the auxiliary motor in the centre of the turntable.

The gear pump consists of an end cover, a body, housing a matched gear pair, bushes and a mounting flange fixed together with bolts. The gear journals are supported in plain bearings within pressure balanced bushes to give high volumetric and mechanical efficiencies.

The direction of rotation of the pump is indicated by an arrow on the body near to the driveshaft.

Check (Condition)

Each component should be thoroughly cleaned, carefully checked and assessed for possible re-use again. Use the guide below to check the various components and if any component is unserviceable, replace the complete pump assembly.

Body

Check the body bore cut-in on the inlet side where the gears touch the body. The body can only be re-used if the cut-in is bright and polished in appearance and the depth does not exceed 0.08mm. The body should not be scored, have a 'matt' appearance or show signs that the tip of the gears have dug in and torn away the surface material.

The body must be checked to make sure that there is no superficial damage, which may badly affect performance or sealing. Give particular attention to the port threads and the body O-ring seal recesses.

Mounting flange and end cover

The inner surfaces must be checked to make sure that there is no unusual wear or scoring in the area where the body O-rings and bush seals contact, which could result in external leakage.

Check the shaft seal recess for scoring or damage that could result in oil leakage around the outer diameter of the shaft seal. Shaft seals can be re-used with Loctite hydraulic sealant to overcome small damage in this area.

Bushes

The side faces, which abut the gears, should be perfectly flat, should not have any signs of scoring. Characteristically there are bright polished areas on this surface caused by loading against the gear side faces and is often more pronounced on the low pressure side.

Often there is a witness mark where the tips of the opposing gears have wiped an overlap resembling a half moon shape. There must be no noticeable wear step as it is critical that the bush side face is completely flat on the gear side face.

The bush bearing liners are acceptable for use unless they are not scored, have bronze appearing through the grey surface or show any prominent signs of wear.

Gears

The gear side faces should be checked for bruising or scoring. Often operation on contaminated fluid shows scoring between the root of the gear and the journal, which leaves a wear step. If a wear step can be felt coincident with the root diameter by drawing a fingernail across the surface from the journal outwards to the tip of the gear, then the gear is unserviceable.

The gear teeth must be carefully checked to make sure that there are no signs of scuffing or pitting on the involute face.

The journal bearing surfaces should be completely free from scoring or bruising. The surface should appear highly polished and smooth to the touch.

Make sure that the area where the shaft seal lips run on the driveshaft, this shows up as a polished ring or rings. If a noticeable groove can be felt or there is scoring the shaft is unserviceable.

If the driveshaft is not damaged from the drive coupling and the gears have not been harmed as described above, then the gears can be used again.

When pumps are disassembled, all the seals must be replaced. It is most important that genuine JCB parts are used.

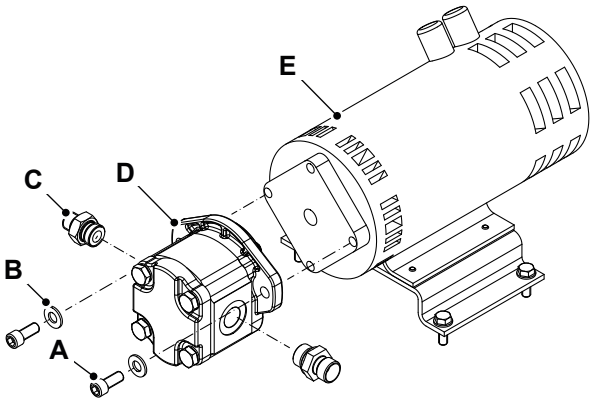
Remove and Install

Gear Pump Mounted to Auxiliary Pump

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
   Refer to: Discharge and Pressurise (PIL 30-00-00).
3. Drain the hydraulic oil.
   Refer to: Drain and Fill (PIL 30-00-00).
4. Disconnect the hoses from the gear pump.
5. Put a label on the hoses to help installation.
6. Plug all the open ports and hoses to prevent contamination.
7. Support the gear pump suitably.
8. Remove the bolts (x2) and washer from the gear pump.
9. Remove the gear pump from the machine.
10. If required, remove the adaptor (x2).

Figure 194.



A Bolt (x2)
B Washer (x2)
C Adaptor (x2)
D Gear pump
E Auxiliary pump electric motor

Install

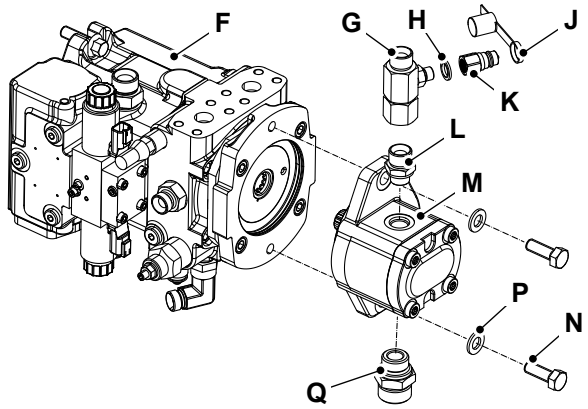
1. The installation procedure is the opposite of the removal procedure.
2. Tighten the bolt (x2) and adaptor (x2) to the correct torque value. Refer to Table 100.

Gear Pump Mounted to Transmission Pump

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
   Refer to: Discharge and Pressurise (PIL 30-00-00).
3. Drain the hydraulic oil.
   Refer to: Drain and Fill (PIL 30-00-00).
4. Disconnect the hoses from the gear pump.
5. Put a label on the hoses to help installation.
6. Plug all the open ports and hoses to prevent contamination.
7. Support the gear pump suitably.
8. Remove the setscrew (x2) and washer 2 (x2)) from the gear pump.
9. Remove the gear pump from the machine.
10. If required, remove the adaptor 1, washer 1, coupling cap, male coupling, adaptor 2 and adaptor 3.

Figure 195.



F Transmission pump
G Adaptor 1
H Washer 1
J Coupling cap
K Male coupling
L Adaptor 2
M Gear pump
N Setscrew (x2)
P Washer 2 (x2)
Q Adaptor 3

Install

1. The installation procedure is the opposite of the removal procedure.
2. Tighten the setscrew (x2) to the correct torque value.

   Refer to: PIL 72-03-00.

   2.1. Tighten the adaptor 1, male coupling, adaptor 2 and adaptor 3 to the correct torque value. Refer to Table 100.

Table 100. Torque Values

Item	Nm
A	65–71
C	65–71
G	60–66
K	25–28
L	45–50
Q	95–108

12 - Variable Displacement Pump

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00 - General

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Introduction

The most common variable displacement pump used in vehicle technology is the axial piston pump. This pump has several pistons in cylinders arranged parallel to each other and rotating around a central shaft. A swashplate at one end is connected to the pistons. As the pistons rotate, the angle of the plate causes them to move in and out of their cylinders.

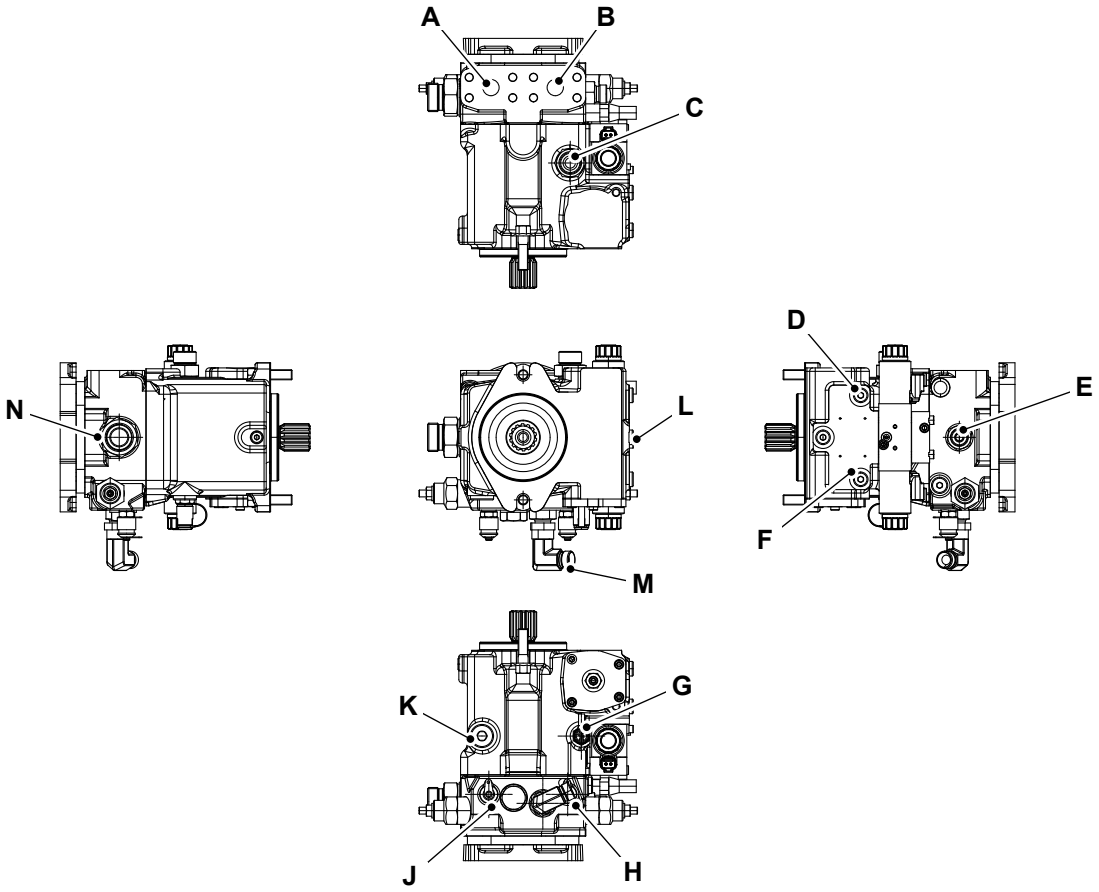
A rotary valve at the opposite end from the swashplate alternately connects each cylinder to the fluid supply and delivery lines. By changing the angle of the swashplate, the stroke of the pistons can be varied continuously. If the swashplate is perpendicular to the axis of rotation, no fluid will flow. If it is at a sharp angle, a large volume of fluid will be pumped.

Some pumps allow the swashplate to be moved in both directions from the zero position, pumping fluid in either direction without reversing the rotation of the pump.

Piston pumps can be made variable-displacement by inserting springs inline with the pistons. The displacement is not positively controlled, but decreases as the back-pressure increases.

Component Identification

Figure 196.



A Service line port A
B Service line port B
C Case drain/ fill port T1
D Control pressure port X1
E Filter inlet
F Control pressure port X2
G Test point (control pressure supply)
H Operating pressure measuring point MB
J Operating pressure measuring point MA
K Case drain/fill port T2
L Air bleed port
M Boost pressure port
N Boost suction port

Fault-Finding

Fault

Unusual noises	Table 101.	Page 30-83
Increased, unusual vibration	Table 102.	Page 30-83
No or insufficient flow	Table 103.	Page 30-83
No or insufficient pressure	Table 104.	Page 30-84
Pressure/flow fluctuations or instabilities	Table 105.	Page 30-84
Excessively high temperature of hydraulic fluid and housing	Table 106.	Page 30-85

Table 101. Unusual noises

Cause	Remedy
Insufficient air bleeding of the hydraulic system	Fill the axial piston unit, suction line for the hydraulic pump and the reservoir. Completely air bleed the axial piston unit and hydraulic system. Check correct installation position.
Insufficient suction conditions, insufficient sizing of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, foreign particles in the suction line, suction filter too small or blocked, etc.	Machine or system manufacturer: Check the system, optimize inlet conditions, use suitable hydraulic fluid. Fill the suction line with hydraulic fluid. Remove foreign particles from the suction line. Check the filter system and change the filter as necessary.
Drive speed too high	Reduce drive speed. Contact JCB Service.
Wrong direction of rotation	Check correct direction of rotation. Contact JCB Service.
Improper mounting of the axial piston unit	Check the mounting of the axial piston unit according to the specifications of the machine/ system manufacturer (observe tightening torques).
Improper mounting of assembled parts, hydraulic lines or improper installation of the coupling	Mount assembled parts according to the information provided by the coupling fitting manufacturer.
Oscillate pressure limiting and control valves in the axial piston unit (boost-pressure relief valve, high-pressure relief valve, pressure cut-off, pressure reducing valve)	Air bleed the axial piston unit and hydraulic system. Optimize the setting of the pressure limitation and pressure control valve. Contact JCB Service.
Mechanical damage to the axial piston unit (e.g., bearing damage)	Replace axial piston unit. Contact JCB Service.

Table 102. Increased, unusual vibration

Cause	Remedy
Bearings worn	Contact JCB Service.

Table 103. No or insufficient flow

Cause	Remedy
Insufficient air bleeding of the hydraulic system	Fill the axial piston unit, suction line for the hydraulic pump and the reservoir. Completely air bleed the axial piston unit and hydraulic system.
Faulty mechanical drive (e.g. defective coupling)	Contact machine/system manufacturer.
Drive speed too low	Contact machine/system manufacturer.
Insufficient suction conditions, e.g., insufficient dimensioning of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, foreign particles in the suction line, suction filter too small or blocked, etc.	Machine/system manufacturer: Check the system, e.g., optimize inlet conditions, use suitable hydraulic fluid. Fill the suction line with hydraulic fluid. Remove foreign particles from the suction line. Check the filter system and change the filter as necessary.
Hydraulic fluid not in optimal viscosity range	Machine/system manufacturer: Check temperature range and use suitable hydraulic fluid.
Insufficient boost pressure	Check boost pressure. Contact JCB Service.

Cause	Remedy
Insufficient pilot pressure or control pressure	Check pilot pressure or control pressure. Contact JCB Service.
Malfunction of the control device or controller of the axial piston unit	Contact JCB Service.
Control of the control device defective	Check control (contact machine/system manufacturer or JCB Service).
Wear or mechanical damage to the axial piston unit	Replace axial piston unit. Contact JCB Service.

Table 104. No or insufficient pressure

Cause	Remedy
Insufficient air bleeding of the hydraulic system	Fill the axial piston unit, suction line for the hydraulic pump and the reservoir. Completely air bleed the axial piston unit and hydraulic system. Check correct installation position.
Faulty mechanical drive (e.g. defective coupling)	Contact JCB Service.
Drive power too low	Contact JCB Service.
Insufficient suction conditions, e.g., insufficient dimensioning of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, foreign particles in the suction line, suction filter too small or blocked, etc.	Machine/system manufacturer: Check the system, e.g., optimize inlet conditions, use suitable hydraulic fluid. Fill the suction line with hydraulic fluid. Remove foreign particles from the suction line. Check the filter system and change the filter as necessary.
Hydraulic fluid not in optimal viscosity range	Check temperature range and use suitable hydraulic fluid. Contact JCB Service.
Insufficient boost pressure	Check boost pressure. Contact JCB Service.
Insufficient pilot pressure or control pressure	Check pilot pressure or control pressure. Contact JCB Service.
Malfunction of the control device or controller of the axial piston unit	Contact JCB Service.
Control of the control device defective	Check control (contact machine/system manufacturer or JCB Service)
Wear or mechanical damage to the axial piston unit	Replace axial piston unit. Contact JCB Service.
Output unit defective (e.g. hydraulic motor or cylinder)	Contact JCB Service.

Table 105. Pressure/flow fluctuations or instabilities

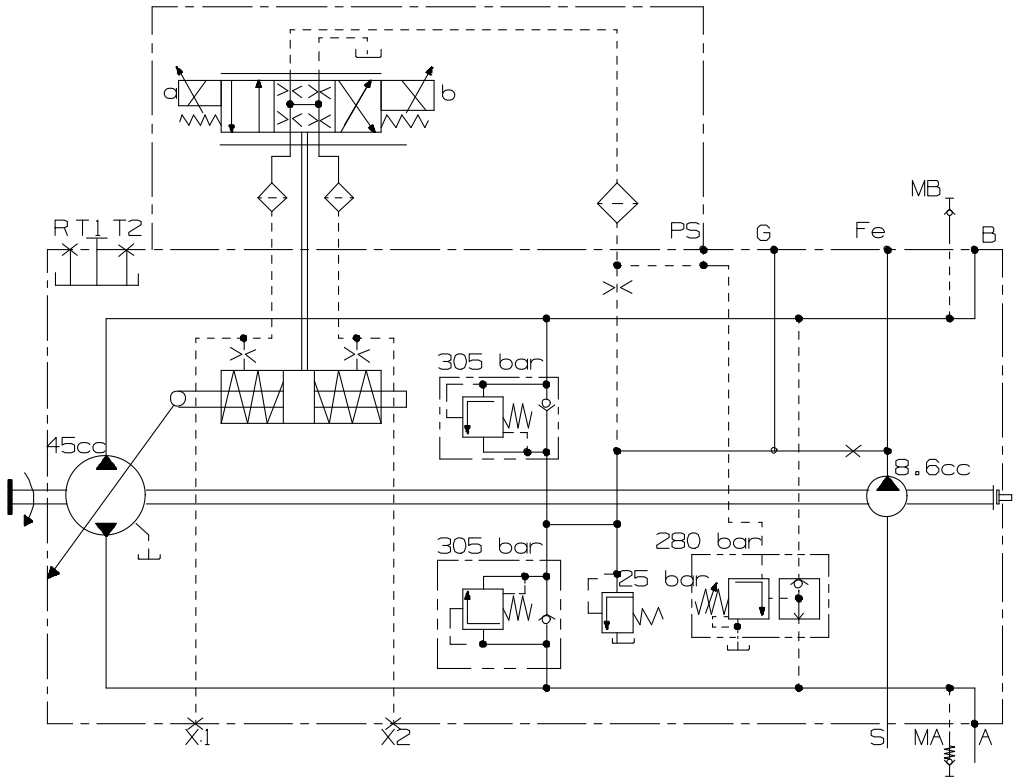
Cause	Remedy
Insufficient air bleeding of the hydraulic system	Fill the axial piston unit, suction line for the hydraulic pump and the reservoir. Completely air bleed the axial piston unit and hydraulic system. Check correct installation position
Insufficient suction conditions, e.g., insufficient dimensioning of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, foreign particles in the suction line, suction filter too small or blocked, etc.	Check the system, e.g., optimize inlet conditions, use suitable hydraulic fluid. Fill the suction line with hydraulic fluid. Remove foreign particles from the suction line. Check the filter system and change the filter as necessary. Contact JCB Service.
Oscillate pressure limiting and control valves in the axial piston unit (boost-pressure relief valve, high-pressure relief valve, pressure cut-off, pressure reducing valve)	Air bleed the axial piston unit and hydraulic system. Contact JCB Service.
Unstable control signal	Contact JCB Service.
Malfunction in the control devices or the controller	Contact JCB Service.

Table 106. Excessively high temperature of hydraulic fluid and housing

Cause	Remedy
Excessively high inlet temperature at the axial piston unit	Inspect system, e.g., malfunction in the cooler, insufficient hydraulic fluid in the reservoir. Contact JCB Service.
Wrong setting or malfunction of the pressure relief and pressure control valves (e.g., high pressure relief valve, pressure cut-off, pressure reducing valve)	Optimize the adjustment of the pressure limitation and pressure control valves of the axial piston unit and the pressure safeguarding in the hydraulic system. Contact JCB Service
Flushing flow of the flushing valve too low	Contact JCB Service.
Axial piston unit worn	Replace axial piston unit; contact JCB Service.

Diagram

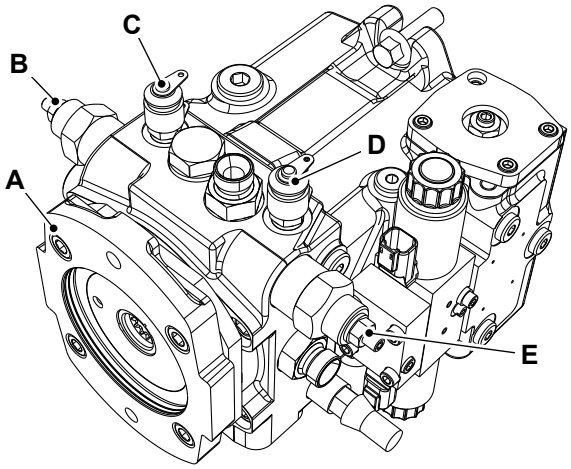
Figure 197.



Adjust

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Remove the gauge port plugs from the ports MA and MB.
   2.1. Connect a suitable pressure gauge to each of the ports MA and MB.
   Pressure: 350bar (5,076.3psi)
3. Disconnect the external control input from the control.
4. Start the charge pump and operate at normal speed.
5. Use a internal hexagon wrench of the specified dimension to hold the adjusting screw stationary.
   Dimension: 4mm
6. Check the reading on the pressure gauges.
   6.1. If necessary, turn the adjusting screw to reduce any pressure differential.
   6.2. Note that a pressure differential of the specified value or less is acceptable.
   Pressure: 1.5bar (21.8psi)
7. Note that the adjustment of the EDC (Electronic Displacement Control) is very sensitive.

Figure 198.



A Variable displacement pump
B Adjusting screw MA
C Gauge port MA
D Gauge port MB
E Adjusting screw MB

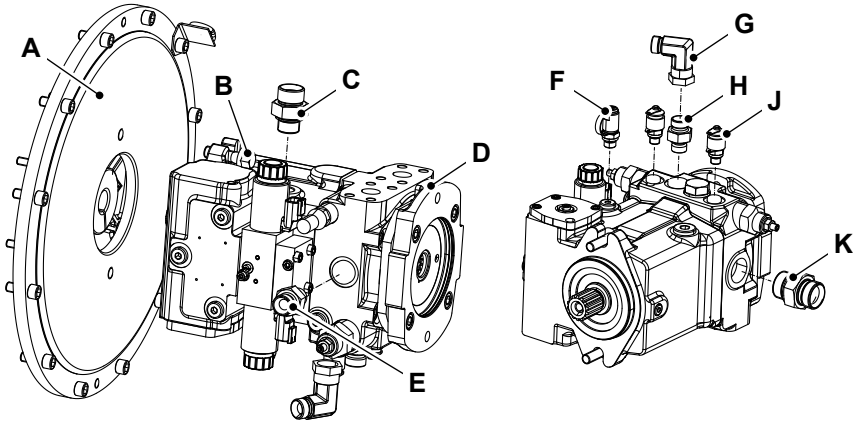
8. Stop the charge pump.
9. Remove the pressure gauges.
   9.1. Install the gauge port plugs.
10. Connect the external control input.

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
   Refer to: Discharge and Pressurise (PIL 30-00-00).
3. Drain the hydraulic oil.
   Refer to: Drain and Fill (PIL 30-00-00).
4. Remove the gear pump.
   Refer to: Remove and Install (PIL 30-11-00).
5. Disconnect the electrical connector.
6. Disconnect the hoses from the pump.
7. Put a label on the hoses to help installation.
8. Plug all the open ports and hoses to prevent contamination.
9. Support the pump suitably.
10. Remove the bolts (x2) from the pump.
11. Remove the pump from the machine.
12. If required, remove the adaptors, test points and pressure measuring points.

Figure 199.



A Engine pump mount plate
B Bolts (x2)
C Case drain/fill port adaptor
D Variable displacement pump
E Filter inlet adaptor
F Test point
G Boost pressure port
H Boost pressure port adaptor
J Operating pressure measuring points
K Boost suction port adaptor

Install

1. The installation procedure is the opposite of the removal procedure.
2. Tighten the bolts, adaptors, test points and pressure measuring points to the correct torque value. Refer to Table 107.

Table 107. Torque Values

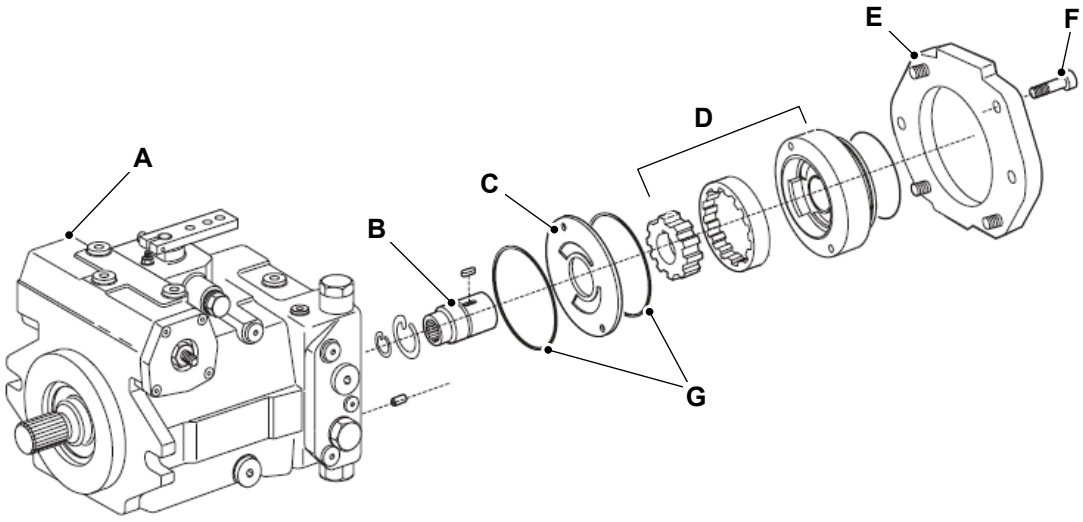
Item	Nm
B	104
C	75–82
E	65–71
F	35–40
G	50–55
J	31–37
K	160–176

Disassemble and Assemble

Disassemble

1. Remove the gear pump and connecting shaft.
2. Place the pump on a clean workbench with the end cover facing upwards.
3. Use a suitable internal hexagon wrench to remove the screw (x4).
4. Remove the end cover.
5. Remove and discard the O-ring.
6. Remove the coupling.
   6.1. If necessary, use a suitable hook to remove the coupling.
7. Remove the boost pump components.
8. Remove the wear plate.

Figure 200.



A Variable displacement pump
B Coupling
C Wear plate
D Boost pump components
E End cover
F Screw (x4)
G O-ring

Assemble

1. The assembly procedure is the opposite of the disassembly procedure. Additionally do the following steps.
2. Inspect the components for wear, scratches or pitting.
   2.1. If you find any wear, scratches or pitting, replace the damaged component.
3. Lubricate the new O-ring.
4. Tighten the screw (x4) to the correct torque value.
   Refer to: PIL 72-03-00.

50 - Solenoid Control Valve

Introduction 30-92
Operation 30-93
Remove and Install 30-94

Introduction

The swashplate position of the pump is controlled through the solenoid control valve. This system is called an EDC (Electronic Displacement Control) system.

Depending on the preselected current at the two proportional solenoids (a and b), the stroke cylinder of the pump is supplied with control pressure via the EP control unit. Thus the swash plate and the displacement are infinitely adjustable. One direction of through flow is assigned to each proportional solenoid.

Operation

EDC Principle

This pump is installed with EDC (Electronic Displacement Control) system.

An EDC is a displacement (flow) control system of the pump. The pump swashplate position is proportional to the input command and therefore the machine speed, is dependent only on the prime mover speed or motor displacement.

The EDC consists of a pair of proportional solenoids on each side of a three-position, four-way porting spool. The proportional solenoid applies a force input to the spool, which ports hydraulic pressure to either side of a double acting servo piston. Differential pressure across the servo piston rotates the swashplate, changing the pump displacement from full displacement in one direction to full displacement in the opposite direction.

Under some circumstances, such as contamination, the control spool could stick and cause the pump to stay at some displacement. A serviceable 10 micron filter is located in the supply line immediately before the control porting spool.

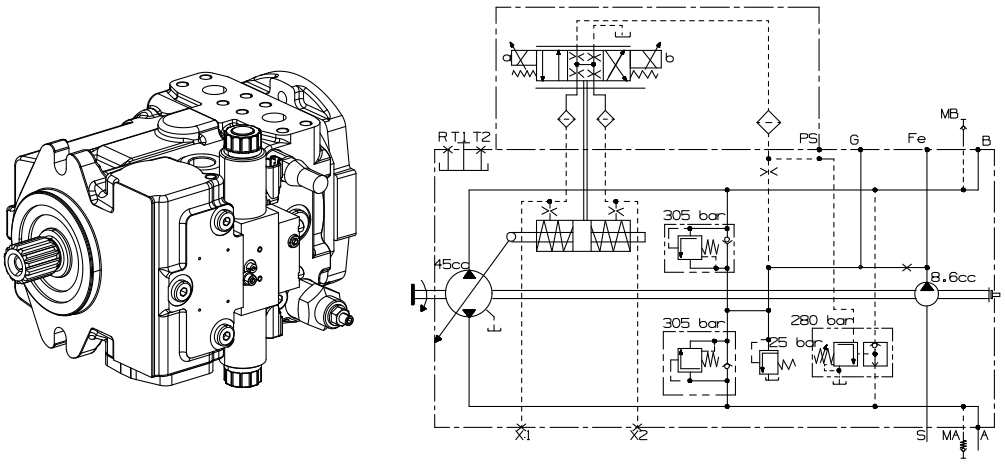
EDC Operation

The EDC is a current driven control that requires a PWM (Pulse Width Modulation) signal. The PWM allows more precise control of current to the solenoids. The PWM signal causes the solenoid pin to push against the porting spool, which pressurizes one end of the servo piston, while draining the other. The pressure differential across the servo piston moves the swashplate.

A swashplate feedback link, opposing control links, and a linear spring provide swashplate position force feedback to the solenoid. The control system reaches equilibrium when the position of the swashplate spring feedback force exactly balances the input command solenoid force from the operator. As hydraulic pressures in the operating loop change with load, the control assembly and servo/ swashplate system work constantly to maintain the commanded position of the swashplate.

The EDC incorporates a positive neutral deadband as a result of the control spool porting, pre-loads from the servo piston assembly, and the linear control spring. Once the neutral threshold current is reached, the swashplate is positioned directly proportional to the control current. To minimize the effect of the control neutral dead band, we recommend the transmission controller or operator input device incorporate a jump up current to offset a portion of the neutral dead band. The neutral position of the control spool does provide a positive preload pressure to each end of the servo piston assembly. When the control input signal is either lost or removed, or if there is a loss of charge pressure, the spring loaded servo piston will automatically return the pump to the neutral position.

Figure 201.

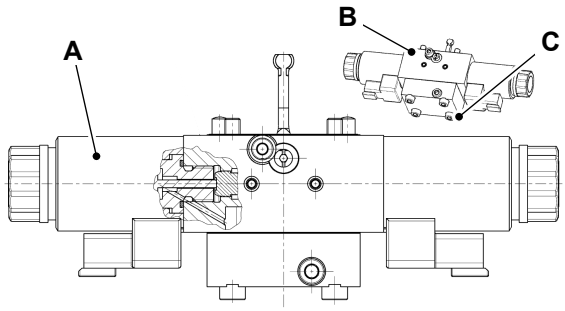


Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Disconnect the hydraulic and electrical connections.
   2.1. Plug all the open ports and hoses to prevent contamination.
3. Use a suitable internal hexagon wrench to remove the capscrew (x4).
4. Remove the control module.

Figure 202.



A Solenoid
B Control module
C Capscrew (x4)

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Inspect the machined surfaces on the control module.
   2.1. If you find nicks or scratches, replace the damaged component.
3. Tighten the capscrew (x4) to the correct torque value.
   Refer to: PIL 72-03-00.

63 - Charge Pressure Relief Valve

Introduction 30-95
Operation 30-96
Remove and Install 30-96

Introduction

The charge PRV (Pressure Relief Valve) is an integrated part of the pump. The charge PRV maintains the system pressure above the case pressure.

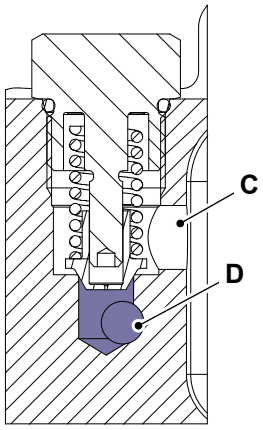
An internal charge relief valve regulates charge pressure. Charge pressure maintains a minimum pressure in the low side of the transmission loop

Operation

Charge Pressure Relief Valve

An internal charge PRV (Pressure Relief Valve) regulates the charge pressure within the hydraulic circuit. The charge PRV is a direct acting poppet valve that regulates charge pressure at a designated level above case pressure. The charge PRV is set at 25bar (362.6psi).

Figure 203.



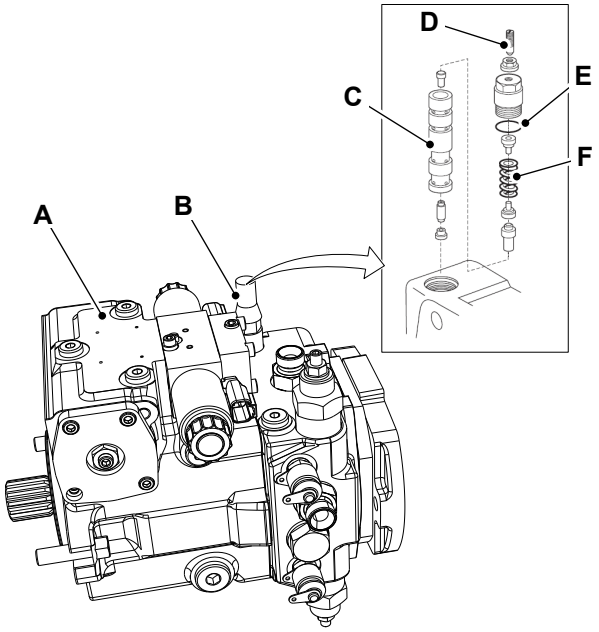
C Case drain
D Charge pressure

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Use a suitable wrench to remove the pressure relief valve.
3. Remove and discard the O-ring.
4. Remove the adjusting screw,spring and control piston.

Figure 204.



A Variable displacement pump
B Pressure relief valve
C Control piston
D Adjusting screw
E O-ring
F Spring

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Do an inspection of the pressure relief valve, control piston, spring and adjusting screw.
   2.1. If necessary, replace the damaged components.
3. Inspect the sealing surfaces of the pump for nicks or scratches.

66 - High Pressure Relief Valve

Introduction 30-97
Operation 30-98
Remove and Install 30-98

Introduction

The pumps are installed with HPRV (High Pressure Relief Valve). The purpose of the HPRV is to release the excess system pressure.

The HPRV is installed with an integrated charge check valve.

Operation

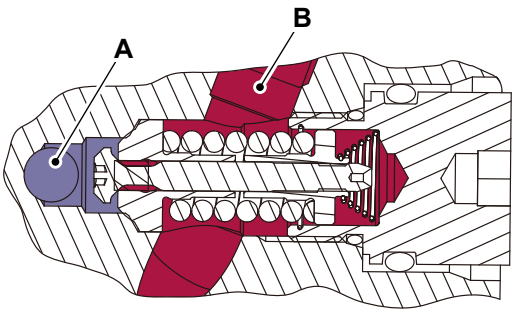
HPRV and Charge Check Valve

The pump is equipped with a combination HPRV (High Pressure Relief Valve) and charge check valve. The HPRV function is a dissipative (with heat generation) pressure control valve for the purpose of limiting excessive system pressures. The charge check function acts to replenish the low pressure side of the working loop with charge oil.

Each side of the transmission loop has a dedicated HPRV that is non-adjustable with a factory set pressure. When system pressure exceeds the factory setting of the valve, oil is passed from the high pressure system loop, into the charge gallery, and into the low pressure system loop through the charge check valve.

The HPRV also provides a loop bypass function when each of the two HPRV internal hexagon plugs are mechanically backed out 3 full turns. Engaging the bypass function mechanically connects both A and B sides of the working loop to the common charge gallery. The bypass function allows a machine to be moved without rotating the pump shaft or prime mover.

Figure 205.



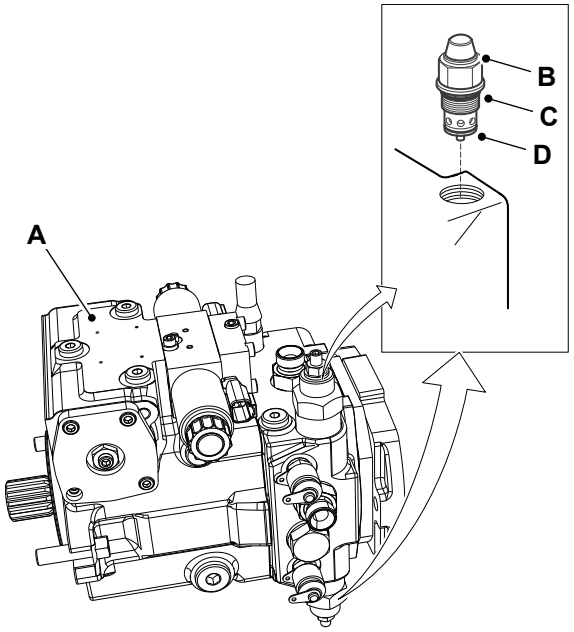
A Low pressure
B High pressure

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Use a suitable internal hexagon wrench to remove the HPRV (High Pressure Relief Valve)s.
3. Remove and discard the O-rings and back-up rings.

Figure 206.



A Variable displacement pump
B HPRV
C O-ring
D Backup ring

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Do an inspection of the HPRVs.
   2.1. If necessary, replace the damaged HPRVs.
3. Inspect the sealing surfaces of the pump for nicks or scratches.

15 - Cylinder / Ram

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Check (Leaks) 30-107

Introduction

A hydraulic cylinder ram is a mechanical actuator that is used to give a single directional force through a single action stroke. It is used in many applications, the cylinder gets the power from pressurised hydraulic oil. The hydraulic cylinder consists of a cylinder barrel, in which a piston connected to a piston rod moves back and forth.

The barrel is closed on one end by the cylinder cap and the other end by the cylinder head where the piston rod comes out of the cylinder. The piston has sliding rings and seals. The piston divides the inside of the cylinder into two chambers, the bottom chamber (head end) and the piston rod side chamber (rod end).

Health and Safety

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before connecting or removing any hydraulic hose, residual hydraulic pressure trapped in the service hose line must be vented. Make sure the hose service line has been vented before connecting or removing hoses. Make sure the engine cannot be started while the hoses are open.

Lifting Equipment

You can be injured if you use incorrect or faulty lifting equipment. You must identify the weight of the item to be lifted then choose lifting equipment that is strong enough and suitable for the job. Make sure that lifting equipment is in good condition and complies with all local regulations.

WARNING! *A raised and badly supported machine can fall on you. Position the machine on a firm, level surface before raising one end. Ensure the other end is securely chocked. Do not rely solely on the machine hydraulics or jacks to support the machine when working under it. Disconnect the battery, to prevent the machine being started while you are beneath it.*

Precautions for Installation

1. Precautions when installing the ram on the machine.
    1.1. When installing and removing from the machine, suspend the ram safely.
    1.2. Suspending the ram by the piping is not only dangerous, but can also cause damage to the cylinder.
    1.3. Secure the piston rod with a band. It is very dangerous if the rod extends unexpectedly. Also, the rod can be damaged and become unusable.
2. Welding after installing the ram may result in damage.
    2.1. If electric welding is done even at a point away from the ram, there may be sparking inside the ram and it will become necessary to replace the ram with a new one.
3. When painting the machine, mask the ram. If paint adheres to the rod surface or to the wiper ring and the ram is operated, the wiper ring will not function properly and foreign matter and paint can easily enter the ram. This will cause damage to the seals, drastically shortening the life of the ram.
4. Install the ram only when it is clean.

Caution During Use

1. Use only under designated conditions.
    1.1. If hydraulic oil other than the designated oil is used, the seals quickly degenerate and become damaged. If the relief valve is set at a value higher than specified, it may cause ram damage and is dangerous.
    1.2. In high temperature environments (approx. 90°C and above) or low temperature environments (below -20°C), seals quickly become damaged. Special seal materials are necessary so check to see if the ram that you are using is suitable or not.
    1.3. The number one cause of ram oil leakage is rod damage. Be careful not to damage the rod.
2. Warm up sufficiently before beginning work.
    2.1. In cold conditions the rod seals may be frozen, so if the ram is operated at maximum pressure and maximum speed, the seals will be damaged.
    2.2. There is a large amount of air in a new ram or one which has been left for a long time, so the ram will not operate smoothly. Also, if pressure is applied suddenly without bleeding the air, high temperatures will be generated due to adiabatic compression and the seals may burn.
    2.3. Before beginning work, always move the ram at full stroke with no load and expel air from the cylinder.
3. When stopping or storing, do it at a safe and fixed position.
    3.1. The installed ram cannot maintain the same position for a long period of time, because the oil inside the ram may leak and the hydraulic oil volume decreases as it cools. Stop or store the machine in a safe and fixed position.

Maintenance, Inspection Points

1. Carry out daily maintenance and inspection.
    1.1. The key point for correct long-term ram function is daily maintenance and inspection. Carry out maintenance and inspection so that the ram functions fully at all times. Always remove any mud, water, dust or oil film adhering to the rod and keep it in normal condition. However, when cleaning the wiper ring and seals, do not get them wet with water but wipe clean with a rag. To prevent rust forming during storage, the amount of exposed ram piston rod

should be kept to a minimum. If leaving for more than one week, apply a light coating of suitable grease or petroleum jelly to the exposed part of the ram piston rod.

2. Use genuine JCB parts when replacing parts.

   2.1. If parts other than genuine JCB parts are used, the desired results may not be obtained. Use only genuine JCB parts.

3. Caution during dismantling and reassembly.

   3.1. Dismantling the ram while it is still installed on the machine can be dangerous as unexpected movements of the machine can occur. Remove the ram from the machine and then dismantle.

   3.2. If reassembled with dirty hands, foreign matter can enter the ram causing a shorter life span and also the other hydraulic equipment may be damaged. Reassemble in a clean state.

   3.3. Follow the instructions in the diagrams regarding torque tightening for screwed parts. If the torque is too high or too low, it can cause damage.

Technical Data

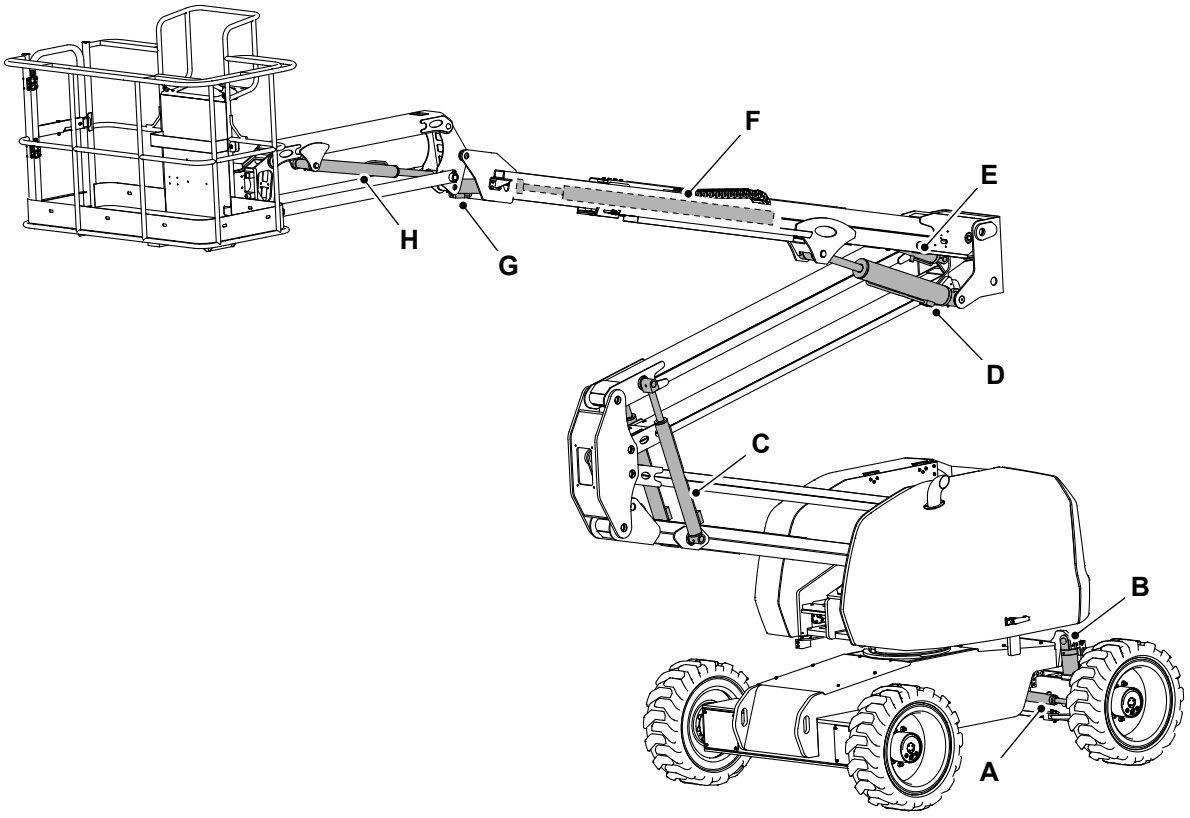
Table 108.

Description	Details	Data
Jib lifting ram	Cylinder outer diameter	73mm
	Bore	63mm
	Rod	45mm
	Stroke	618mm
	Open length	1,535mm
	Closed length	917mm
	Maximum operating pressure	210bar (3,045.8psi)
Lower levelling ram	Cylinder outer diameter	92mm
	Bore	80mm
	Rod	40mm
	Stroke	355mm
	Open length	992mm
	Closed length	637mm
	Maximum operating pressure	210bar (3,045.8psi)
Upper levelling ram	Cylinder outer diameter	92mm
	Bore	80mm
	Rod	40mm
	Stroke	324mm
	Open length	954mm
	Closed length	630mm
	Maximum operating pressure	210bar (3,045.8psi)
Steering ram	Cylinder outer diameter	62mm
	Bore	50mm
	Rod	32mm
	Stroke	185mm
	Open length	670mm
	Closed length	485mm
	Maximum operating pressure	210bar (3,045.8psi)
Front axle oscillation ram	Cylinder outer diameter	105mm
	Bore	80mm
	Rod	75mm
	Stroke	128mm
	Open length	499mm
	Closed length	371mm
	Maximum operating pressure	210bar (3,045.8psi)
Telescopic boom lift ram	Cylinder outer diameter	126mm
	Bore	110mm

Description	Details	Data
	Rod	63mm
	Stroke	595mm
	Open length	1,768mm
	Closed length	1,173mm
	Cushion	Both ends
	Maximum operating pressure	210bar (3,045.8psi)
Articulated boom lift ram	Cylinder outer diameter	82mm
	Bore	70mm
	Rod	45mm
	Stroke	705mm
	Open length	1,693mm
	Closed length	988mm
	Cushion	Retraction (cap end)
	Maximum operating pressure	210bar (3,045.8psi)
Telescopic boom extension ram	Cylinder	73mm
	Bore	63mm
	Rod	45mm
	Stroke	1,900mm
	Open length	4,150mm
	Closed length	2,250mm
	Maximum operating pressure	210bar (3,045.8psi)

Component Identification

Figure 207.



A Steer cylinder ram
B Oscillating axle cylinder rams (x2)
C Articulated boom lift cylinder ram (x2)
D Main boom lift cylinder ram
E Lower levelling cylinder
F Main boom telescopic cylinder ram
G Upper levelling cylinder
H Jib cylinder ram

Check (Condition)

Consumables

Description	Part No.	Size
Surface Cleaning Fluid	4103/1204	1 L

1. Make the machine safe.

   Refer to: PIL 01-03-27.

2. Extend each ram fully.
3. Clean the piston, gland, piston rod and tube with cleaning solvent.

   Consumable: Surface Cleaning Fluid

4. Visually examine each ram for score marks, dents, leaks or similar defects.
5. Remove the ram from the machine, and disassemble it.
6. Check the condition of the tube as follows.
   - 6.1. Illuminate the inside of the tube.
   - 6.2. Inspect the inside of the tube for deep grooves and other damage. If damaged, replace the tube.
   - 6.3. Remove small scratches on the inside of the tube with a medium grain emery cloth. Use the emery cloth with a rotary motion.
   - 6.4. Inspect the gland end of the tube for sharp edges that will cut the gland O-ring.
   - 6.5. Remove the sharp edges from the tube as required.
7. Check the condition of the piston rod as follows.
   - 7.1. Inspect the piston for damage and wear.
   - 7.2. If the piston is damaged or worn, replace it.
   - 7.3. Make sure that the piston rod is straight.
   - 7.4. If the piston rod is not straight, install a new piston rod.
8. Check the condition of the gland as follows.
   - 8.1. Inspect the gland for rust.
   - 8.2. Remove rust and clean as required.

Check (Leaks)

Leakage in the ram hydraulic circuit causes ram creep.

Ram creep can be caused by a number of reasons:

- Cylinder/ piston Leakage
- Spool leakage
- ARV leakage

The machine, equipment or attachment movement in hold position, due to drift or creep or when power supply stops must be limited to extend. Make sure there is no actuation of the controls by the operator.

If creep is suspected the following test procedures must be carried out to make sure the equipment is extended within tolerance limit.

This should be carried out in two conditions with specified rated load placed on platform. 250kg

- Maximum horizontal outreach condition.
- Maximum vertical outreach condition.

Creep Test

1. Operate the machine to bring the hydraulic oil to a normal working temperature.
2. Setup the machine in maximum horizontal outreach condition or maximum vertical outreach condition.
3. Using a felt tip pen and ruler, make a mark at the suitable distance from the edge of the wiper seal on the piston rod.
4. Measure the actual movement of the piston rod over the specified time period.

   Duration: 12h
5. Compare the measured figure to the maximum allowable ram creep. Refer to Table 109.

Table 109.

Rams Description	Maximum ram creep after 12 hours
Articulated boom ram	25mm
Main boom ram	
Telescopic boom ram	
Jib boom ram	
Upper leveling ram	

07 - Lift Extension

Introduction 30-108
Remove and Install 30-109

Introduction

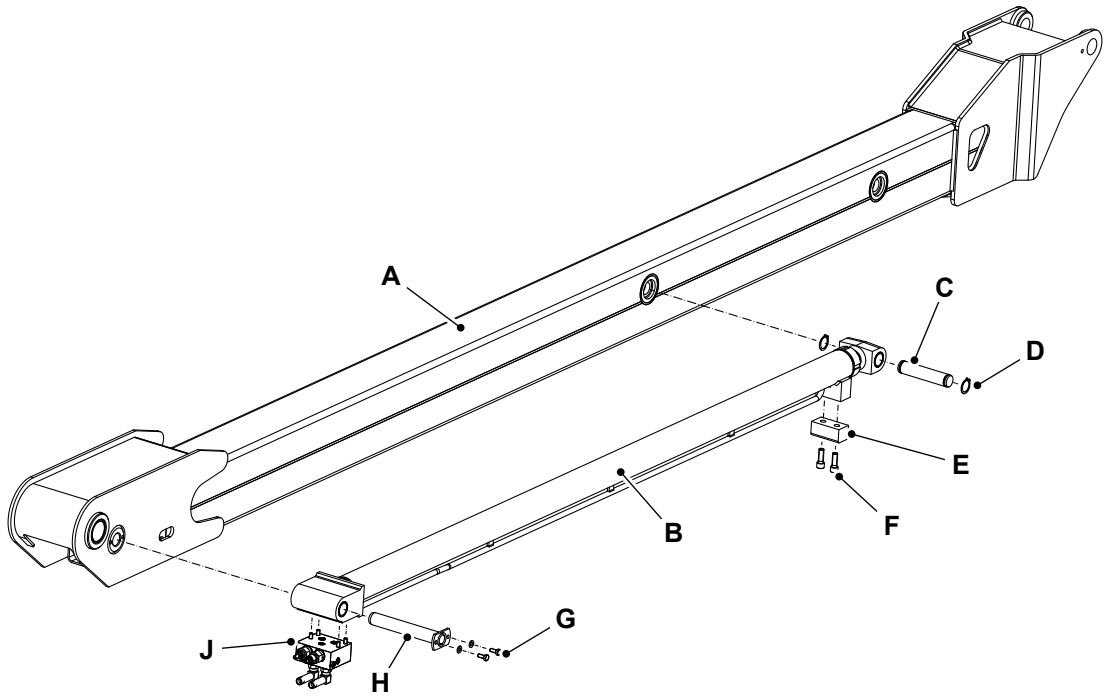
The main boom telescopic cylinder is attached to the inner and outer sections of the main boom. The cylinder extends and retracts the main boom. The cylinder is fitted with load holding counterbalance valves in case of a hose burst scenario.

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
   Refer to: PIL 30-00-00.
3. Get access to the main boom telescopic cylinder.
4. Put a label on the hoses to help installation.
   4.1. Remove the hoses from the ram.
   4.2. Plug all the open ports and hoses to prevent contamination.
5. From the rod side, remove the circlip (x2) and pivot pin 1.
6. Remove the bolt 1 (x2) and wear pad.
7. Remove the bolt 2 (x2) and washer (x2).
   7.1. Remove the pivot pin 2.
8. Mark the installation position of the counter balance valve to help installation.
9. Remove the fasteners from counter balance valve and remove the valve.
10. Remove the lift telescopic extension cylinder from the machine.

Figure 208.



A Main telescopic boom
B Telescopic extension cylinder
C Pivot pin 1
D Circlip (x2)
E Wear pad
F Bolt 1 (x2)
G Bolt 2 (x2)
H Pivot pin 2
J Counter balance valve

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Tighten the bolt 1 (x2) and bolt 2 (x2) to the correct torque value.
3. Make sure that the installation position of the counter balance valve is correct.

Table 110. Torque Values

Item	Nm
F	125
G	22

17 - Boom Lift

Introduction 30-111
Remove and Install 30-112

Introduction

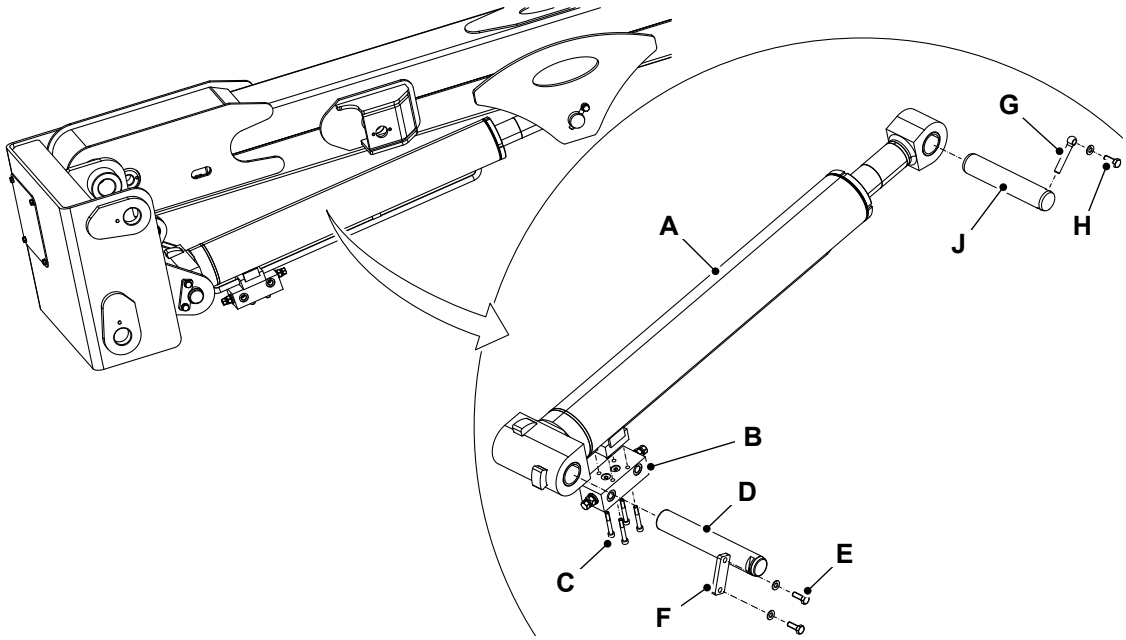
The main boom lift cylinder is attached to the main boom rear knuckle and the main boom. The cylinder lifts and lowers the main boom. The cylinder is fitted with load holding counterbalance valves in case of a hose burst scenario.

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
   Refer to: PIL 30-00-00.
3. Get access to the main boom lift cylinder.
4. Put a label on the hydraulic hoses to help installation.
   4.1. Remove the hoses from the ram.
   4.2. Plug all open ports and hoses to prevent contamination.
5. Support the ram with suitable lifting equipment.
6. From the cylinder side, remove the bolt 2 (x2), washer (x2) and pivot pin lock plate.
   6.1. Remove the pivot pin 1.
7. From the rod side, remove the bolt 3, washer and pivot pin lock.
   7.1. Remove the pivot pin 2.
8. Remove the ram from the machine.
9. If required, remove the bolt 1 (x4) and ram valve.

Figure 209.



A Lift arm ram
B Valve
C Bolt 1 (x4)
D Pivot pin 1
E Bolt 2 (x2)
F Pivot pin lock plate
G Pivot pin lock
H Bolt (x3)
J Pivot pin 2

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Tighten the bolts and adaptors to the correct torque value

Table 111. Torque Values

Item	Nm
E	43
H	43

20 - Articulated Lift Arm

Introduction 30-114
Remove and Install 30-115

Introduction

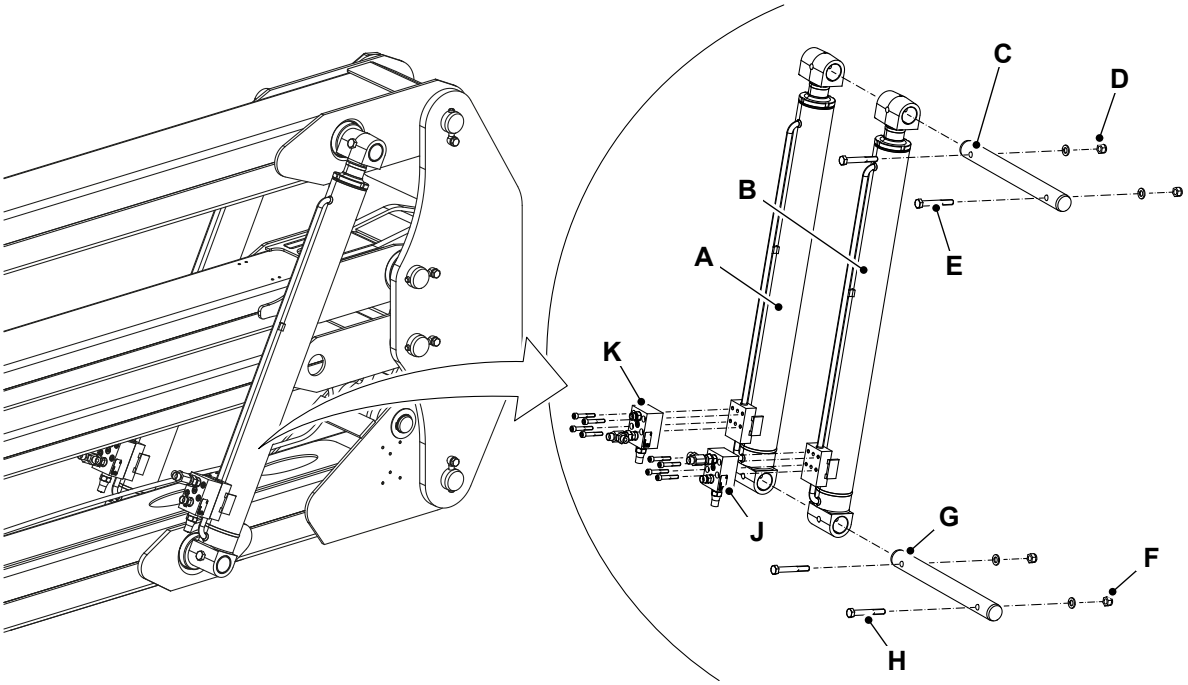
The articulated boom lift cylinders are attached to the articulated boom stages 1 and 4. The cylinders act in parallel to lift and lower the articulated boom. The cylinders are fitted with load holding counterbalance valves in case of a hose burst scenario.

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
   Refer to: PIL 30-00-00.
3. Get access to the articulated boom lift cylinder.
4. Put a label on the hoses to help installation.
   4.1. Remove the hoses from the ram.
   4.2. Plug all the open ports and hoses to prevent contamination.
5. Support both the left side and right side articulated boom lift cylinder with suitable lifting equipment.
6. From the rod side, remove the lock nut 1 (x2), washer (x2) and bolt 1 (x2).
   6.1. Remove the pivot pin 1.
7. From the cylinder side, remove the lock nut 2 (x2), washer (x2) and bolt 2 (x2)
   7.1. Remove the pivot pin 2.
8. Remove both the articulated boom lift cylinder away from the machine.
9. If required remove the bolts from the counter balance valve.
   9.1. Remove the counter balance valve.

Figure 210.



A Articulated boom lift cylinder - right side
B Articulated boom lift cylinder - left side
C Pivot pin 1
D Lock nut 1 (x2)
E Bolt 1 (x2)
F Lock nut 2 (x2)
G Pivot pin 2
H Bolt 2 (x2)
J Counter balance valve - left side
K Counter balance valve - right side

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Tighten the bolt 1 (x2) and bolt 2 (x2) to the correct torque value.

Table 112. Torque Values

Item	Nm
D	89.5
F	89.5

34 - Steering

Introduction 30-117
Remove and Install 30-118

Introduction

The steering cylinder is attached to the front axle and the front wheels. The cylinder turns the wheels to steer the machine.

Remove and Install

The procedure given below is for the right steering cylinder ram. The procedure for the left steering cylinder ram is similar.

Remove

1. Make the machine safe with the platform lowered.

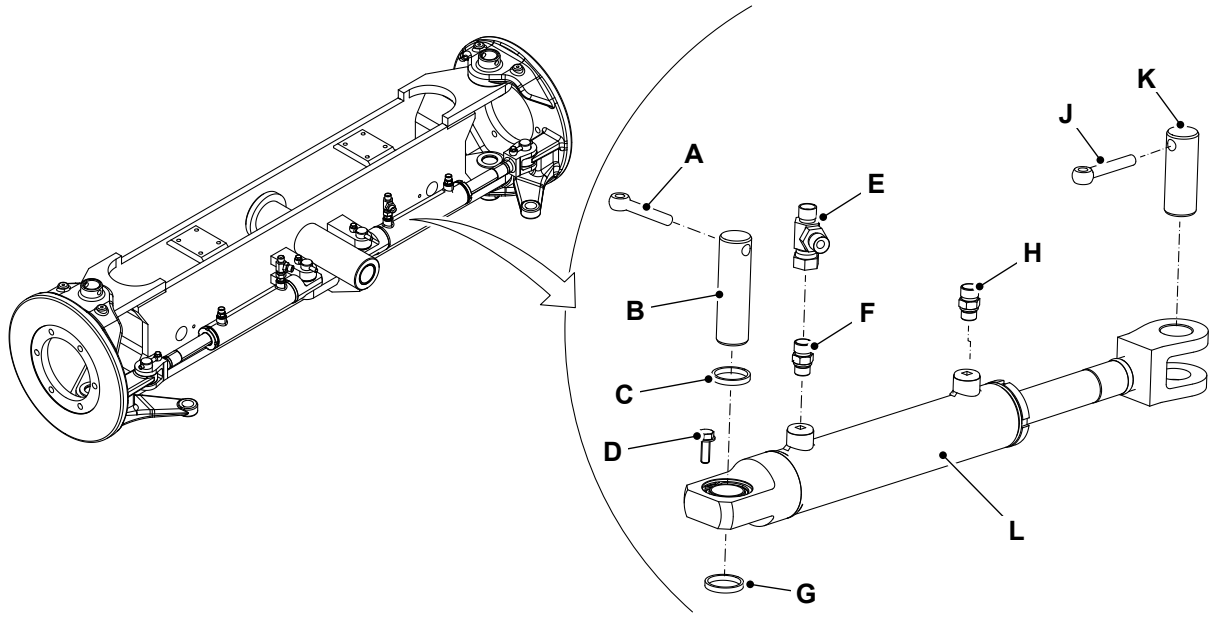
   Refer to: PIL 01-03-27.

2. Discharge the hydraulic pressure.

   Refer to: Discharge and Pressurise (PIL 30-00-00).

3. Disconnect the hydraulic hoses from the steering cylinder ram.
4. Put a label on the hoses to help installation.
5. Plug all the open ports and hoses to prevent contamination.
6. Remove the bolt from pivot pin lock 1 and 2.
7. Remove the pivot pin lock 1 and 2.
8. Remove the pivot pin 1 and 2.
9. Remove the steering ram from the axle.
10. Remove the spacer 1 and 2.
11. If required, remove the T-adaptor and adaptor 1 and 2.

Figure 211.



A Pivot pin lock 1
B Pivot pin 1
C Spacer 1
D Bolt
E T-adaptor
F Adaptor 1
G Spacer 2
H Adaptor 2
J Pivot pin lock 2
K Pivot pin 2
L Steering cylinder ram

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Tighten the adaptors to the correct torque value.

Table 113. Torque Values

Item	Nm
E	35–39
F	31–37
H	31–37

67 - Axle Oscillation

Introduction 30-120
Remove and Install 30-121

Introduction

The axle oscillation cylinders are attached to the front axle and the chassis. The cylinders enable the front axle to pivot when the hydraulic circuit is unlocked in the forward and stowed driving condition. This enables all four wheels to maintain ground contact when driving over rough terrain. The cylinders are fitted with load holding counterbalance valves in case of a hose burst scenario.

Remove and Install

The procedure given below is for the left axle oscillation cylinder ram. The procedure for the right axle oscillation cylinder ram is similar.

Remove

1. Make the machine safe with the platform lowered.

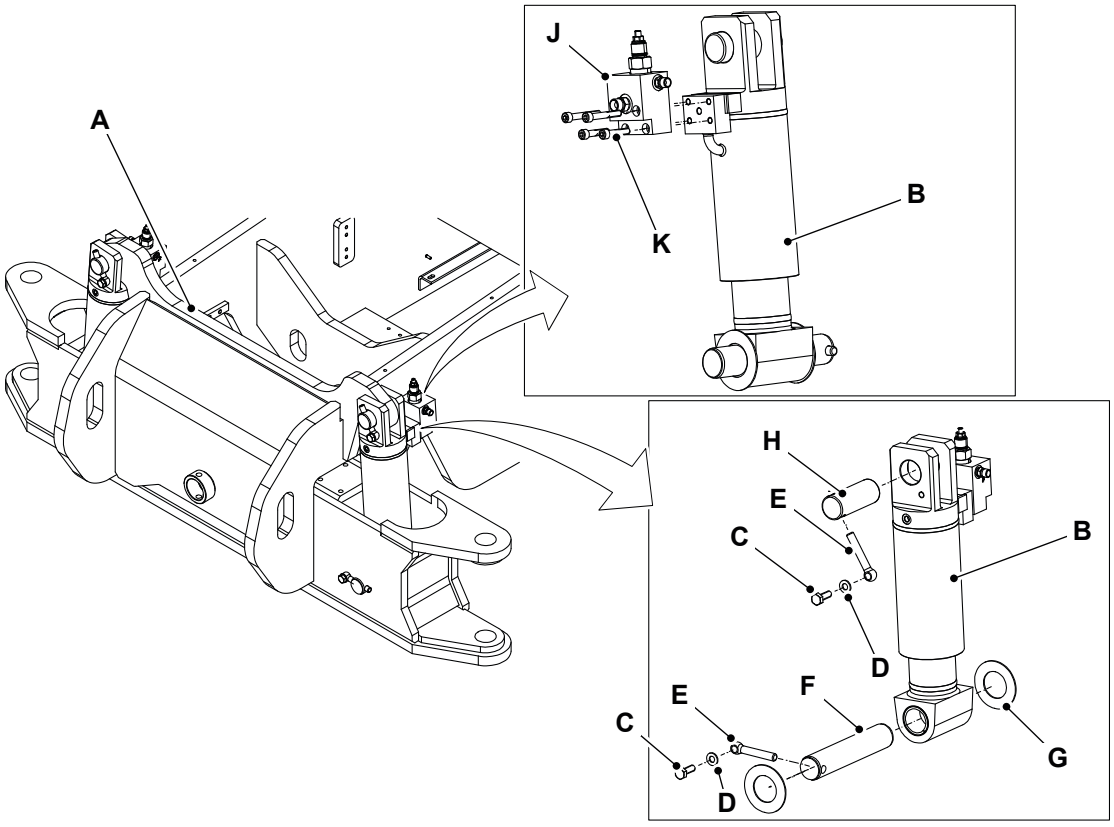
   Refer to: PIL 01-03-27.

2. Discharge the hydraulic pressure.

   Refer to: Discharge and Pressurise (PIL 30-00-00).

3. Disconnect the hydraulic hoses from the axle oscillation cylinder ram.
4. Put a label on the hoses to help installation.
5. Plug all the open ports and hoses to prevent contamination.
6. Support the axle suitably.
7. Remove the washer 2 (x2).
8. Remove the bolt 1 and washer 1 from the pin 1.
9. Remove the pin 1.
10. Remove the pivot pin 1 from the lower end of the axle oscillation cylinder ram.
11. Support the axle oscillation cylinder ram suitably.
12. Remove the pivot pin 2 from the upper end of the axle oscillation cylinder ram.
13. Remove the oscillation balance valve.
14. Remove the capscrew (x4).
15. Remove the axle oscillation cylinder ram from the axle.

Figure 212.



A Axle
B Left axle oscillation cylinder ram
C Bolt 1
D Washer 1
E Pin 1
F Pivot pin 1
G Washer 2
H Pivot pin 2

J Oscillation balance valve

K Capscrew

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Tighten the fasteners to the correct torque value.
3. Bleed the axle oscillation circuit.

   Refer to: Bleed (PIL 27-20-01).

Table 114. Torque Values

Item	Nm
C	43

78 - Jib

Introduction 30-124
Remove and Install 30-125

Introduction

The jib cylinder is attached to the jib parallelogram. The cylinder lifts and lowers the jib, maintaining a constant angle of the platform. The cylinder is fitted with a load holding counterbalance valve in case of a hose burst scenario.

Remove and Install

Remove

1. Make the machine safe.

   Refer to: PIL 01-03-27.

2. Discharge the hydraulic pressure.

   Refer to: Discharge and Pressurise (PIL 30-00-00).

3. Put a label on the hoses to help installation.

   3.1. Remove the hoses from the ram.

   3.2. Plug all the open ports and hoses to prevent contamination.

4. Support the jib lifting cylinder with suitable lifting equipment.

5. From the cylinder end, remove the bolt 2 and washer.

   5.1. Remove the lock pivot pin and pivot pin.

6. Support the platform with suitable lifting equipment.

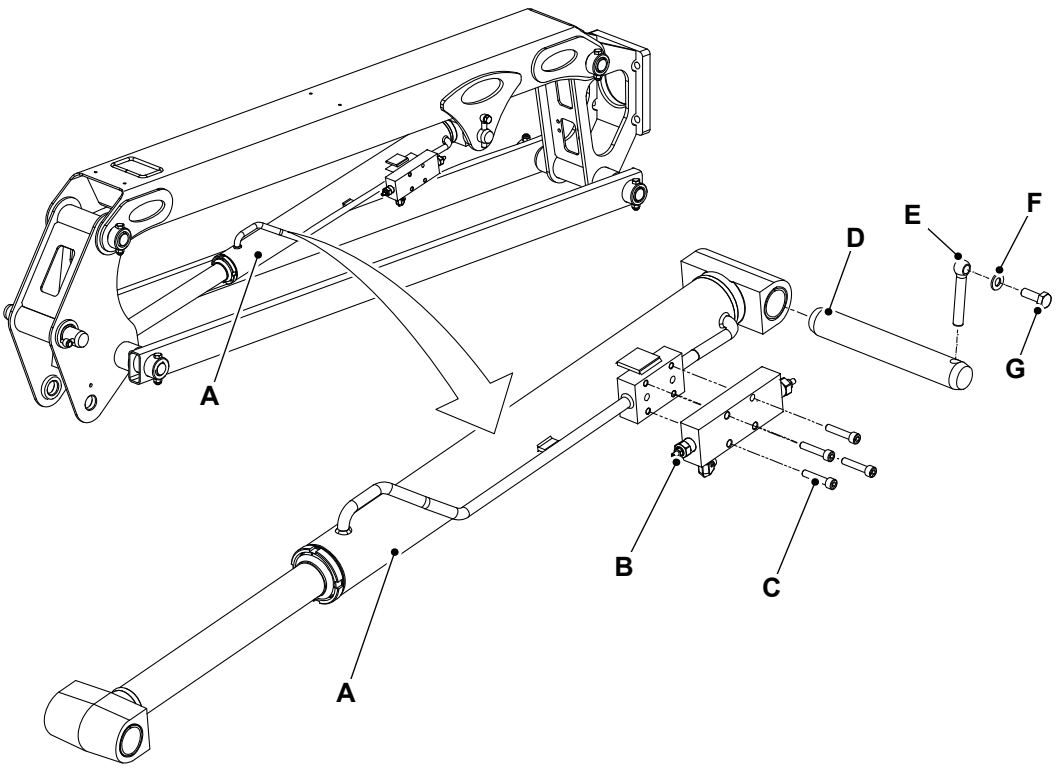
   6.1. Support the lower booms of the jib with suitable lifting equipment.

7. Remove the jib lifting cylinder from the machine.

8. If required, remove the bolt 1 (x4).

   8.1. Remove the jib counter balance valve.

Figure 213.



A Jib lifting cylinder
B Jib counter balance valve
C Bolt 1 (x4)
D Pivot pin
E Lock pivot pin
F Washer
G Bolt 2

Install

1. Align the booms, cylinder and knuckles.
2. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
3. Tighten the bolt 2 to the correct torque value.

   Torque: 43N·m

   3.1. Tighten the bolt 2 to the correct torque value.

   Refer to: PIL 72-06-00.

82 - Lower Levelling

Introduction 30-127
Bleed 30-128
Remove and Install 30-129

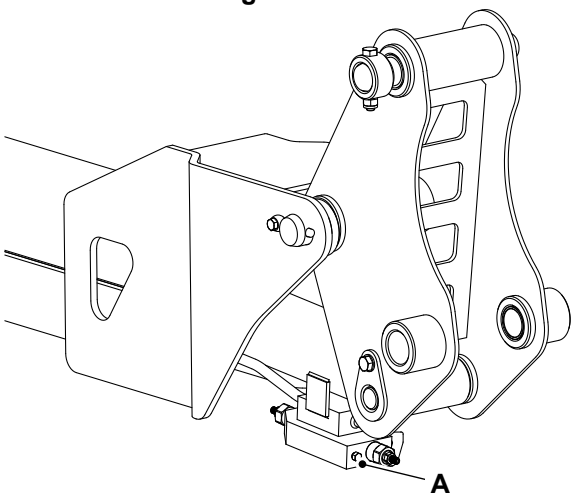
Introduction

The lower levelling cylinder is attached to the main boom rear knuckle and the main boom. The cylinder acts as the master cylinder for the platform levelling circuit. The slave cylinder is the upper levelling cylinder. As the main boom lifts and lowers, the lower levelling cylinder extends and retracts, transferring pressure through a closed loop hydraulic system to the upper levelling cylinder, which then maintains the level of the platform. The cylinder is fitted with load holding counterbalance valves in case of a hose burst scenario.

Bleed

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Make sure the jib and platform are in horizontal position.
   2.1. Operate articulated boom to achieve specified height of the platform.
   Distance: 4m
3. Make sure telescopic lift cylinder fully closed.
4. Operate the levelling switch in upward direction from base control panel to raise the platform at full height.
   Refer to: PIL 33-24-02.
5. Use a wrench to loosen the bleed screw.
6. Operate the levelling switch in upward direction from base control panel.
   6.1. Hold the position for specified time.
   Duration: 90s
   6.2. Release the switch and tighten the bleed screw to specified torque value.
   Torque: 4.5–5.5N·m
7. Operate the levelling switch in downward direction from base control panel to bring the platform at fully down position.
   Refer to: PIL 33-24-02.
8. Use a wrench to loosen the bleed screw.
9. Operate the levelling switch in downward direction from base control panel.
   9.1. Hold the position for specified time.
   Duration: 90s
   9.2. Release the switch and tighten the bleed screw to specified torque value.
   Torque: 4.5–5.5N·m
10. Bring the machine in stowed position.
11. Raise the main boom up and observe the platform is auto levelled as boom goes up.
12. Operate to bring the main boom in down position and observe the platform is auto levelled as boom comes down.
13. If the auto levelling is not within the acceptable range of ± 5°, perform the procedure again to make sure it is within acceptable range.

Figure 214.



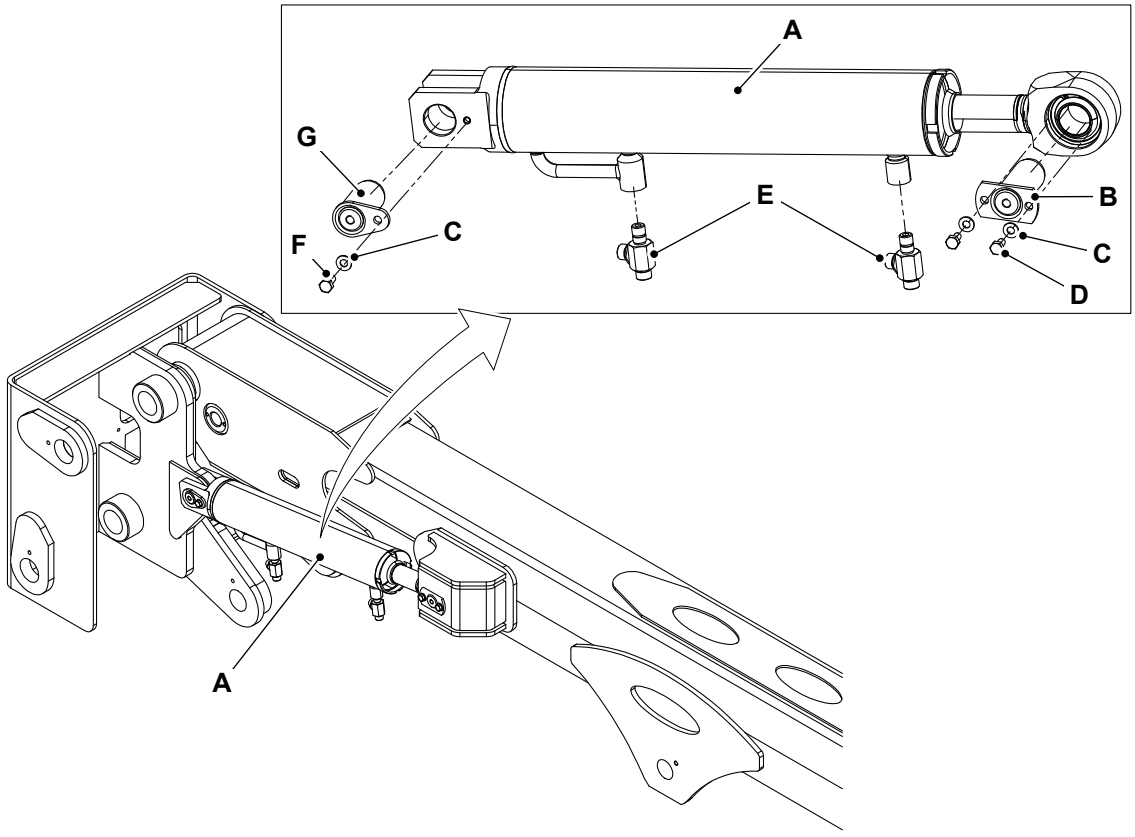
A Bleed screw

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
   Refer to: PIL 30-00-00.
3. Get access to the lower levelling cylinder.
4. Put a label on the hydraulic hoses to help installation.
   4.1. Remove the hoses from the ram.
   4.2. Plug all open ports and hoses to prevent contamination.
5. Support the ram with suitable lifting equipment.
6. From the rod side, remove the bolt 1 (x2), washer (x2) and pivot pin 1.
7. From the cylinder side, remove the bolt 2, washer and pivot pin.
8. Remove the ram from the machine.
9. If required, remove the adaptor (x2) from the ram.

Figure 215.



A Lower levelling ram
B Pivot pin 1
C Washer
D Bolt 1 (x2)
E Adaptor (x2)
F Bolt 2
G Adaptor 2

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Tighten the bolts and adaptors to the correct torque value
3. Bleed the levelling ram circuit.

   Refer to: Bleed (PIL 30-15-82).

Table 115. Torque Values

Item	Nm
D	22
E	35–39
F	22

83 - Upper Levelling

Introduction 30-131
Remove and Install 30-132

Introduction

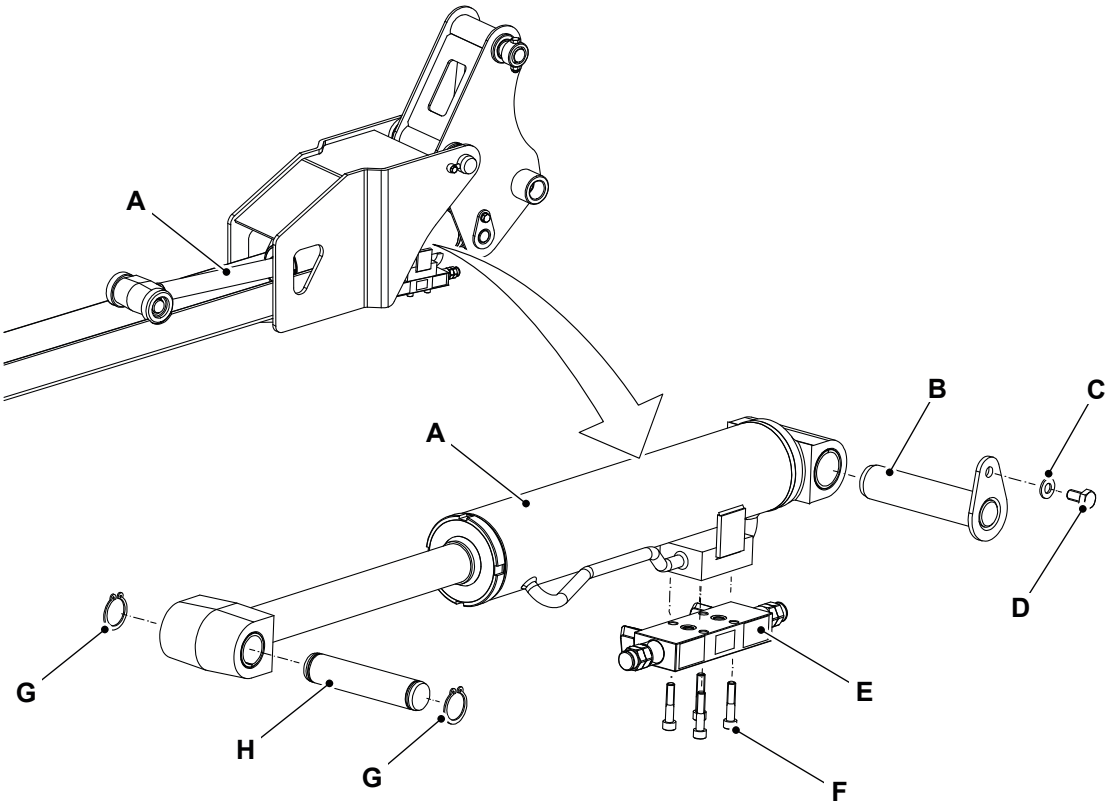
The upper levelling cylinder is attached to the main boom and the jib knuckle. The cylinder lifts and lowers the jib, causing the platform to rotate up and down to change or maintain the platform level. In combination with the lower levelling cylinder, the upper leveling cylinder acts as the slave cylinder in a master-slave hydraulic circuit, to keep the platform level with the chassis as the main boom lifts and lowers. The cylinder is fitted with a load holding counterbalance valve in case of a hose burst scenario.

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Extend the telescopic boom to get access to the levelling ram.
3. Discharge the hydraulic pressure.
   Refer to: PIL 30-00-00.
4. Put a label on the hoses to help installation.
   4.1. Remove the hoses from the ram.
   4.2. Plug all the open ports and hoses to prevent contamination.
5. Support the upper levelling ram with suitable lifting equipment.
6. From the rod end, remove the circlip (x2).
   6.1. Remove the pivot pin 2.
7. From the cylinder end, remove the bolt 1 and washer.
   7.1. Remove the pivot pin 1.
8. Support the platform with suitable lifting equipment.
9. Remove the upper levelling ram from the machine.
10. If required, remove the bolt 2 (x4).
    10.1. Remove the counter balance valve.

Figure 216.



A Upper levelling ram
B Pivot pin 1
C Washer
D Bolt 1
E Counter balance valve
F Bolt 2 (x4)
G Circlip (x2)
H Pivot pin 2

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Tighten the bolt 1 to the correct torque value.
3. Bleed the levelling ram circuit.
   Refer to: Bleed (PIL 30-15-82).

Table 116. Torque Values

Item	Nm
D	43

39 - Slew Motor

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00 - General

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Fault-Finding 30-137
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Introduction

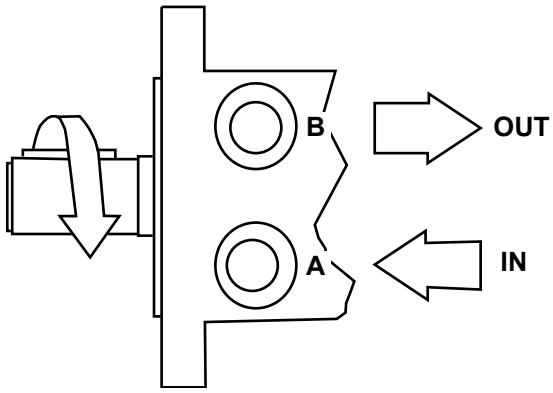
The slew motor is a hydraulic orbital type motor that converts hydraulic flow supplied from the hydraulic pump into rotary motion.

The slew motor is controlled by hydraulic valves in the main valve block that consists of cross-line relief valves, which in conjunction with a double acting spool installed to the valve block, make sure that the inertia produced when the machine is stopped is absorbed through the cross-line relief valves. This in turn produces a smooth machine stop also preventing the hydraulic motor becoming overloaded.

Operation

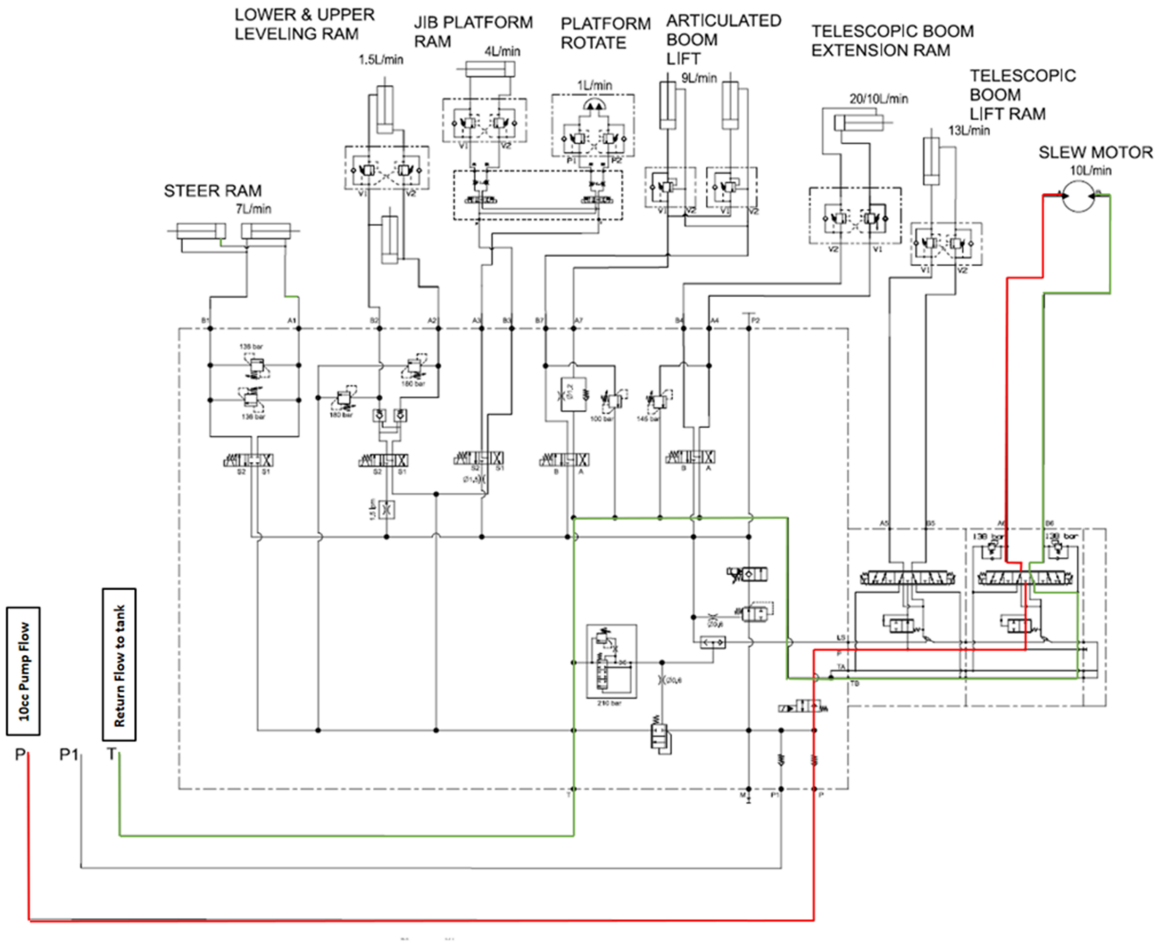
Slew motor is connected with a slew ring on this machine. When pressurized flow passes in motor from port B to A, the machine will slew in right direction and when flow passes from port A to B, the machine will slew in left direction. Slew operation is protected by 138bar (2,001.5psi) port relief pressure.

Figure 217.



When slew switch or joy stick is operated A7, B7 Slew spool is operated. When solenoid of Port A7 is energized machine is slewed in right direction and when port B7 is energized machine is slewed in left direction.

Figure 218.



Fault-Finding

Fault		
Motor does not turn (The supplied pressure is correct)	Table 117.	Page 30-137
Insufficient torque	Table 118.	Page 30-137
Abnormal noise	Table 119.	Page 30-137
Oil leakage at housing joint face	Table 120.	Page 30-137
Oil leakage at pinion gear	Table 121.	Page 30-137
Delay in starting	Table 122.	Page 30-137
Excessive heat generation	Table 123.	Page 30-138

Table 117. Motor does not turn (The supplied pressure is correct)

Cause	Remedy
Relief valve pressure too low or faulty	Replace the relief valve
Motor has too much internal leakage	Replace the motor assembly
Motor has burned inner parts	Replace the motor assembly
Reduction gears damaged	Replace the gears
Overload	Remove the overload

Table 118. Insufficient torque

Cause	Remedy
Relief valve pressure too low or faulty	Replace the relief valve
Motor has too much internal leakage	Replace the motor assembly
Motor has burned inner parts	Replace the motor assembly
Reduction gears damaged	Replace the gears
Bearings damaged	Replace the bearings

Table 119. Abnormal noise

Cause	Remedy
Cavitation noise due to insufficient flow	Inspect the oil level and pipework
Motor has damaged sliding parts	Replace the motor assembly
Reduction gears damaged	Replace the gears
Bearings damaged	Replace the bearings
Pinion gear damaged	Replace the pinion

Table 120. Oil leakage at housing joint face

Cause	Remedy
Damaged O-rings	Replace the O-rings
Loose bolts	Tighten to the correct torque value

Table 121. Oil leakage at pinion gear

Cause	Remedy
Damaged oil seal	Replace the oil seal

Table 122. Delay in starting

Cause	Remedy
Relief valve pressure too low or faulty	Replace the relief valve
Check valve internal leakage	Replace the check valve

Table 123. Excessive heat generation

Cause	Remedy
Motor has burned or damaged sliding parts	Replace the motor assembly
Reduction gears damaged	Replace the gears
Bearings damaged	Replace the bearings

Check (Condition)

Reduction Gear

Table 124.

Item	Item inspected for	Inspection	Repair
	Excessive wear of the surface	Pitching area is 5% or more of the gear surface	Replace the carrier kit
Ring	Damage to spline section	Visual check	Replace the carrier kit
S1 Gear, S2 Gear, B1 gear, B2 Gear	Excessive wear of the surface	Pitching area is 5% or more of the gear surface	Replace the carrier kit
	Excessive wear of the bearing surface	Visual check, pitching and flaking apparent	
Ring	Excessive wear of the bearing surface	Visual check, pitching and flaking apparent	Replace the carrier kit
Roller	Excessive wear of the bearing surface	Visual check, pitching and flaking apparent	Replace the carrier kit
Other (O ring, screw etc.)	Damage or excessive rust	-	Replace applicable part

Hydraulic Motor

Table 125.

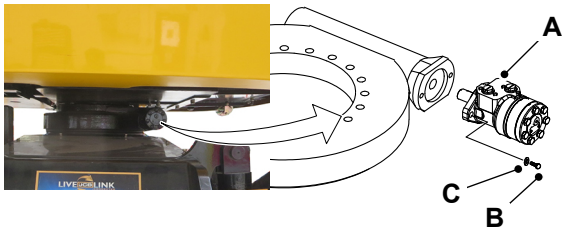
Item	Item inspected for	Inspection	Repair
Shaft	Excessive wear of the shaft key section	Worn depth 25µm or more	Replace the shaft
Housing	Excessive wear of the housing	Worn depth 20µm or more	Replace the housing
Endcover	Excessive wear of the plate	Worn depth 20µm or more	Replace the endcover
Wear plate	Wear of the plate	Worn depth 20µm or more	Replace the wear plate
Rotor set assembly	Excessive wear of the gear wheel set	Worn depth 0.1mm or more	Replace the rotor assembly
Other (O ring, screw etc.)	Damage or excessive rust	-	Replace applicable part

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
   Refer to: Discharge and Pressurise (PIL 30-00-00).
3. Disconnect the hydraulic hoses.
4. Put a label on the hoses to help installation.
5. Plug all the open ports and hoses to prevent contamination.
6. Support the slew drive motor with suitable lifting equipment.
7. Remove the bolt (x2) and washer (x2).
8. Install slew locking pin.
9. Remove the slew drive motor from the machine.

Figure 219.



A Slew drive motor
B Bolt (x2)
C Washer (x2)

Install

1. The installation procedure is the opposite of the removal procedure.

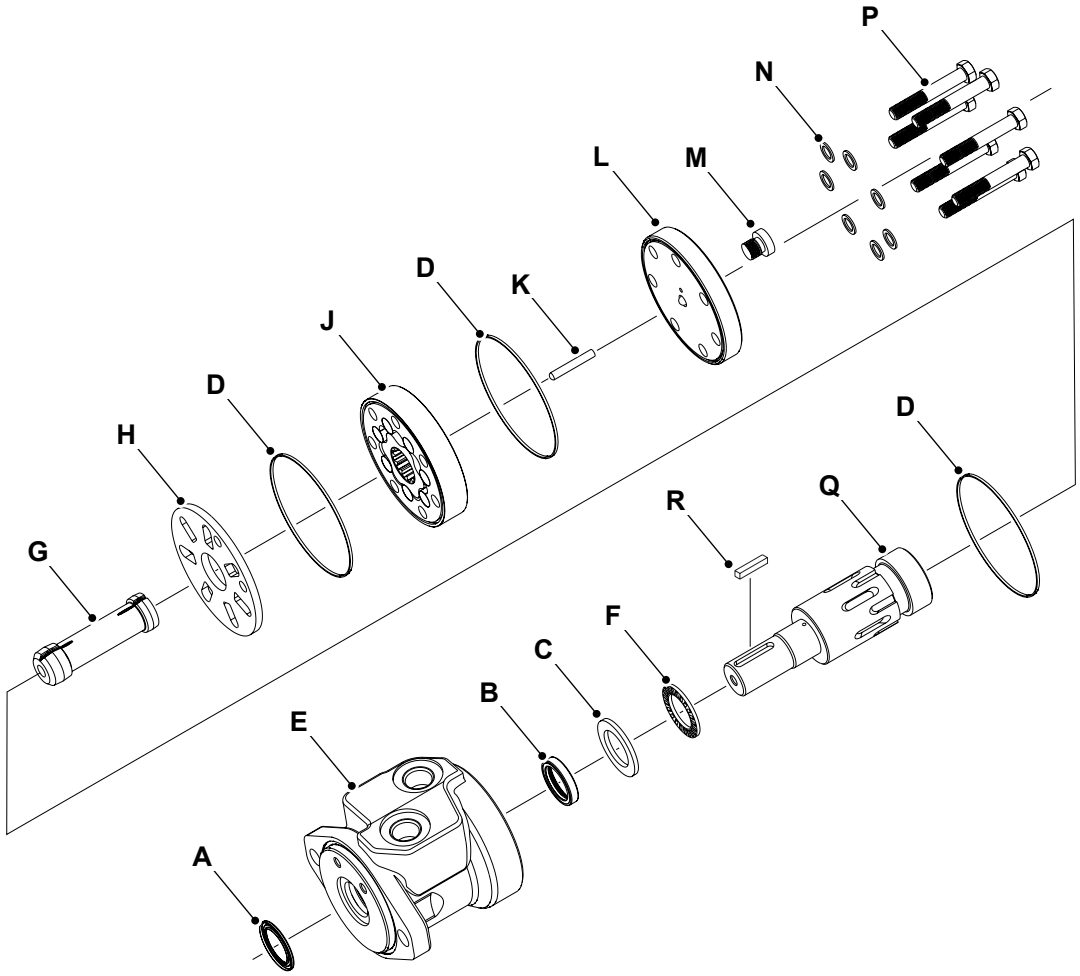
Disassemble and Assemble

The orientation of the internal parts and internal timing is highly critical for the correct operation of the slew motor.

Disassembly

1. Remove the slew motor from the machine.
   Refer to: PIL 30-39-00.
2. Remove the nut and key from the shaft.
3. Mark a V-shaped set of lines from the end cover to the case with suitable marker to help installation.
4. Hold the slew motor in a suitable vice or on a workbench.
   4.1. Make sure that the shaft end of the slew motor faces downwards.
5. Remove the bolts (x7).
6. Remove the end cover.
7. Remove and discard the body seals.
8. Remove the rotor set assembly and wear plate.
9. Remove and discard the body seals.
10. Remove the drive link pin and drive link from the slew motor.
11. Gently tap the shaft upwards through the case.
12. Remove the shaft from the rear of the case.
13. Remove the case from the vice.
14. Collect the thrust bearing and thrust washer.
    14.1. Turn the case to remove the thrust bearing and thrust washer.
15. Hold the case in the vice with the flange end facing upwards.
16. Remove the dust seal from case with a small screwdriver and hammer.
17. Remove the shaft seal with a small screwdriver,
18. Discard the shaft seal.

Figure 220.

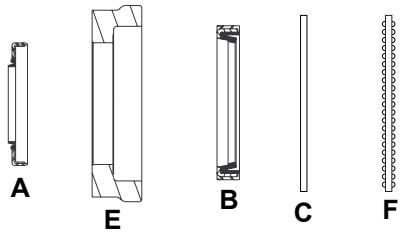


A Dust Seal
B Shaft Seal
C Thrust Washer
D Body Seals (x3)
E Case
F Thrust Bearing
G Drive Link
H Wear Plate
J Rotor Assembly
K Drive Link Pin
L End cover
M End cover plug
N Washers (x7)
P Bolts (x7)
Q Shaft
R Shaft key

Assembly

1. Clean all the parts in an oil based solvent. Use compressed air to dry the parts.
2. Apply a thin layer of clean oil to all new seals.
3. Place the shaft on a clean flat surface with the output end facing upwards.
4. Place the thrust bearing and thrust washer on the shaft.
5. Install the shaft seal down onto the shaft.
6. Make sure that the lip on the shaft seal faces downwards.

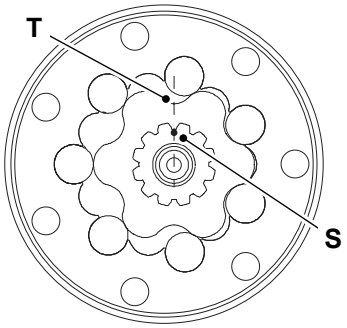
Figure 221.



A Dust Seal
B Shaft Seal
C Thrust Washer
E Case
F Thrust Bearing

7. Turn the shaft so that the output end of the shaft faces downwards.
8. Lower the drive link into the shaft. Make sure that the timing mark end of the drive link faces upwards and that the timing mark on the end of the drive link is aligned to the left of any short, open cutter slot on the shaft.
9. Turn the case so that the pilot of the case faces downwards.
10. Hold the case in a suitable vice.
11. Carefully lower the shaft assembly into the case.
    11.1. Make sure that you do not disturb the shaft seal and the drive link.
12. Make sure that the shaft end is in flush or slightly lower than the case bolt hole surface. Use an arbor press or a rubber mallet as required.
13. Place a body seal in the groove in the rear surface of the case.
14. Place a wear plate on the case.
15. Make sure that the valving slots on the wear plate are lined up with the bolt holes on the case.
16. Place a body seal in the groove in the face of the rotor assembly.
17. With the seal groove surface on the rotor assembly facing the wear plate, lower the rotor assembly onto the drive link. Make sure that the timing mark on the drive link is aligned with a valley on the rotor.

Figure 222.



S Timing mark on drive link
T Valley on rotor

18. Rotate the rotor assembly to line up the assembly bolt holes.
19. Install the drive link pin into the end of the drive link, Make sure that the concave or indented end faces upwards.
20. Place the remaining body seal in the groove in the end cover.
21. Place the end cover onto the motor. Make sure that the end of the drive link pin is in the hole in the centre of the end cover.
22. Install a washer on each of the bolts from the threaded end side.
23. Install the bolts (x7) with washers into the bolt holes.
24. Tighten the bolts to the correct pre-torque value.
    Torque: 13.6N·m
25. Tighten the bolts to the correct final torque value. Use the criss-cross method for tightening.
    Torque: 60N·m
26. Remove the motor from the vice.
27. Place the motor on a clean work surface with the shaft facing upwards.
28. Install the dust seal.
    28.1. Make sure that the lip on the dust seal faces upwards.
    28.2. Carefully drive the dust seal into its correct position.

28.3. Use a sleeve and hammer as required.

56 - Main Control Valve Block

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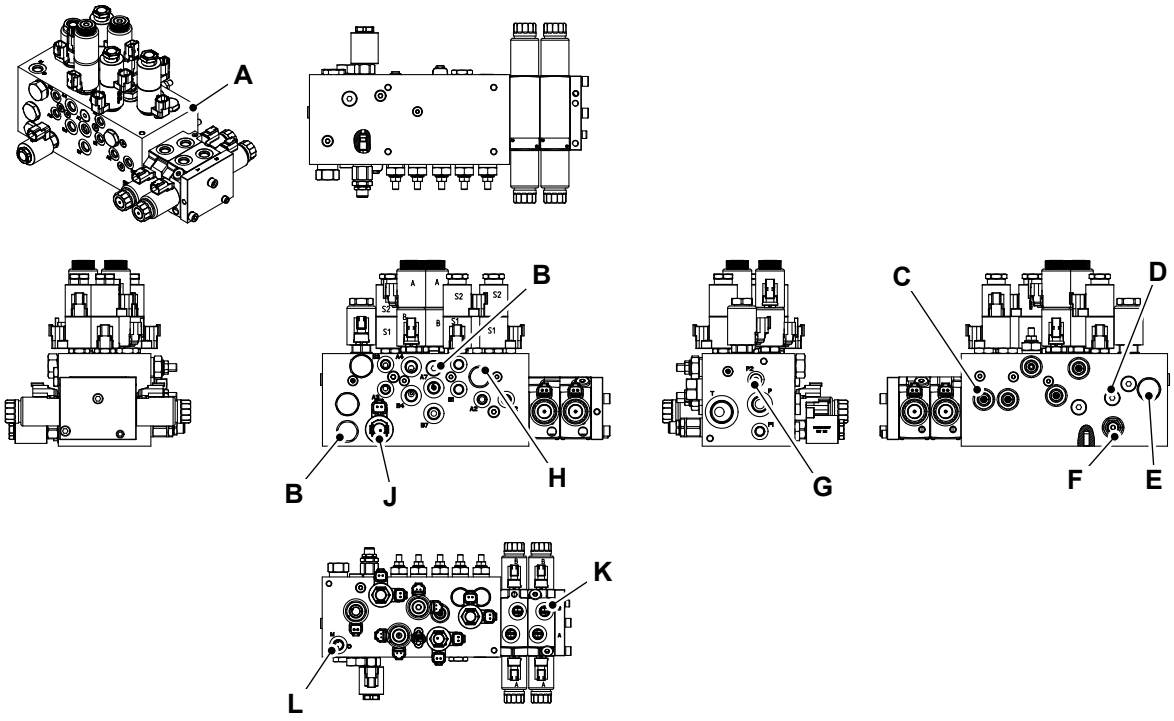
Introduction

The main control valve block controls the hydraulic functional elements of the slew, articulated boom lift, main boom lift, telescopic extension, flow to jib lift & platform rotate, platform levelling and steering.

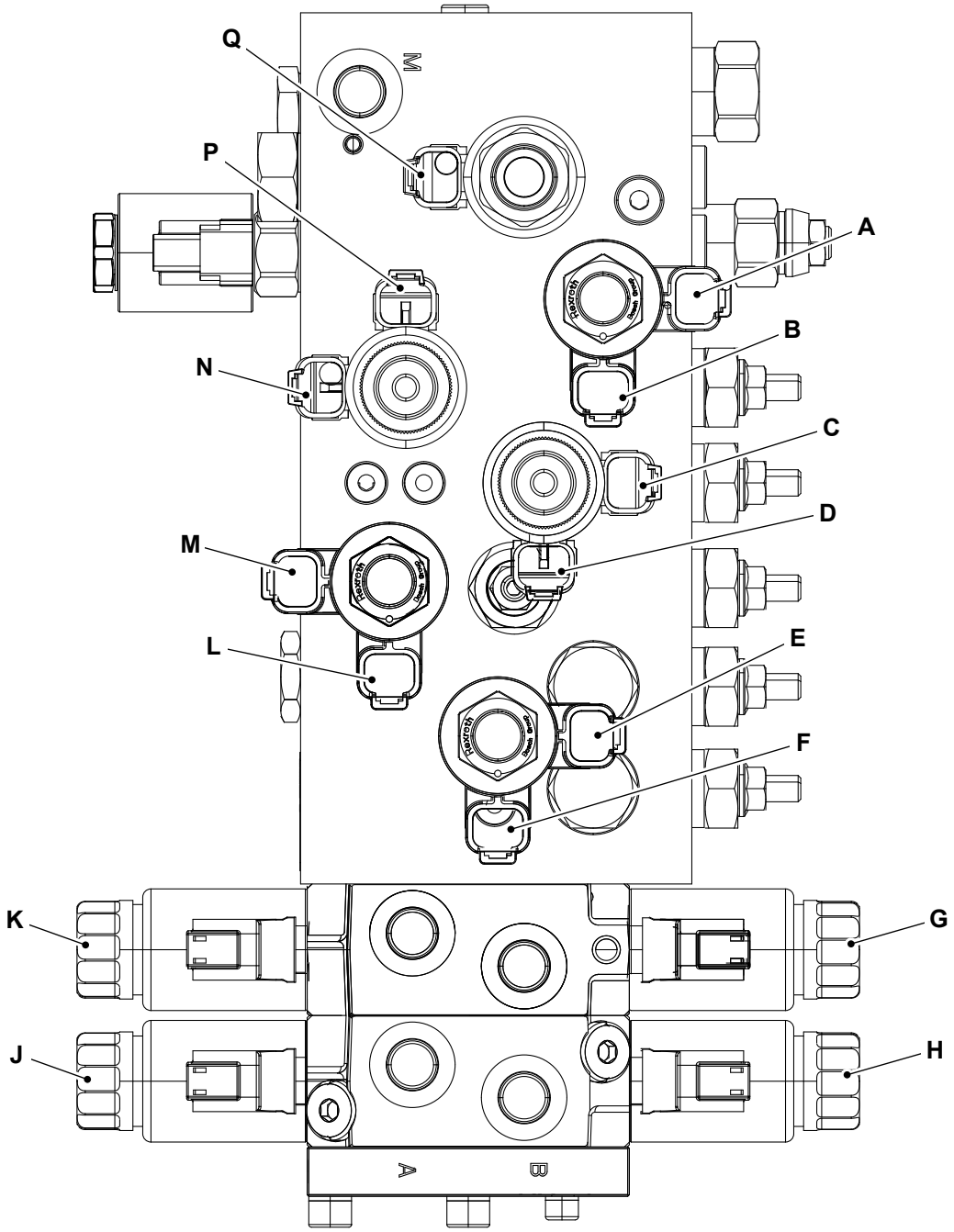
Component Identification

Figure 223.



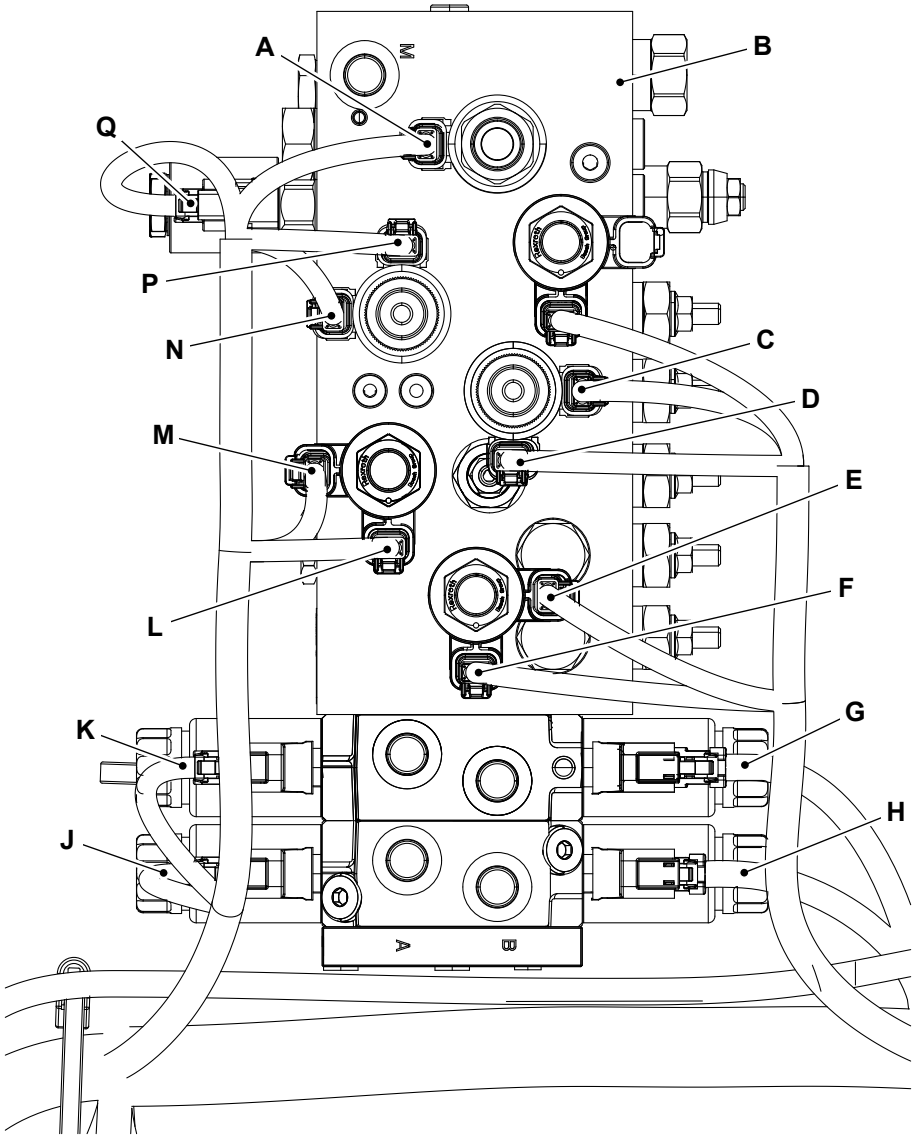
A Main boom control valve
B Valve check
C Valve pressure relief
D Valve shuttle
E Valve pressure control
F Relief valve
G Plug
H Valve flow control
J Cartridge
K Valve direction control
L Hydraulic test point adaptor

Figure 224.



A Flow to jib platform P port
B Flow to jib platform T port
C Articulated boom lift up
D Articulated boom lift down
E Levelling down
F Levelling up
G Telescopic boom down
H Slew motor anticlockwise rotation
J Slew motor clockwise rotation
K Telescopic boom up
L Steering (left)
M Steering (right)
N Telescopic boom extension
P Telescopic boom retraction
Q Proportional flow regulator

Figure 225.

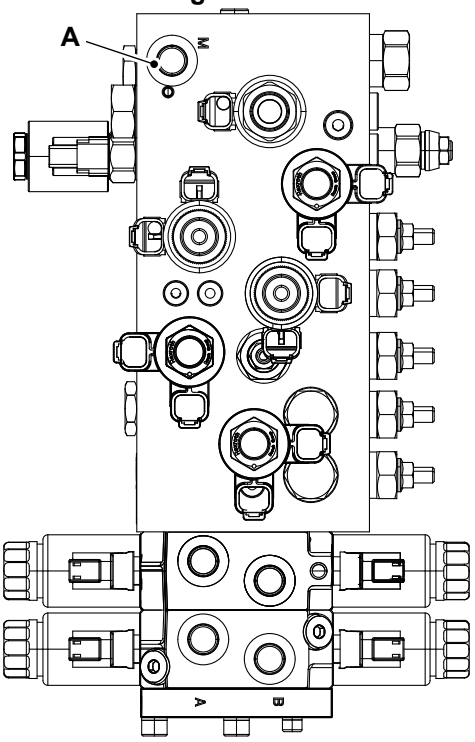


A Proportional flow hose
B Main boom control valve
C Articulated boom lower hose
D Articulated boom raise hose
E Levelling down hose
F Levelling up hose
G Telescopic boom down hose
H Swing left hose
J Swing right hose
K Telescopic boom up hose
L Steering (left) hose
M Steering (right) hose
N Telescopic boom retract hose
P Telescopic boom extend hose
Q Lift and slew solenoid hose

Check (Pressure)

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Remove the gauge port plug from the port M.
   2.1. Connect a suitable pressure gauge to the port M.
   Pressure: 250bar (3,625.9psi)
3. Start the engine.
4. Make sure the pressure gauge displays specified idle pressure.
   Pressure: 15–18bar (217.6–261.1psi)
5. To check maximum pressure of hydraulic system for retract telescopic boom lift or telescopic retraction, continuously hold the operation switch from base control.
   5.1. The pressure gauge should show a specified value.
   Pressure: 210–220bar (3,045.8–3,190.8psi)
6. There are different relief pressure set for various boom operations. Refer to Table 126.

Figure 226.



A Port M

Table 126.

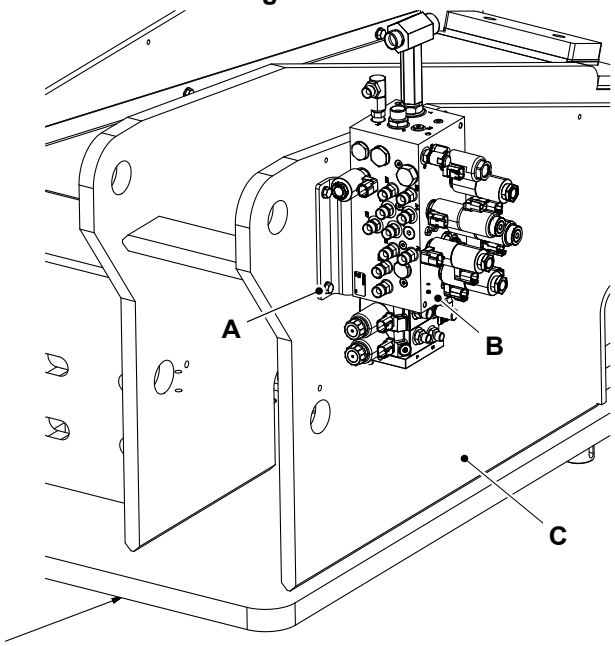
Boom Function	Maximum Relief Pressure
Steering right	138bar (2,001.5psi)
Steering left	138bar (2,001.5psi)
Platform levelling up	180bar (2,610.7psi)
Platform levelling down	180bar (2,610.7psi)
Platform jib up	210bar (3,045.8psi)
Platform jib down	210bar (3,045.8psi)
Platform rotate right	210bar (3,045.8psi)
Platform rotate left	210bar (3,045.8psi)
Articulated boom lift up	210bar (3,045.8psi)
Articulated boom lift down	100bar (1,450.4psi)
Telescopic boom extension	145bar (2,103.0psi)
Telescopic boom retract	210bar (3,045.8psi)
Telescopic boom lift	210bar (3,045.8psi)
Telescopic boom down	210bar (3,045.8psi)
Slew right	138bar (2,001.5psi)
Slew left	138bar (2,001.5psi)

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
   Refer to: PIL 30-00-00.
3. Get access to the main control valve block.
4. Put a label on the hoses to help installation.
   4.1. Disconnect the hydraulic hoses.
   4.2. Plug all the open ports and hoses to prevent contamination.
5. Support the valve block with suitable lifting equipment.
6. Remove the bolt (x4).
7. Remove the valve block with mounting bracket from the machine.

Figure 227.



A Bolt (x4)
B Main control valve
C Turntable

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. After installation, check the operation of hydraulic services.

57 - Transmission Control Valve Block

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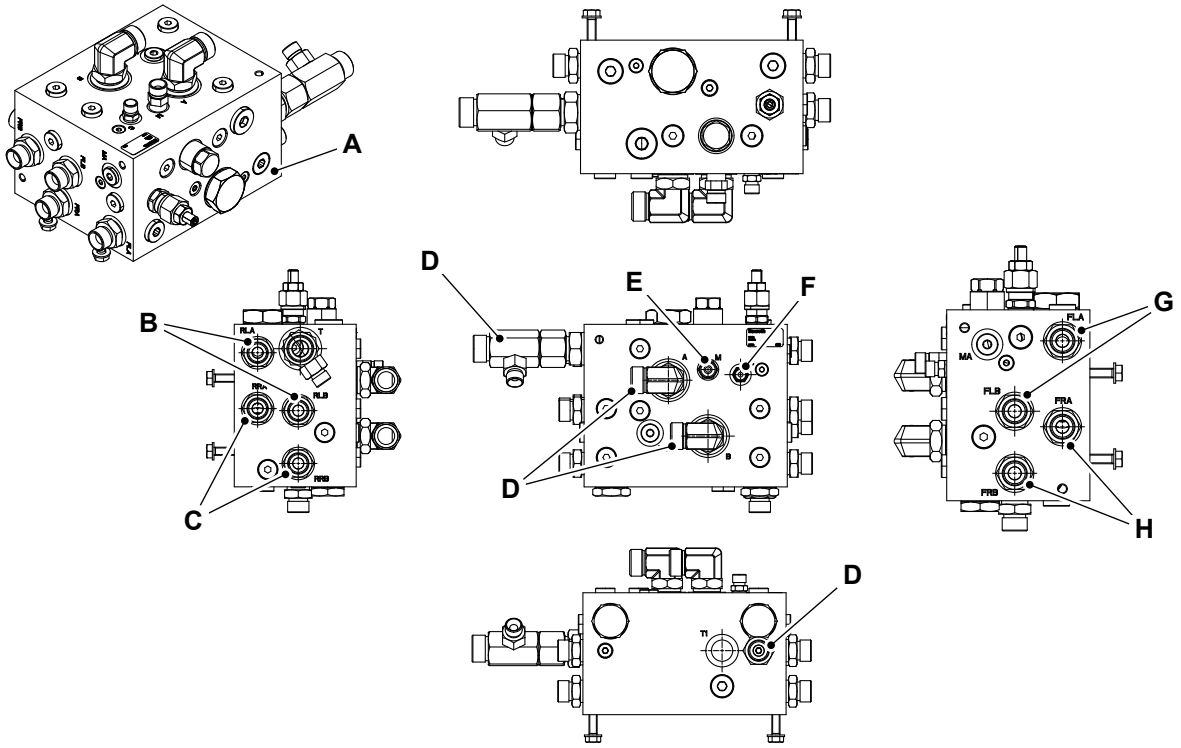
Introduction

The transmission control valve block directs the hydraulic flow to the wheel motors for forward and reverse drive.

Component Identification

Figure 228.



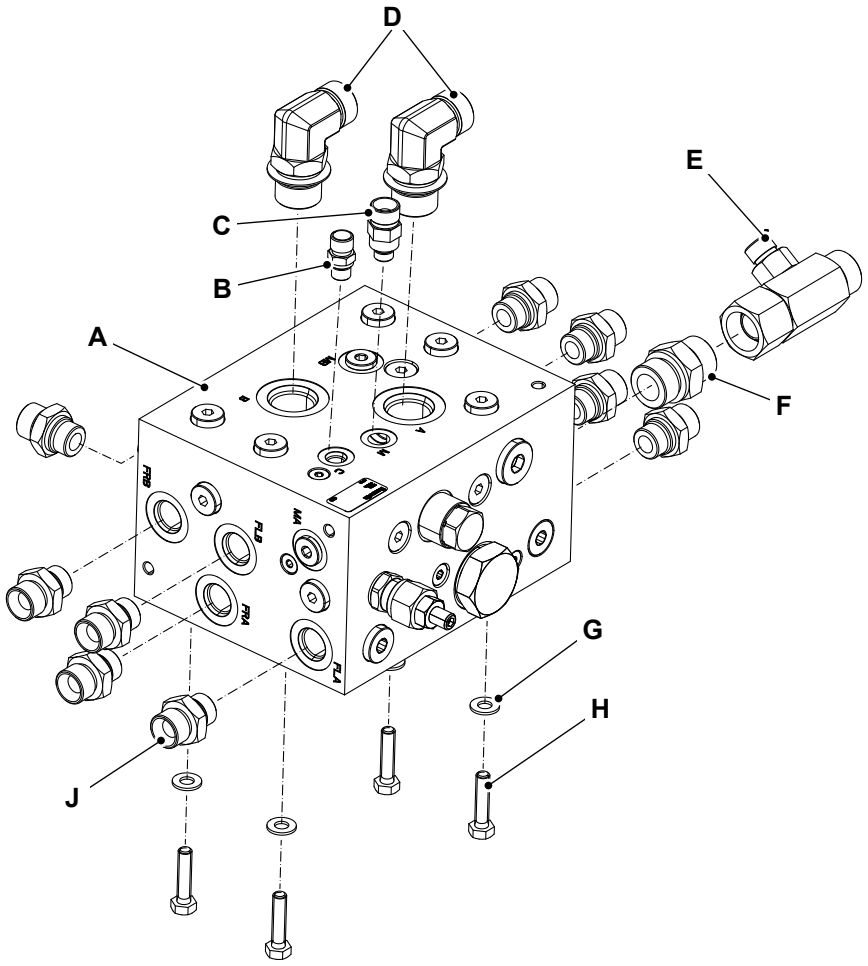
A Transmission control valve
B Hose adaptor- left hand drive motor (rear)
C Hose adaptor- right hand drive motor (rear)
D Hose adaptor- hydraulic drive circuit
E Hose adaptor- hydraulic break circuit
F Hose adaptor
G Hose adaptor- left hand drive motor (front)
H Hose adaptor- right hand drive motor (front)

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03.
2. Open the chassis cover.
3. Get access to the transmission control valve block.
4. Chock the wheels and switch the machine off to discharge the hydraulic pressure from the park brake and drive circuit.
5. Put a label on the hoses to help installation.
6. Disconnect the hoses.
7. Plug all the open ports and hoses to prevent contamination.
8. Remove the setscrew (x4) and washer (x4).
9. Remove the transmission control valve block from the machine.
10. If required, remove adaptor 1, adaptor 2. elbow adaptor (x2), T- adaptor, adaptor 3 and adaptor 4 (x9).

Figure 229.



A Transmission control valve
B Adaptor 1
C Adaptor 2
D Elbow adaptor (x2)
E T- adaptor
F Adaptor 3
G Washer (x4)
H Setscrew (x4)
J Adaptor 4 (x9)

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Tighten the setscrew and adaptors to the correct torque value.

Table 127. Torque Values

Item	Nm
B	20–22
C	20–22
D	95–108
E	85–94
F	95–108
H	22

60 - Directional Control Valve

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03 - Brake

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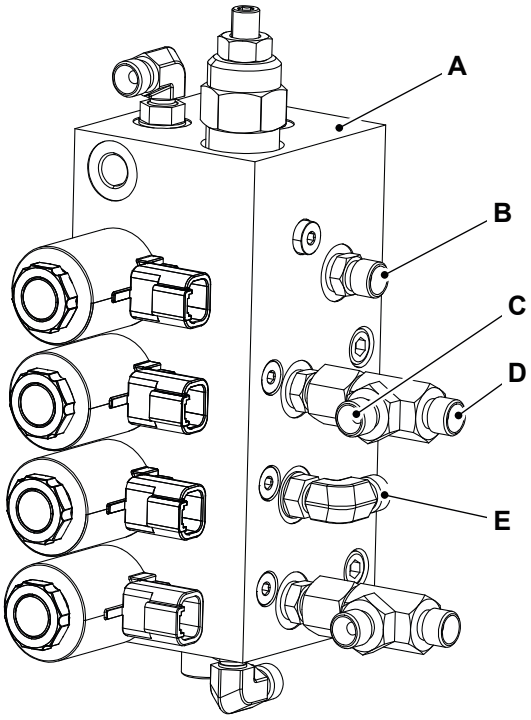
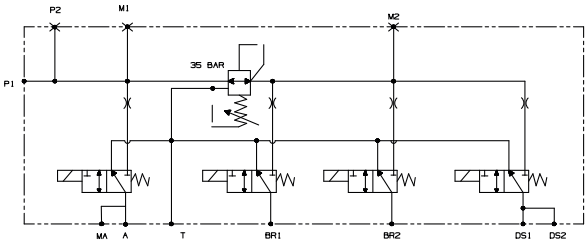
Component Identification

Figure 230.



A Brake control valve
B Port - brake control valve transmission control valve
C Port - brake control valve to adaptor bulkhead to front right hand side drive motor
D Port - brake control valve to adaptor bulkhead to front left hand side drive motor
E Port - brake control valve to adaptor bulkhead to rear side drive motors

Figure 231. Schematic Diagram

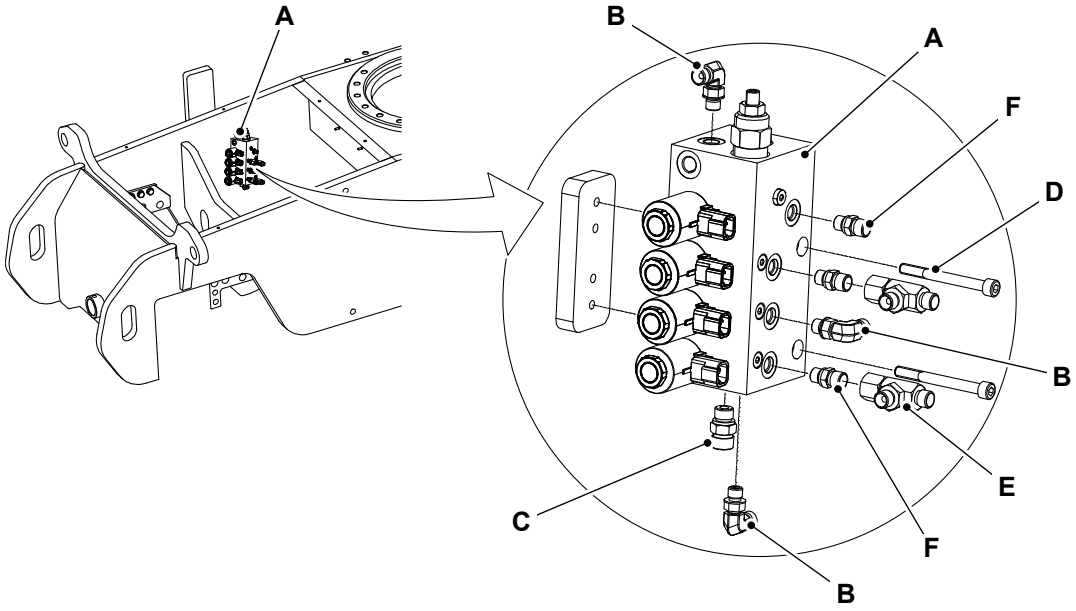


Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Get access to the brake control valve.
3. Disconnect the harness from the solenoid electrical connector.
4. Disconnect and plug the brake valve hoses to prevent the ingress of dirt.
   4.1. Label the hoses to help installation.
5. Remove the capscrew (x2) and lift the brake valve from the machine.

Figure 232.



A Brake control valve
B Elbow adaptor (x3)
C Adaptor 1
D Capscrew (x2)
E Adaptor 2 (x2)
F Adaptor 3 (x3)

Install

1. The installation is the opposite of the removal procedure. Additionally do the following the steps.

   1.1. Check the hydraulic tank level.

   1.2. Bleed the brake control valve system.

2. Tighten the fasteners to the correct torque value.

Table 128. Torque Values

Item	Nm
B	20–22
C	30–37
D	36
E	25–28
G	20–22

68 - Platform

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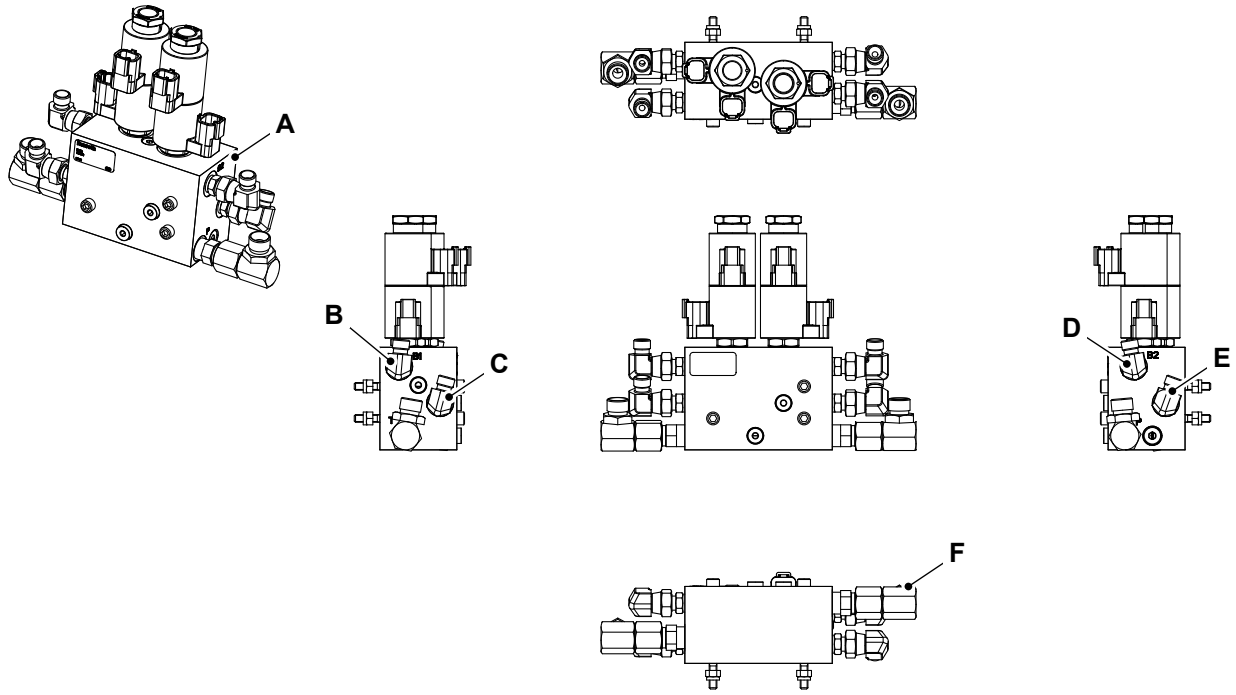
Introduction

The platform control valve is fitted on the jib knuckle. It receives flow from the platform or jib flow valve output of the main valve block. It consists of two solenoid controlled spools, two orifices of size 1.5mm (jib), and two orifices of size 0.4mm (platform rotate). The main function of the platform control valve is to raise and lower the jib, and to rotate the platform left and right.

Component Identification

Figure 233.



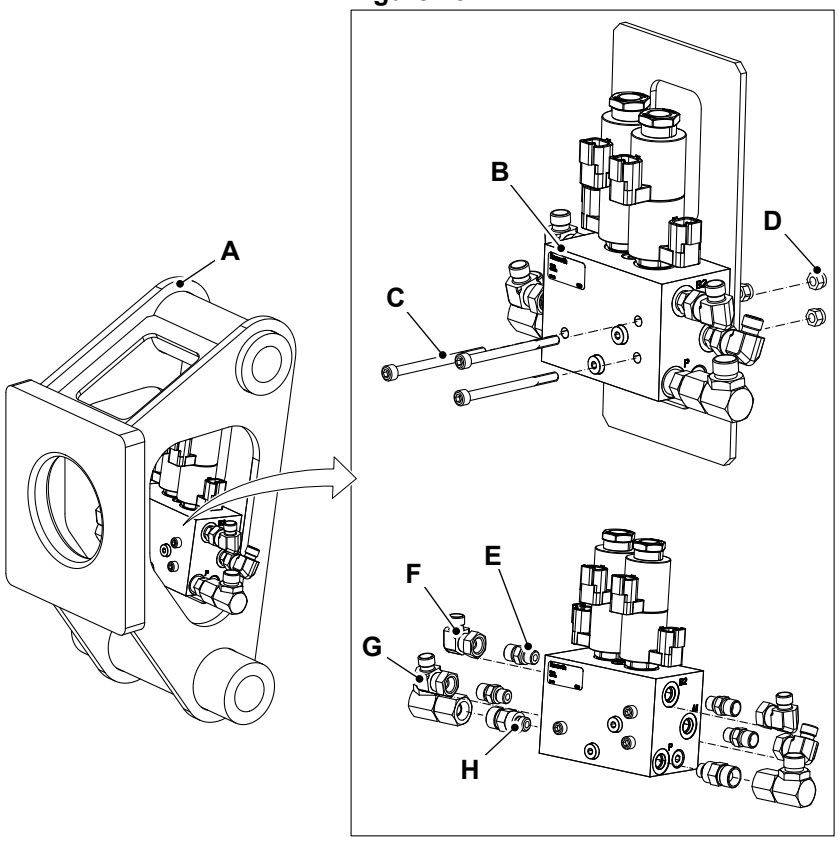
A Platform Control Valve
B Adaptor- B1
C Adaptor- A1
D Adaptor- B2
E Adaptor- A1
F Pressure point

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Get access to the jib knuckle.
3. Put a label on the hoses to help installation.
4. Disconnect the hoses.
5. Plug all the open ports and hoses to prevent contamination.
6. Remove the capscrew (x3) and nut (x3).
7. Remove the platform control valve from the machine.
8. If required, remove the adaptor 1, adaptor 2, adaptor 3 and adaptor 4

Figure 234.



A Rear jib knuckle
B Platform control valve
C Capscrew (x3)
D Nut (x3)
E Adaptor 1
F Adaptor 2
G Adaptor 3
H Adaptor 4

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Tighten the nuts and adaptors to the correct torque value.

Table 129. Torque Values

Item	Nm
D	8.8
E	20–22
F	25–28
G	35–39
H	20–22

93 - Hose

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Introduction

Hydraulic hoses are used to connect different components in the hydraulic circuit. The hoses are graded by pressure, temperature, and fluid compatibility. Hoses are built up with rubber and steel layers. A rubber interior is surrounded by multiple layers of woven wire and rubber. The exterior is designed for abrasion resistance. The bend radius of a hydraulic hose is carefully designed for the machine, since hose failures can be deadly, and violating the hose's minimum bend radius will cause failure. Hydraulic hoses generally have steel fittings swaged on the ends.

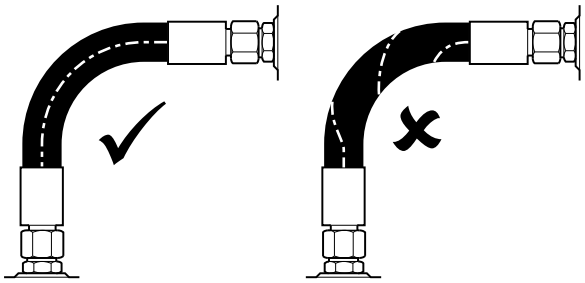
Disconnect and Connect

Some attachments are hydraulically powered. The following procedures show how to connect and disconnect the hydraulic hoses safely.

Connecting the Hydraulic Hoses

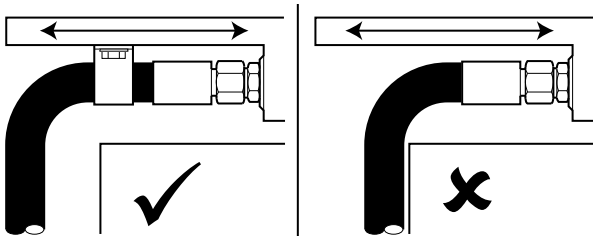
1. Make the machine safe.
   Refer to: PIL 01-03.
2. Discharge the hydraulic system pressure.
   Refer to: PIL 30-00-00.
3. Check the hoses and adaptors for damage.
4. Connect the hoses:
   4.1. Make sure that the hose is not twisted. Pressure applied to a twisted hose can cause the hose to fail or the connections to loosen.

Figure 235.



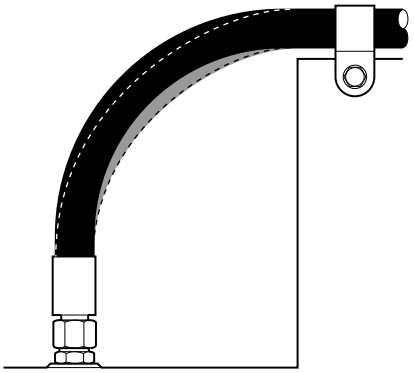
   4.2. Make sure that the hose does not touch hot parts. High ambient temperatures can cause the hose to fail.
   4.3. Make sure that the hose does not touch parts which can rub or cause abrasion.
   4.4. Use the hose clamps (where possible) to support long hose runs and keep the hoses away from moving parts, etc.

Figure 236.



   4.5. To allow for length changes when the hose is pressurised, do not clamp at the bend. The curve absorbs the change.

Figure 237.



5. Check for leaks:
   5.1. Start the machine.
   5.2. Operate the related controls to increase the pressure in the hydraulic system.
   5.3. Stop the machine then remove the key.
   5.4. Check for indications of leakage at the hose connections. Correct, as necessary.

Disconnecting the Hydraulic Hoses

1. Make the machine safe.
   Refer to: PIL 01-03.
2. Discharge the hydraulic system pressure.
   Refer to: PIL 30-00-00.
3. Disconnect the hoses.
4. Check the hoses and adaptors for damage.
5. If necessary, install the blanking caps.
6. Check for leaks:
   6.1. Start the machine.
   6.2. Operate the related controls to increase the pressure in the hydraulic system.
   6.3. Stop the machine then remove the key.
   6.4. Check for indications of leakage at the hose connections. Correct, as necessary.

Check (Condition)

Hydraulic Hoses

⚠ **WARNING** Damaged hoses can cause fatal accidents. Examine the hoses regularly. Do not use the machine if a hose or hose fixture is damaged.

WARNING Fine jets of fluid at high pressure can penetrate the skin. Keep face and hands well clear of fluid under pressure and wear personal protective equipment. Hold a piece of cardboard close to suspected leaks and then examine the cardboard for signs of fluid. If fluid penetrates your skin, get medical help immediately.

Examine the hoses for:

- Damaged hose ends
- Worn or cracked outer covers
- Ballooned outer covers
- Kinked or crushed hoses
- Exposed armouring in the outer covers
- Displaced hose end fittings.
- Worn cover sheathing or hose burst protection covering

Replace a damaged hose before you use the machine again.

The replacement hoses must be of the same size, standard and pressure rating. If necessary, for more information contact your JCB dealer.

96 - Pipe

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00 - General

Check (Condition)

The hydraulic system pipework comprises flexible hoses and steel hydraulic pipes.

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Visually check the system pipework for the following defects:
   2.1. Hydraulic oil leaks.
   2.2. Security of ties and clamps.
   2.3. Security of connections.
   2.4. Crushed or kinked pipes and hoses.
   2.5. Chaffed pipes and hoses.
   2.6. Corroded steel pipes.
3. If one or more of the listed defects is identified, replace the applicable pipe/hose or retaining ties and clamps.

97 - Connectors

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00 - General

Technical Data

O-Ring Face Seal UNF Threads on the ORFS Fittings

Table 130. Torque Settings - ORFS

UNF Thread Size	Torque Value
inch x pitch	N·m
9/16 x 18	24–27N·m
11/16 x 16	40–44N·m
13/16 x 16	55–60N·m
1 x 14	60–66N·m
1 3/16 x 12	90–99N·m
1 5/16 x 12	115–126N·m
1 7/16 x 12	125–138N·m
1 11/16 x 12	170–187N·m
2 x 12	200–220N·m

Adaptors Connected into Valve Blocks

Table 131. Torque Settings - BSP Adaptors

BSP Adaptor Size	BSP Adaptor Size	Hexagon (A/F)	Torque Value
Inch	mm	mm	N·m
1/4	6.35	19mm	18N·m
3/8	9.525	22mm	31N·m
1/2	12.7	27mm	49N·m
5/8	15.875	30mm	60N·m
3/4	19.05	32mm	81N·m
1	25.4	38mm	129N·m
1 1/4	31.75	50mm	206N·m

Table 132. Torque Settings - SAE Connections

Dash Size	SAE Port Thread Size	Hexagon (A/F)	Torque Value
	inch x pitch	mm	N·m
4	7/16 x 20	15.9mm	20–28N·m
6	9/16 x 18	19.1mm	46–54N·m
8	3/4 x 16	22.2mm	95–105N·m
10	7/8 x 14	27mm	130–140N·m
12	1 1/16 x 12	31.8mm	190–210N·m
16	1 5/16 x 12	38.1mm	290–310N·m
20	1 5/8	47.6mm	280–380N·m

Table 133. Torque Settings - SAE UNF O-ring boss port adaptors; straight and phased (heavy duty S series)

SAE Thread Size	Adaptor Torque Into Aluminium Body	Adaptor Torque Into Ferrous Body	Plug Torque Into Ferrous Body
inch x pitch	N·m	N·m	N·m
3/8 x 24	10–12	10–12	20–22
7/16 x 20	20–22	20–22	35–39
1/2 x 20	25–27.5	25–27.5	40–44
9/16 x 18	31–37	35–39	45–50
3/4 x 16	45–50	70–77	85–93
7/8 x 14	65–71	100–110	110–120
1-1/16 x 12	95–108	170–187	170–187

SAE Thread Size	Adaptor Torque Into Aluminium Body	Adaptor Torque Into Ferrous Body	Plug Torque Into Ferrous Body
inch x pitch	N·m	N·m	N·m
1-3/16 x 12	127–140	215–236	215–236
1-5/16 x 12	158–169	270–297	270–297
1-5/8 x 12	197–210	285–310	Contact JCB service
1-7/8 x 12	220–235	370–400	Contact JCB service

Table 134. Metric ports / adaptors with O-ring seal (light duty L series and heavy duty S series)

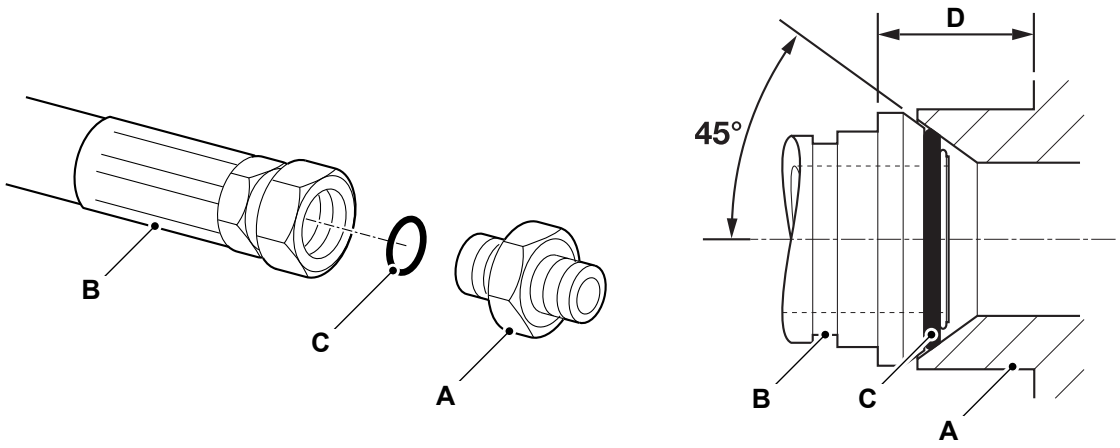
Metric thread	Adaptor Torque Into Aluminium Body (S&L series)	Adaptor Torque Into Ferrous Body (Light duty L series)	Adaptor Torque Into Ferrous Body (Heavy duty S series)	Plug Torque Into Ferrous Body (Heavy duty S series)
	N·m	N·m	N·m	N·m
M 8 x 1	6-8	8-9	10-11	10-11
M10 x 1	18-20	18-20	20-22	20-22
M12x 1,5	31-37	31-37	35-38	35-38
M14 x 1,5	35-40	35-40	45-49	45-49
M16 x 1,5	45-50	45-50	55-60	55-60
M18 x 1,5	65-71	65-71	70-77	70-77
M20 x 1,5	-	-	80-88	80-88
M 22 x 1,5	75-82	75-82	100-110	100-110
M 27 x 2	85-95	100-110	170-187	170-187
M30 x 2	95-108	130-143	215-236	215-236
M33 x 2	158-169	160-176	270-297	310-340
M 42 x 2	197-210	220-235	270-297	330-370
M48 x 2	220-235	220-235	270-297	330-370
M60 x 2	220-235	220-235	270-297	330-370

Table 135. Metric ports / adaptors with type E seal or O-ring with collar (heavy duty S series)

Metric thread	Adaptor Torque Into Aluminium Body	Adaptor Torque Into Ferrous Body
	N·m	N·m
M12 x 1,5	31-37	45-50
M14 x 1,5	35-40	60-66
M16 x 1,5	45-50	80-88
M18 x 1,5	55-60	100-110
M20 x 1,5	65-71	140-154
M22 x 1,5	75-82	150-165
M27 x 2	95-108	200-220
M33 x 2	158-169	380-418
M42 x 2	197-210	380-418
M48 x 2	220-235	380-418

Hoses installed into Adaptors

Figure 238.



A Adaptor
B Hose
C O-ring
D Dimension will vary depending upon the torque applied.

Hoses installed into adaptors seal onto an `O' ring which is compressed into a 45° seat machined into the face of the adaptor port.

Table 136. BSP Hose - Torque Settings

BSP Hose Size	Hexagon (A/F)	Nm	kgf m	lbf ft
in	mm			
1/8	14.0	14.0 - 16.00	1.4 - 1.6	10.3 - 11.8
1/4	19.0	24.0 - 27.0	2.4 - 2.7	17.7 - 19.9
3/8	22.0	33.0 - 40.0	3.4 - 4.1	24.3 - 29.5
1/2	27.0	44.0 - 50.0	4.5 - 5.1	32.4 - 36.9
5/8	30.0	58.0 - 65.0	5.9 - 6.6	42.8 - 47.9
3/4	32.0	84.0 - 92.0	8.6 - 9.4	61.9 - 67.8
1	38.0	115.0 - 126.0	11.7 - 12.8	84.8 - 92.9
1 1/4	50.0	189.0 - 200.0	19.3 - 20.4	139.4 - 147.5
1 1/2	55.0	244.0 - 260.0	24.9 - 26.5	180.0 - 191.8

SAE Flange Connection Bolts

Table 137. Code 61 torques

Nominal size (DN)[1]	Screw torque[2]
13	32 -0/+3.2N·m
19	70 -0/+7N·m
25	70 -0/+7N·m
32	70 -0/+7N·m
38	130 -0/+13N·m
51	130 -0/+13N·m
64	130 -0/+13N·m
76	295 -0/+29.5N·m
89	295 -0/+29.5N·m
102	295 -0/+29.5N·m
127	295 -0/+29.5N·m

(1) Dimension Nominal
(2) These torque values (from ISO 6162 parts 1 and 2) are only a guide when using G10.9 metric phosphor-coated and lubricated screws with a coefficient of friction of 0,17; net tightening torque depends on many factors, including lubrication, coating, surface finish and material.

Table 138. Code 62 torques

Nominal size (DN)(1)	Screw torque(2)
13	32 -0/+3.2N·m
19	70 -0/+7N·m
25	70 -0/+7N·m
32	70 -0/+7N·m
38	130 -0/+13N·m
51	130 -0/+13N·m
64	130 -0/+13N·m
76	295 -0/+29.5N·m

(1) Dimension Nominal
(2) These torque values (from ISO 6162 parts 1 and 2) are only a guide when using G10.9 metric phosphor-coated and lubricated screws with a coefficient of friction of 0,17; net tightening torque depends on many factors, including lubrication, coating, surface finish and material.

09 - Adaptor

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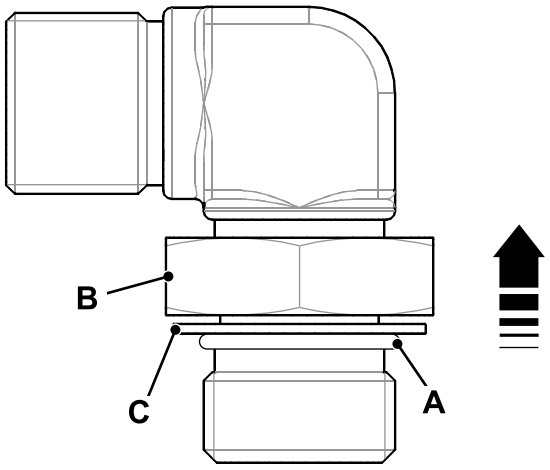
Remove and Install 30-180

Introduction

On a typical machine, some hydraulic components may utilise Positional Type Hydraulic Adaptors. When you install a Positional Type Hydraulic Adaptor, it is important to adopt the Remove and Install procedure.
Refer to: Remove and Install (PIL 30-97-09).

If this procedure is not followed correctly, damage to the O-ring seal can occur which can result in oil leaks.

Figure 239.

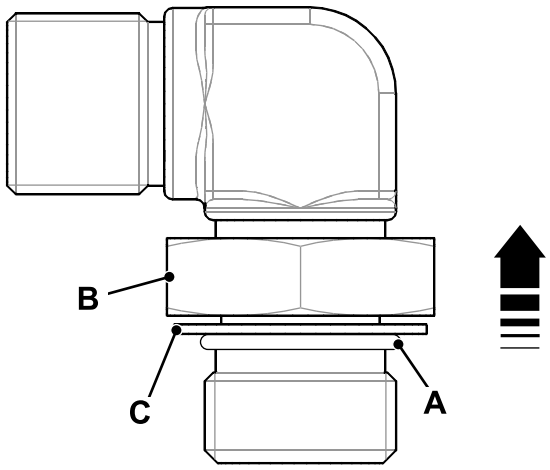


A O-ring seal
B Locknut
C Washer

Remove and Install

1. Make sure that the locknut is screwed back on to the body of the adaptor as far as possible.
2. Check that the O-ring backing washer is a tight fit on the adaptor. Note that the washer should not move freely, if the washer is slack do not use the adaptor.
3. Check that the O-ring seal is installed and that it is free from damage or nicks. Before you install the adaptor, smear the O-ring with clean hydraulic fluid. The dimensions and shore hardness of the O-ring seal is critical. Should it become necessary to replace the O-ring seal, make sure you use JCB Genuine Parts.

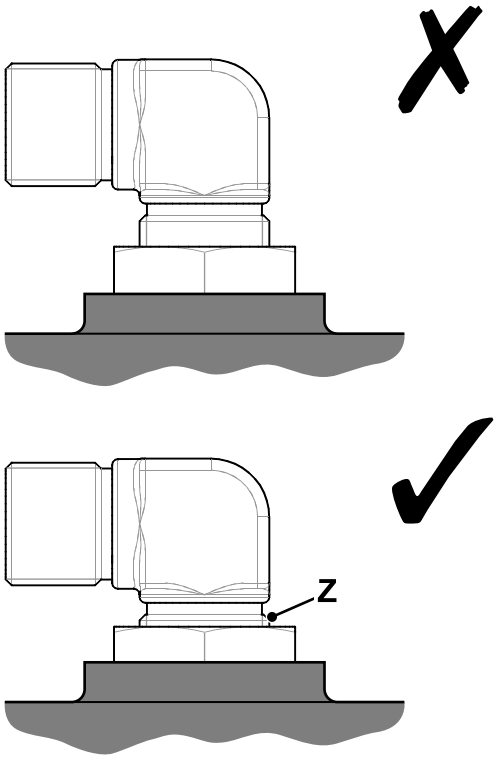
Figure 240.



A O-ring seal
B Locknut
C Backing washer

4. Screw the adaptor into the port of the hydraulic component as far as possible, so that all the threads engage and the O-ring seal is correctly seated against the sealing face.
5. Set the angular position of the adaptor as required, then secure by tightening the locknut. When installed correctly no more than one thread should be visible at Z as shown.

Figure 241.



Z Adaptor thread

6. Tighten the locknut to the correct torque value.

80 - Rotary Actuator

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00 - General

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Remove and Install 30-189
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Introduction

The rotator or rotary actuator is a hydro-mechanical component which converts axial piston motion into powerful shaft rotation. It works on the sliding spline concept.

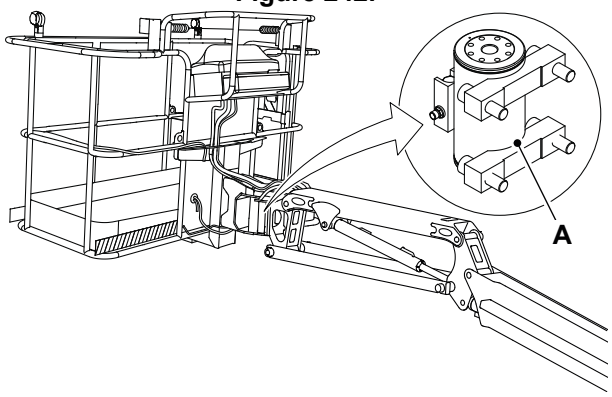
The major components of a typical rotary actuator assembly are.

- Shaft
- Case
- Piston sleeve
- End cap

The rotary actuator installed on these machines can turn the platform through 160°.

Component Identification

Figure 242.



A Rotary actuator

Operation

The rotary actuator is a simple mechanism that uses the sliding spline operating concept to convert linear piston motion into powerful shaft rotation.

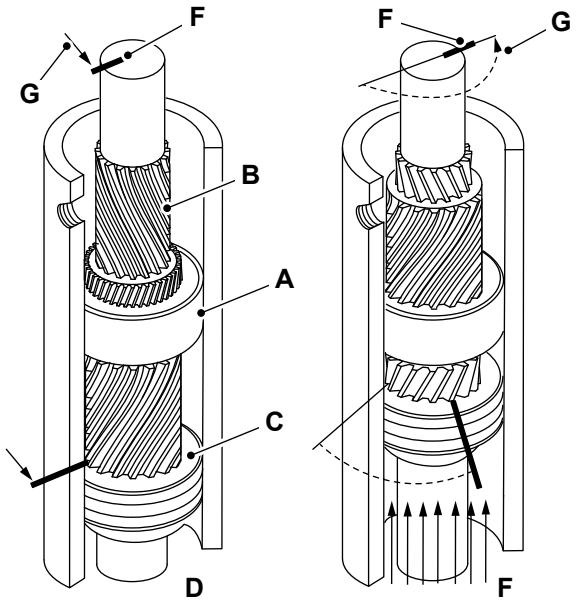
The rotary actuator has a case with integrated gear teeth, central shaft with integrated bearing tube, mounting flange and the annular piston sleeve.

The helical spline teeth machined on the shaft are engaged with matching splines on the inside diameter of the piston. The outside diameter of the piston carries a second set of splines, of opposite hand, which are engaged with matching splines in the case.

The shaft is supported radially by the large upper radial bearing and the lower radial bearing. The shaft is axially separated from the case by the upper and lower thrust washers. The end cap is adjusted for axial clearance and locked in position by set screws or pins.

When hydraulic pressure is applied, the piston is displaced axially within the case and the splines rotate the shaft. When the control valve is closed, oil is trapped inside the actuator, preventing piston movement and locking the shaft in position.

Figure 243.



A Case
B Shaft
C Annular piston sleeve
D Central position (Locked)
E Turned position (Hydraulic pressure is applied)
F Reference position of shaft
G Direction of rotation

Fault-Finding

Fault		
Slow or no shaft rotation	Table 139.	Page 30-185
Operation is erratic or not responsive	Table 140.	Page 30-185
Shaft will not fully rotate	Table 141.	Page 30-185
Selected position cannot be maintained	Table 142.	Page 30-185

Table 139. Slow or no shaft rotation

Cause	Remedy
Insufficient torque output	Check the correct operating hydraulic pressure. Check the load on the platform.
Low fluid flow rate	Check the condition of the ports for obstructions and hydraulic lines for restrictions and leaks.
Control or counterbalance valve leaking internally	Disconnect the hydraulic lines and bypass valve. Leave the valve ports open and operate the actuator through the case ports. The valve must be replaced if a steady flow of fluid is seen coming from the valve ports.
Piston and/or shaft seal leaking	Remove the plug and the case valve ports. Operate the actuator through the case ports. Check the rotator for leaks.
Corrosion buildup on the thrust surfaces	Disassemble the rotator. Remove all rust then polish. Replace the parts as required.
Swollen seals and composite bearings caused by incompatible hydraulic fluid	Disassemble the rotator. Replace the seals. Use correct fluid that is compatible with seals and bearings.

Table 140. Operation is erratic or not responsive

Cause	Remedy
Air in rotator	Bleed the rotator.

Table 141. Shaft will not fully rotate

Cause	Remedy
Twisted or chipped gear teeth	Check for gear binding. Rotator may not be able to be re-built and may need to be replaced. Damage could be a result of overload or shock.
Port fittings are obstructing the piston	Check thread length of port fittings. Fittings should during stroke not reach inside the housing bore.

Table 142. Selected position cannot be maintained

Cause	Remedy
Control or counterbalance valve leaking internally	Disconnect the hydraulic lines and bypass valve. Leave the valve ports open and operate the actuator through the case ports. The valve must be replaced if a steady flow of fluid is seen coming from the valve ports.
Piston and/or shaft seal leaking	Remove the plug and the case valve ports. Operate the actuator through the case ports. Check the rotator for leaks.
Air in rotator	Bleed the rotator.

Check (Condition)

1. Clean all parts thoroughly.
2. Check condition of all parts for excessive wear, cracks and chips. If necessary, replace the parts.
   2.1. Make a note that a small amount of wear in the spline teeth will have little effect on the actuator strength.
   2.2. New spline sets are manufactured with a specified backlash per mating set.
   Dimension: 0.127mm
   2.3. After a long service, a specified backlash per set may still be acceptable, depending on the required accuracy of the application.
   Dimension: 0.381mm
3. Check condition of the ring gear for wear and weld damage to the pins.
4. Check condition of the cylinder bore for wear and scratches.

Check (Leaks)

1. Plug the ports of the counterbalance valve.
2. Connect the hydraulic hoses to the case ports.
3. Bleed all air from the actuator.
   Refer to: Bleed (PIL 30-80-00).
4. Rotate the shaft to the end of rotation at the specified pressure. Maintain the specified pressure.
   Pressure: 207bar (3,002.3psi)
5. Remove the hydraulic hoses from the non-pressurised side.
6. Continuous oil flow from the open case port indicates internal leakage across the piston.
7. Replace the hoses.
8. Rotate the shaft to the end of rotation in the opposite direction at the specified pressure. Maintain the specified pressure.
   Pressure: 207bar (3,002.3psi)
9. Continuous oil flow from the open case port indicates internal leakage across the piston.
10. If the internal leakage is found, disassemble and repair the rotary actuator.

Bleed

It is necessary to bleed the rotary actuator, if excessive backlash is exhibited after the rotary actuator is connected to the hydraulic system.

1. Make the machine safe with the platform lowered.

   Refer to: PIL 01-03-27.

2. Connect a suitable hose to each bleed point.
3. Put a suitable container under the other end of the hoses to collect the drained hydraulic fluid.
4. Loosen the bleed points by 1/4 turn.
5. Operate the platform control lever to rotate the platform until the end of rotation (either clockwise or anticlockwise).
6. Maintain the hydraulic pressure.

   6.1. Hydraulic oil with small air bubbles will be seen flowing through the hoses.

7. Allow the specified quantity of hydraulic oil to be purged from the rotary actuator.

   Volume: 1.9L

8. Keep the fittings open and rotate the platform in the opposite direction to the end position.
9. Maintain the hydraulic pressure until an additional specified quantity of hydraulic oil is pumped into the container.

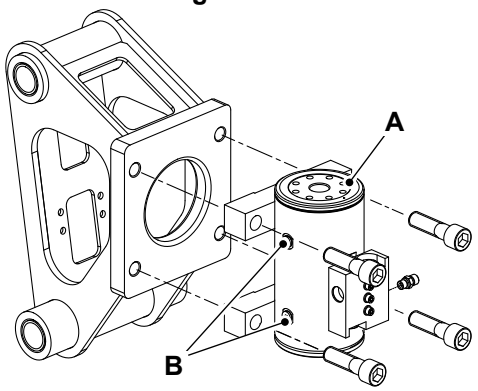
   Volume: 0.95L

10. Do the steps 5 to step 9 again.
11. Close both bleed points before rotating away from the end position.
12. Disconnect the hoses from the bleed points.
13. Check the hydraulic oil level and top up as required.

    Refer to: PIL 30-00-00.

    13.1. You can fill the hydraulic tank again with the drained hydraulic oil. Make sure that it is clean and free from contamination.

Figure 244.



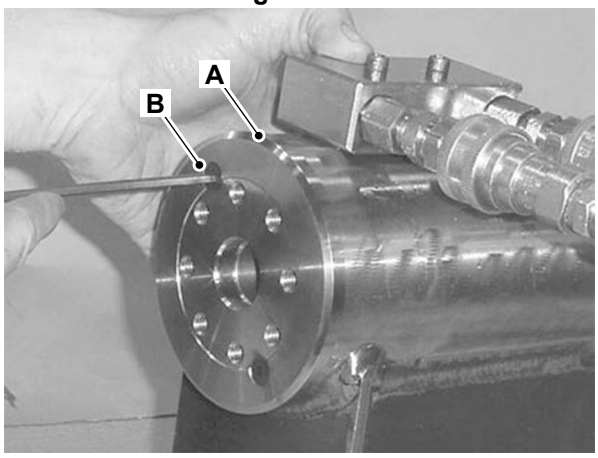
A Rotary actuator
B Bleed points

Lubricate

After the actuator is assembled but before it is put into service, you must secure the thrust washer area with Lithium grease. There are two grease ports located on both the shaft flange and the end cap. The grease ports are plugged with capscrews.

1. Remove the capscrews.

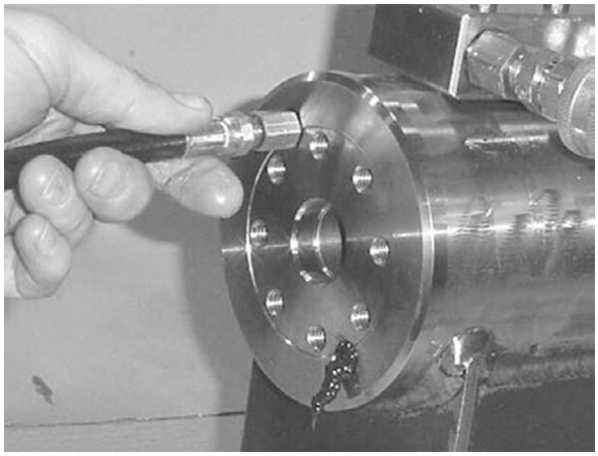
Figure 245.



A Rotary actuator
B Capscrews

2. Insert the tip of a grease gun into one port and apply grease to the shaft flange.
3. Continue to apply grease until it flows from the opposite port.

Figure 246.



4. Rotate the actuator five times.
   4.1. Open the pressure ports.
   4.2. Use a pry bar with capscrews inserted into the shaft flange to turn the shaft in the desired direction.
5. Apply the grease again.
6. Do the steps 1 to steps 5 on the end cap.
7. Install the capscrews into the grease ports.
8. Tighten the capscrews to the correct torque value.

Table 143. Torque Values

Item	Nm
B	2.8

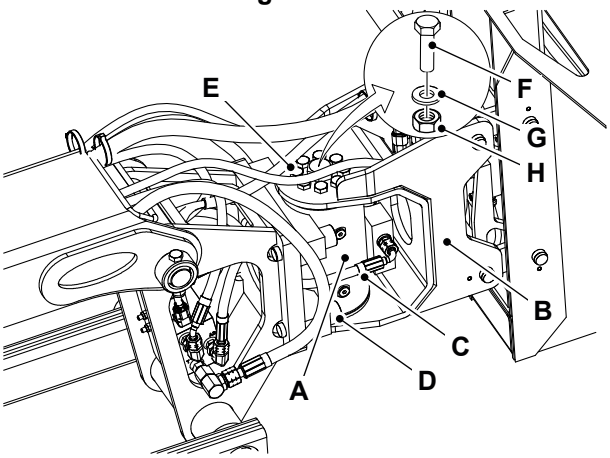
Remove and Install

⚠ **CAUTION** This component is heavy. It must only be removed or handled using a suitable lifting method and device.

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
   Refer to: Discharge and Pressurise (PIL 30-00-00).
3. Remove the platform from the machine.
   Refer to: PIL 06-97-00.
4. Bleed the rotary actuator.
   Refer to: Bleed (PIL 30-80-00).
5. Disconnect the hydraulic hoses from the rotary actuator.
6. Put a label on the hoses to help installation.
7. Plug all the open ports and hoses to prevent contamination.
8. Remove the screw (x8) from the rotary actuator.
9. Remove the pivot pin, washer and nut from the rotary actuator.
10. Remove the bracket from the rotary actuator.
11. Remove the capscrew (x4) from the rear jib knuckle.
12. Remove the rotary actuator from the rear jib knuckle.

Figure 247.



A Rotary actuator
B Bracket
C Hydraulic hose
D Capscrew (x4)
E Screw (x8)
F Pivot pin
G Washer
H Nut

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. The capscrews must be replaced for new ones every time they are removed.
   2.1. Must use OEM specific capcsrews.
3. Use a specific torque with calibrated torque control method.
   Torque: 383N·m

Disassemble and Assemble

The following procedure requires a replacement service parts kit. Make sure that you obtain the correct parts kit for replacement. Refer to SPP (Service Parts Pro) for details.

Disassemble

1. Remove the rotary actuator from the machine.

   Refer to: Remove and Install (PIL 30-80-00).

2. Check the condition of the rotary actuator for corrosion.

   2.1. Severe corrosion can make it difficult to remove the lock pins and end cap.

   2.2. If the corrosion is evident, soak the lock pins and end cap with penetrating oil for several hours before you disassemble.

3. Remove the port plugs.

4. Drain the hydraulic oil.

5. Check the condition of the oil for signs of contamination, water or metal shavings.

6. Remove the capscrews.

7. Remove the end cap lock pins.

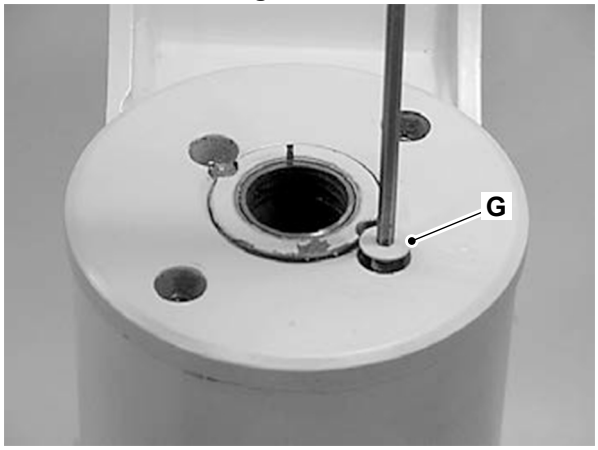
   7.1. Use the specified drill bit to drill a hole in the centre of each lock pin.

   Dimension: 3mm

   7.2. Make sure that you do not drill to more than the specified depth.

   Distance: 5mm

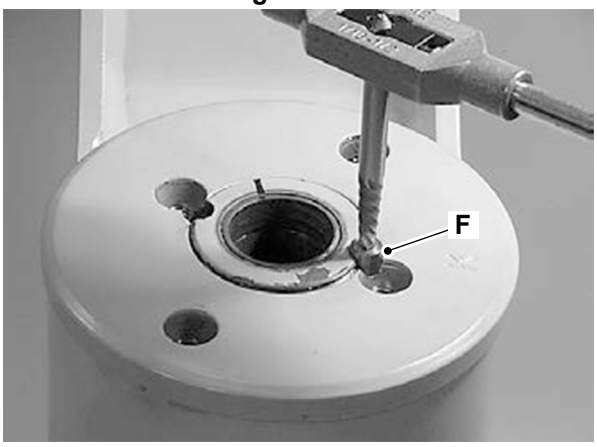
Figure 248.



G Capscrew

8. Remove the lock pins with a suitable screw extraction tool.

Figure 249.



F Lock pin

   8.1. If the pin cannot be removed with the screw extractor, use the specified drill bit to drill out the entire pin.

   Dimension: 8mm

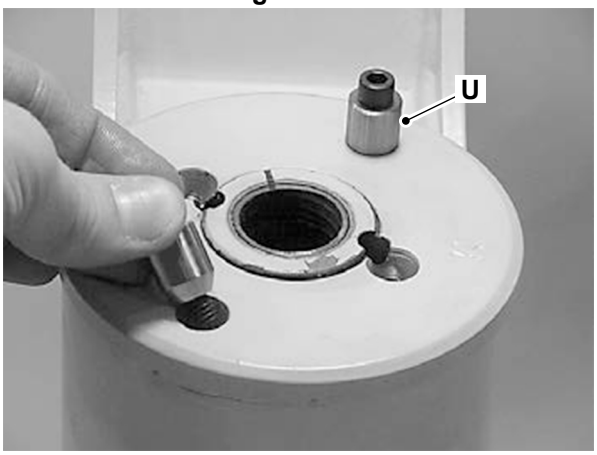
   8.2. Make sure that you do not drill to more than the specified depth.

   Distance: 12.7mm

9. Install the end cap removal tool.

   9.1. The end cap removal tool is provided in the service parts kit. Refer to SPP for details.

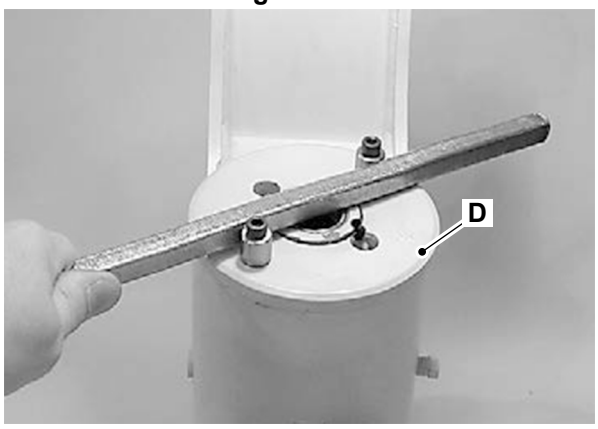
Figure 250.



U End cap removal tool

10. Use a metal bar to rotate the end cap anticlockwise.

Figure 251.



D End cap

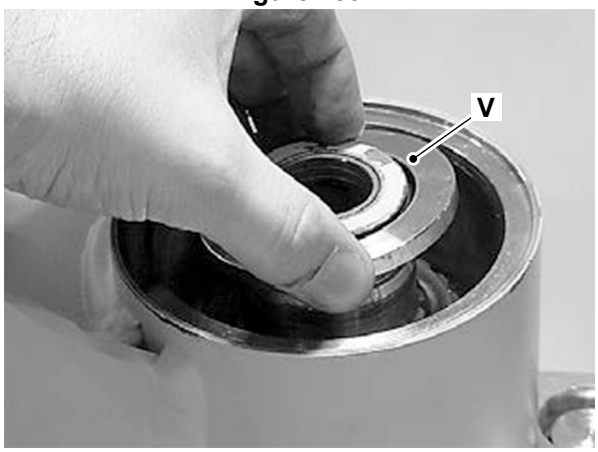
11. Remove the end cap.

Figure 252.

D End cap

12. Remove the stop tube (if installed). The stop tube limits the rotation of the actuator.

Figure 253.



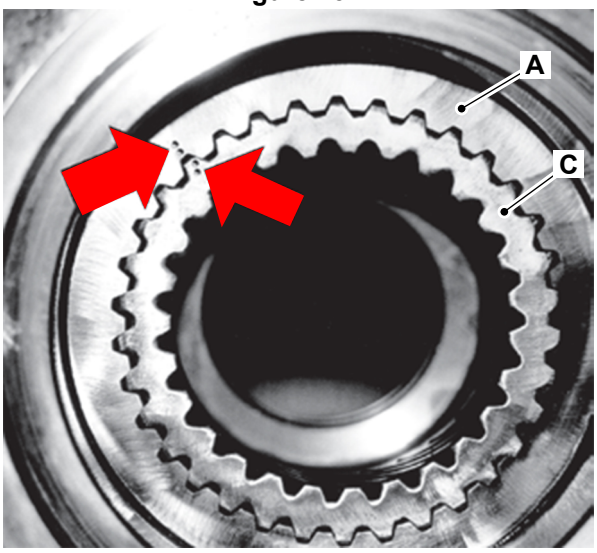
V Stop tube (if installed)

13. Make a note of the timing marks on the rotary actuator.

13.1. The rotary actuator has two sets of small punched timing marks that indicate timing between the gear sets.

13.2. The first set of timing marks indicate the timing between the piston sleeve and the case. Refer to Figure 254.

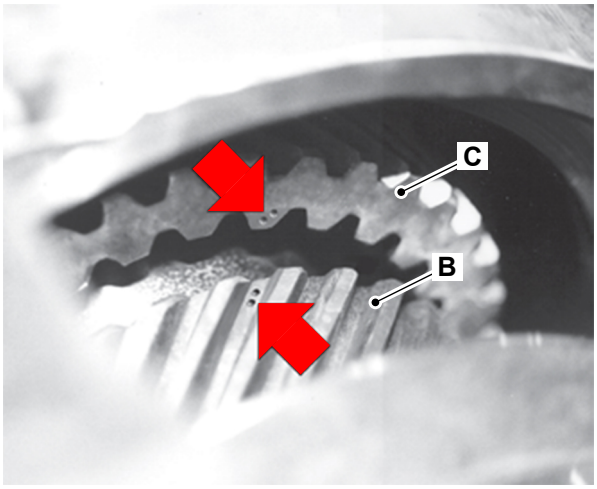
Figure 254.



A Case
C Piston sleeve

13.3. The second set of timing marks indicate the timing between the piston sleeve and the shaft. Refer to Figure 255.

Figure 255.

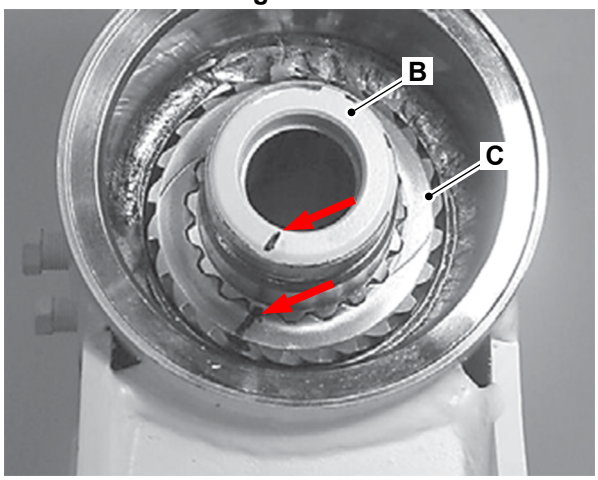


B Shaft
C Piston sleeve

13.4. Put the additional identification mark on the punched timing marks to help installation.

14. Before you remove the shaft, use a felt marker to clearly indicate the timing between the shaft and the piston sleeve.

Figure 256.



B Shaft
C Piston sleeve

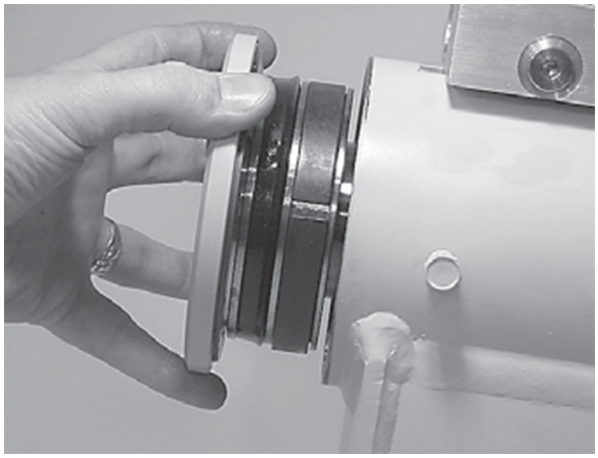
15. Remove the shaft.

    15.1. Rotate the shaft anticlockwise.

    15.2. As you rotate the shaft it will disengage from the piston sleeve.

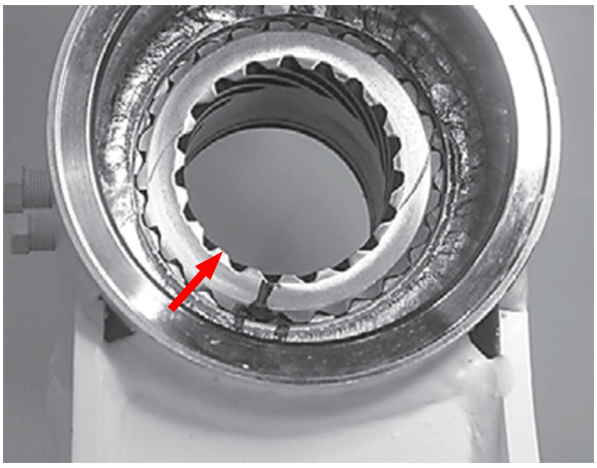
    15.3. If necessary, use a rubber mallet to remove the threaded end of the shaft.

Figure 257.



16. Before you remove the piston sleeve, use a felt marker to clearly indicate the position of the case ring gear and piston outside diameter gear.

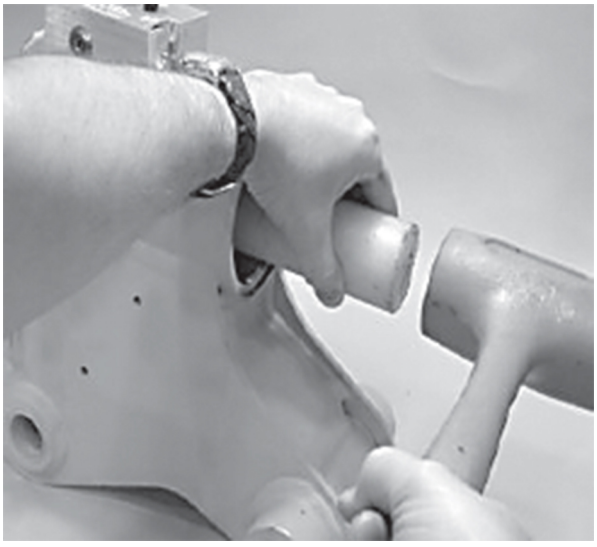
Figure 258.



17. Remove the piston with a rubber mallet and a plastic mandrel.

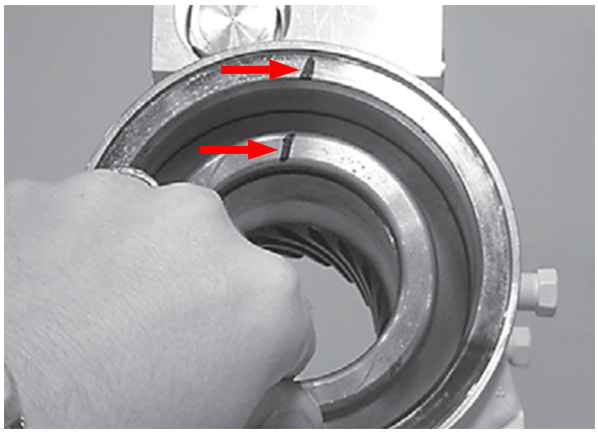
18. Make sure that you do not damage the case bore.

Figure 259.



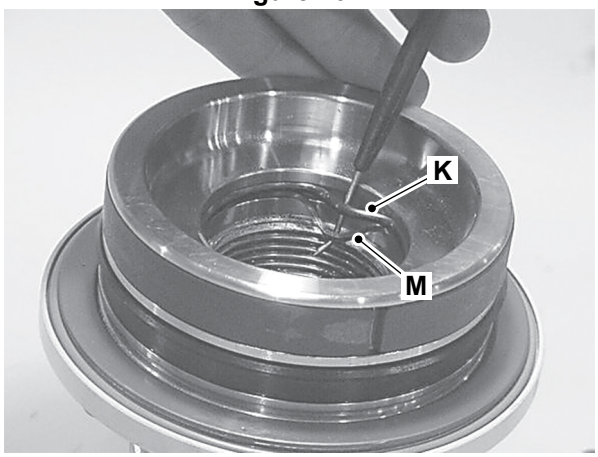
19. At the point when the piston gear teeth come out of engagement with the case gear teeth, mark the piston and case with a marker. Refer to Figure 260.

Figure 260.



20. Remove the O-ring and back-up ring from end cap.

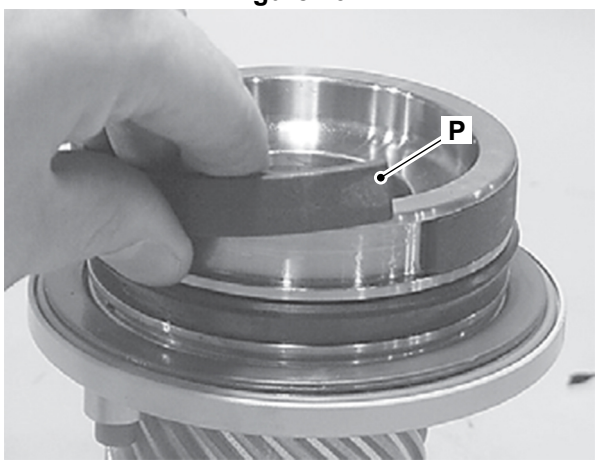
Figure 261.



K O-ring
M Back-up ring

21. Remove the wear guide from the end cap and the shaft.

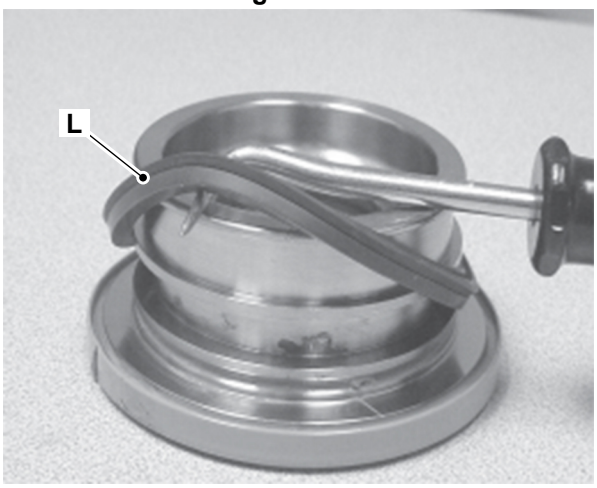
Figure 262.



P Wear guide

22. Remove the main pressure seal.

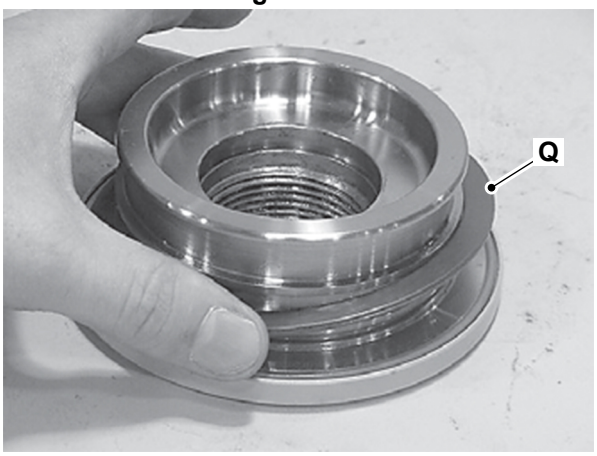
Figure 263.



L Pressure seal

23. Remove the thrust washer from the end cap and the shaft.

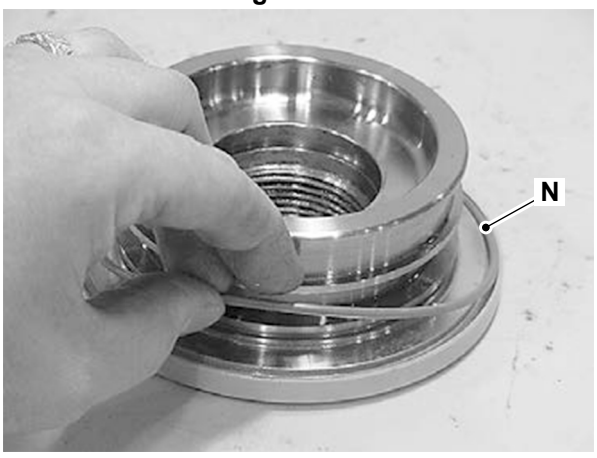
Figure 264.



Q Thrust washer

24. Remove the extrusion seal from its groove in the end cap and the shaft.

Figure 265.



N Extrusion seal

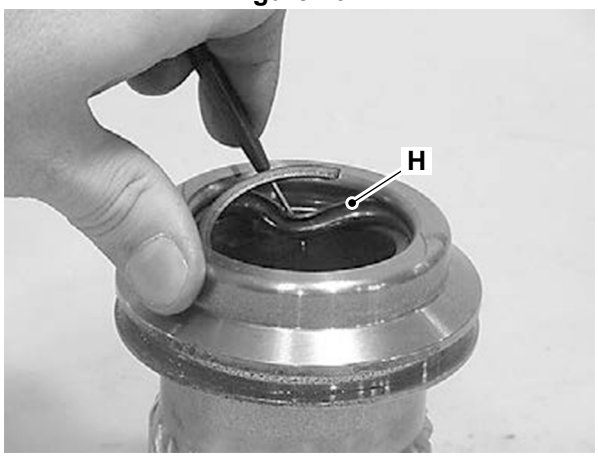
25. Remove the outside diameter piston seal from the piston.

Figure 266.

J Outside diameter piston seal

26. Remove the inside diameter piston seal.

Figure 267.

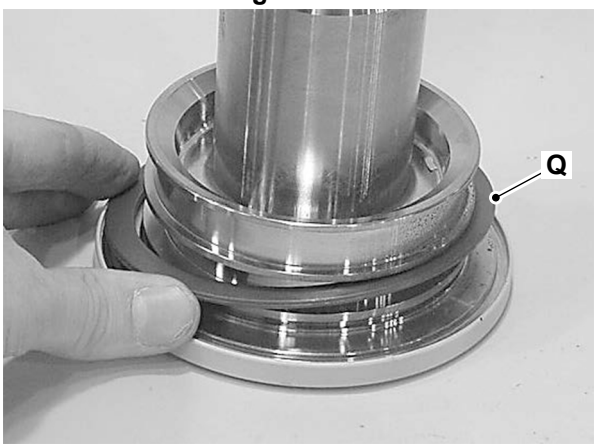


H Inside diameter piston seal

Assemble

1. Check the condition of all parts.
   - 1.1. Clean all parts in a solvent tank.
   - 1.2. Dry with compressed air.
   - 1.3. Check the condition of seal grooves, bearing grooves, thrust surfaces, shaft surface, housing bore and gear teeth for correct surface finish.
   - 1.4. Carefully polish small or minor surface scratches.
2. Apply Lithium grease to the thrust washers.
3. Install the thrust washer onto the shaft and end cap.

Figure 268.



Q Thrust washer

4. Install the exclusion seal into the appropriate grooves on the shaft and end cap around the outside edge of the thrust washer.

Figure 269.

N Extrusion seal

5. Install the main pressure seal onto the shaft and end cap.

Figure 270.

L Pressure seal

5.1. Use a suitable seal removal tool in a circular motion.

6. Install the wear guide on the end cap and the shaft.

Figure 271.

P Wear guide

7. Install the O-ring and the back-up ring into the inner seal groove on the end cap.

Figure 272.

8. Install the piston seals.

8.1. Install the inner T-seal into the appropriate groove in the piston.

Figure 273.

H Inside diameter piston seal (T-seal)

8.2. Use a circular motion to ensure the seal is correctly seated in the groove.

8.3. Install the outer T-seal. Stretch it around the groove in a circular motion for correct installation.

8.4. Make a note that each T-seal has two back-up rings.

8.5. Begin with the inner seal, insert one end of the back-up ring in the lower groove and feed the rest in with a circular motion.

8.6. Make sure that the wedged ends overlap correctly.

8.7. Install the other back-up ring in the upper groove and feed the rest in with a circular motion.

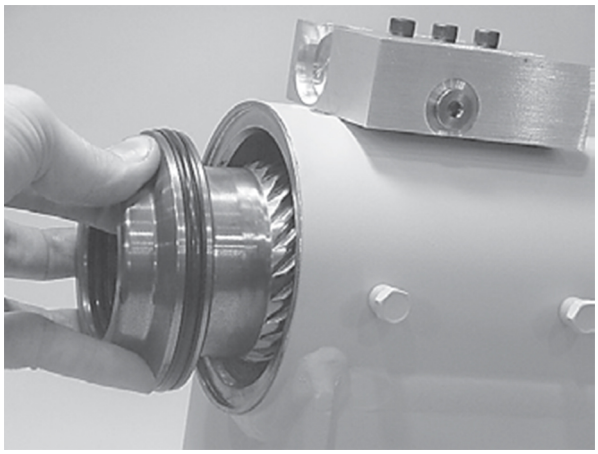
8.8. Make sure that the wedged ends overlap correctly.

Figure 274.

M Back-up ring

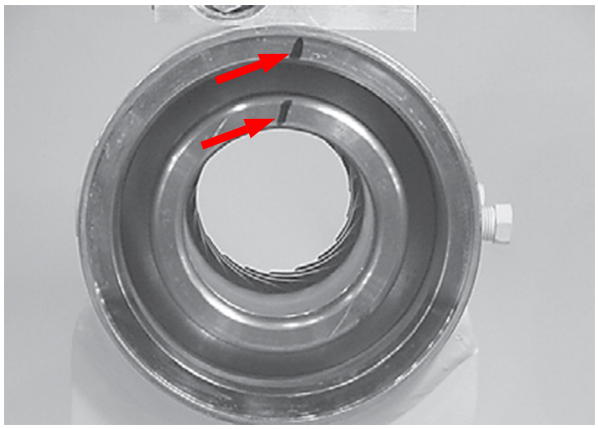
9. Install the piston into the case until the outer piston seal contacts the inside case bore.

Figure 275.



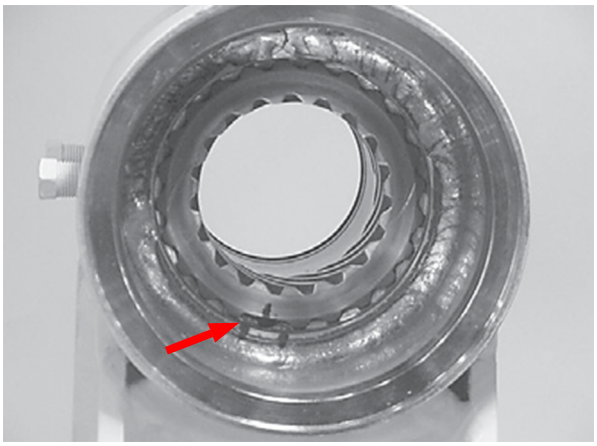
10. Look into the case bore from the shaft flange end and rotate the piston.
11. Make sure that the identification marks on the piston and the case are aligned.
12. Use a rubber mallet to tap the piston into the case until the gear teeth are in contact.

Figure 276.



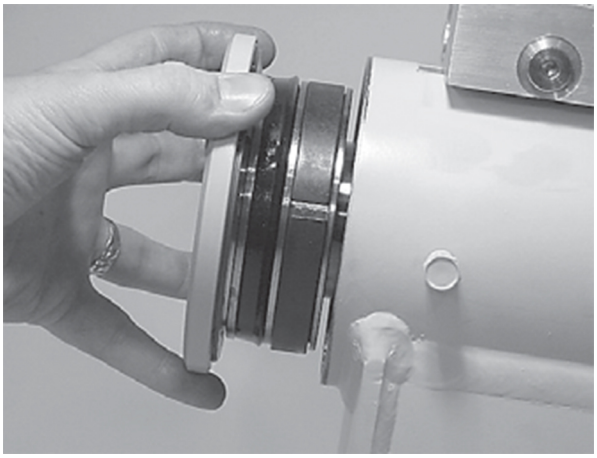
13. Look into the bore from the opposite end of the case. Make sure that the timing marks are aligned correctly.
14. Rotate the piston as required until the timing marks are aligned.
15. Gently tap the piston into the case until the gear teeth mesh together.
16. Tap the piston into the case until it completely bottoms out against the ring gear.

Figure 277.



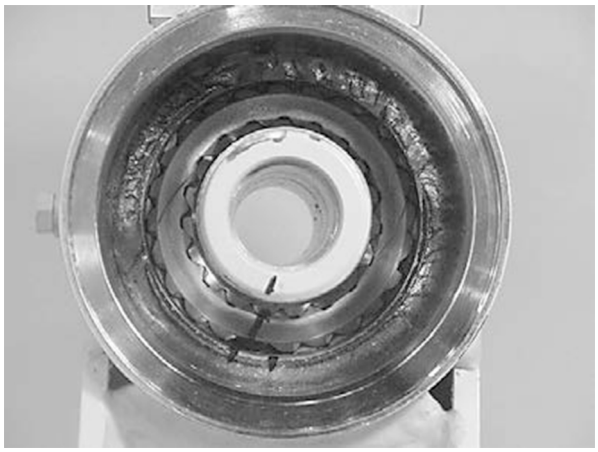
17. Install the shaft into the piston.
    17.1. Be careful not to damage the piston seals.
    17.2. Do not engage the piston gear teeth yet.

Figure 278.



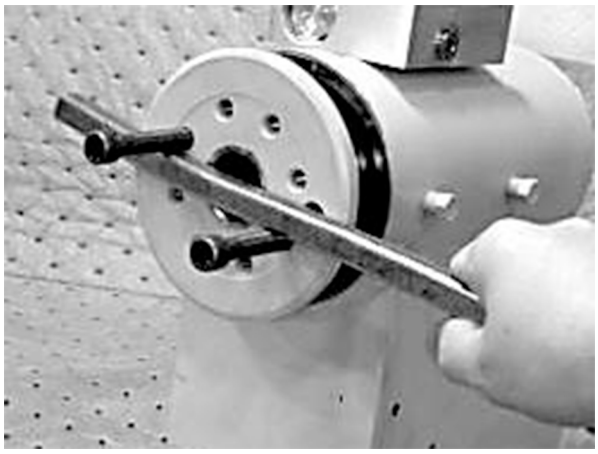
18. Look at the actuator from the end opposite the shaft flange.
19. Use the existing timing marks to align the gear teeth on the shaft with the gear teeth on the inside of the piston.
20. When the marks are aligned, gently tap the flange end of the shaft with a rubber mallet until the gear teeth are engaged.

Figure 279.



21. Install the bolts (x2) in the threaded holes in the flange.
22. Use a metal bar to rotate the shaft in a clockwise direction until the wear guides are seated inside the case bore.
23. As the shaft is rotated, be careful not to disengage the piston and case gearing.

Figure 280.



24. Install the stop tube onto the shaft end (if installed).

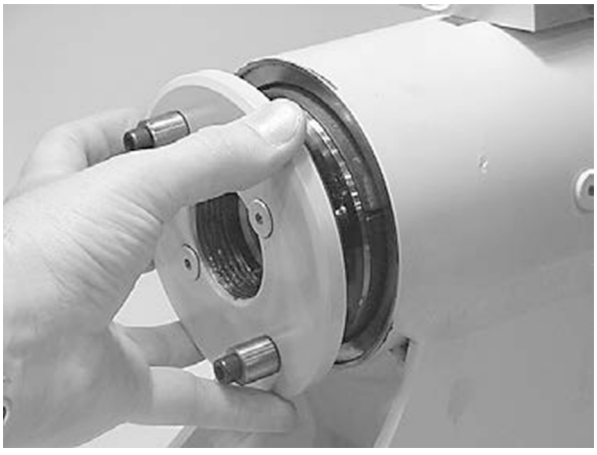
Figure 281.

25. Apply a thin layer of anti-seize grease on the shaft end threads to prevent galling.

Figure 282.

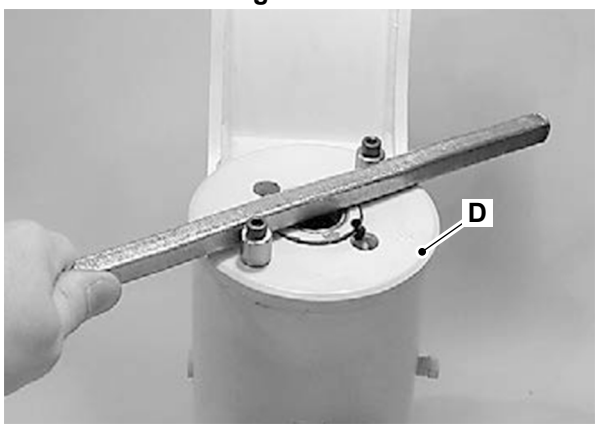
26. Install the end cap onto the shaft. Make sure that the wear guide remains in place on the end cap, when you install it.

Figure 283.



27. Tighten the end cap with a metal bar.

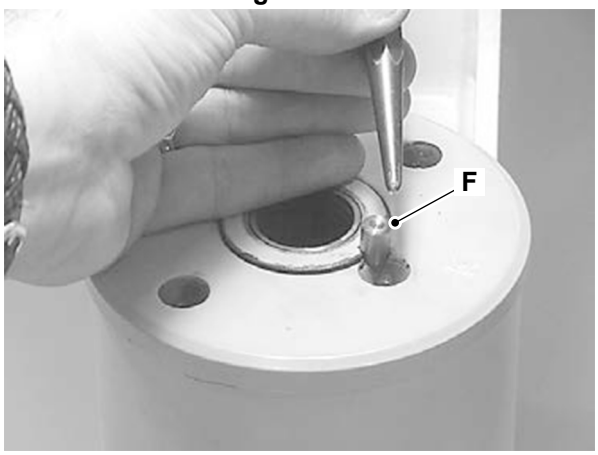
Figure 284.



D End cap

28. Install the lock pins provided with the service seal kit into the holes with the dimple side facing upwards.
29. Use a punch to tap the lock pins to the bottom of the hole.

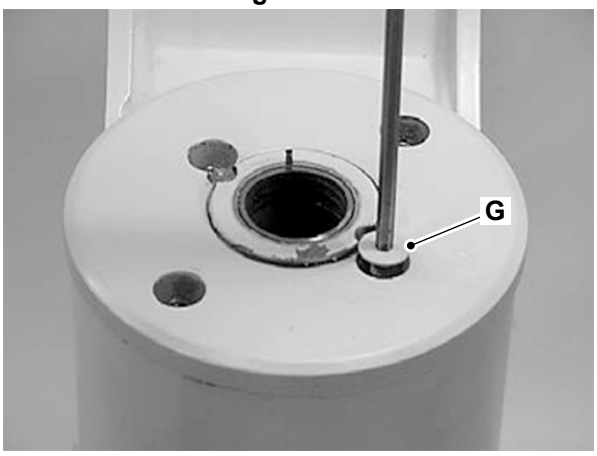
Figure 285.



F Lock pin

30. Install the capscrews over the lock pins.
31. Tighten the capscrews to the correct torque value.

Figure 286.



G Capscrew

32. Lubricate the rotator unit before you install it on the machine.

Refer to: Lubricate (PIL 30-80-00).

33 - Electrical System

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Acronyms Glossary

CAN	Controller Area Network
DC	Direct Current
DLA	Data Link Adaptor
DTC	Diagnostic Trouble Code
ECM	Engine Control Module
ECU	Electronic Control Unit
EGR	Exhaust Gas Recirculation
LED	Light Emitting Diode
MIL	Malfunction Indicator Lamp
RPM	Revolutions Per Minute
SPP	Service Parts Pro
USB	Universal Serial Bus

00 - Electrical System

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00 - General

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Introduction

It is important that the electrical system on the machine is in a sound state of repair.

Make sure that all the health and safety warnings in this section are followed. The machine must be safe with the battery isolated before you attempt to disconnect any electrical connections.

Health and Safety

⚠ **CAUTION** Understand the electrical circuit before connecting or disconnecting an electrical component. A wrong connection can cause injury and/or damage.

Technical Data

Table 144.

Description	Data
Voltage	12V
Capacity	110Ah
Tilt sensor setting	5°
Auxiliary motor power	3kW

Operation

The machine is controlled through electrical switches. The electrical switches give inputs to the controllers. The controllers gives outputs to solenoids on the valve blocks & transmission pump, which decides the direction of hydraulic oil flow.

There are a combination of proportional solenoids and on/off solenoids on the machine. For the proportional solenoids, as the current increases, the hydraulic flow through the valve increases.

Check (Condition)

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Obey all electrical system health and safety information.
   Refer to: Health and Safety (PIL 33-00-00).
3. Isolate the battery.
   Refer to: PIL 33-03-00.
4. Check the condition of the following harnesses for burnt, chafed, corroded and loose wires.
   - 4.1. Engine harness.
   - 4.2. Base control panel harness.
   - 4.3. Turntable harness.
   - 4.4. Platform control panel harness.
   - 4.5. Platform harness.
   - 4.6. Boom harness.
   - 4.7. Sensor harness.
5. Switch the isolator and turn the ignition key to ON position.
6. Turn the engine ON from the base control panel.
7. Check all control functions from the base control panel.
8. Check all control functions from the platform control panel.
9. Stop the engine.

50 - Schematic Circuit

Introduction 33-6
Diagram 33-9

Introduction

A schematic wiring diagram is a simplified pictorial representation of the machines electrical circuit. It shows the components of the circuit as simplified electrical symbols, and the power and signal connections between the devices. The wiring diagram is used to troubleshoot problems and to make sure that all the connections have been made and that everything is present.

Use the schematics together with the correct electrical harness drawings to reference the connector pin details.

This section may contain more than one set of electrical schematics for different machine variants.

Understanding Electrical Schematics

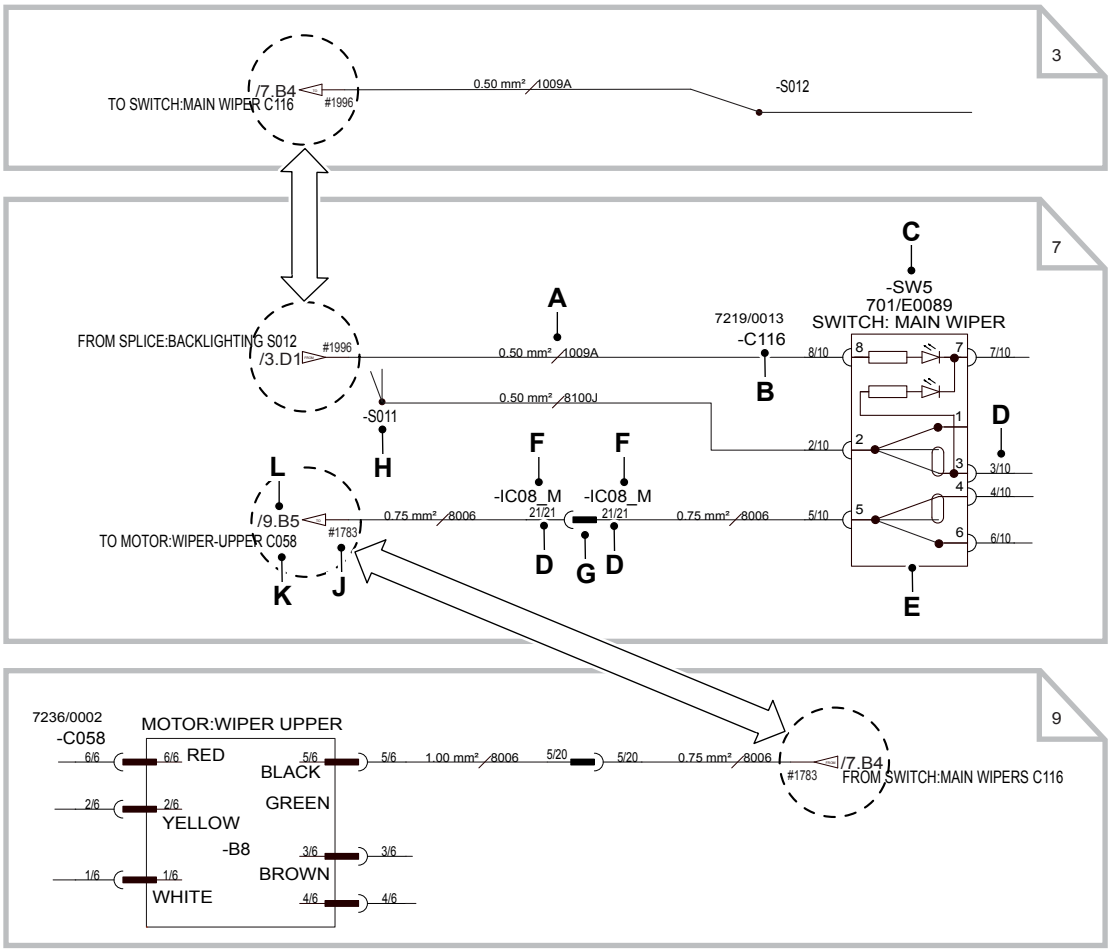
Use the applicable schematic set to trace wires and connections between electrical devices. In most cases it will be necessary to trace wires across more than one schematic sheet.

The example identifies the information contained on the diagrams. It also shows how to follow wires from one diagram sheet to another.

The harness inter-connector codes and device harness connector codes are the same as used on the applicable harness drawings.

Splices are not normally accessible. Splices are inside the harness sheath and not visible on the outside. Wires are welded together at a splice, there are no individual connector components.

Figure 287.

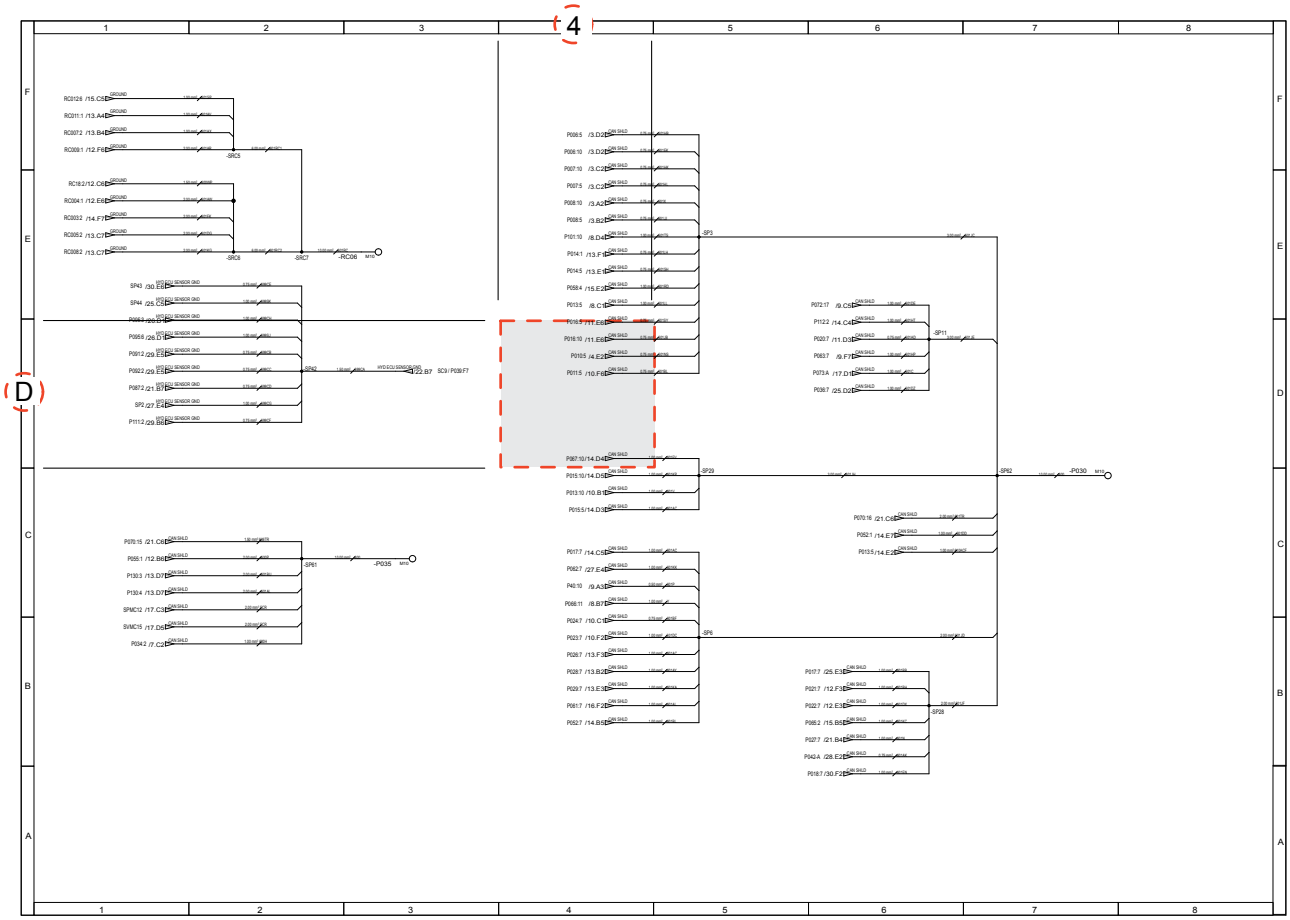


A Wire size (area) and number
B Device harness connector code
C Device description
D Connector pin number (wire location / total)
E Device internal schematic
F Harness inter-connector codes
G Harness inter-connector symbol
H Splice code and symbol
J Destination reference number
K Destination (harness connector code)
L Destination (diagram sheet and grid)

To help locate a wire destination from other diagram sheets use the grid reference. This identifies the applicable location zone on the sheet in a similar way to a map reference.

Due to space limitations, the grid is sometimes omitted.

Figure 288. Grid reference example (D4)



Diagram

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Figure 303. 401/T6225 Issue-8 (Sheet 16 of 22) - Hydraulic Generator Supply AC110V....Page 33-67
Figure 304. 401/T6225 Issue-8 (Sheet 17 of 22) - Hydraulic Generator Supply AC230V....Page 33-71

Sheet 1 is not included as it only contains change summery.

Sheet 18 is not included as it only contains solenoid table.

Notes:

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Figure 289. 401/T6225 Issue-8 (Sheet 2 of 22) - Battery Leads

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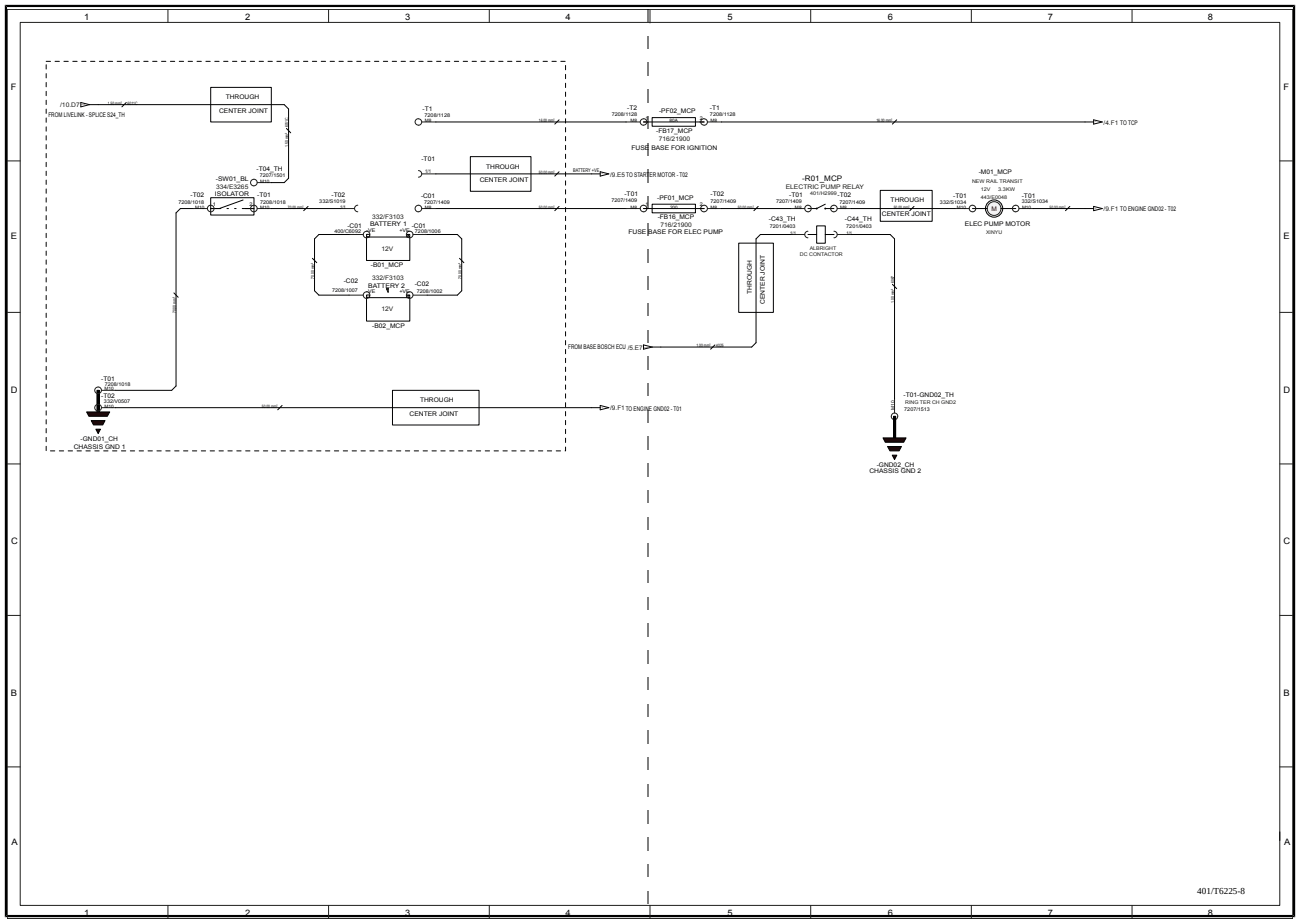

Figure 289. (Part 1 of 2)

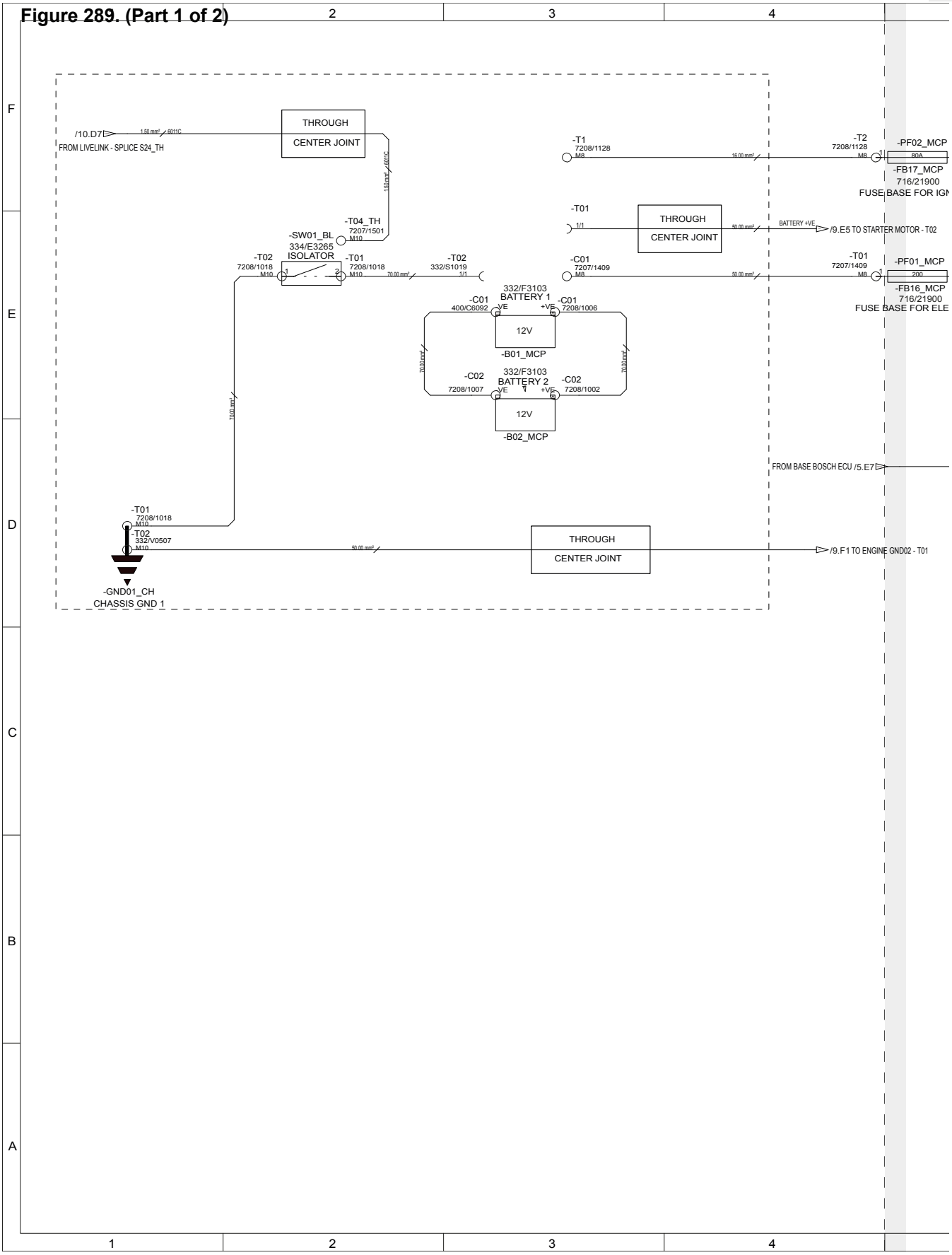

Figure 289. (Part 2 of 2)

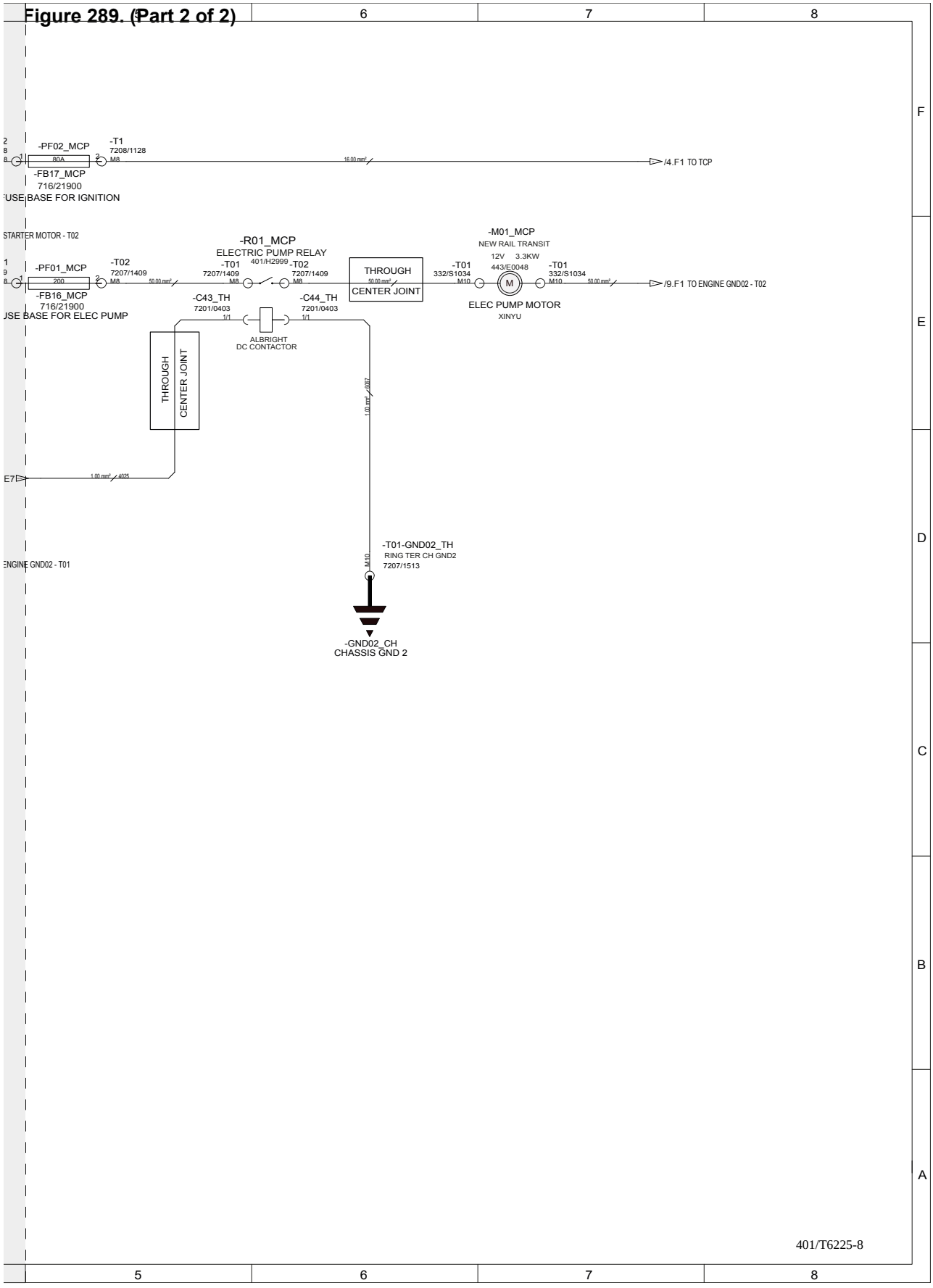

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Figure 290. 401/T6225 Issue-8 (Sheet 3 of 22) - Podbox

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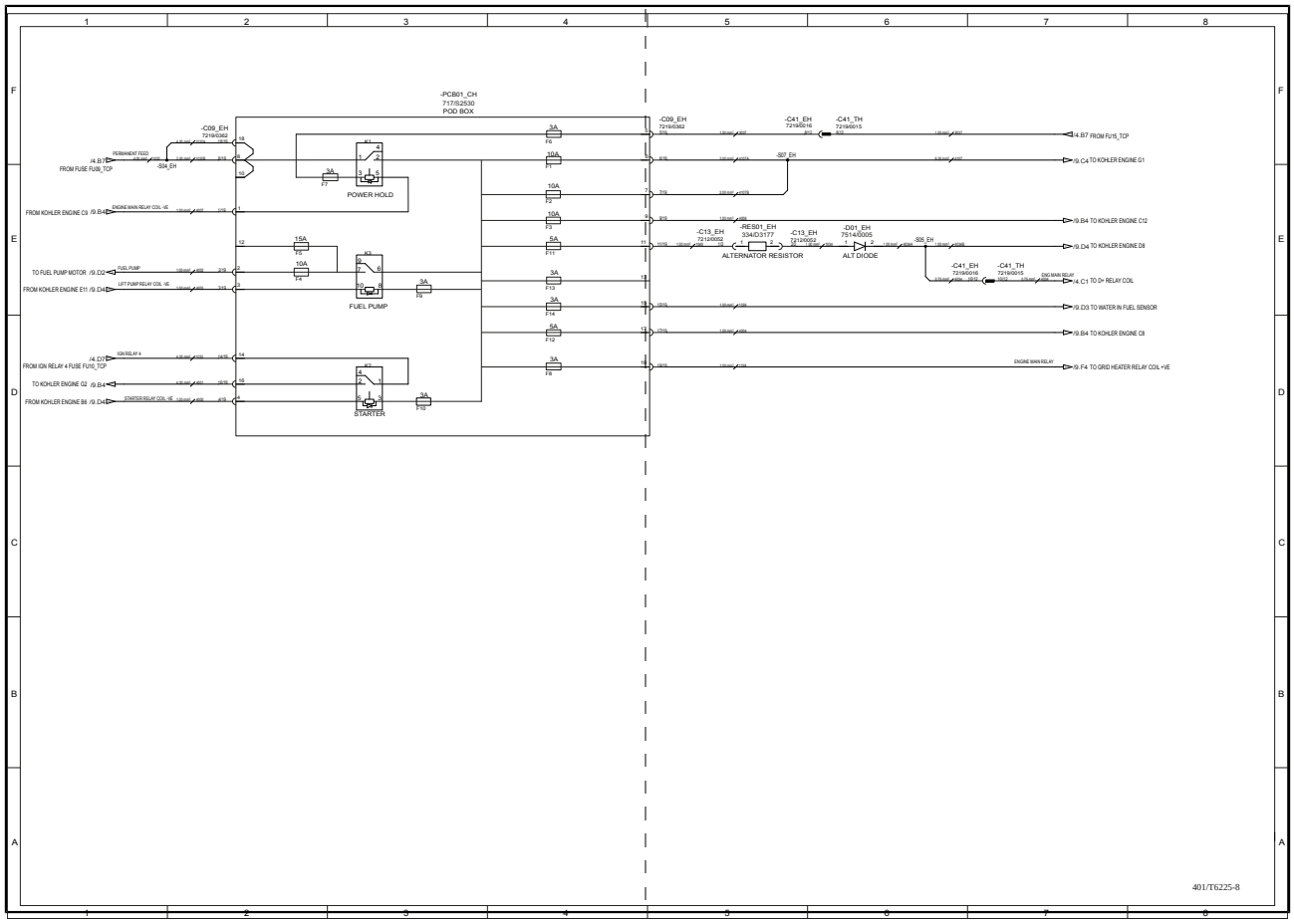

Figure 290. (Part 1 of 2)

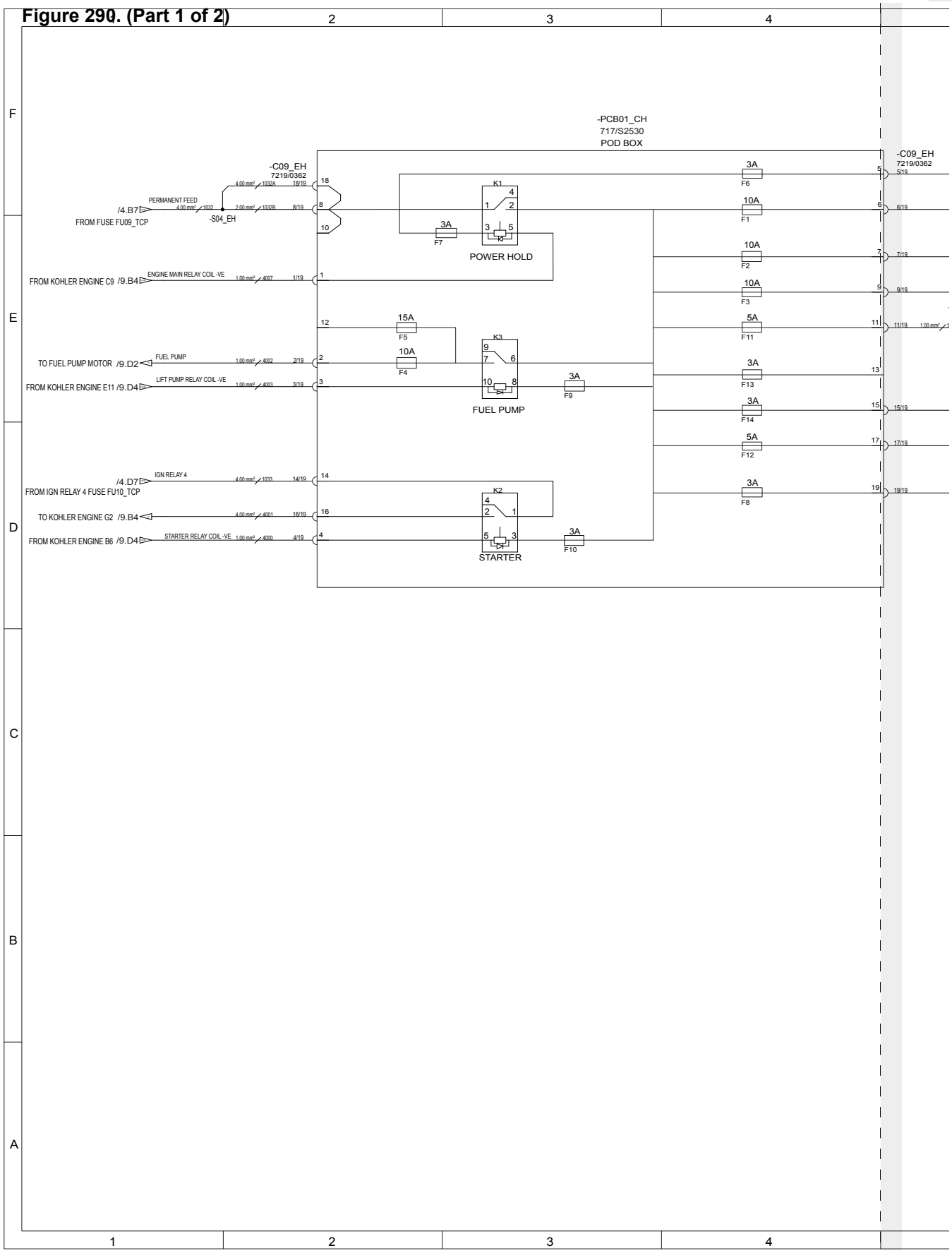

Figure 290. (Part 2 of 2)

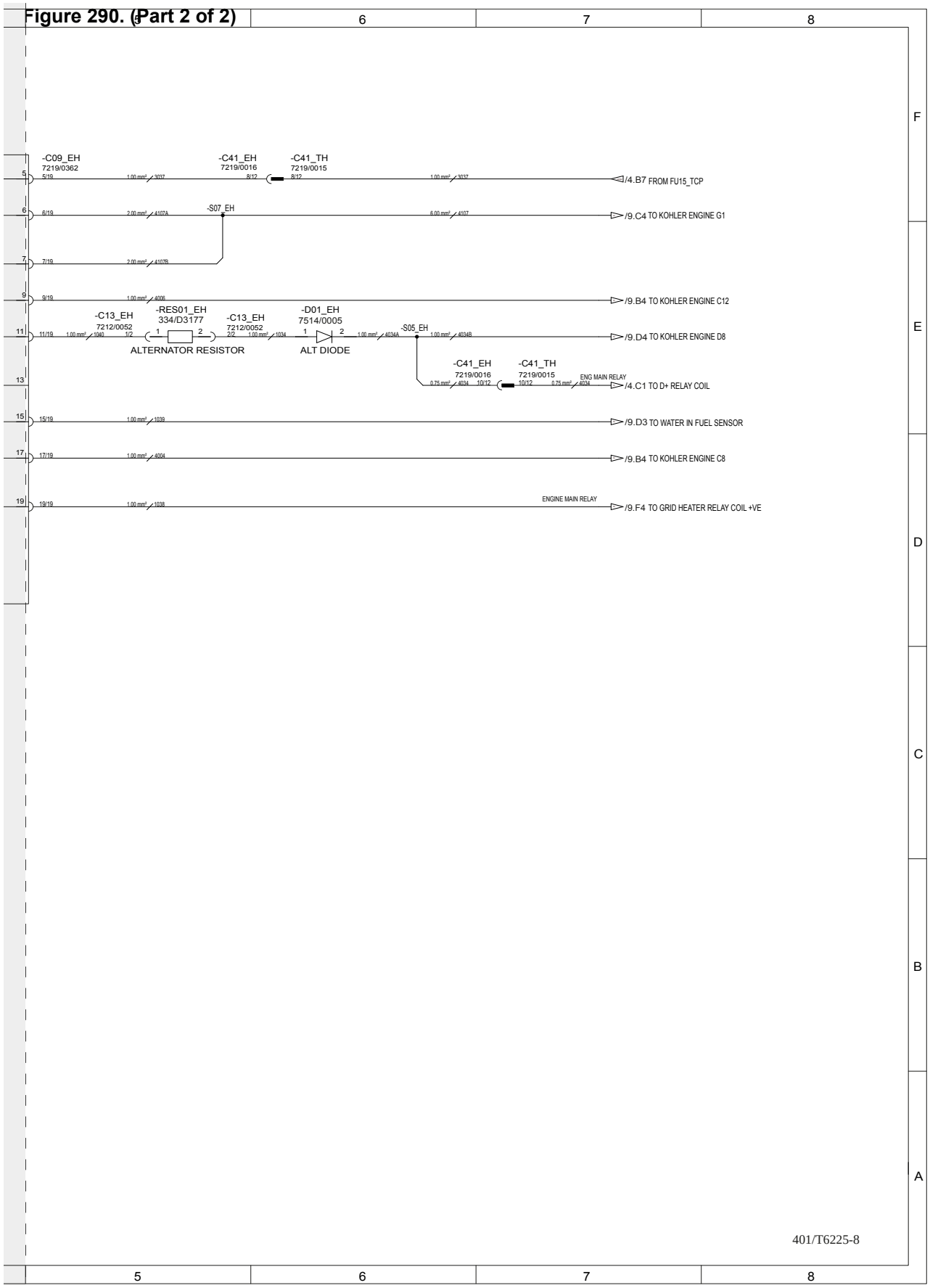

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Figure 291. 401/T6225 Issue-8 (Sheet 4 of 22) - Turntable Control Panel

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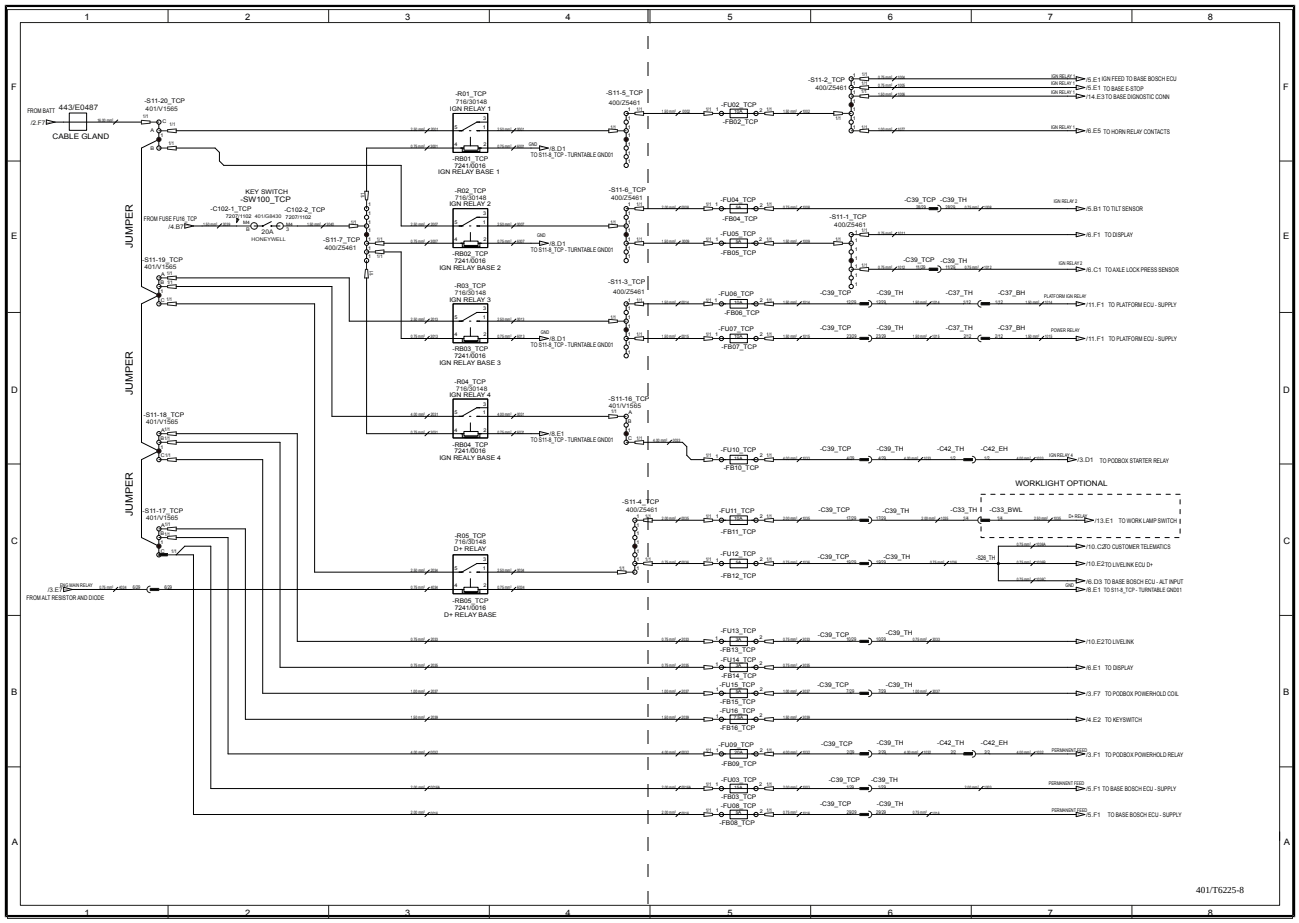

Figure 291. (Part 1 of 2)

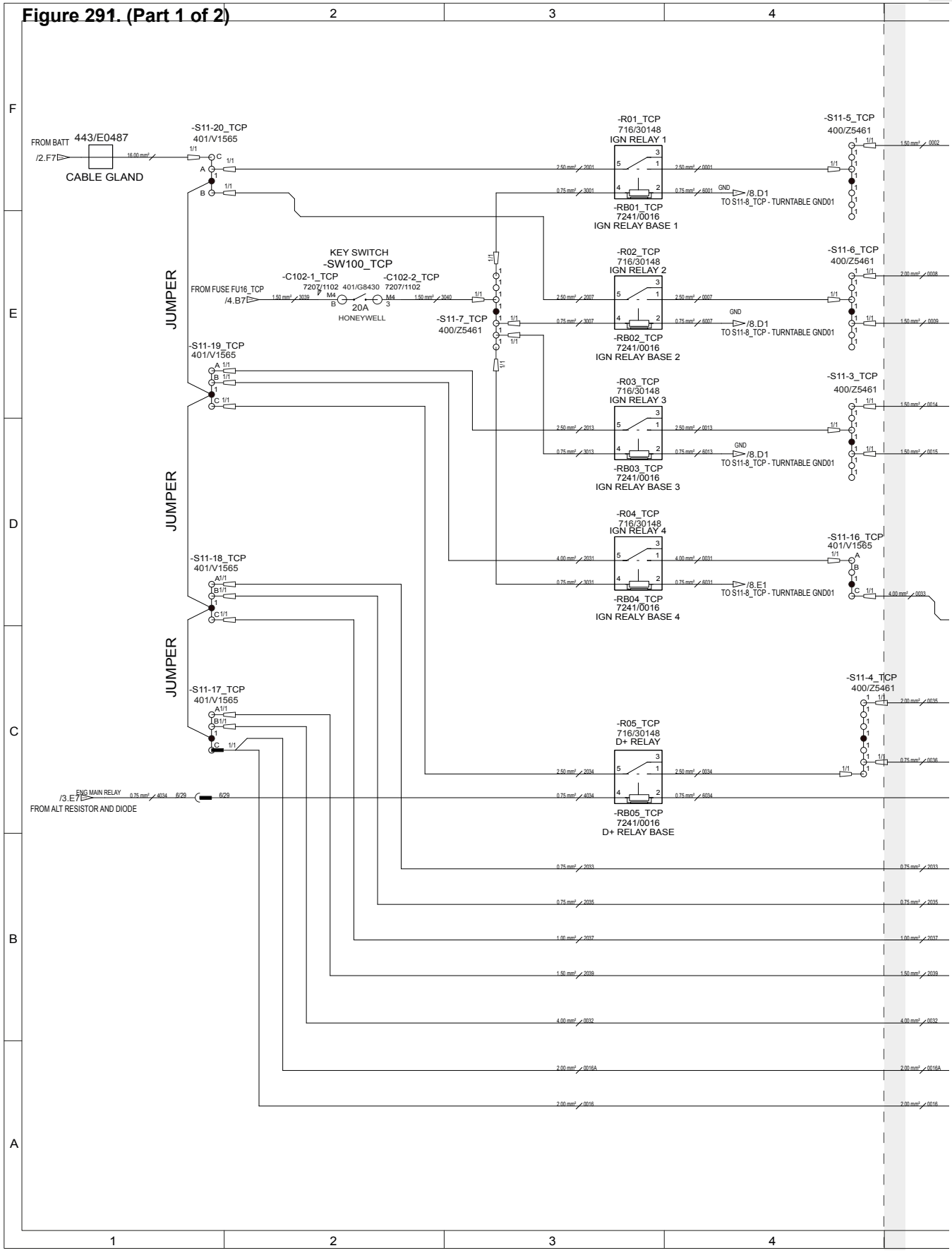

Figure 291. (Part 2 of 2)

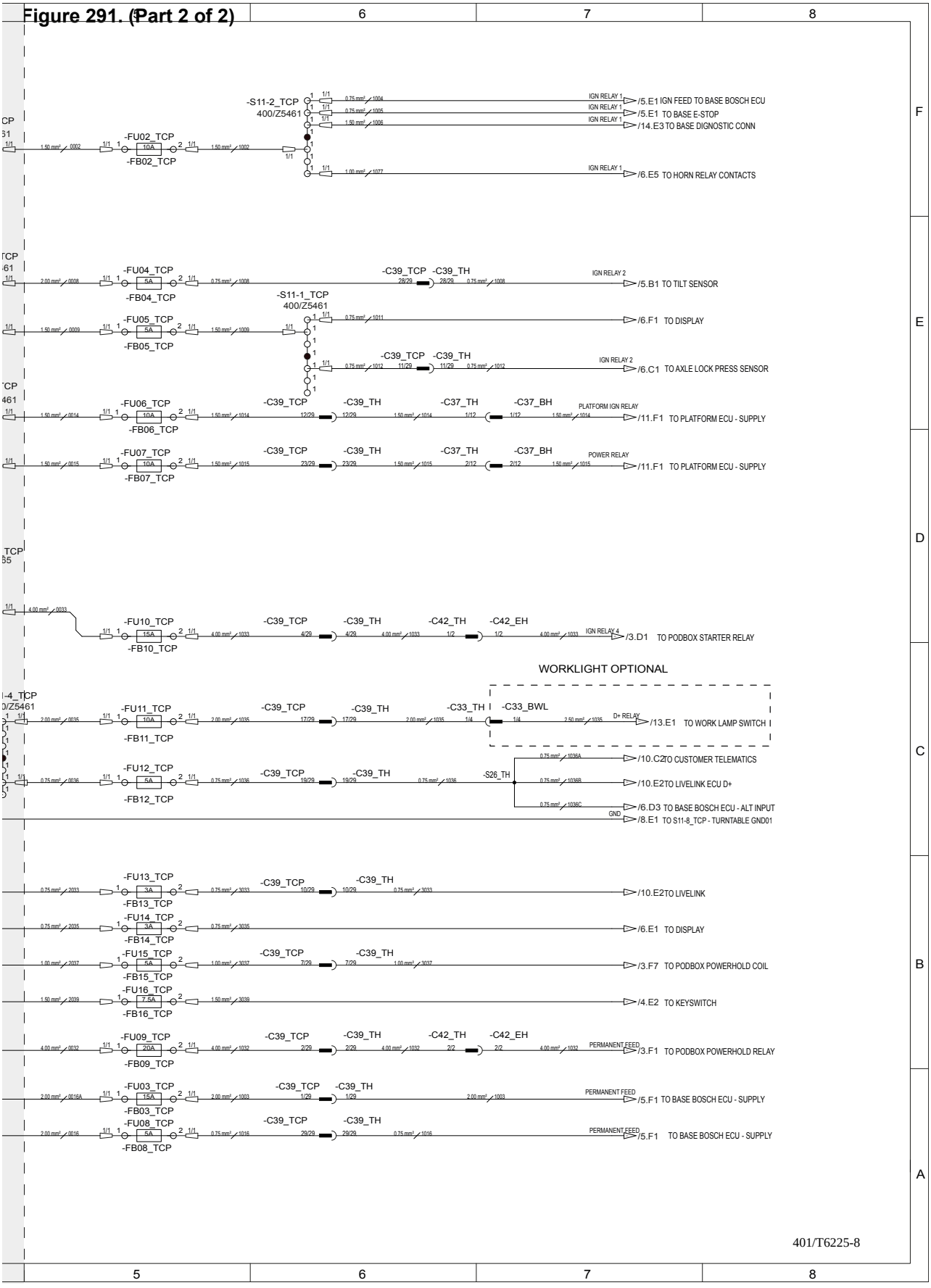

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**Figure 292. 401/T6225 Issue-8
(Sheet 5 of 22) - Turntable Base ECU**

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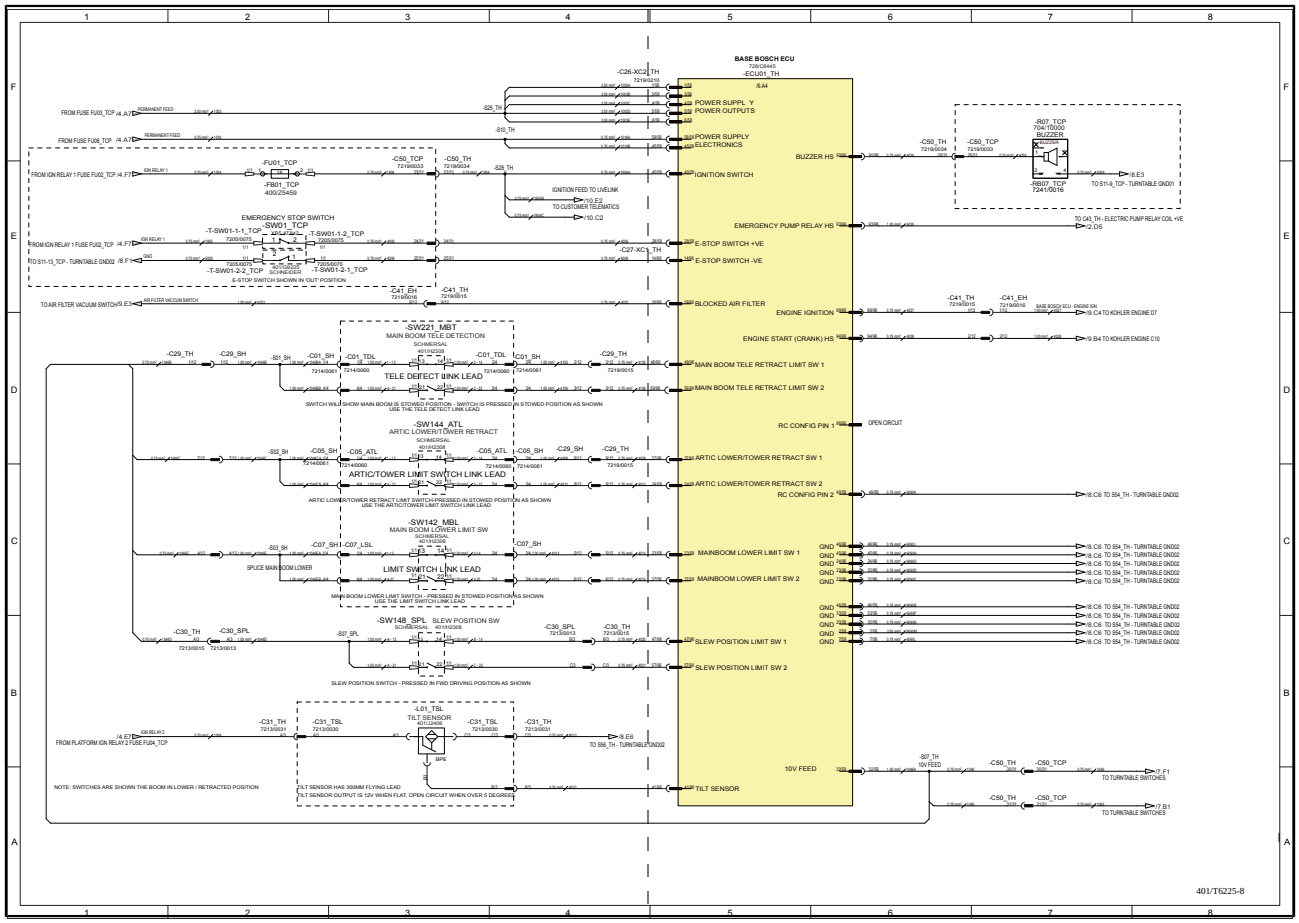

Figure 292. (Part 1 of 2)

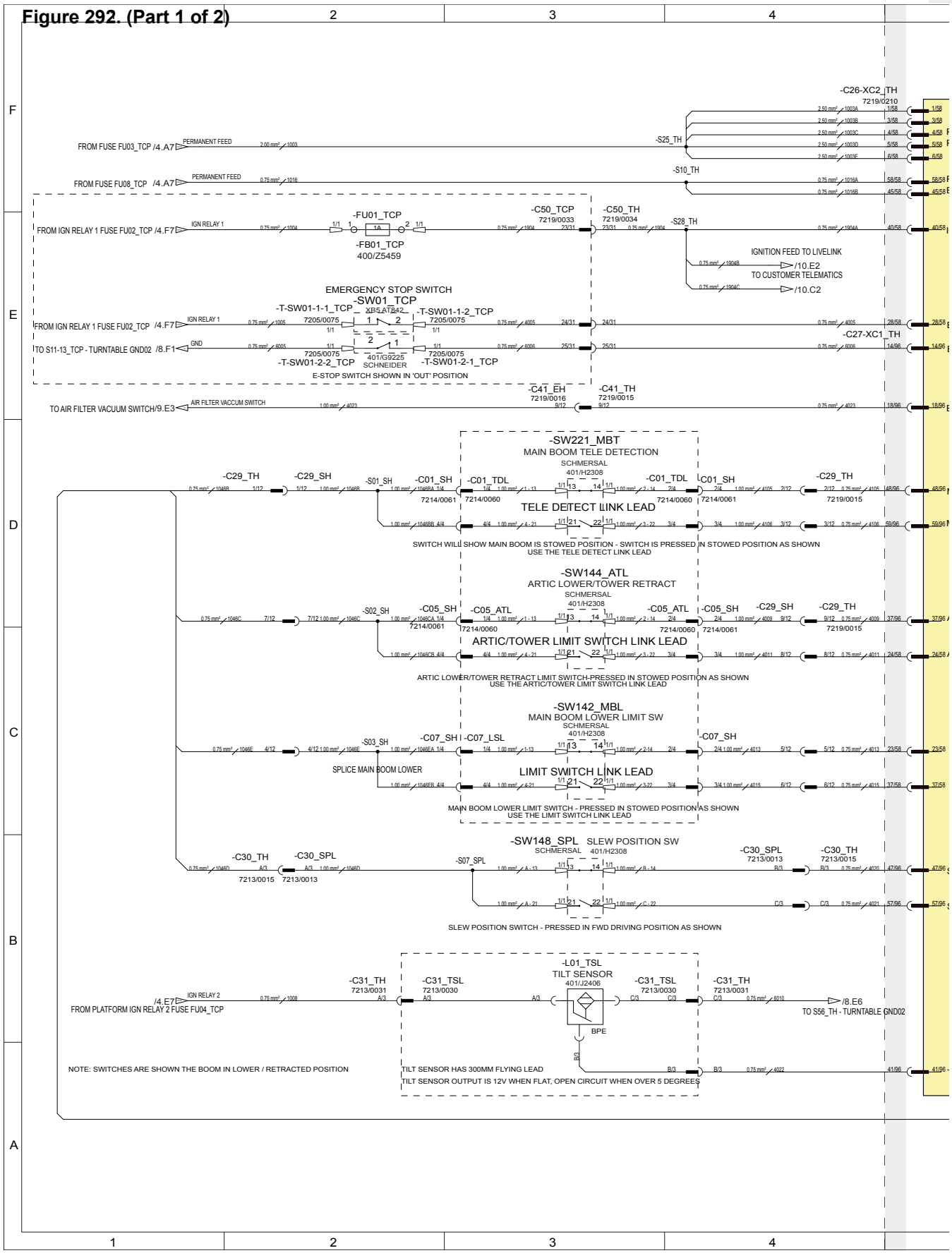

Figure 292. (Part 2 of 2)

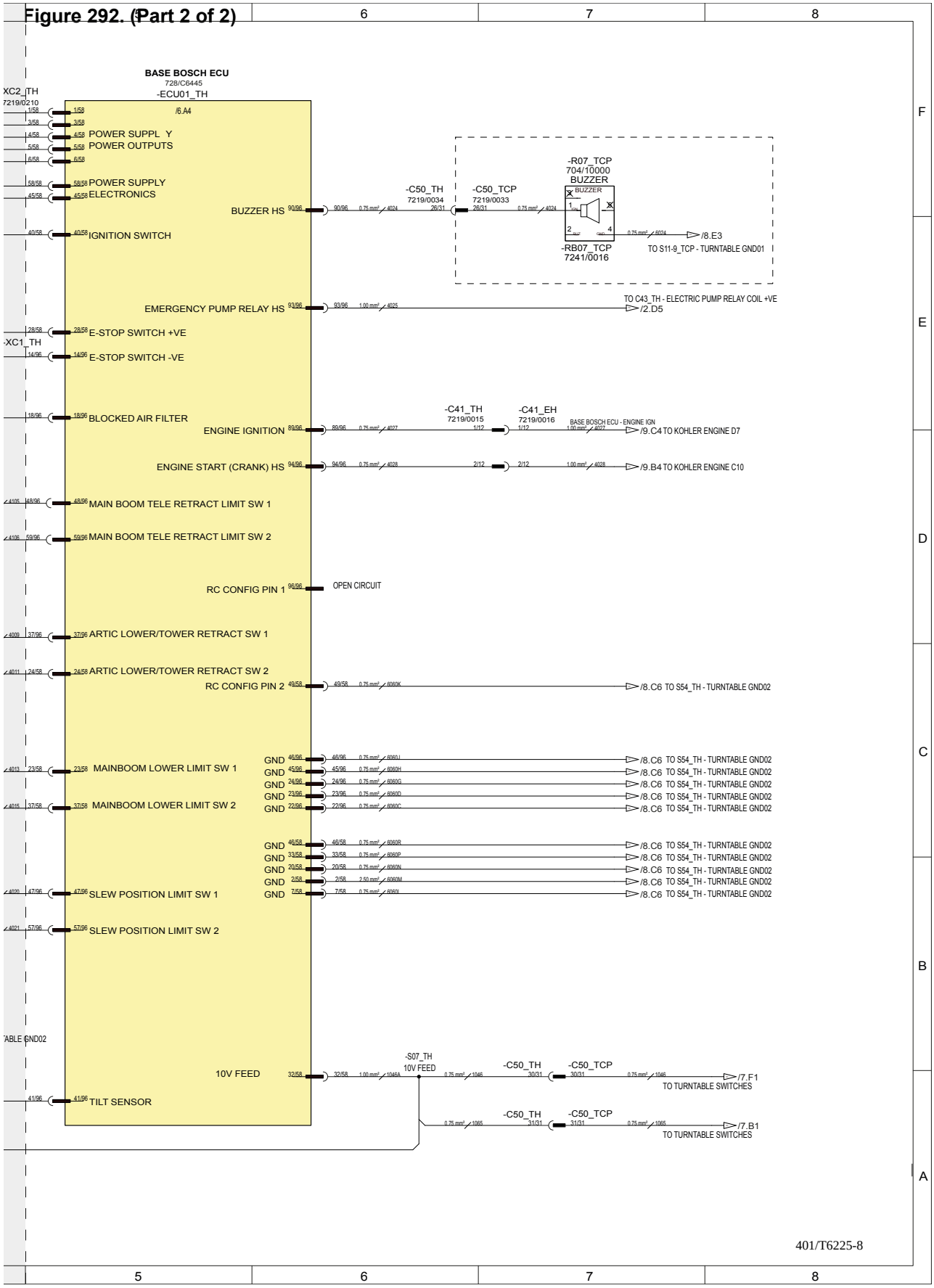

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**Figure 293. 401/T6225 Issue-8
(Sheet 6 of 22) - Turntable Base ECU**

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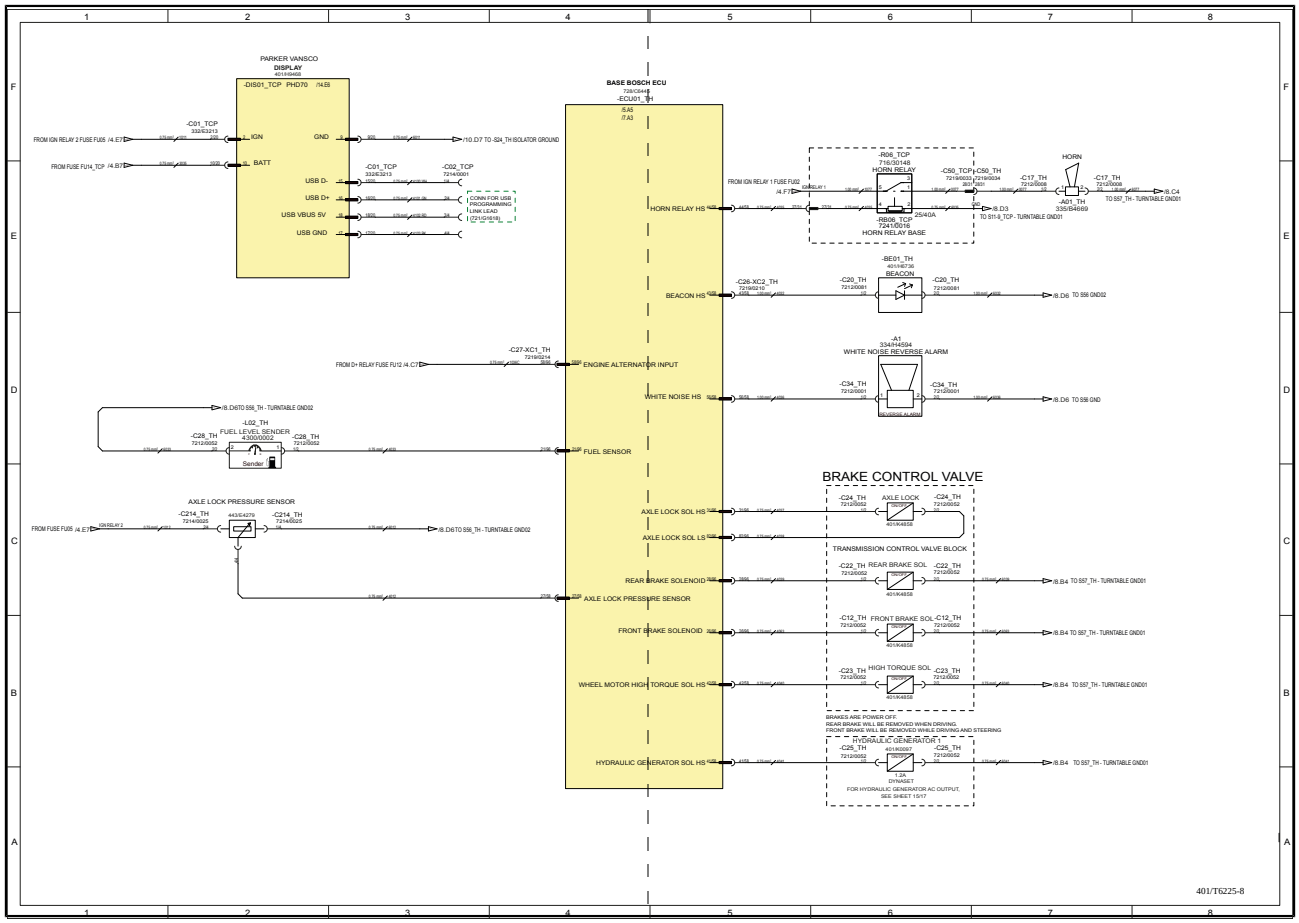

Figure 293. (Part 1 of 2)

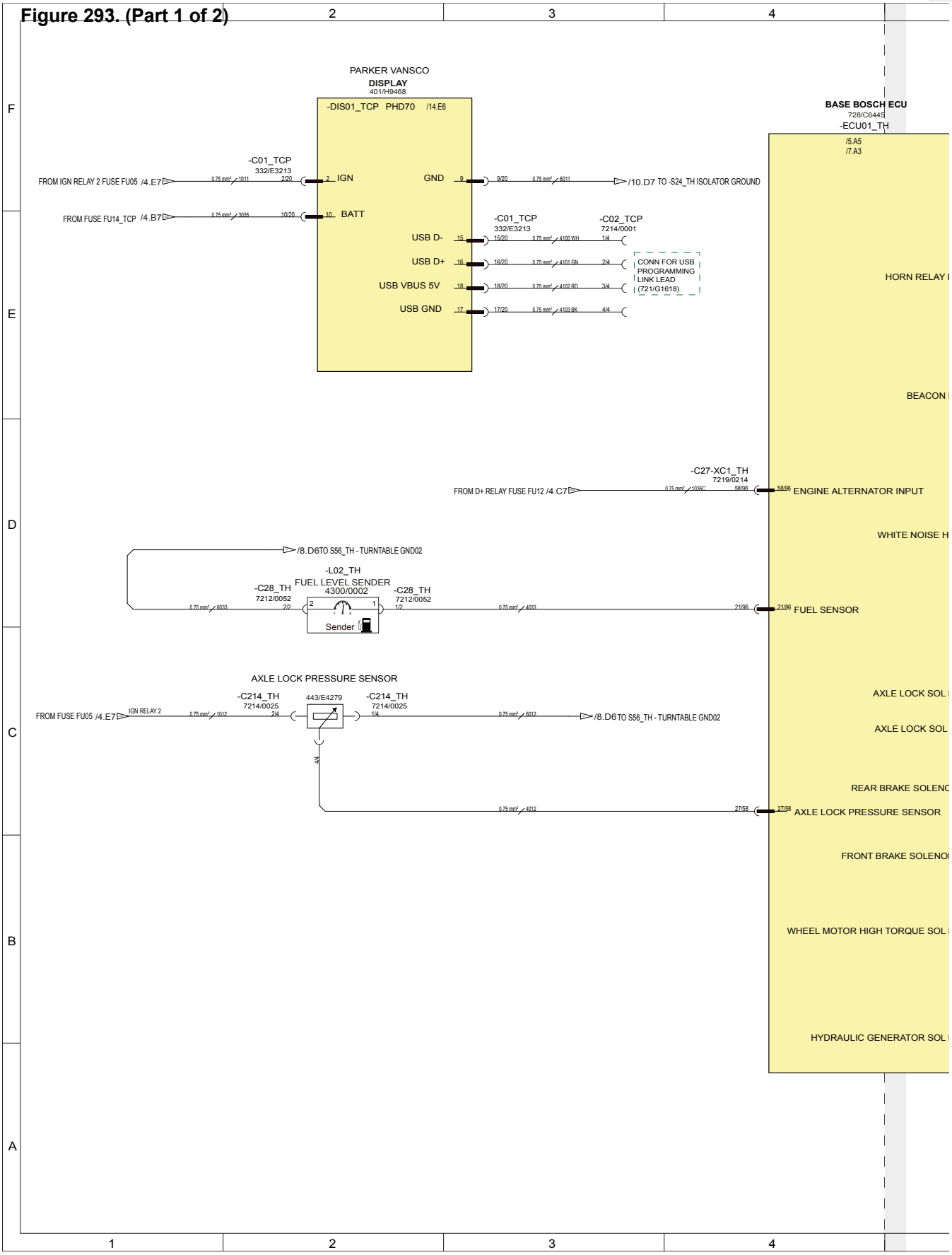

Figure 293. (Part 2 of 2)

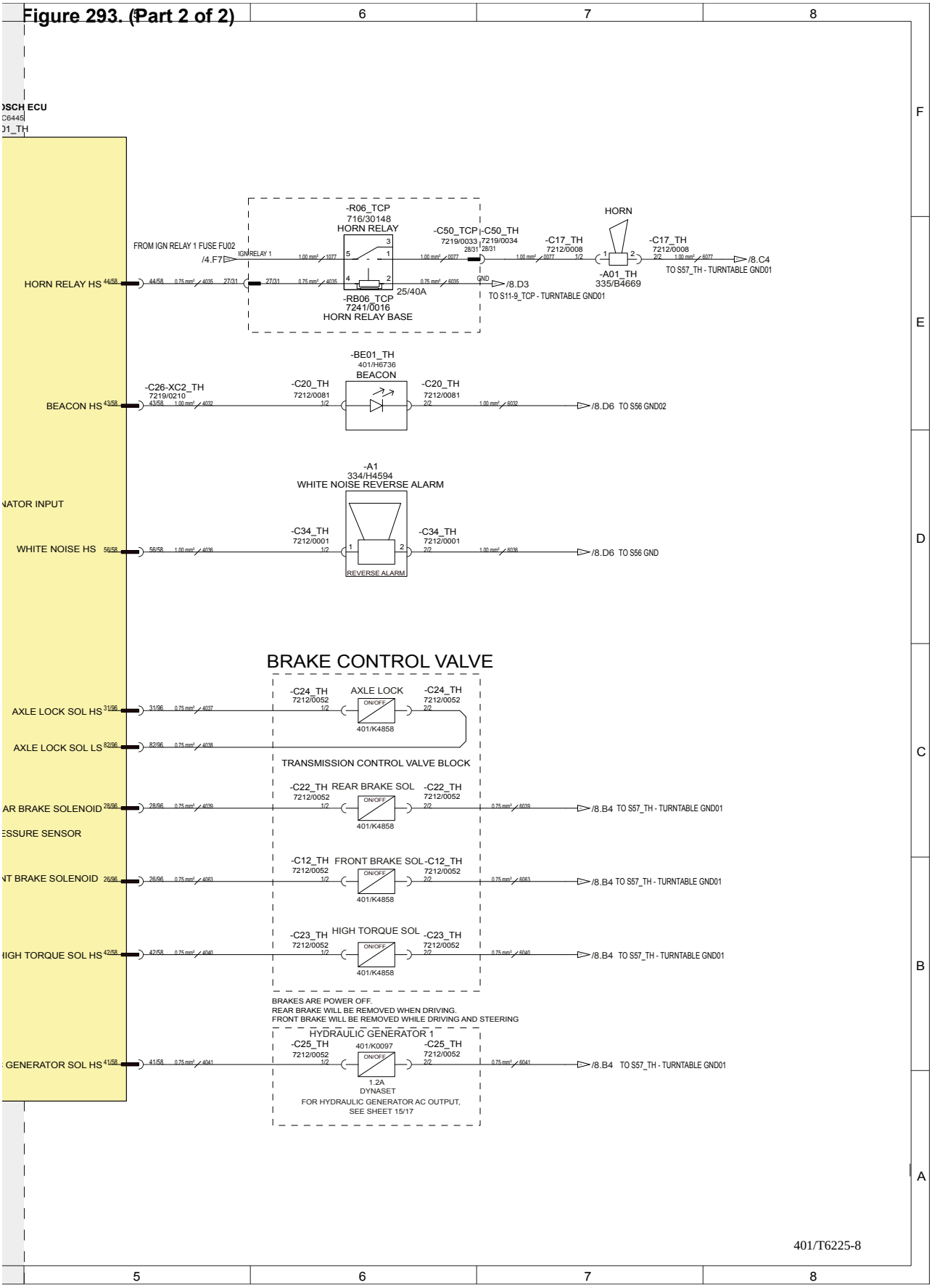

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**Figure 294. 401/T6225 Issue-8
(Sheet 7 of 22) - Turntable Base ECU**

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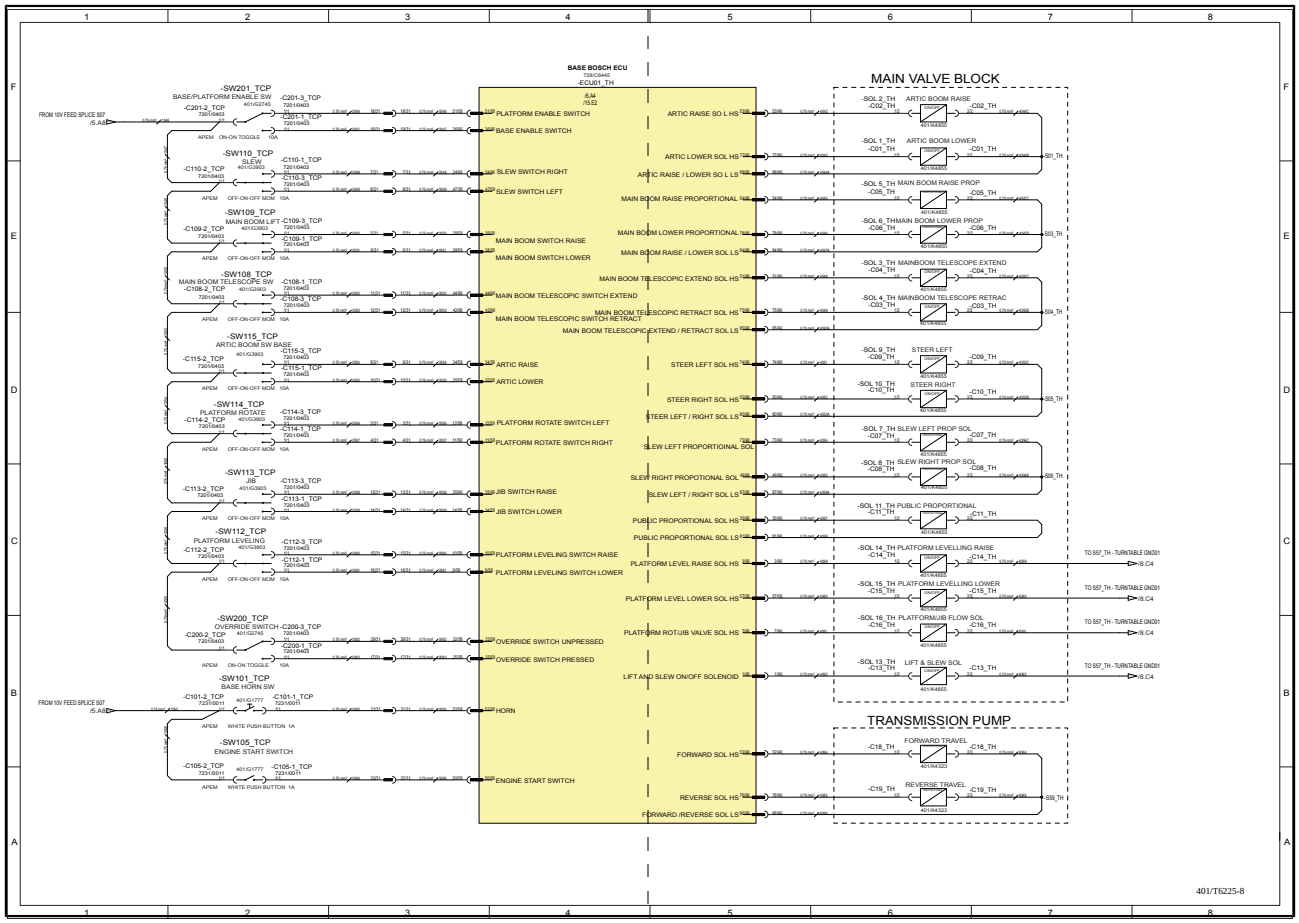

Figure 294. (Part 1 of 2)

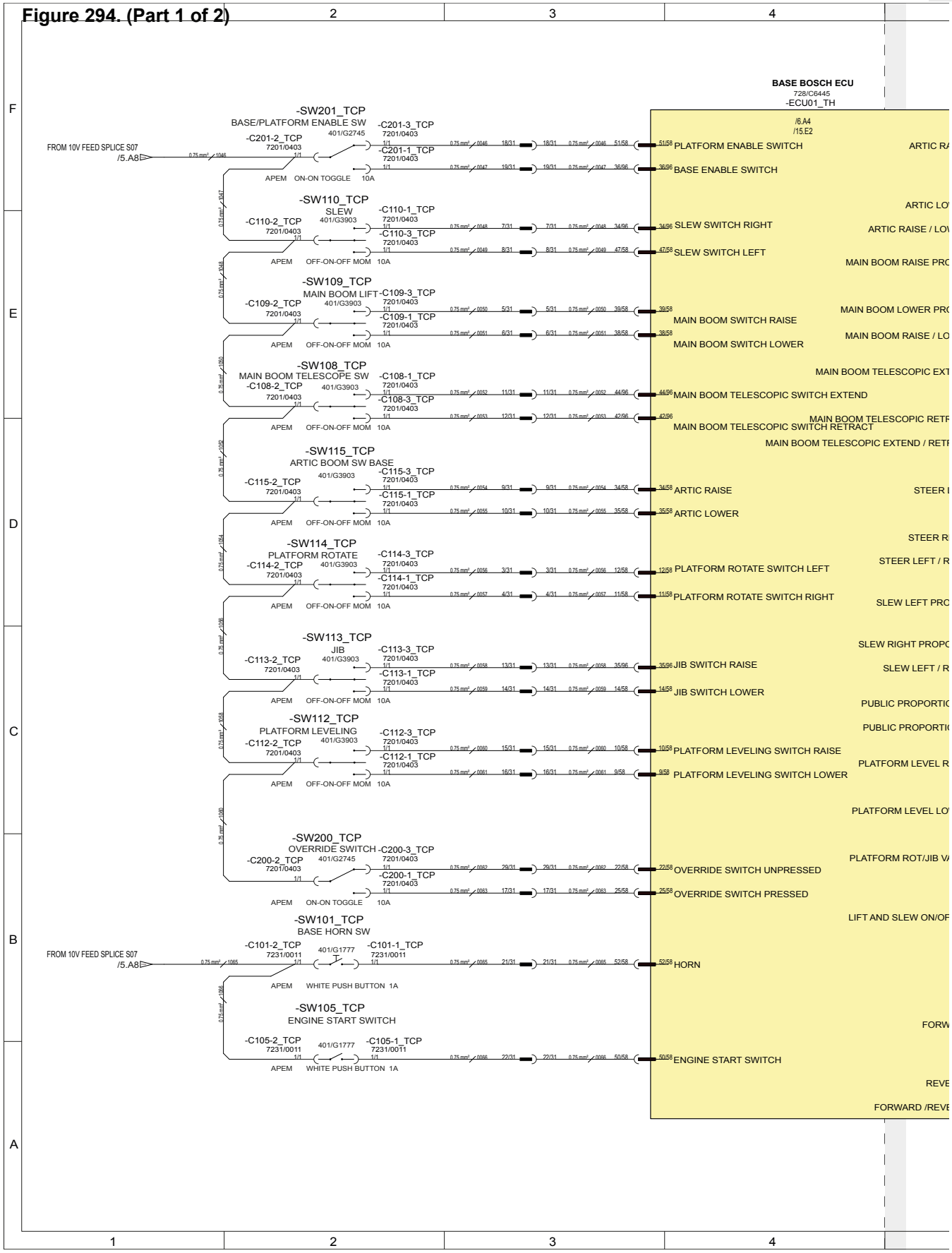

Figure 294. (Part 2 of 2)

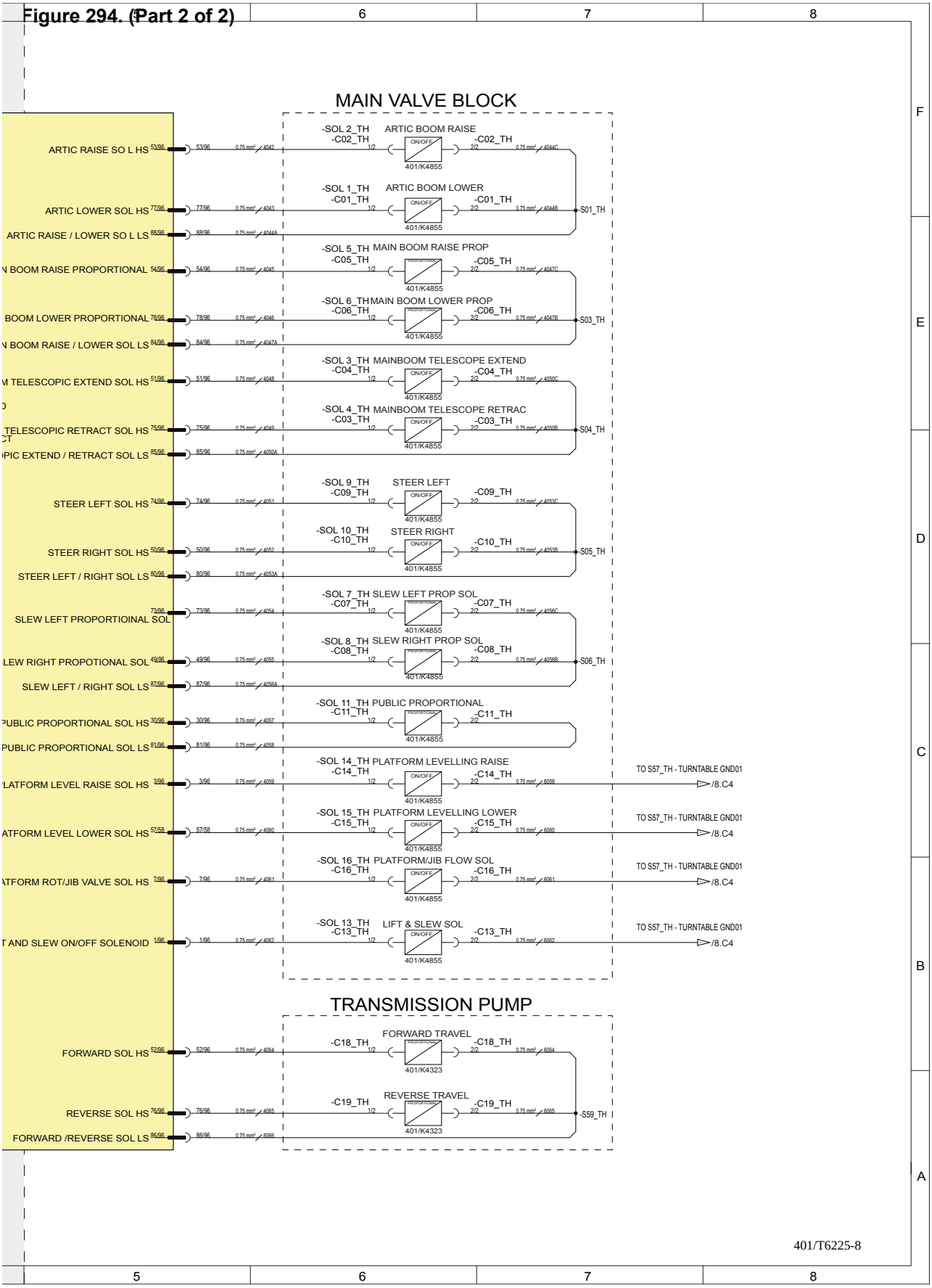

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Figure 295. 401/T6225 Issue-8 (Sheet 8 of 22) - Turntable Ground

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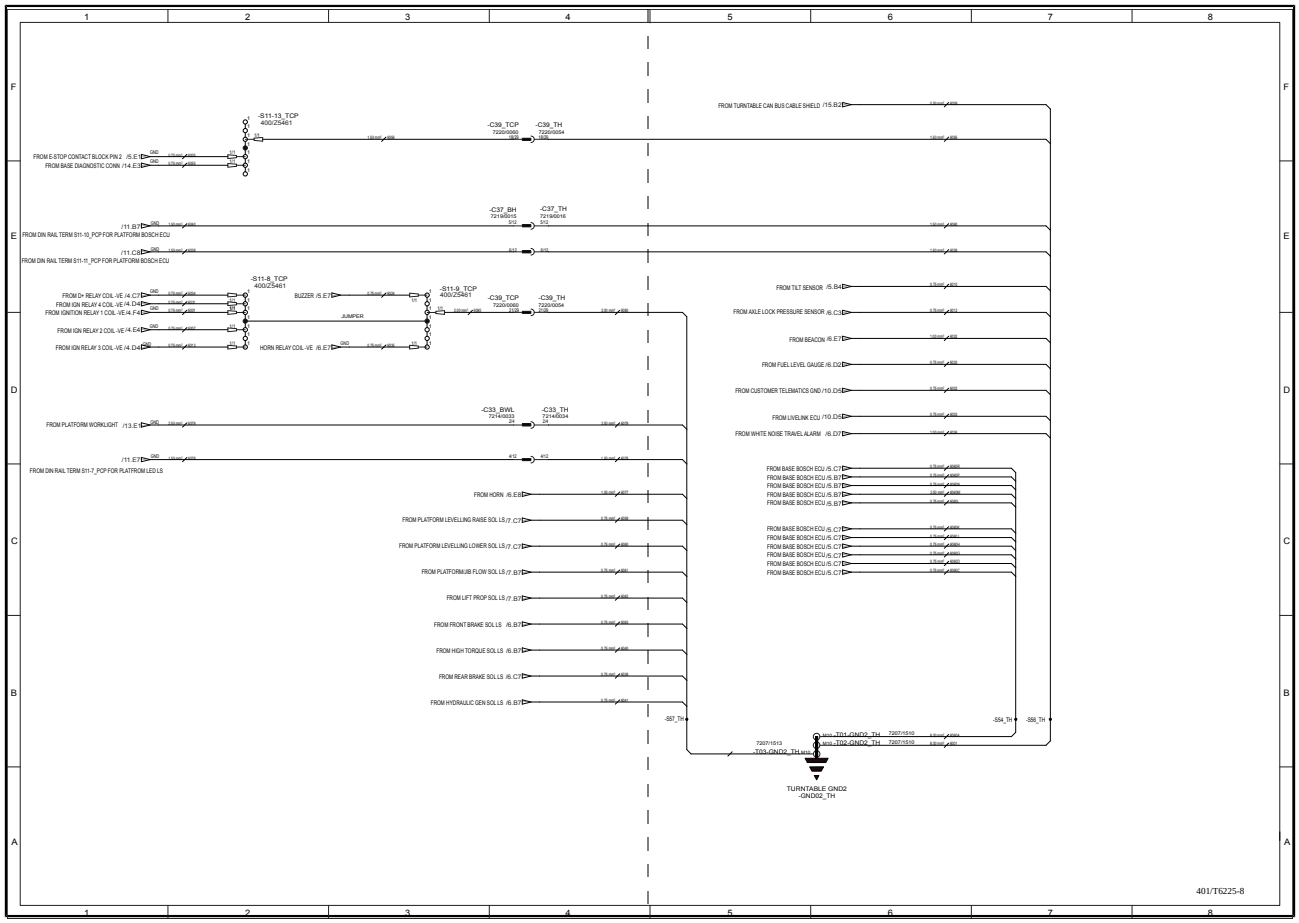

Figure 295. (Part 1 of 2)

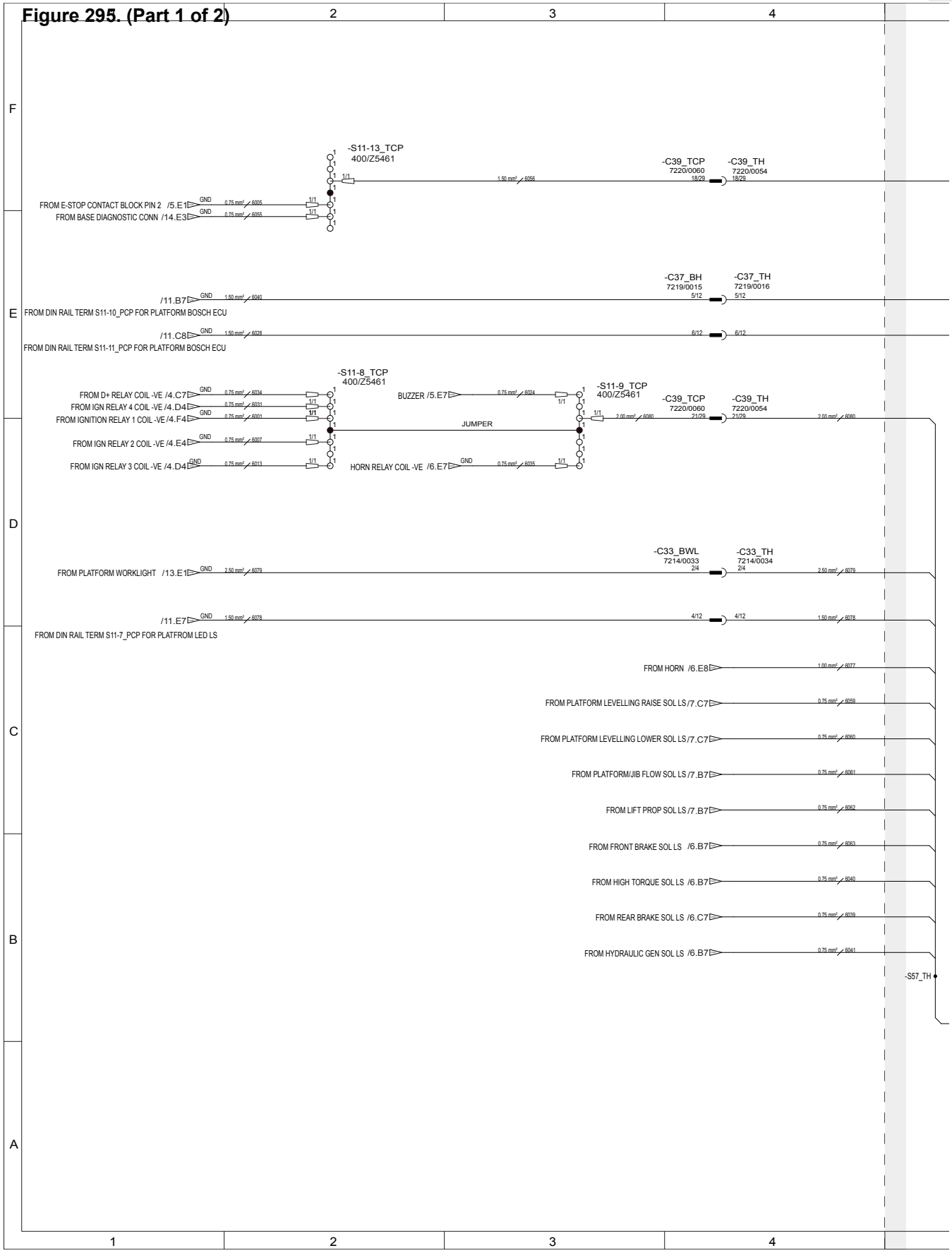

Figure 295. (Part 2 of 2)

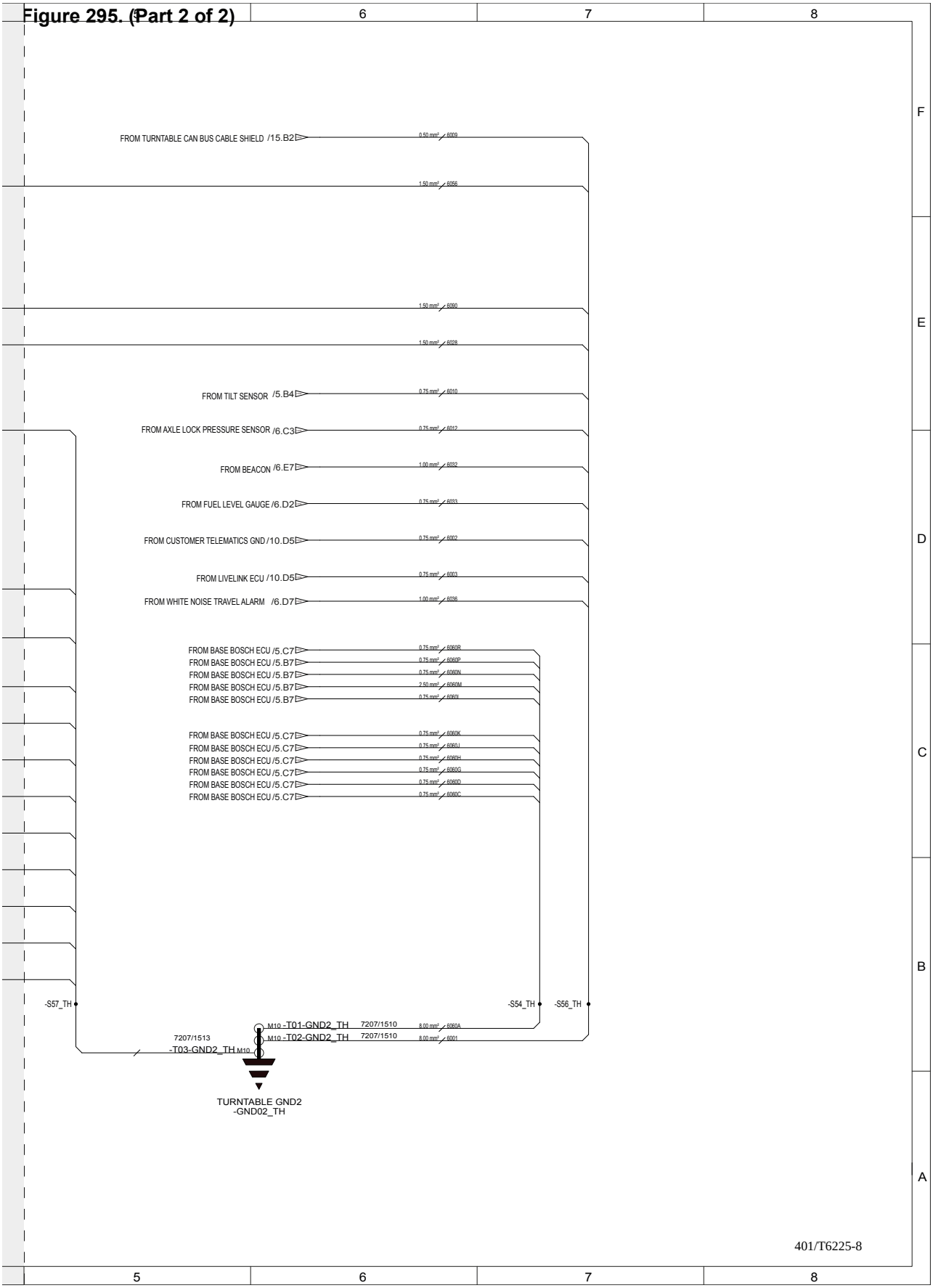

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Figure 296. 401/T6225 Issue-8 (Sheet 9 of 22) - Engine

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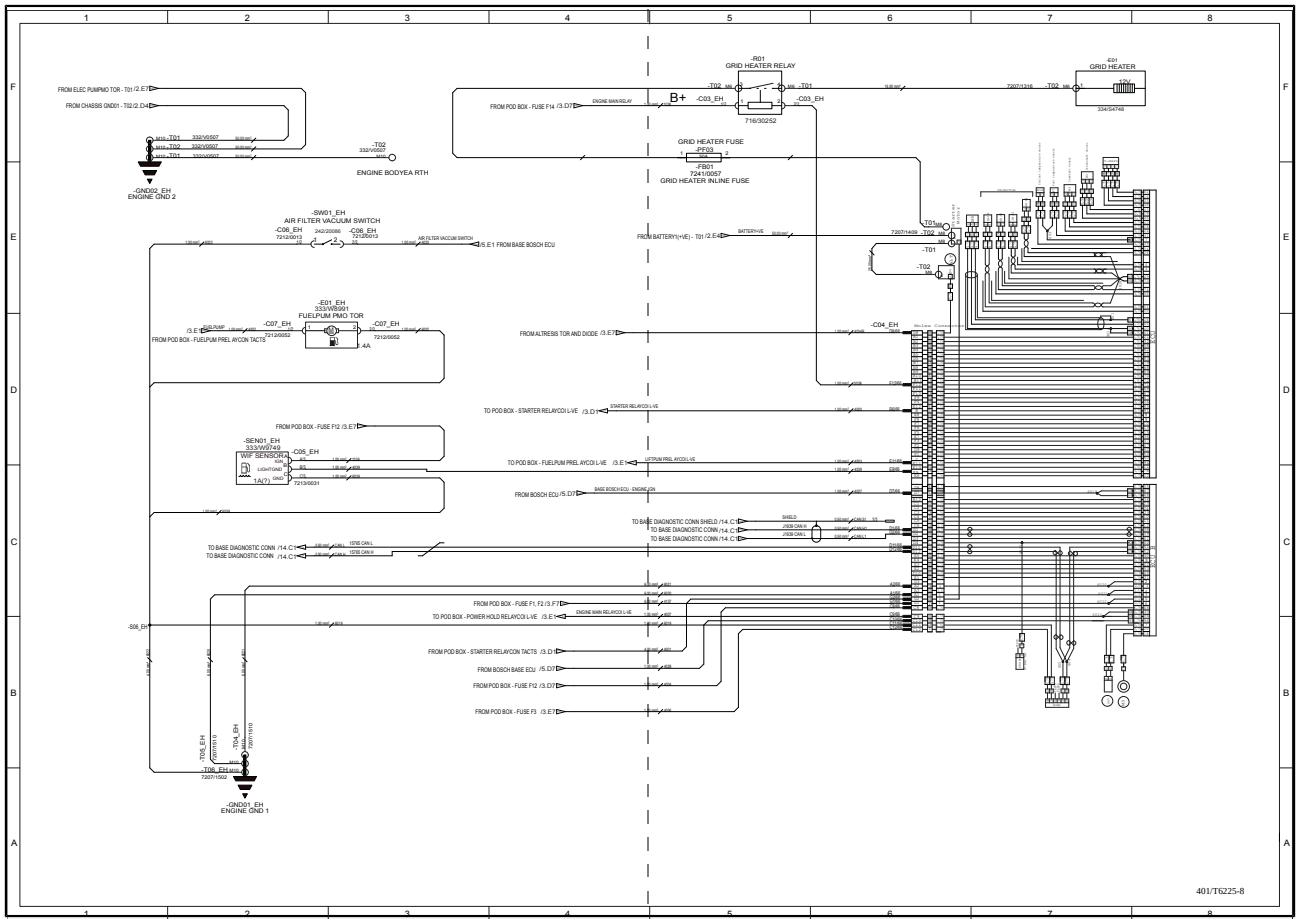

Figure 296. (Part 1 of 2)

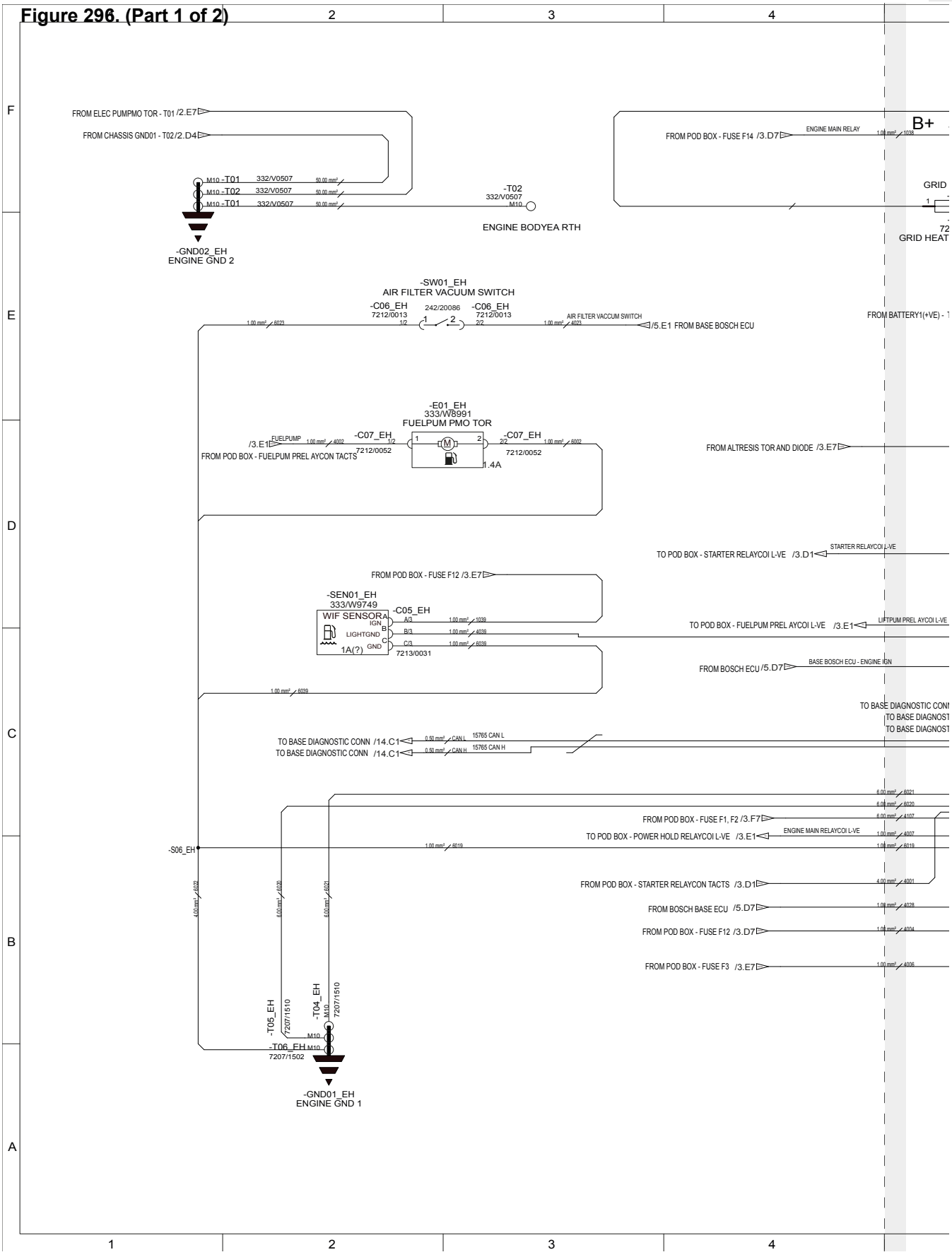

Figure 296. (Part 2 of 2)

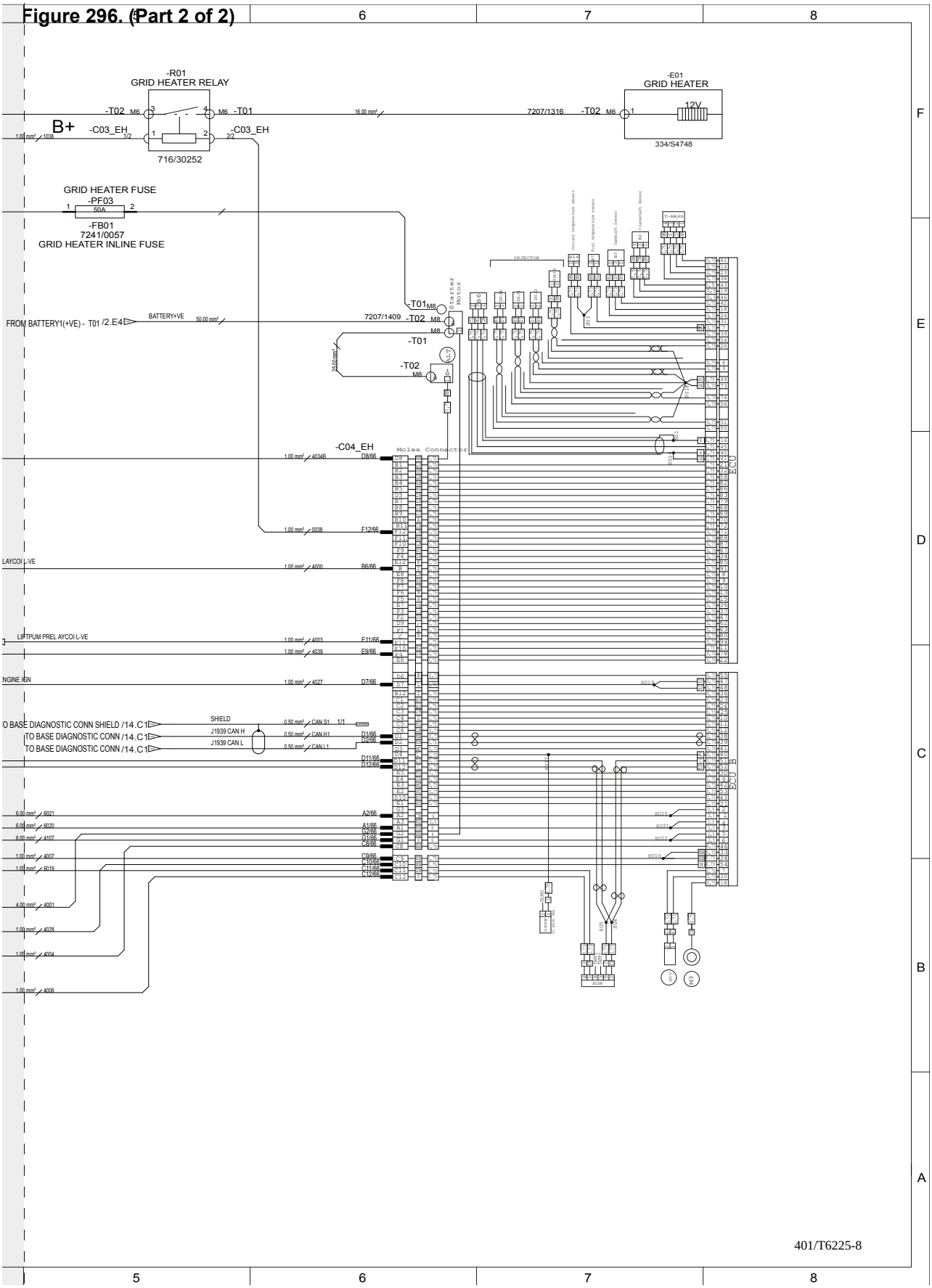

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Figure 297. 401/T6225 Issue-8 (Sheet 10 of 22) - LiveLink ECU

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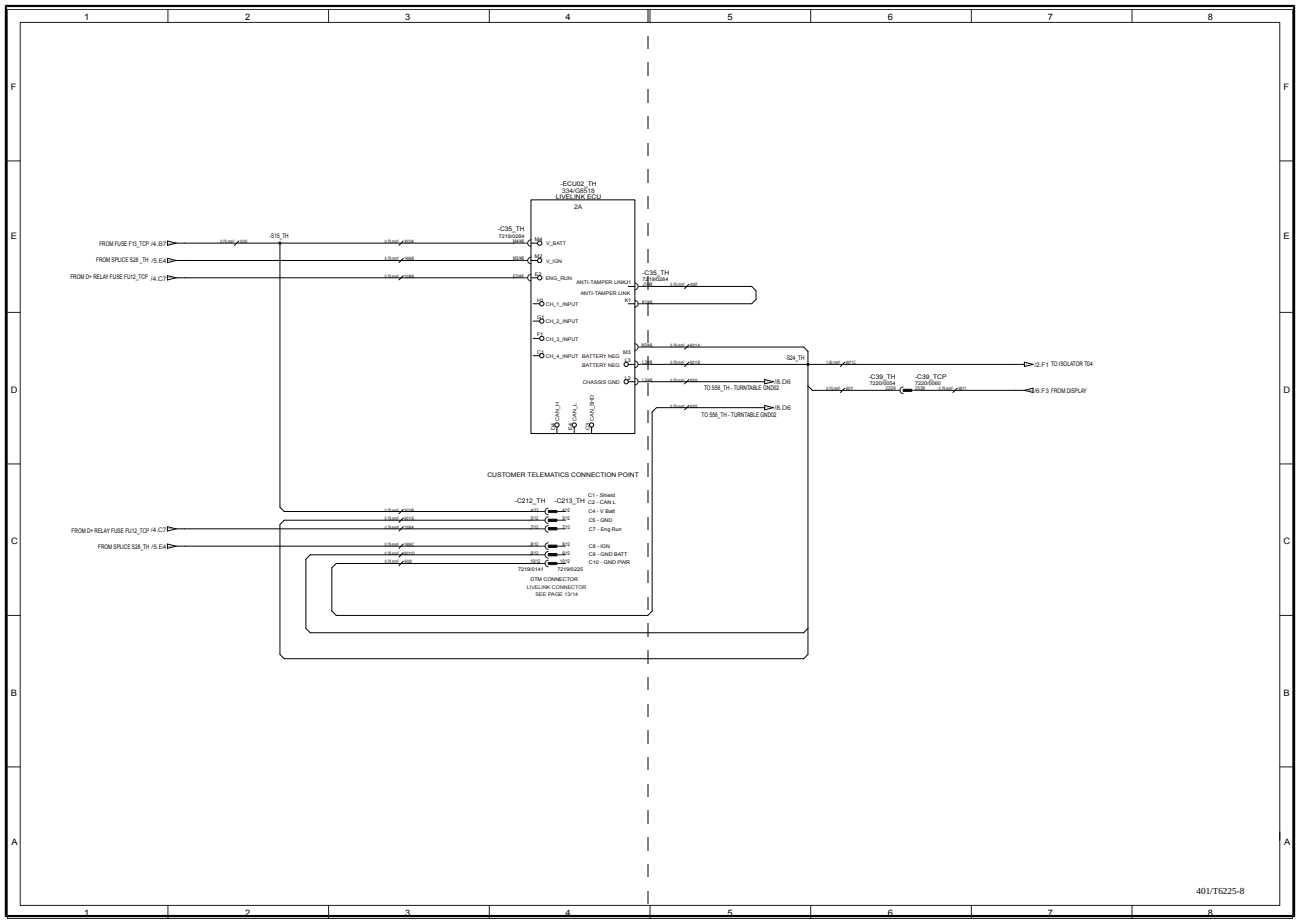

Figure 297. (Part 1 of 2)

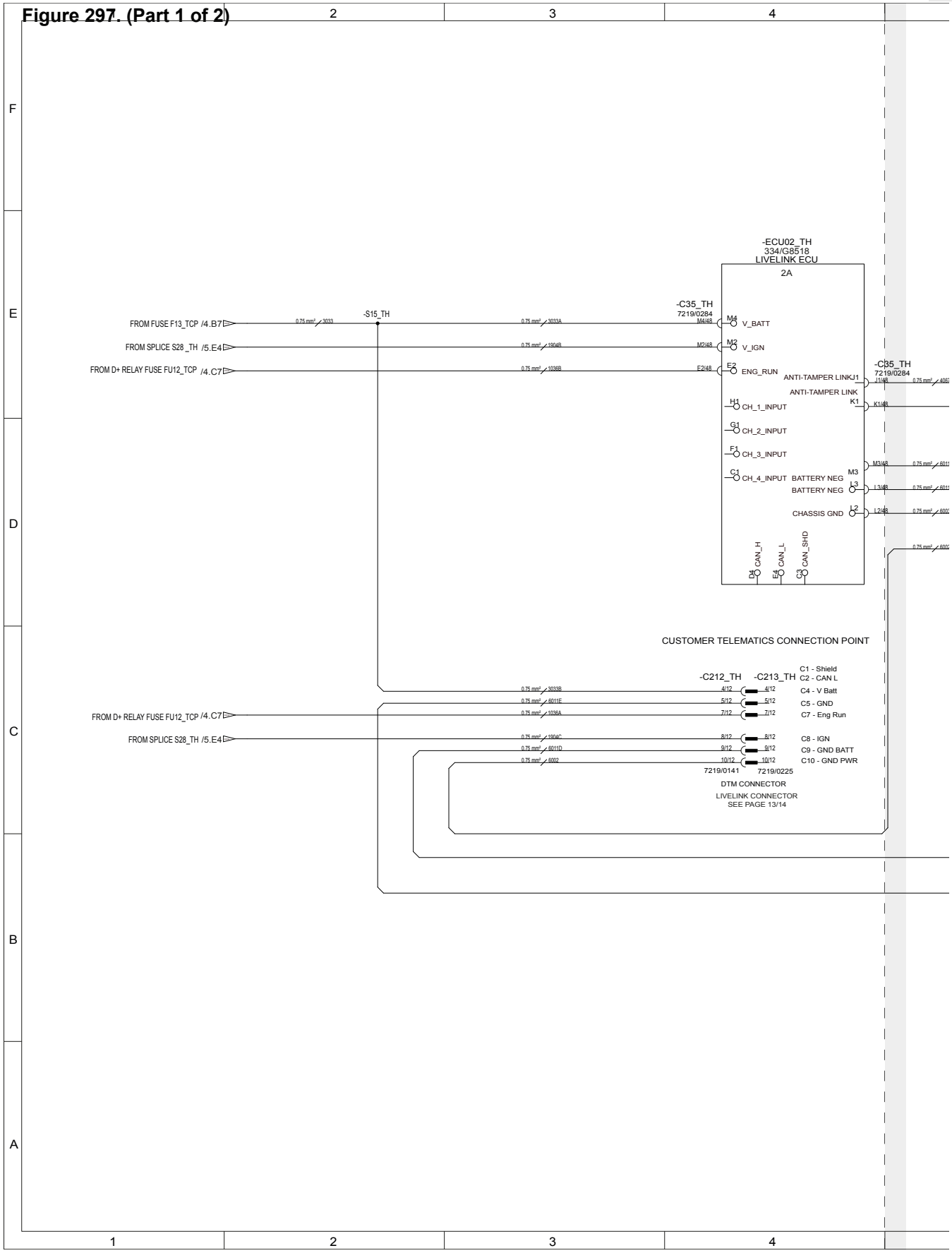

Figure 297. (Part 2 of 2)

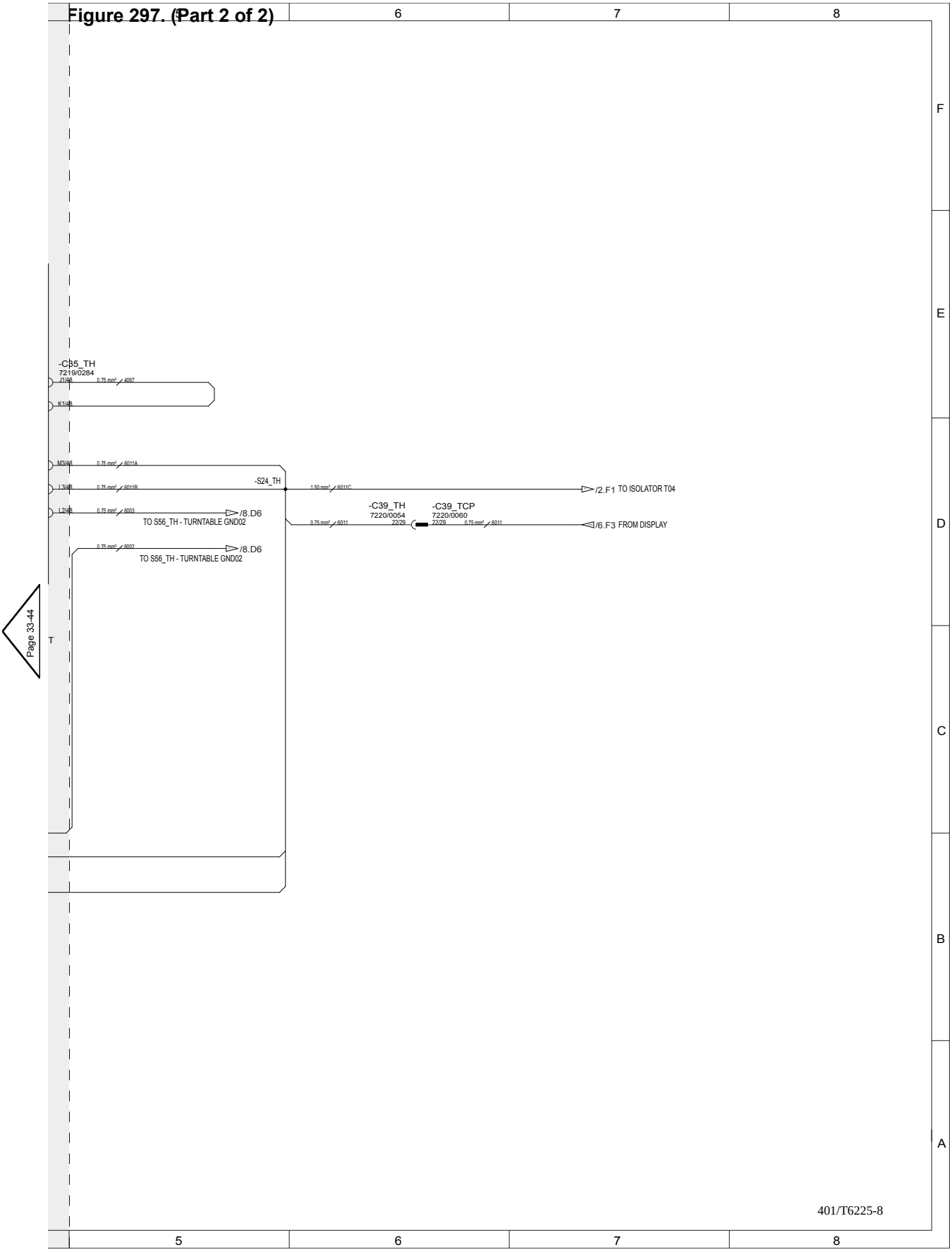

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Figure 298. 401/T6225 Issue-8 (Sheet 11 of 22) - Platform ECU

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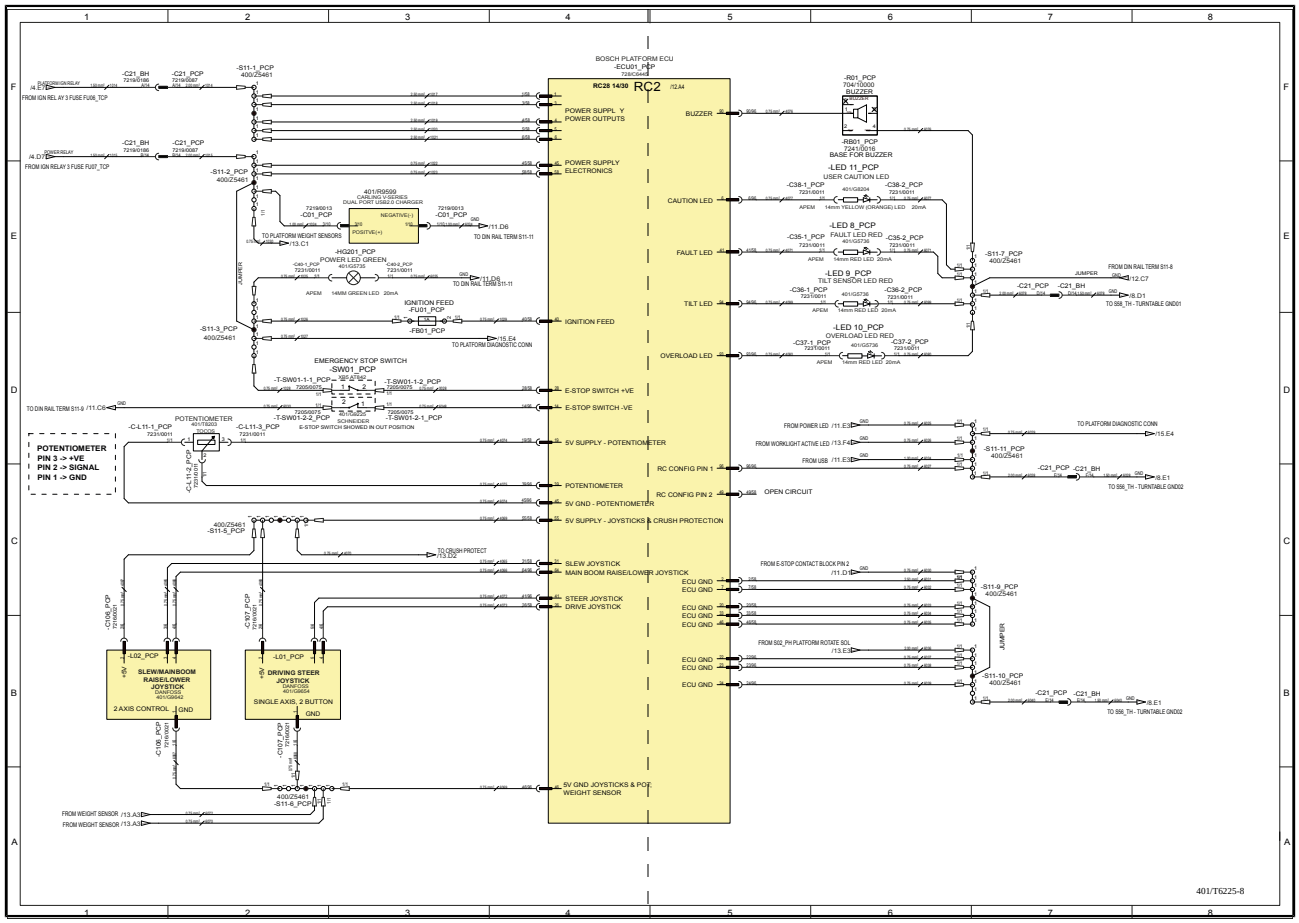

Figure 298. (Part 1 of 2)

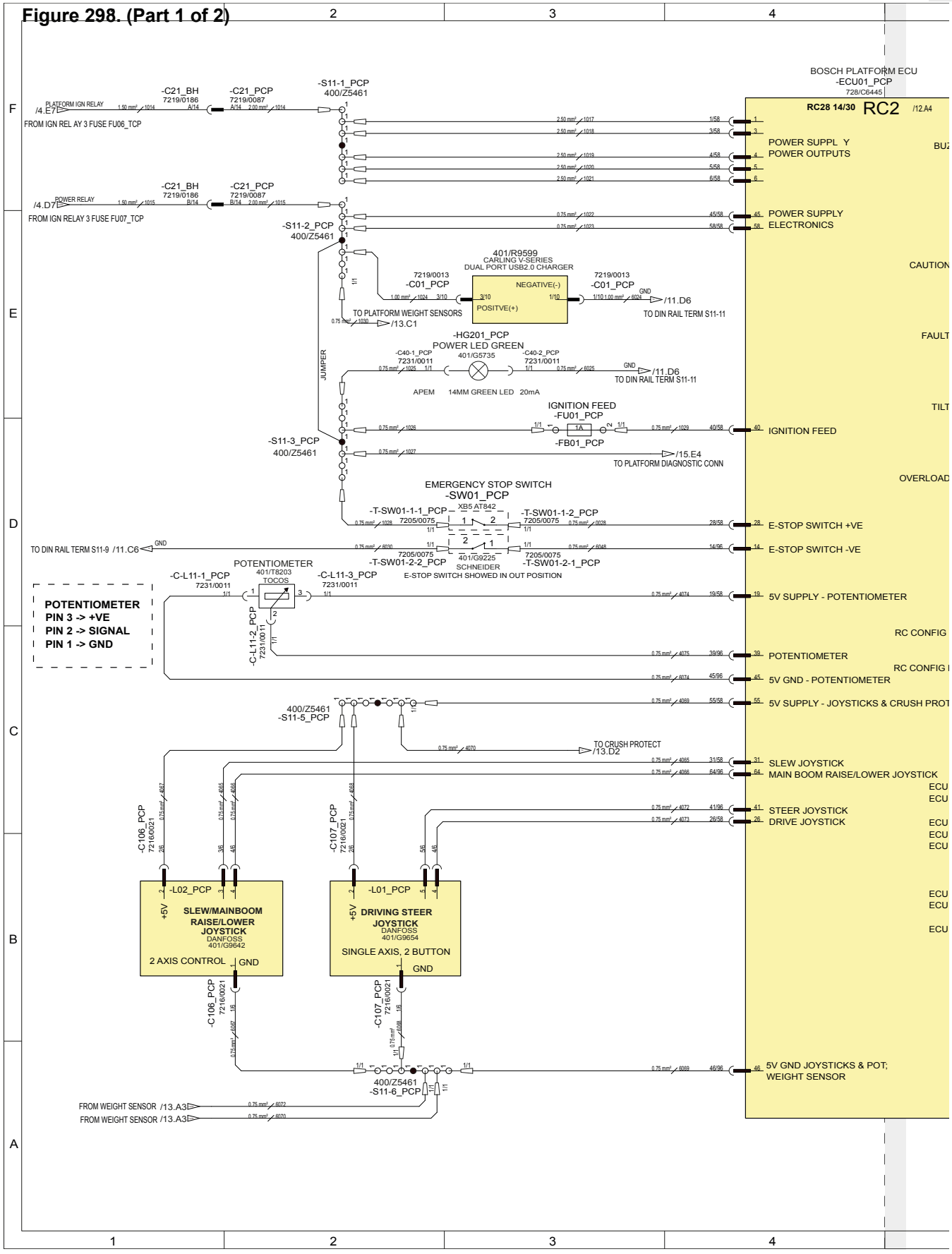

Figure 298. (Part 2 of 2)

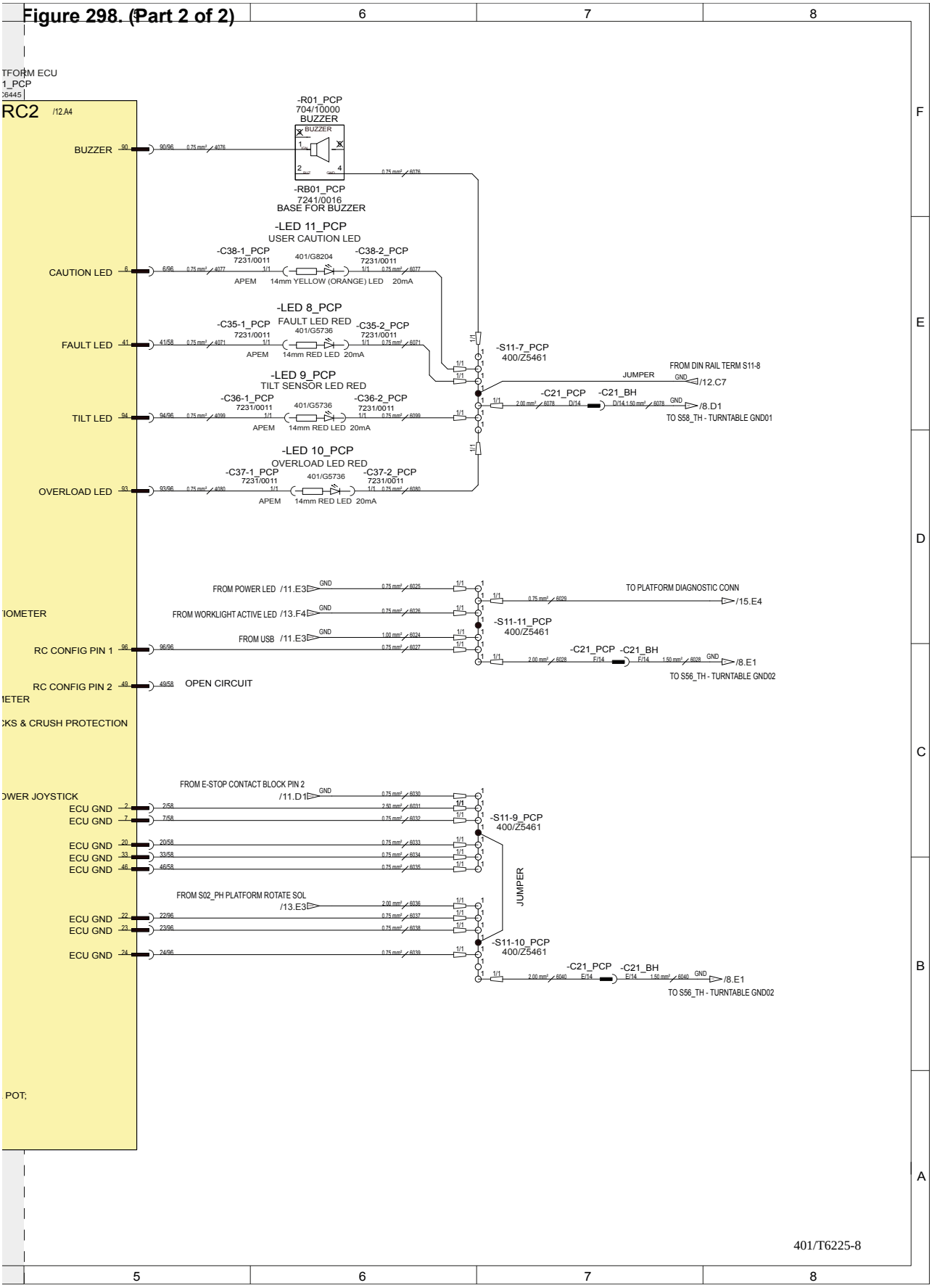

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Figure 299. 401/T6225 Issue-8 (Sheet 12 of 22) - Platform ECU

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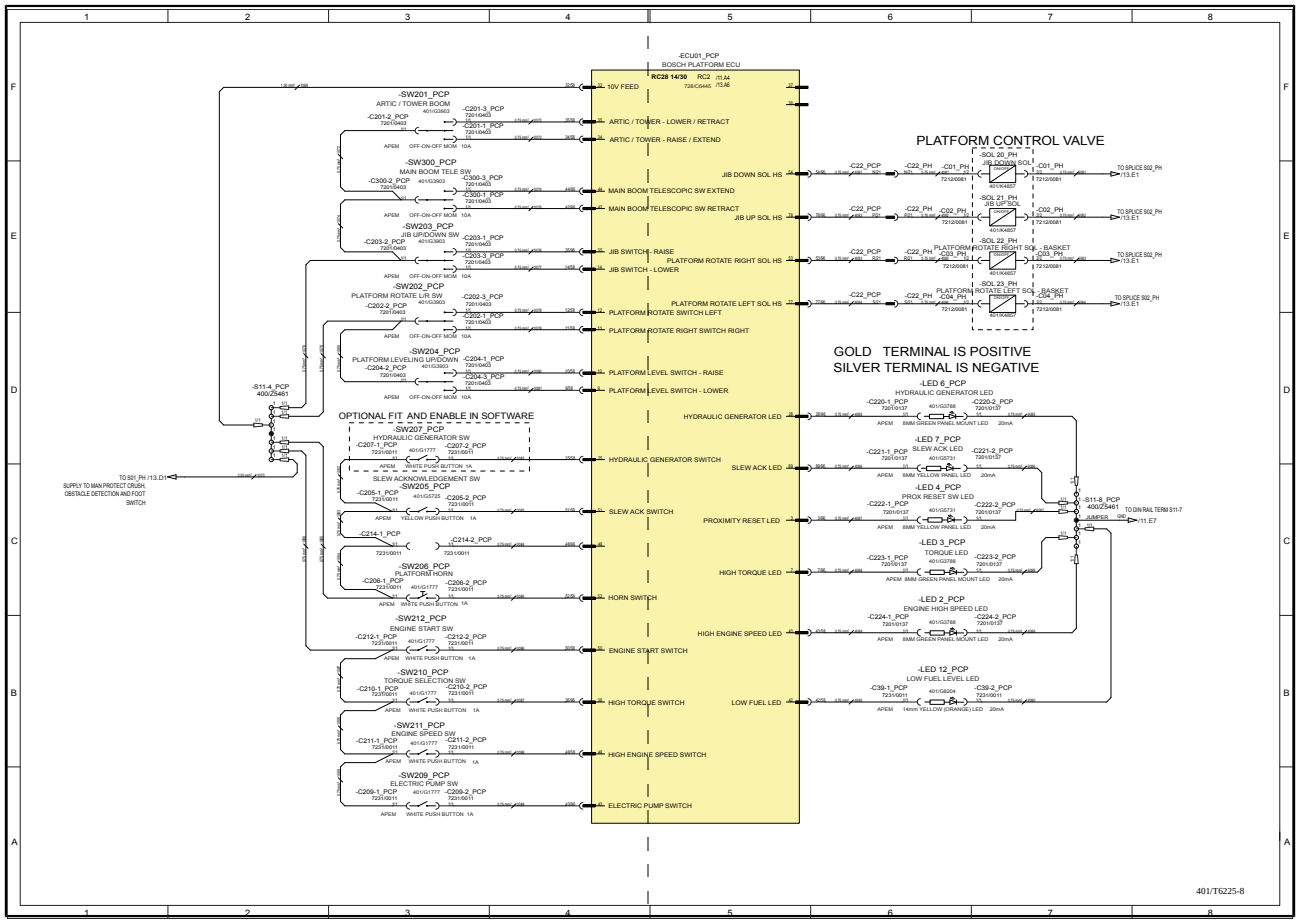

Figure 299. (Part 1 of 2)

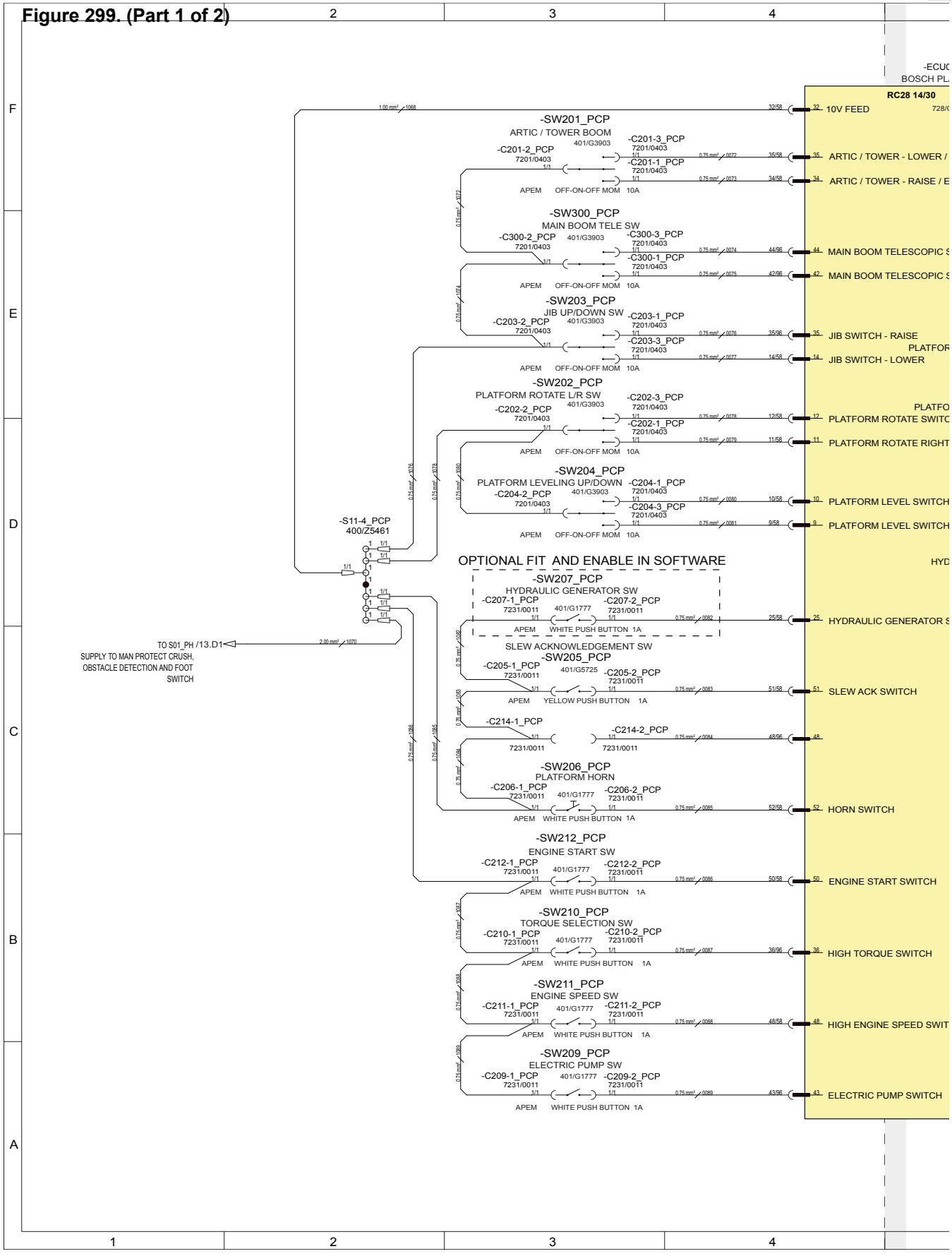

Figure 299. (Part 2 of 2)

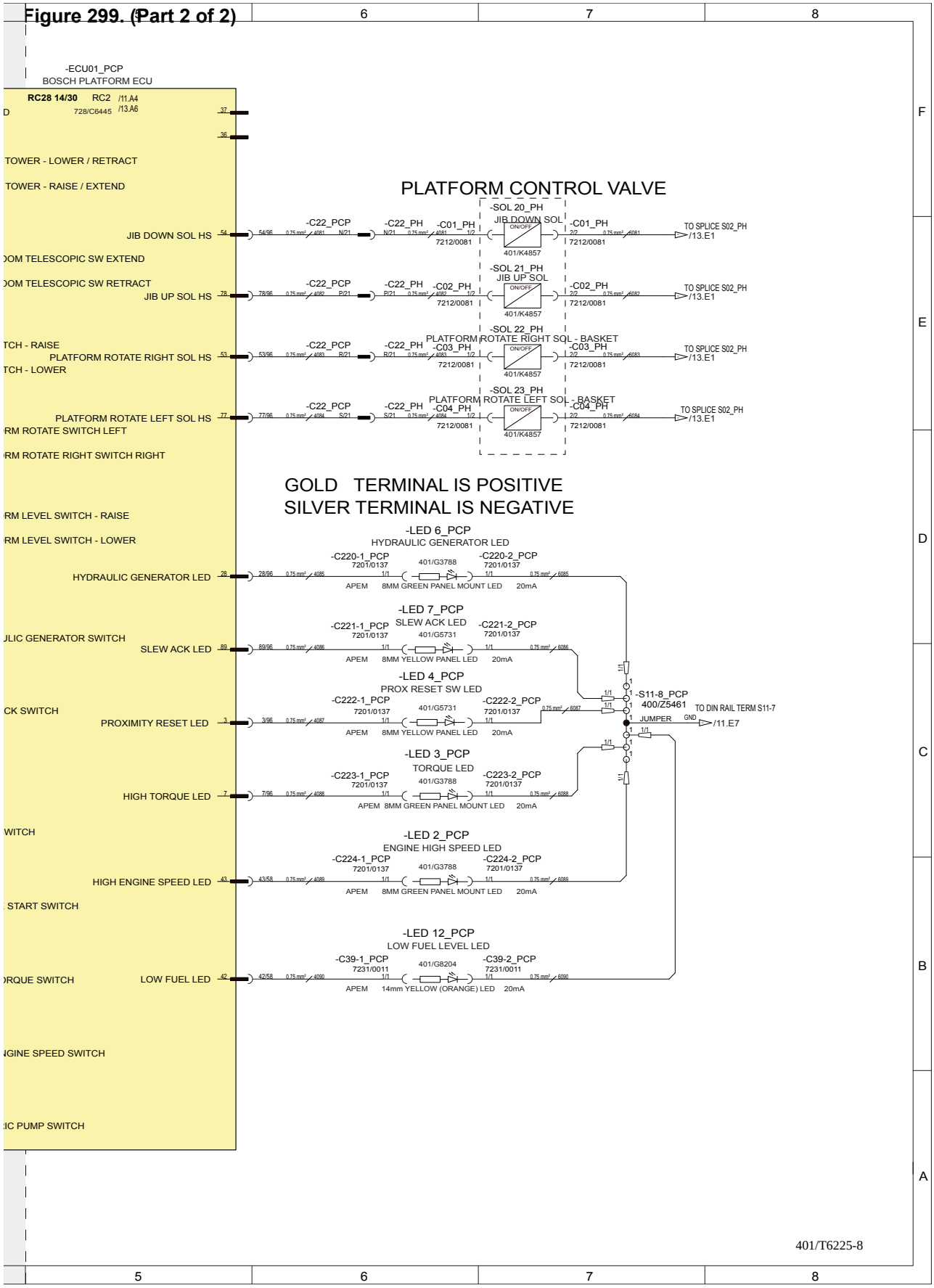

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Figure 300. 401/T6225 Issue-8 (Sheet 13 of 22) - Platform ECU

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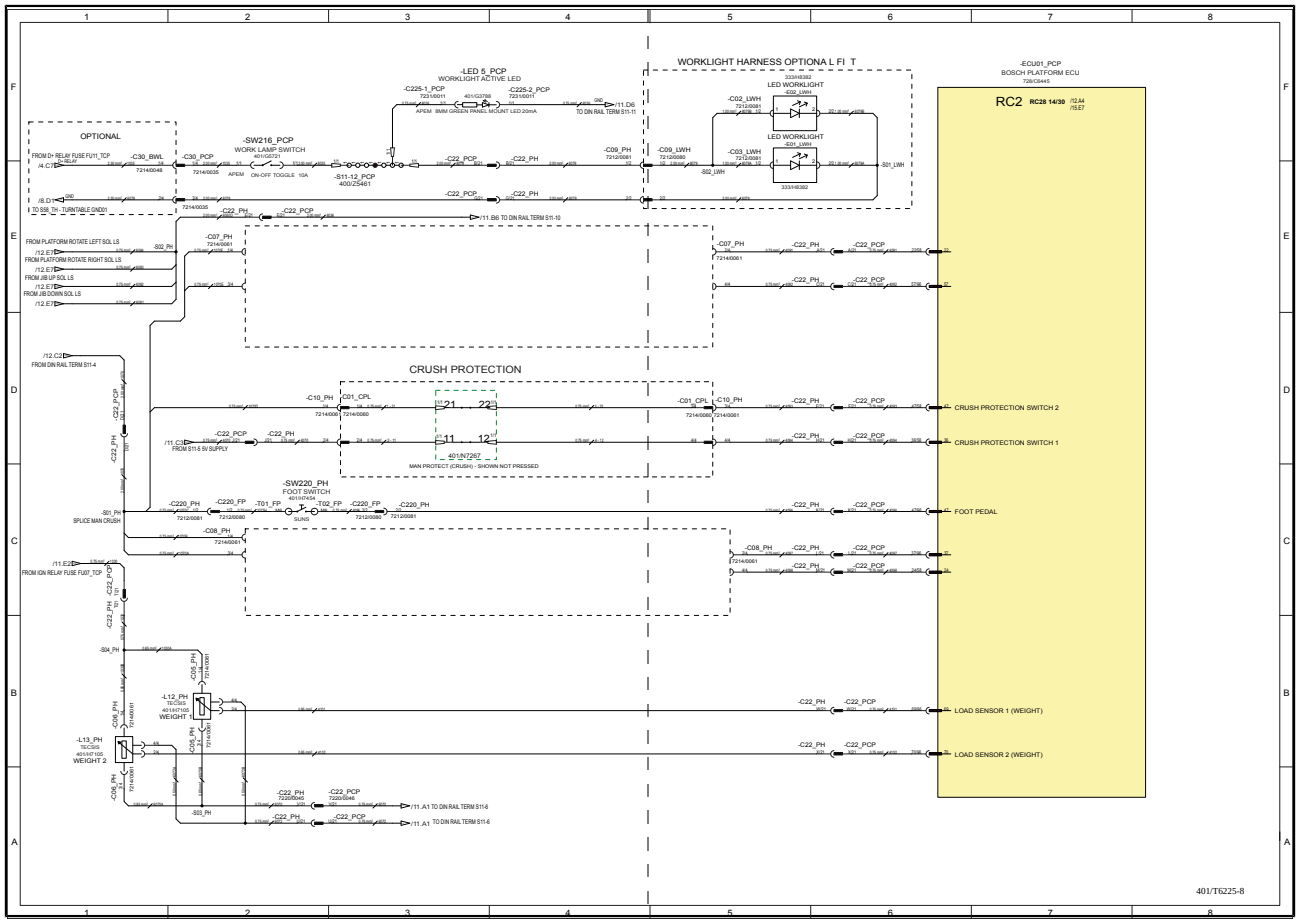

Figure 300. (Part 1 of 2)

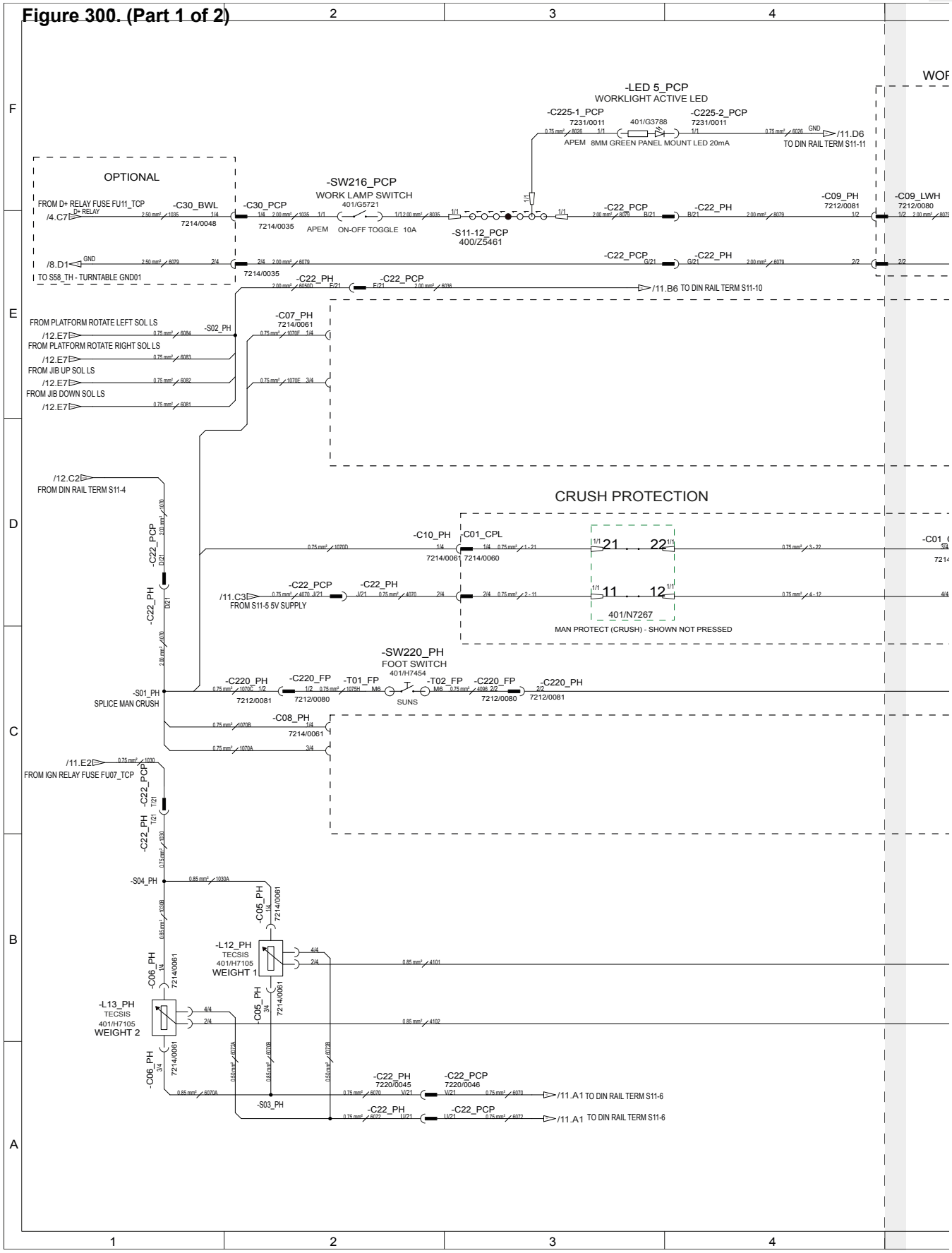

Figure 300. (Part 2 of 2)

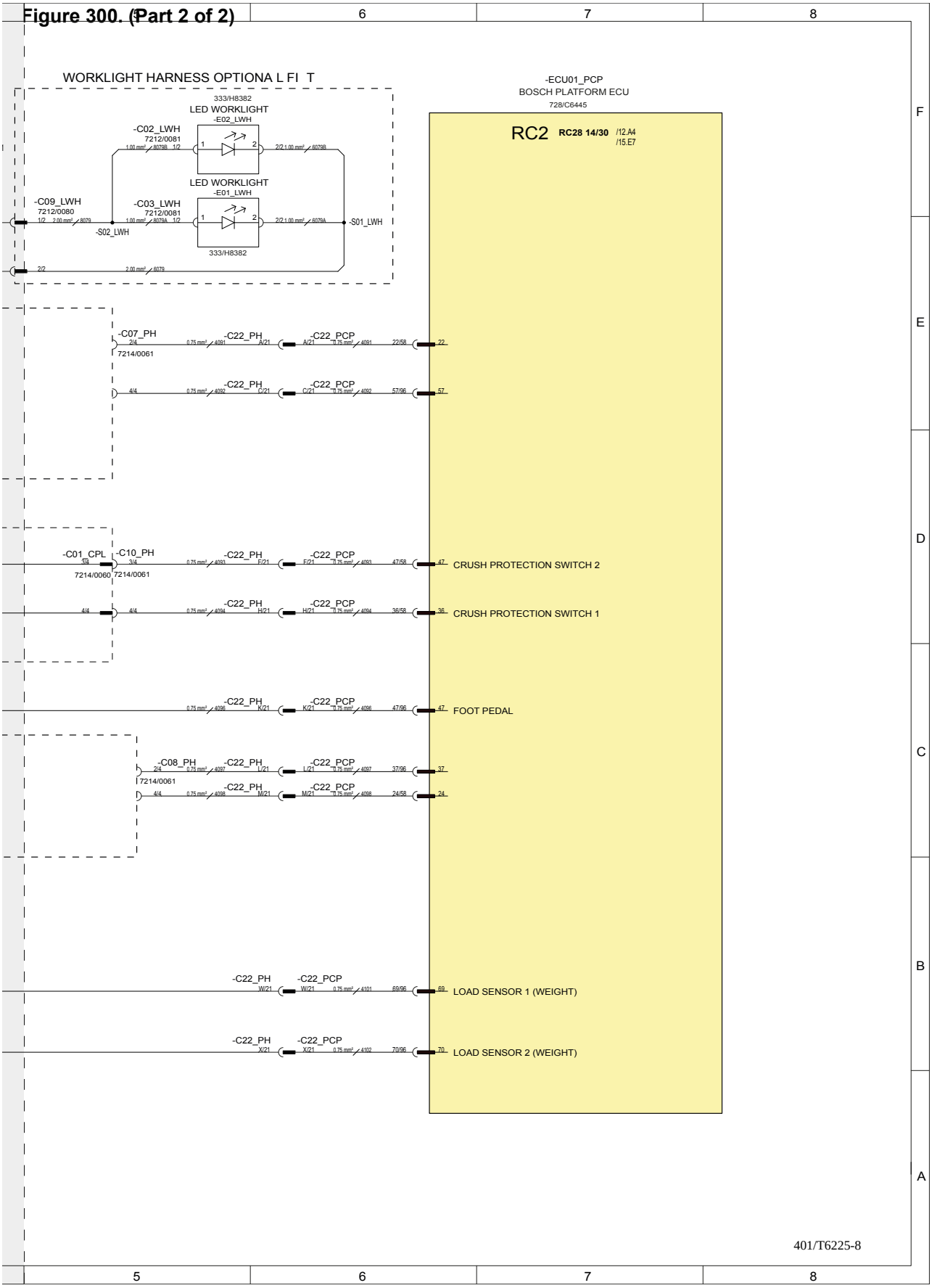

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Figure 301. 401/T6225 Issue-8 (Sheet 14 of 22) - CAN Network

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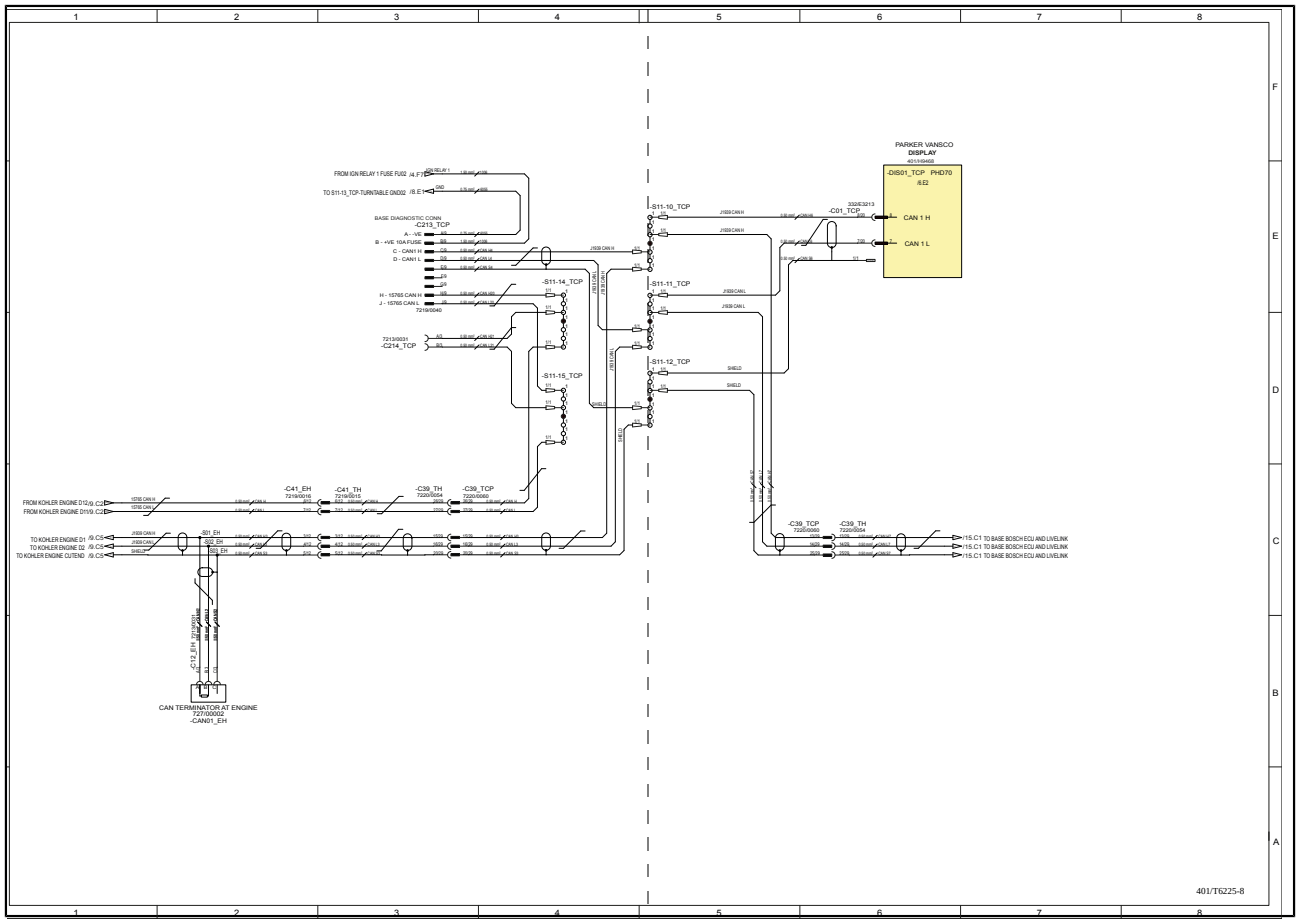

Figure 301. (Part 1 of 2)

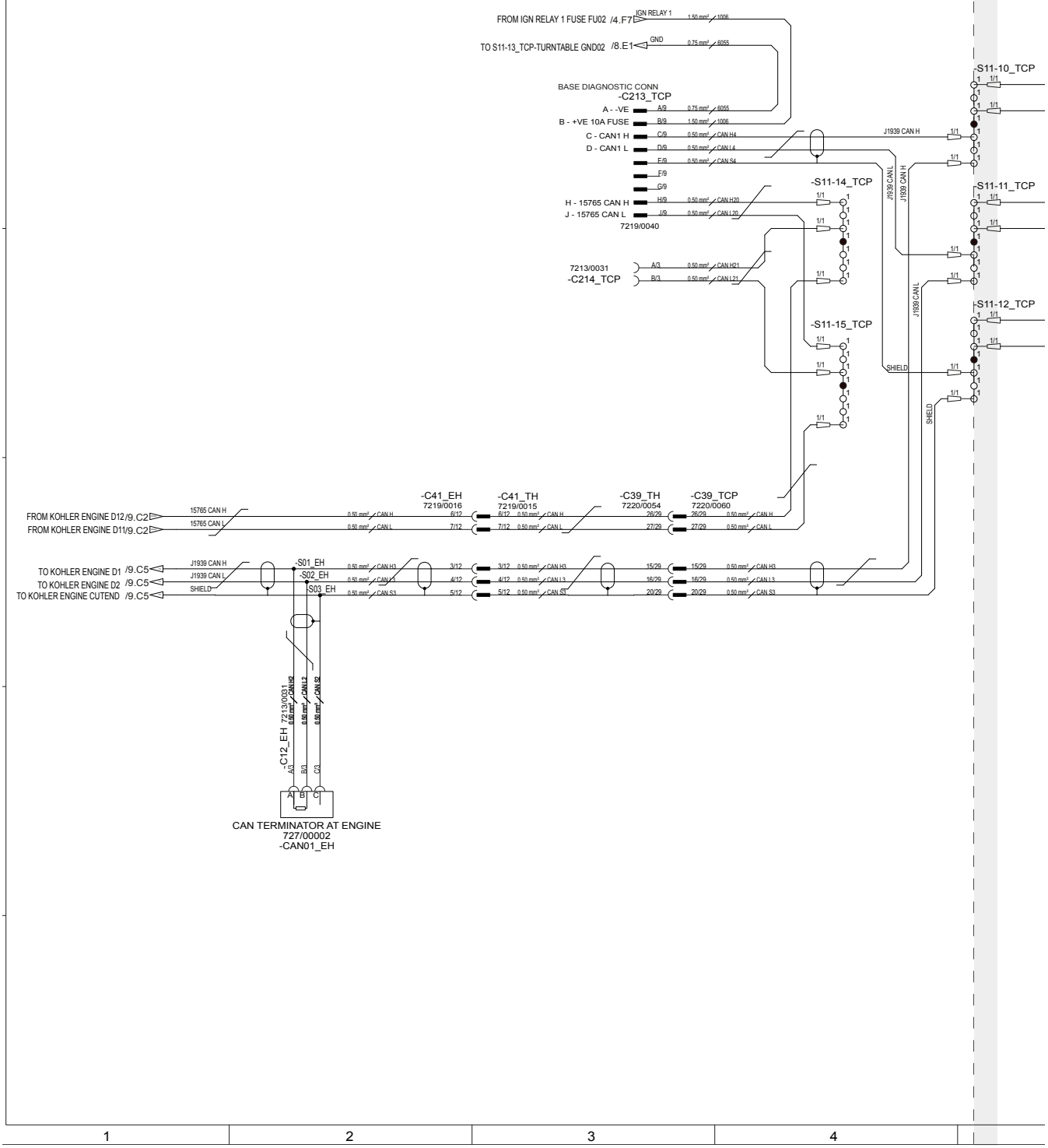

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Figure 301: (Part 2 of 2)

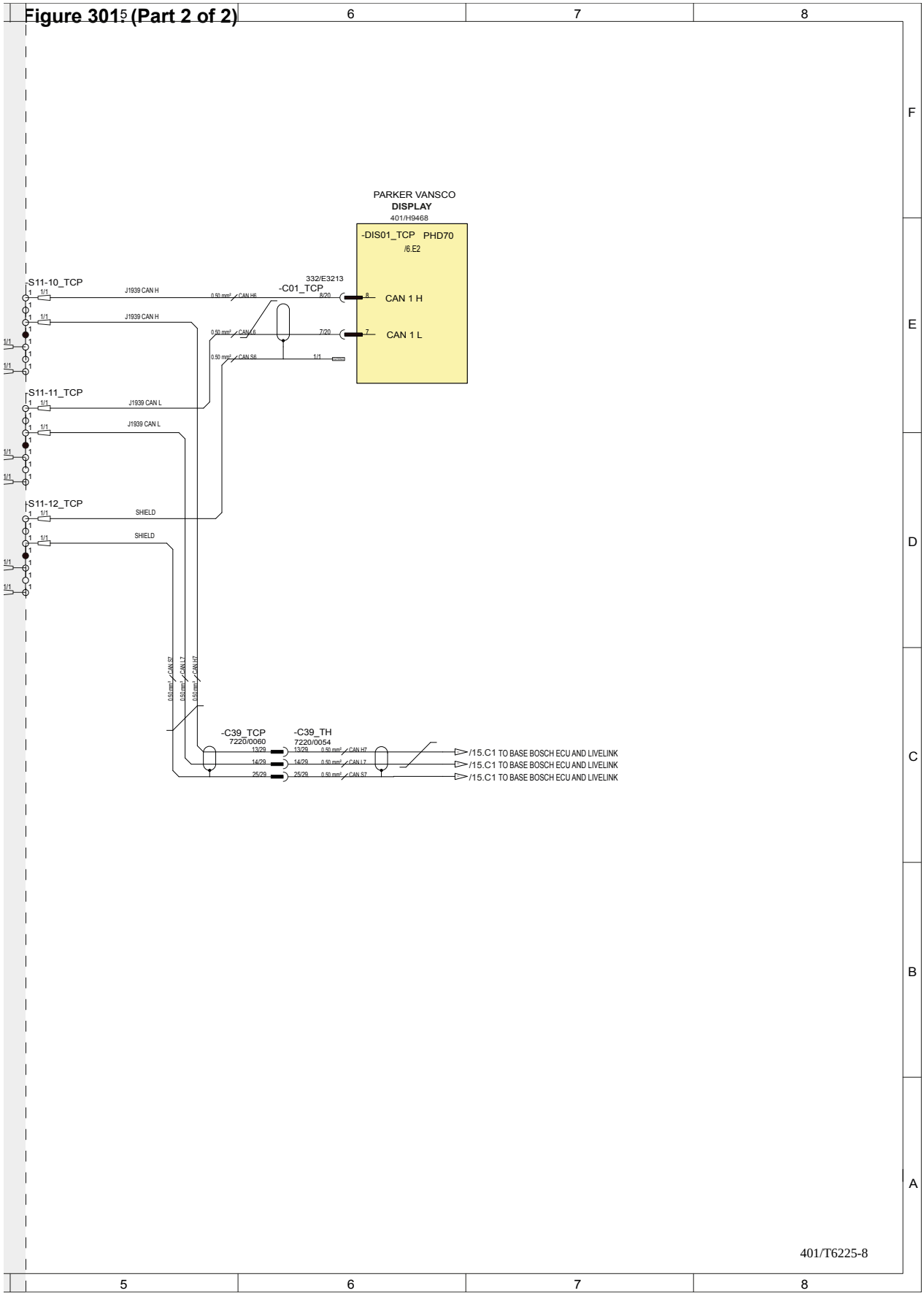

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Figure 302. 401/T6225 Issue-8 (Sheet 15 of 22) - CAN Network

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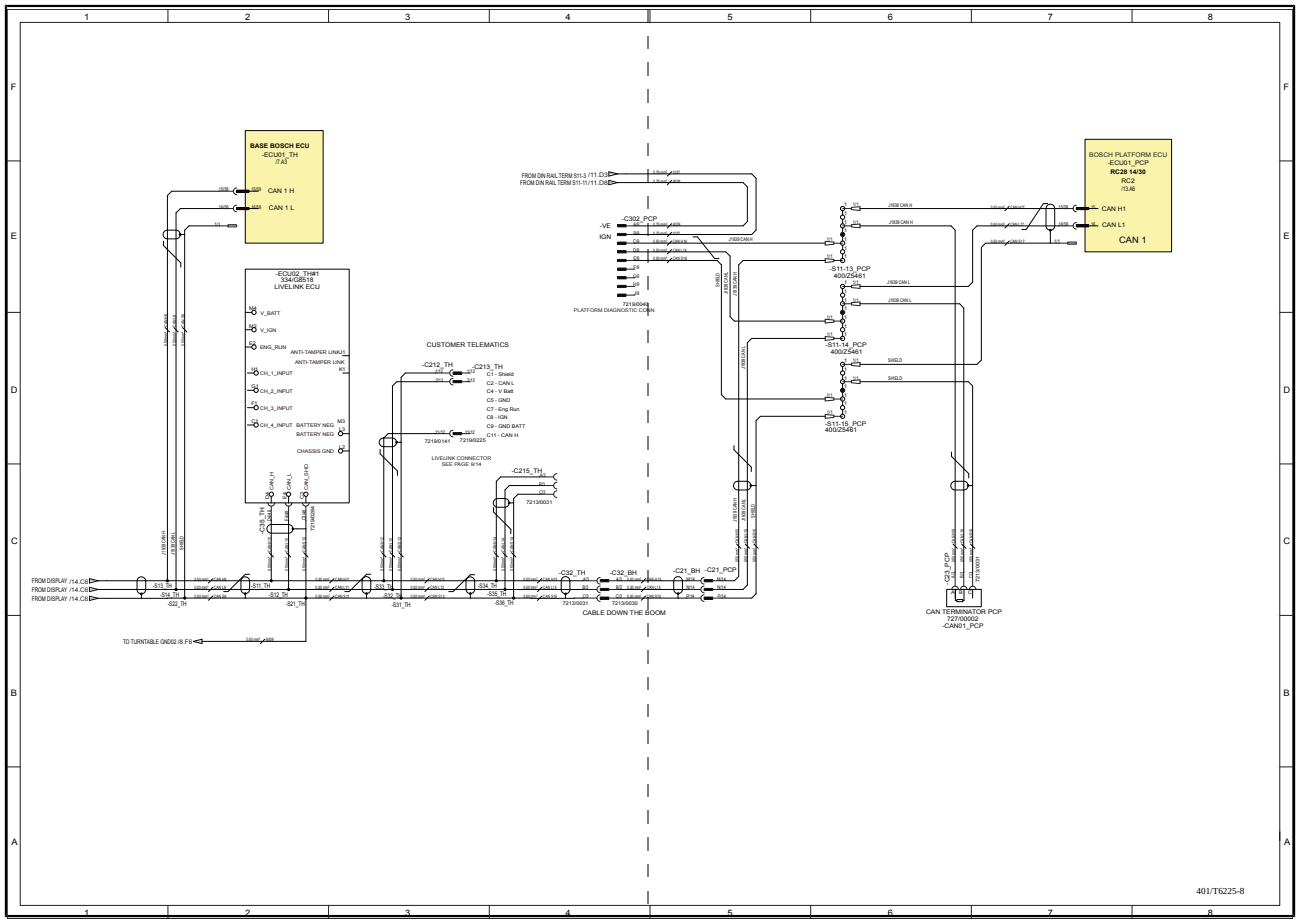

Figure 302. (Part 1 of 2)

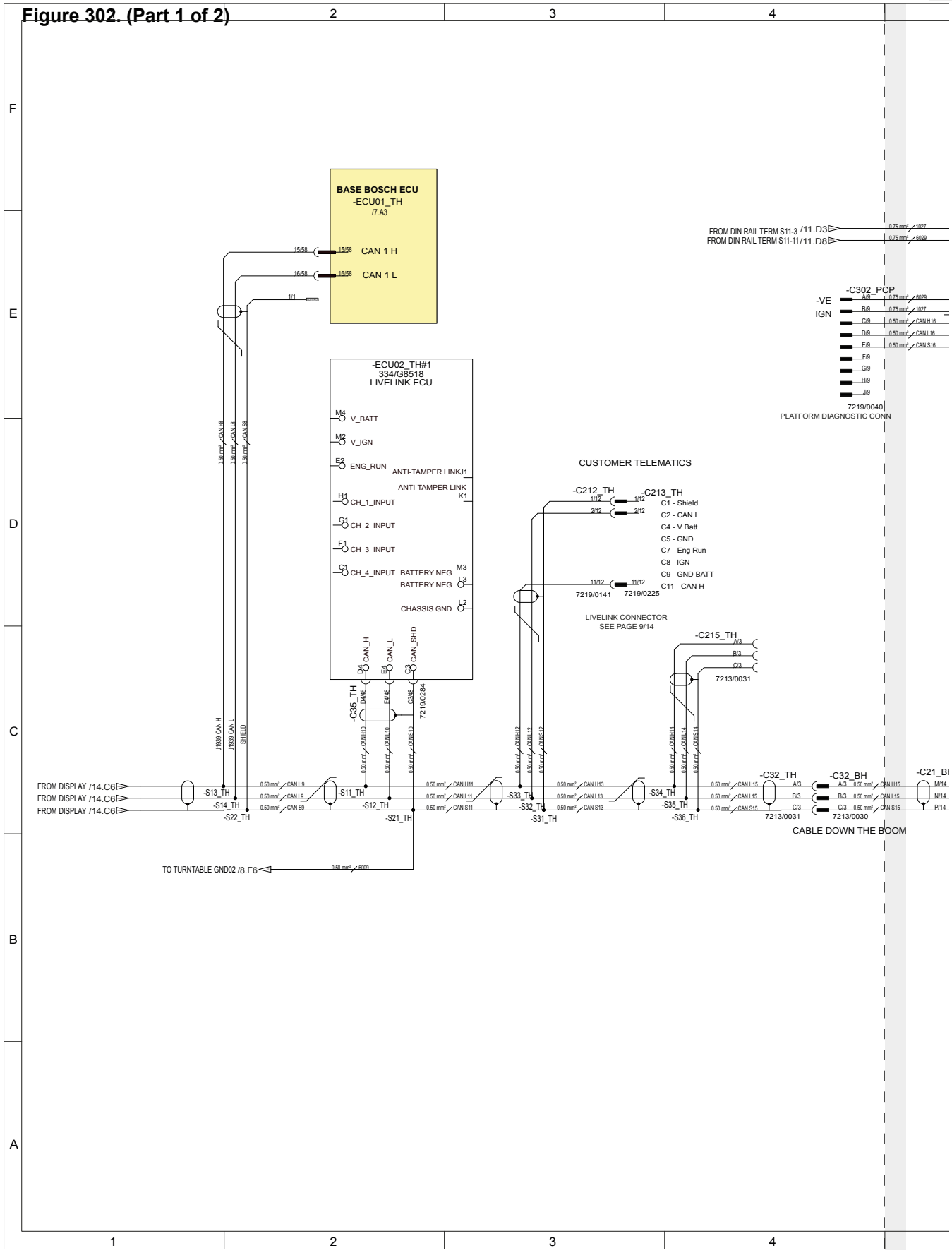

Figure 302. (Part 2 of 2)

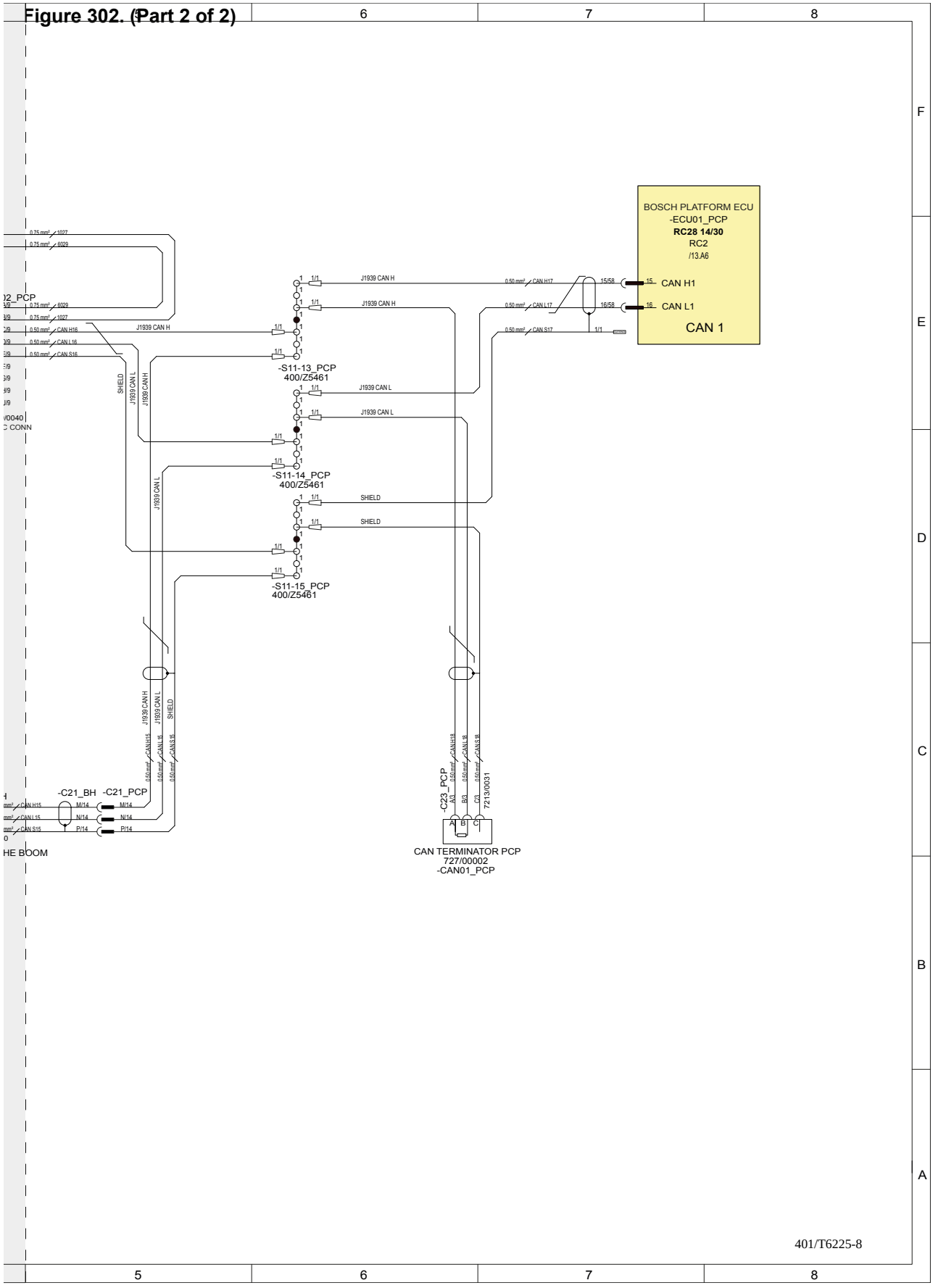

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Figure 303. 401/T6225 Issue-8 (Sheet 16 of 22) - Hydraulic Generator Supply AC110V

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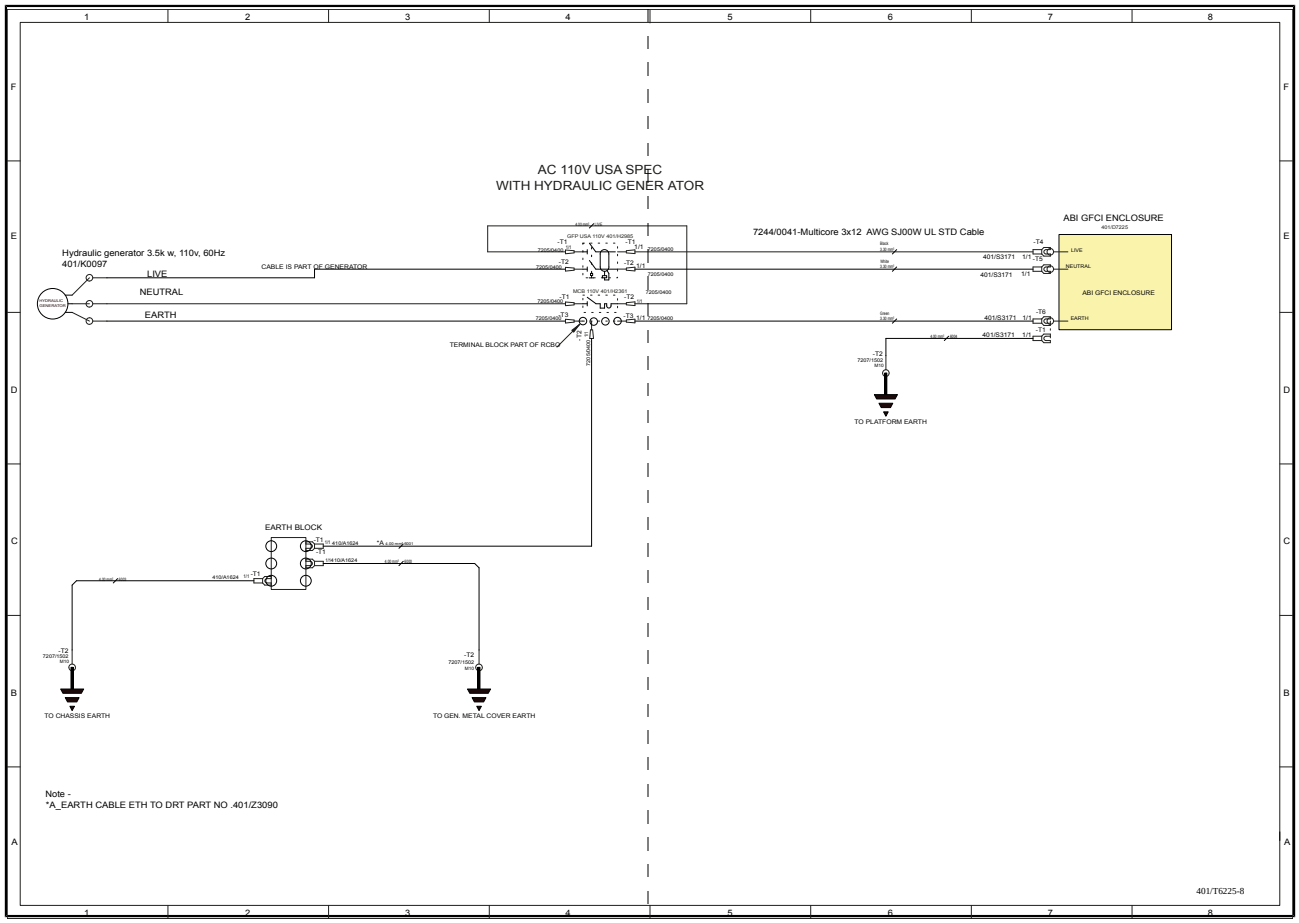
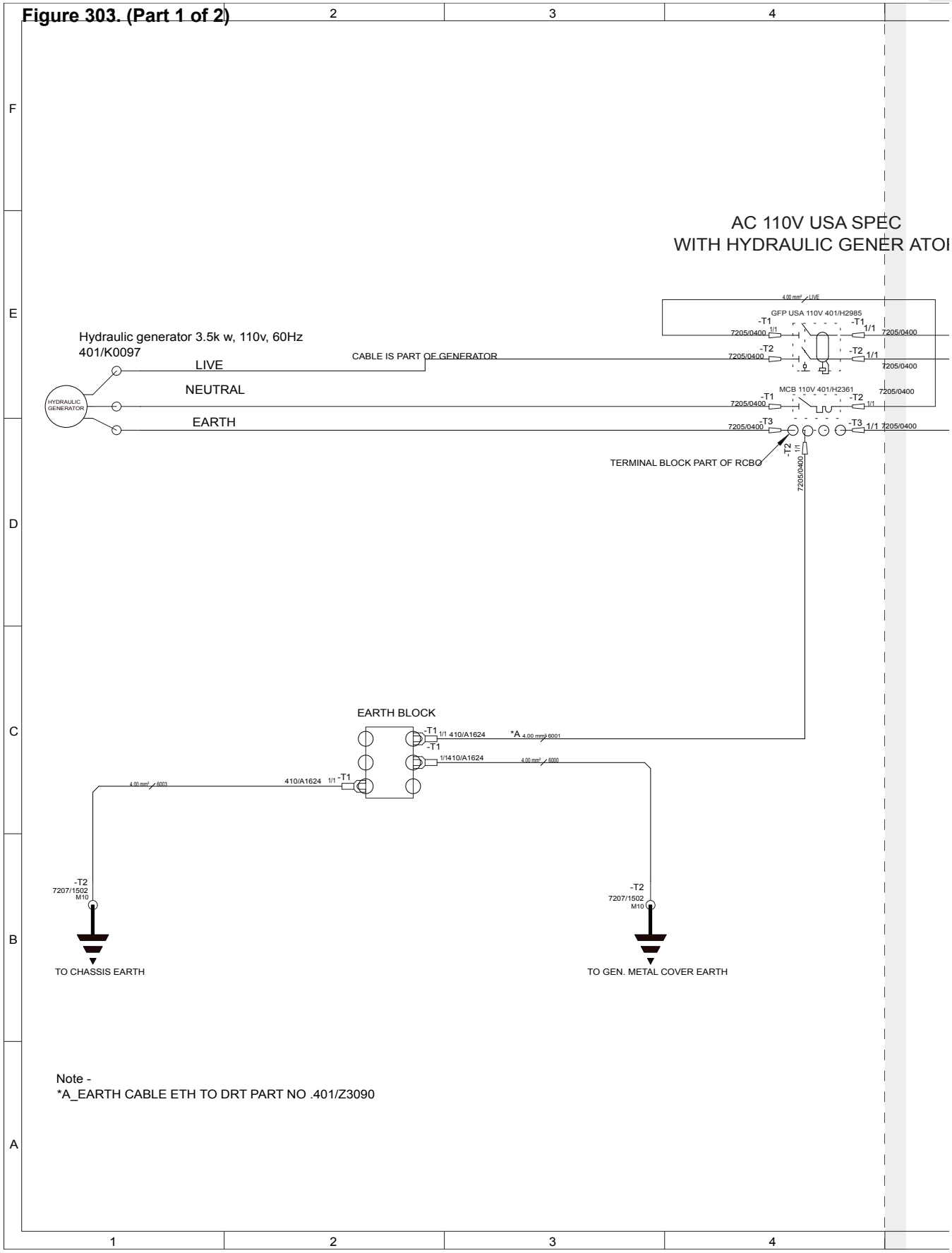


Figure 303. (Part 1 of 2)



Note -
*A_EARTH CABLE ETH TO DRT PART NO .401/Z3090

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Figure 303. (Part 2 of 2)

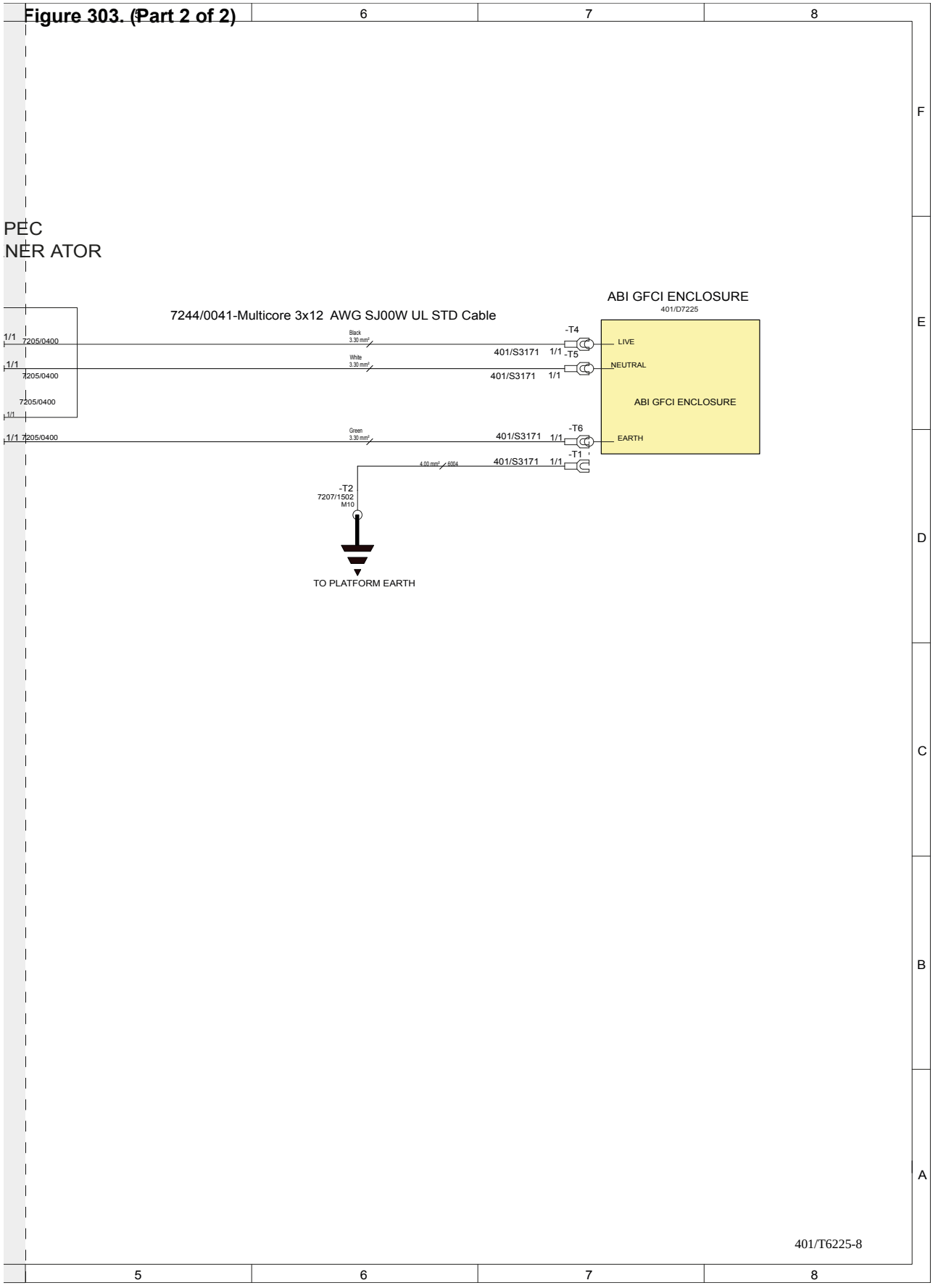

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Figure 304. 401/T6225 Issue-8 (Sheet 17 of 22) - Hydraulic Generator Supply AC230V

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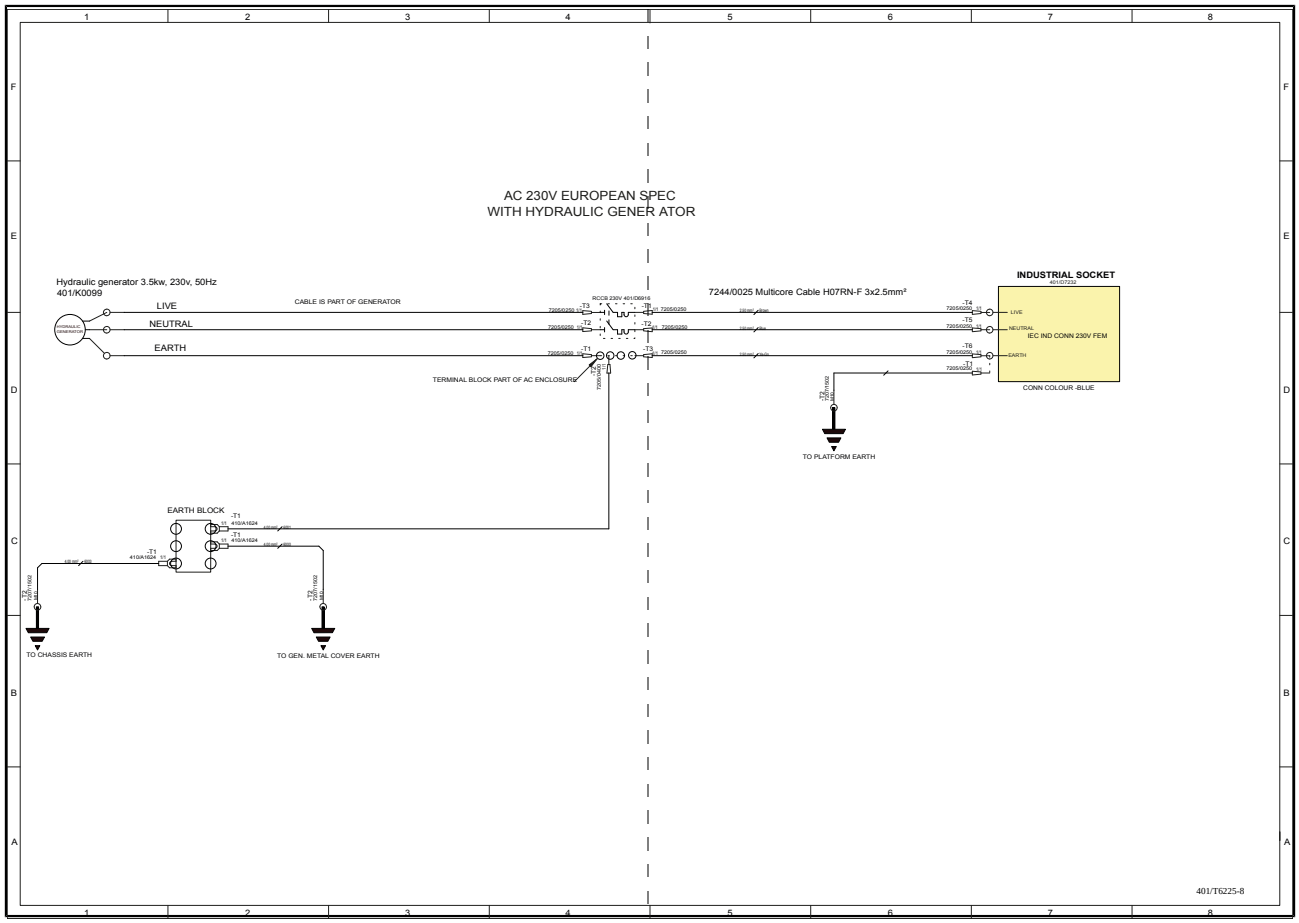

Figure 304. (Part 1 of 2)

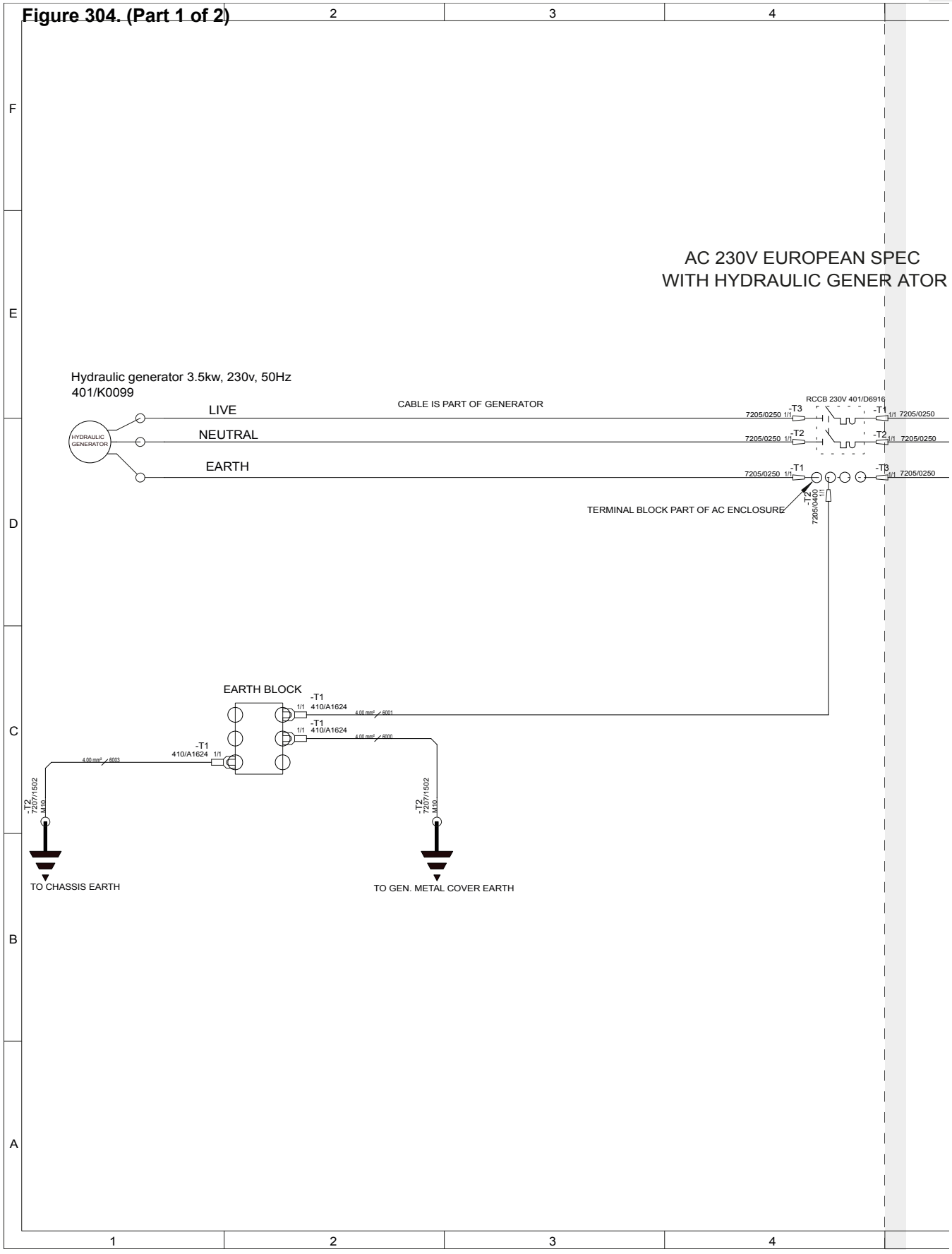

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Figure 304. (Part 2 of 2)

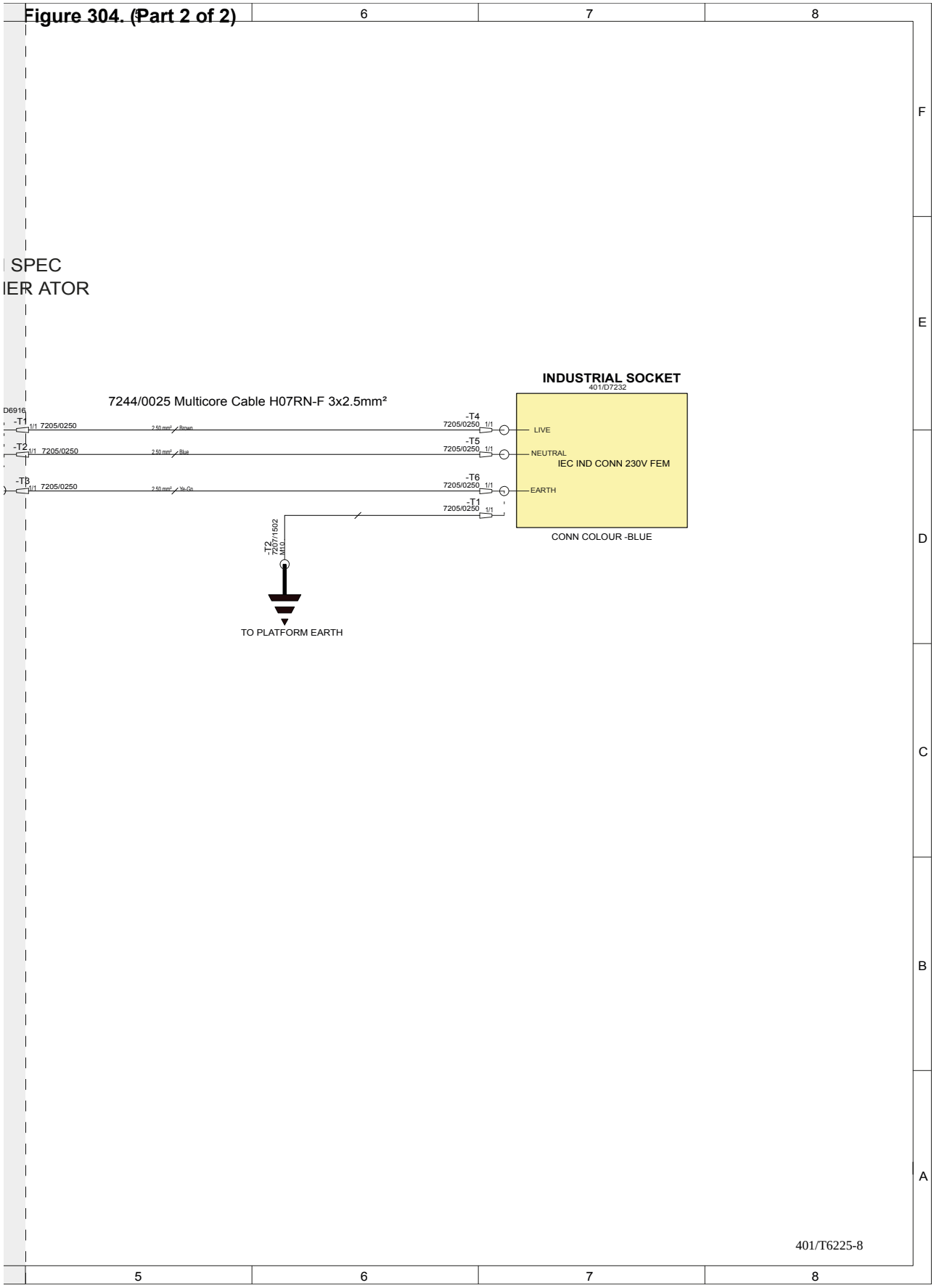


Figure 305. 401/T6225 Issue-8 (Sheet 18 of 22) - Power to Platform AC110V

	4	5	

AC 110V US A SPEC

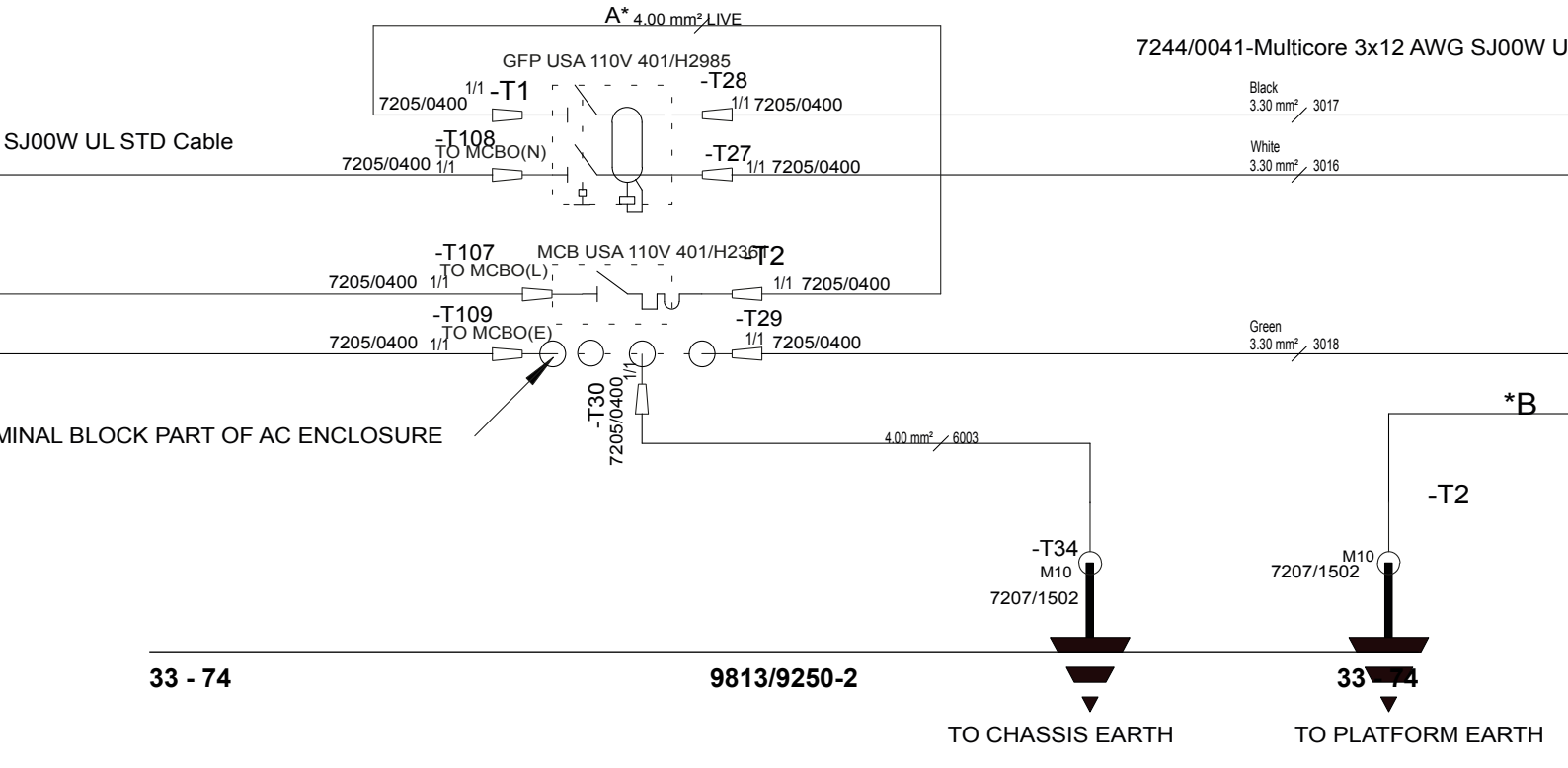


Figure 306. 401/T6225 Issue-8 (Sheet 19 of 22) - Power to Platform AC230V

	4	5	

AC 230V EUROPEAN SPEC

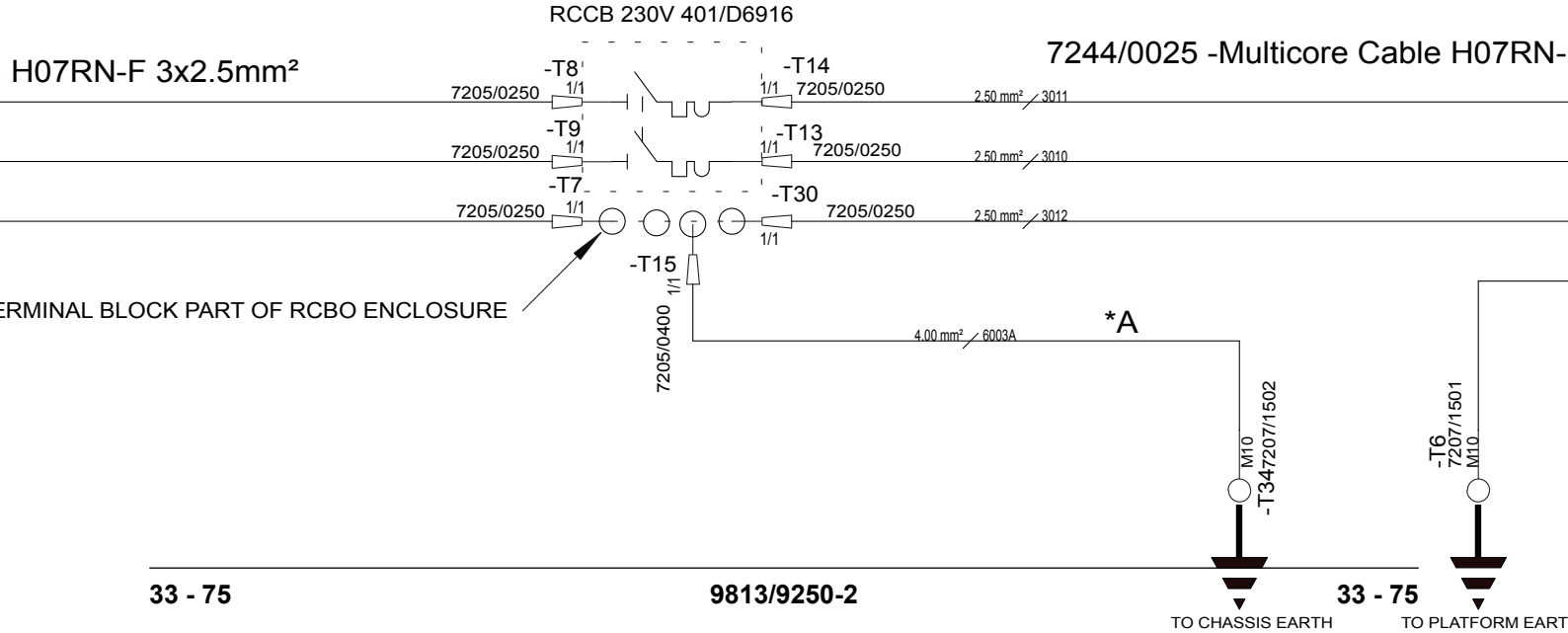


Figure 307. 401/T6225 Issue-8 (Sheet 20 of 22) - Turntable Platform and Worklights Cable

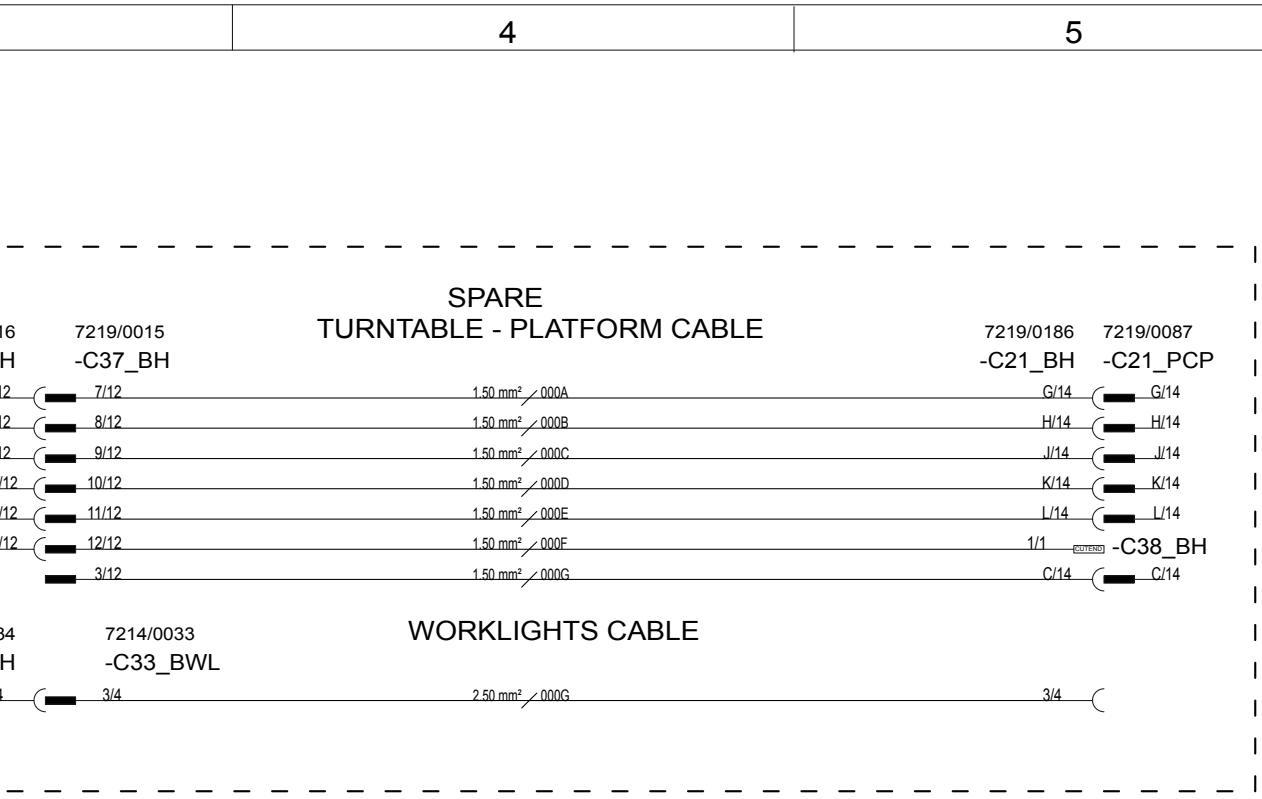
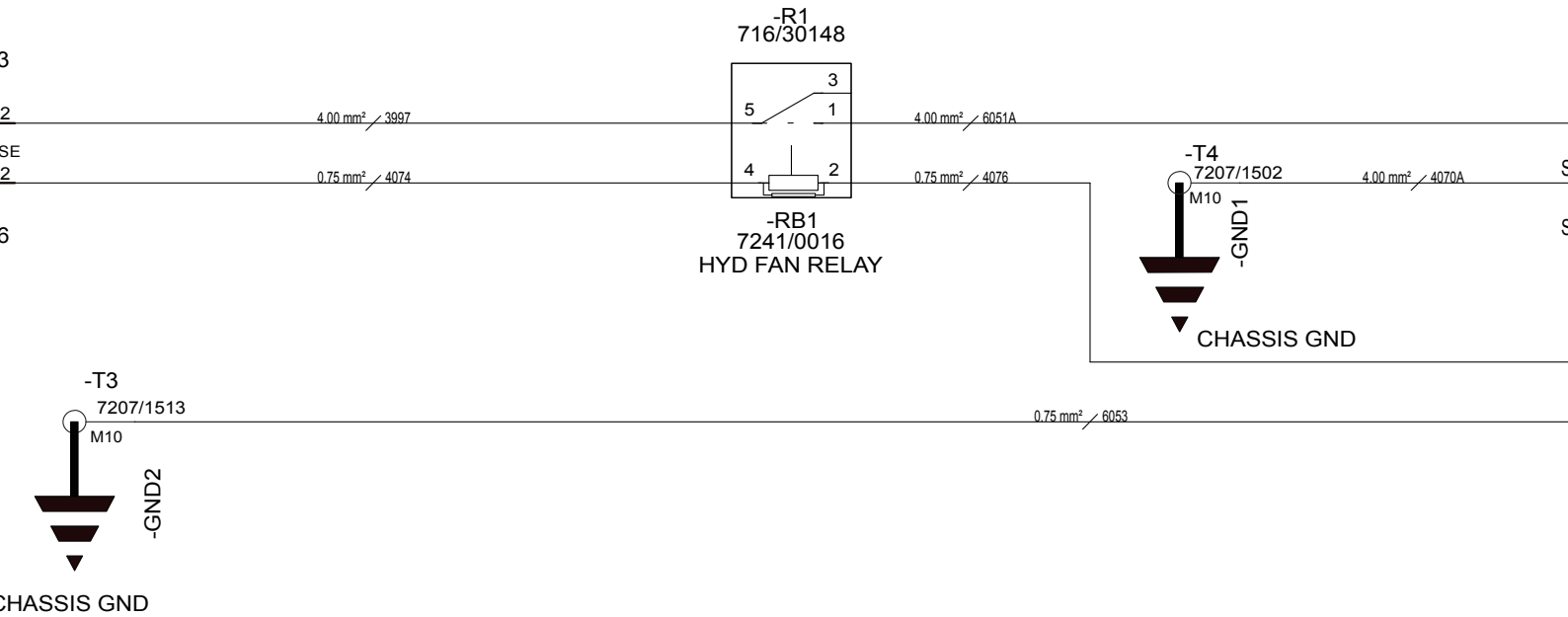


Figure 308. 401/T6225 Issue-8 (Sheet 22 of 22) - Hydraulic Oil Cooler (Optional)

	4	5	

HIS IS APPLICABLE FOR INDIA & MIDDLE EAST.
RID HEATER NOT TO BE FITTED WHEN THIS IS FITTED



90 - Earth Point

Component Identification

Figure 309. Turntable Earth Points

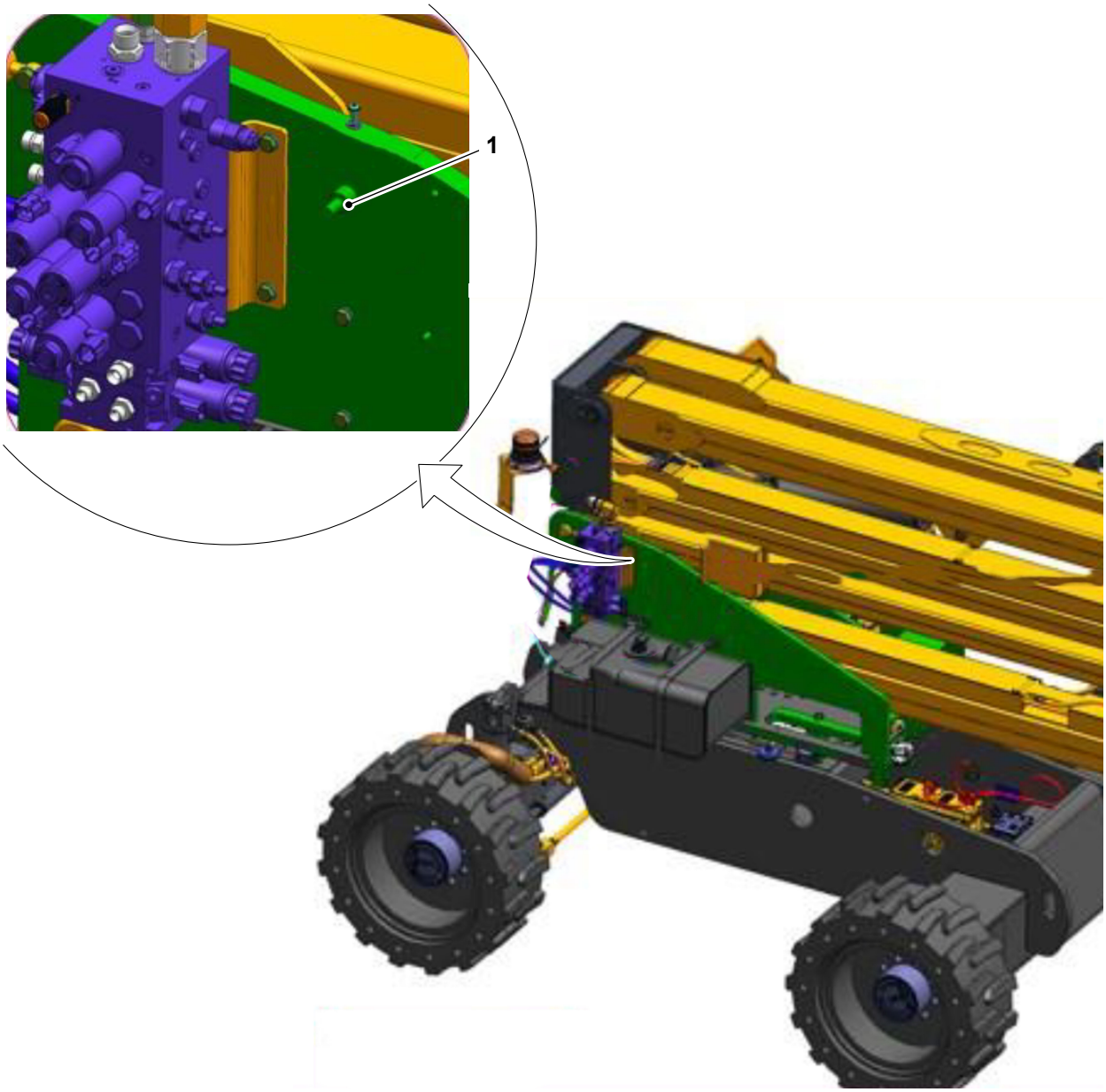


Figure 310. Turntable Earth Points

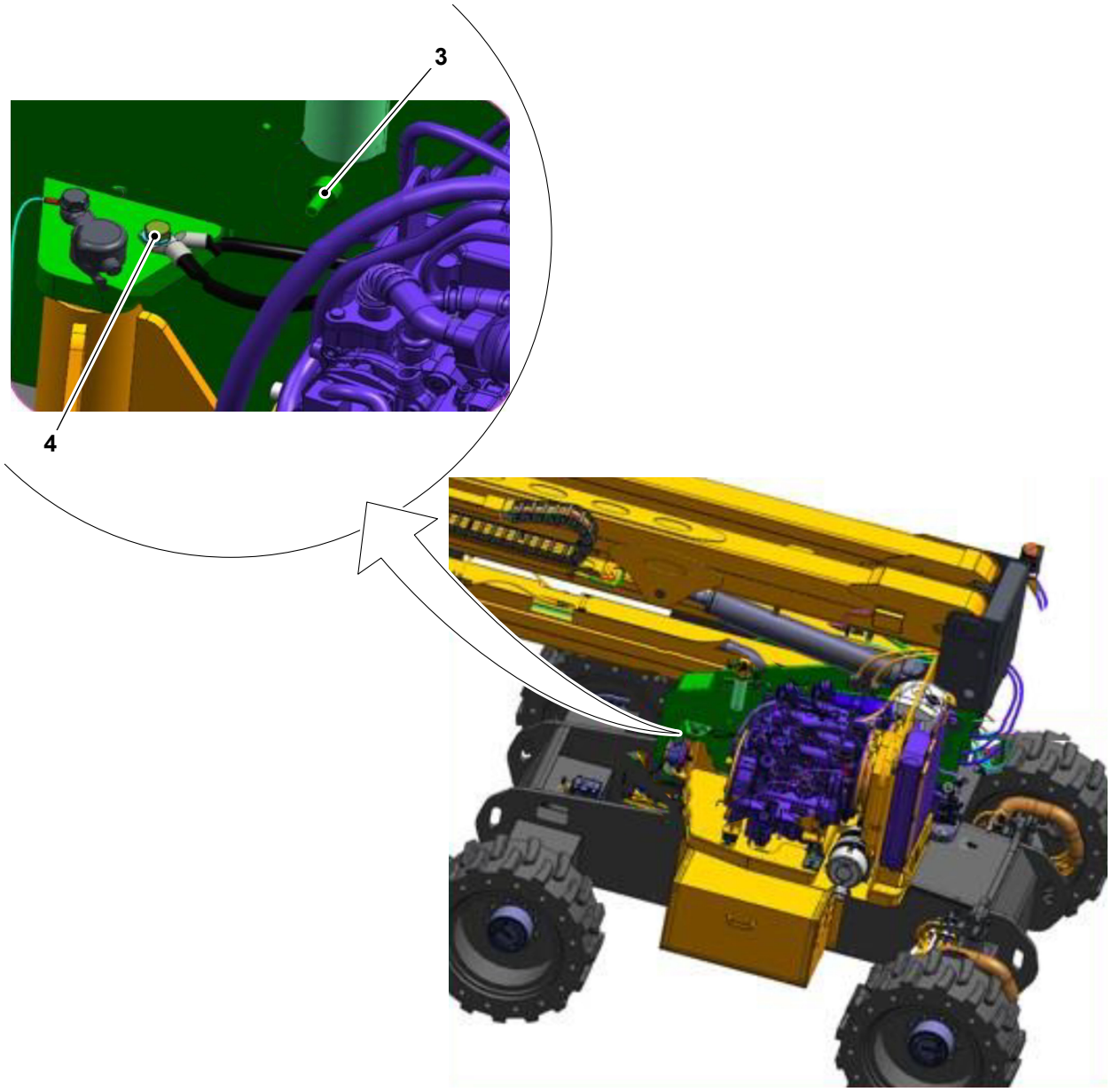


Figure 311. Chassis Earth Points

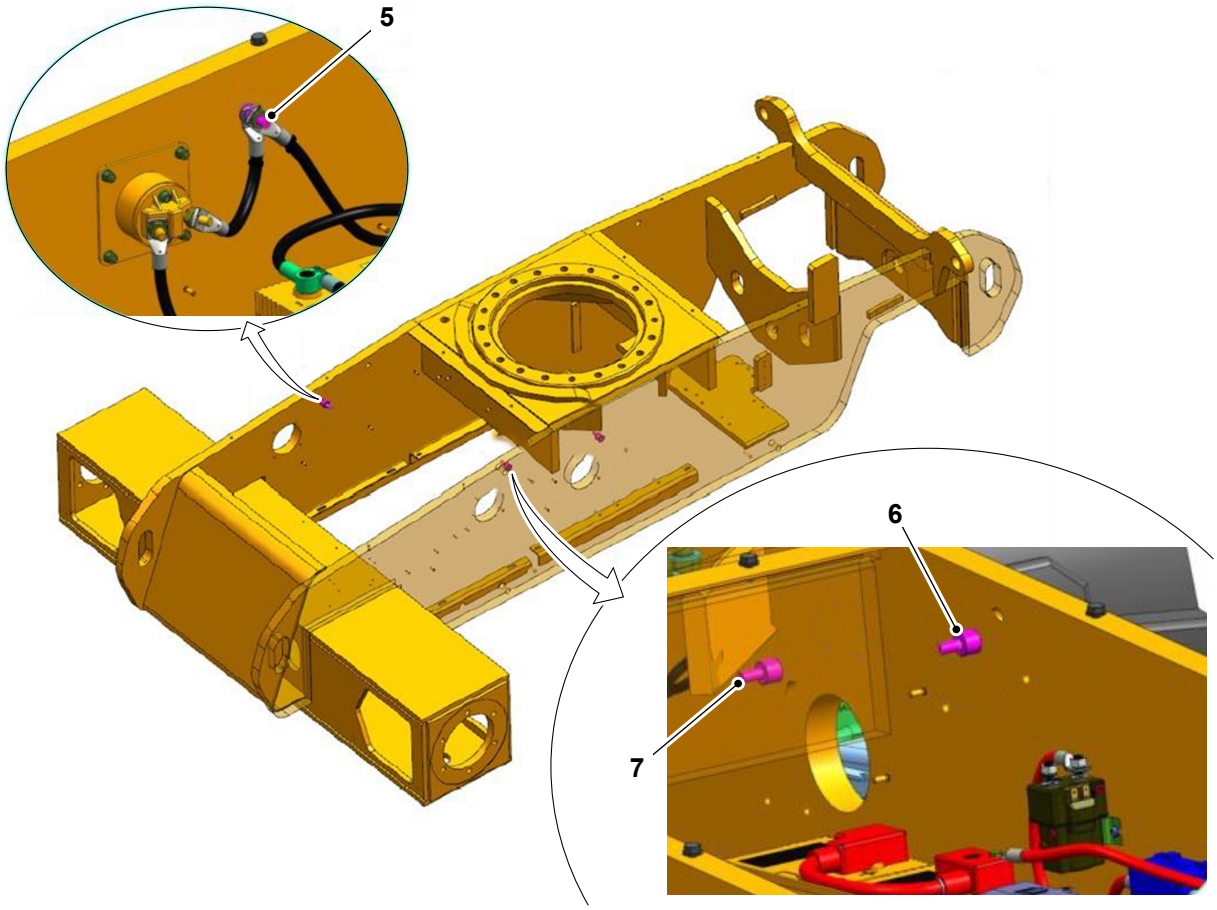
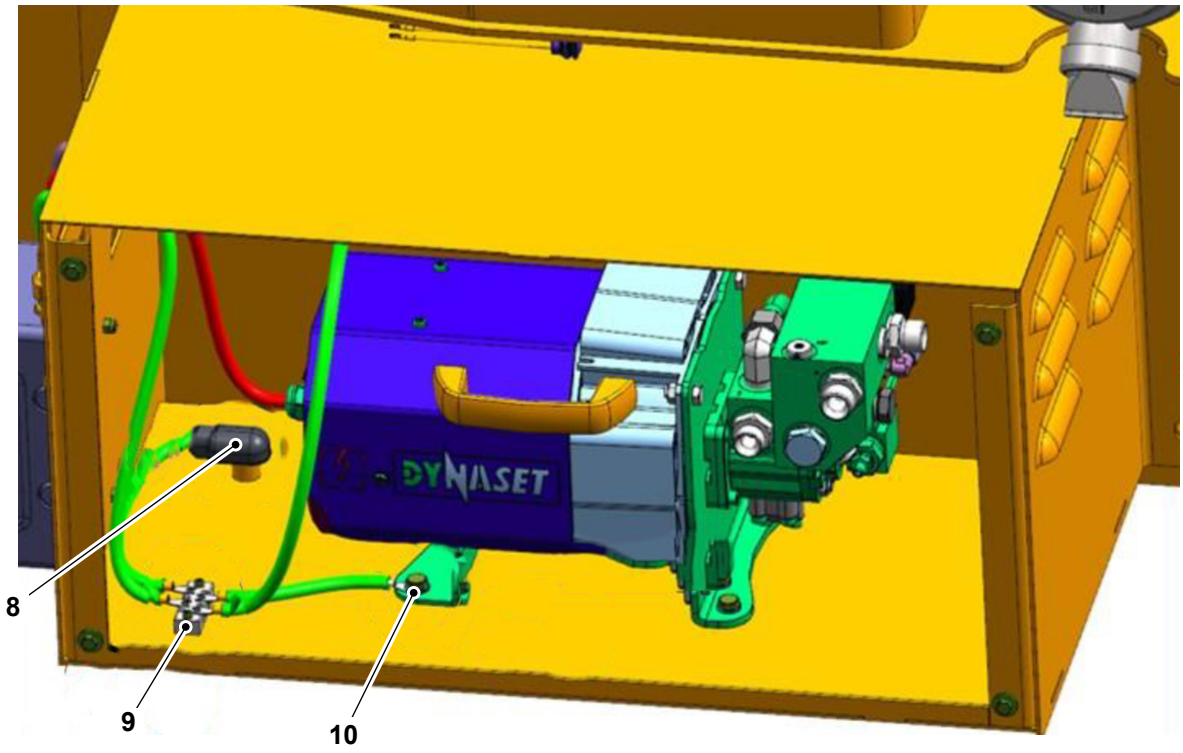


Figure 312. Hydraulic Generator Box Earth Points



03 - Battery

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00 - General

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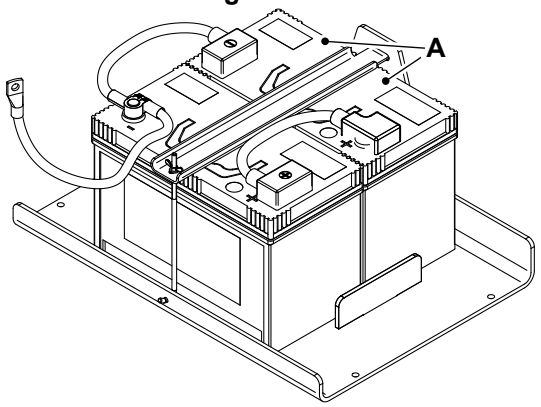
Introduction

This machine is installed with two 12V batteries, connected in parallel. These are low maintenance batteries. Just need periodic visual inspection of battery condition indicator.

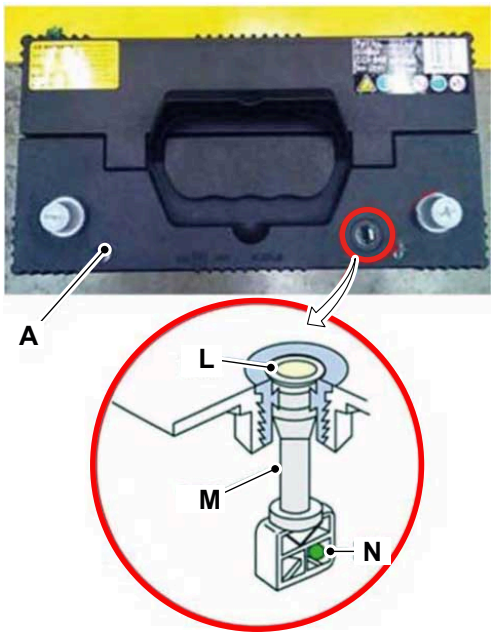
Figure 313.



A Battery

Make a note that shorter maintenance intervals are required if the machine is operating at high ambient temperatures or continuously for long periods. The battery must be replaced immediately when you observe the sight glass changes to a white colour.

Figure 314.



A Battery
L Slight glass
M Plastic tube
N Green ball

The sight glass works on the same principle as a hydrometer with a small coloured ball on top of a prism. When the specific gravity is high the ball sits

on top of the prism, as the gravity becomes lower then the ball slips down one of the sides of the prism. The colour is magnified up to the top glass dependant on the position of the ball.

Table 145. Sight Glass Colour Code

Colour	Symptom
Green	OK
Black	Battery requires charging
White	Battery requires replacement

Maintenance

To make sure that the battery provides optimum performance the following steps should be observed:

- Make sure that the electrical connections are clean and tight. Smear petroleum jelly on connectors to prevent corrosion.
- When applicable - never allow the electrolyte level to fall below the recommended level of 6mm above the plates. Use only distilled water for topping up.
- Keep the battery at least three quarters charged, otherwise the plates may become sulphated (hardened) - this condition makes recharging the battery very difficult.

Extra precautions must be taken when bench charging maintenance free batteries, they are more prone to damage by overcharging than the standard type of battery:

- Never boost charge a maintenance free battery (if installed).
- Never charge a battery at a voltage in excess of 15.8V.
- Never continue to charge a battery after it begins to gas.

Quiescent Current Drain

If the machine has no permanently live circuits there should be zero quiescent current drain, when the key-switch is off and all the lights are switched off.

It should be noted that some permanently live circuits will place a quiescent drain on the battery. Typically the quiescent drain will be in the range of 10–20 mA. If the quiescent drain measures 40 mA or more, there is a problem with the wiring insulation or the accessories, if the fault is not rectified it will continue to drain the battery.

Health and Safety

⚠ **DANGER** Batteries give off an explosive gas. Do not smoke when handling or working on the battery. Keep the battery away from sparks and flames.

Battery electrolyte contains sulphuric acid. It can burn you if it touches your skin or eyes. Wear goggles. Handle the battery carefully to prevent spillage. Keep metallic items (watches, rings, zips etc) away from the battery terminals. Such items could short the terminals and burn you.

Set all switches to off before disconnecting and connecting the battery. When disconnecting the battery, take off the earth (-) lead first.

Re-charge the battery away from the machine, in a well ventilated area. Switch the charging circuit off before connecting or disconnecting the battery. When you have installed the battery in the machine, wait 5 min before connecting it up.

When reconnecting, attach the positive (+) lead first.

WARNING Keep metal watch straps and any metal fasteners on your clothes, clear of the positive (+) battery terminal. Such items can short between the terminal and nearby metal work. If it happens you can get burned.

WARNING Battery electrolyte is toxic and corrosive. Do not breathe the gases given off by the battery. Keep the electrolyte away from your clothes, skin, mouth and eyes. Wear safety glasses.

WARNING Do not top the battery up with acid. The electrolyte could boil out and burn you.

CAUTION Understand the electrical circuit before connecting or disconnecting an electrical component. A wrong connection can cause injury and/or damage.

Notice: Do not disconnect the battery while the engine is running, otherwise the electrical circuits may be damaged.

CAUTION The machine is negatively earthed. Always connect the negative pole of the battery to earth.

When connecting the battery, connect the earth (-) lead last.

When disconnecting the battery, disconnect the earth (-) lead first.

DANGER If you try to charge a frozen battery, or jump start and run the engine, the battery could explode. Do not use a battery if its electrolyte is frozen. To prevent the battery electrolyte from freezing, keep the battery at full charge.

CAUTION Damaged or spent batteries and any residue from fires or spillage must be put in a

suitable closed receptacle and must be disposed of in accordance with local environmental waste regulations.

Notice: Before carrying out arc welding on the machine, disconnect the battery and alternator to protect the circuits and components. The battery must still be disconnected even if a battery isolator is installed.

Fault-Finding

The most obvious sign of a battery problem is a machine not being able to start. However, because the battery is part of a larger electrical system connected to other parts of the machine, a flat battery may indicate another problem.
If something else is going wrong in the electrical system, for example, a weak alternator, corrosion or loose connections, cold weather starting, electrical equipment being left on without the engine running, interrogate the cause of the problem.
The best way to test the condition of the battery is with an electronic battery tester. Refer to Battery-Check Condition.
When the machine is not in use, make sure that the electrical system is not causing a drain on the battery. On machines with electronically controlled engines check the operation of the power hold relay. Refer to PIL 33-09-06.

Disconnect and Connect

⚠ **Notice:** Before you install a pair of batteries to a machine, make sure you know the machines voltage. Some machines require two batteries but have a 12 V electrical system. This means the batteries need to be connected in parallel.

For 24 V machines, the batteries must be connected in series. Incorrect voltage may result in serious damage to the electrical system.

The illustrations show typical battery connections. The actual battery connections installed on your machine may look different.

Make sure you connect the batteries correctly for your machine.

Disconnect

1. Make the machine safe.

   Refer to: Introduction (PIL 01-03-27).

2. Get access to the battery or batteries (depending on the specification of your machine). The actual installation on your machine may vary from those shown below.
3. If the machine has a battery isolator, move the switch to the OFF position, then remove the key.
4. Disconnect the battery negative lead first.
5. Disconnect the battery positive lead and store away from the batteries.
6. Disconnect and remove the battery link lead or leads.

Figure 315. Parallel and Series Connection (Example)

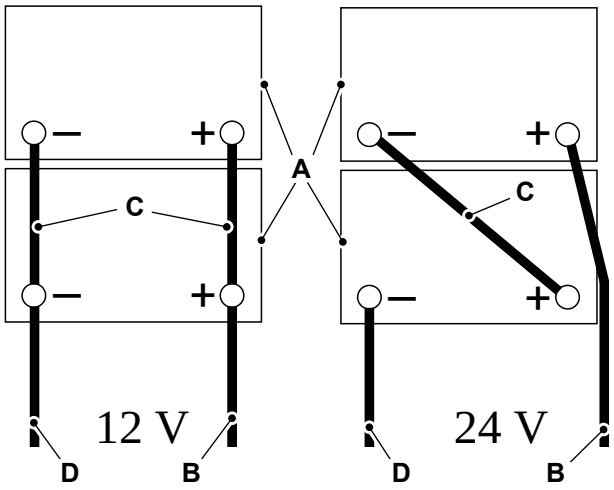
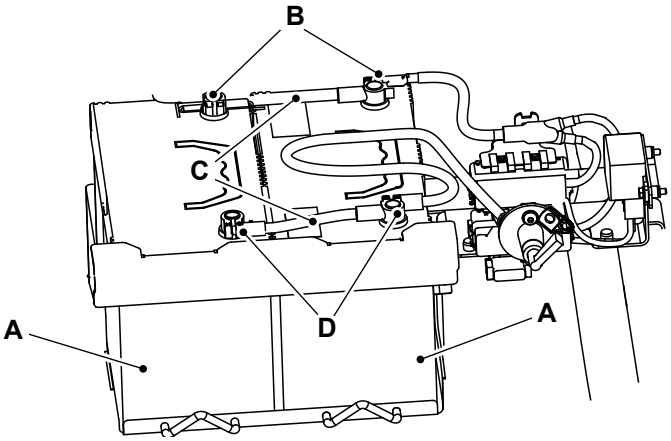
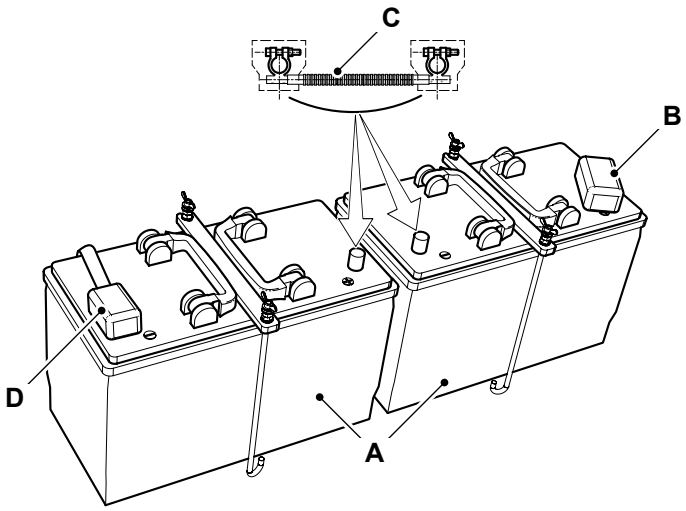


Figure 316. Twin Battery 12V Machines- Parallel Connection (Example)



A Battery
B Positive lead
C Battery link lead
D Negative lead

Figure 317. 24 Volt Machines- Series Connection (Example)



A Battery
B Positive lead
C Battery link lead
D Negative lead

Connect

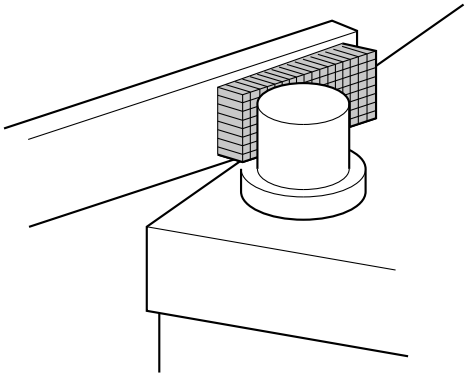
1. Check the battery as follows:

   1.1. If any terminals are dirty, clean them.

   1.2. If the terminal is corroded and has white powder, wash the terminal with hot water. Make sure the water does not enter the battery cells.

   1.3. If considerable corrosion is found, then clean with a wire brush or abrasive paper. Make sure you use eye and hand protection. Refer to Figure 318.

Figure 318.



   1.4. After cleaning, apply a thin coat of petroleum jelly to the terminals.

2. Connect the leads.

   2.1. For single battery machines, connect the positive lead then the negative lead.

   2.2. For twin battery machines, first connect the link lead or leads, then the positive terminal, and finally the negative terminal.

3. If the machine has a battery isolator, move the switch to the ON position.

4. Close and lock the access panels.

Check (Condition)

Special Tools

Description	Part No.	Qty.
Battery Tester	400/G9956	1

Introduction

As of July 2019, this procedure must be used for all battery warranty claims. This procedure provides details on the new battery warranty claim criteria and details of how to test the batteries with the new battery tester kit.

To allow for the effective processing of battery warranty claims you must complete the battery test procedure specified in this document before you submit a warranty claim and in the event of claim submission, all the supporting criteria detailed in this procedure for approval should be made available.

Figure 319.

A Battery Tester Kit

Important Information.

- Any claims submitted without all the required criteria to support may be declined.
- All monthly test receipts and machine delivery test receipt should be kept with the machine or vehicle records and should be able to be evidenced in the event of a battery claim submission.

Battery Warranty Claim Adjudication.

Batteries are only warranted against the defects due to faulty workmanship or materials. Battery failures due to poor maintenance or a consequence of other electrical issues on the machine are not separately claimable.

Note that damaged and leaking batteries are not considered as warrantable defects as such defects do not arise from faulty materials or workmanship. Claims must not be submitted if those are the identified defects. Such claims will get declined.

Batteries must only be returned to JCB Service when requested by the warranty adjudicator.

Important: Any claims submitted without all the below criteria may get declined.

Battery Claim Criteria.

- Images of the machine and battery
- Images of the battery test receipt deeming a 'failed' battery
- Images of the battery test receipt at delivery
- Images of monthly stock check health receipts.

All the criteria should be compiled using the attachment to bulletin (W228) and the pdf attached to the claim.

Battery Maintenance.

Batteries in stock require periodic checking and maintenance, whether on the shelf or in stock.

Dealer Lay-up.

- Upon arrival at your dealership, all machines must have their battery condition checked. The battery must be tested as per this battery test procedure. On the printed test receipt, write the machine serial number, date and sign.
- Important: As best practice for all machines, as of July 2019, the battery test receipt at point of delivery should be retained, even after machine retail.
- Machines in stock must have their batteries tested on a monthly basis. The battery must be tested as per this procedure. On the printed test receipt, write the machine serial number, date and sign.
- If the result deems recharge is required, the battery should be recharged and retested to show successful recharge. Again, on the printed test receipt, write the machine serial number, date and sign.

Important: All monthly battery test receipts should be kept with the machine or vehicle records and should be able to be evidenced in the event of a battery claim submission.

- If a battery is on a machine which is not going to be used for more than one month, it should be disconnected from the machine (Isolated or physically disconnected). Machines have electrical accessories which can slowly discharge the battery even when the ignition key has been removed.

Battery Stock Lay-up.

- Battery stock should be rotated (First in first out - FIFO) to make sure that the customer receives a good quality battery.
- The open circuit voltage of stock batteries should be checked every month (with the use of a digital voltmeter) and the voltage recorded on a ticket (date and voltage and signed) attached to the battery. The results of the test should be retained (by the dealer) upon battery retail for the duration of the battery warranty.
- If a stock battery has a voltage below 12.5V, a fresh recharge must be conducted.
- The battery condition must be checked before hand-over to the customer to make sure that its voltage is 12.5V or more.

Battery Test Procedure.

Note: All images are shown as examples. Some machines may require panels to be removed to get access to the battery. Refer to the respective service manual for information on the machine specific battery location to access.

All details on the battery test procedure can also be found in the battery test kit owner's manual. The engineer who completed this test must be familiar with the kit functionality and features.

The engineer who will carry out the procedure must have completed the JCB basic electrics training course to complete this procedure. They must be fully conversant in battery testing, a function of operation and battery lifting/handling.

1. Locate the negative terminal on the battery and identify the terminal by its symbol ('-'). Refer to Figure 320.

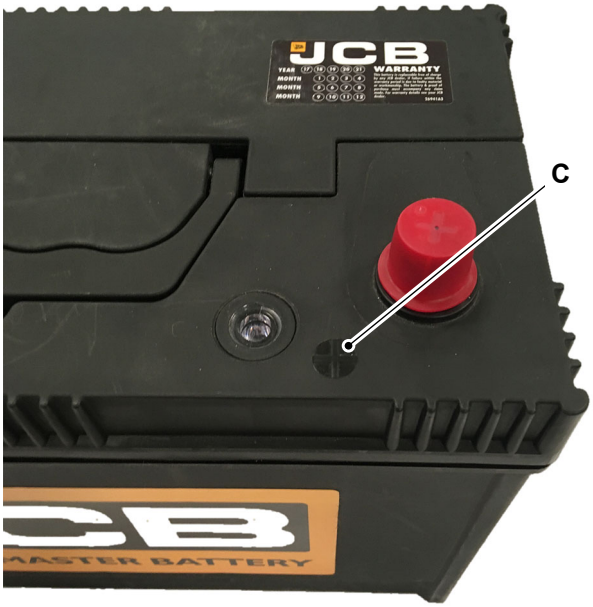
Figure 320.

B Negative battery-terminal identification

2. Connect the black clamp from the testing kit to the negative terminal. Make sure that the clamp is fully secured. Refer to Figure 322.

3. Locate the positive terminal on the battery and identify the terminal by its symbol ('+'). Refer to Figure 321.

Figure 321.



C Positive battery-terminal identification

4. Connect the red clamp from the testing kit to the positive terminal. Make sure that the clamp is fully secured. Refer to Figure 322.

Special Tool: Battery Tester (Qty.: 1)

Figure 322.

D Black clamp
E Red clamp

5. The display of the battery tester will light up when both cables are connected to the battery.

   5.1. If the cables have not been connected to the battery correctly, the test kit will recognise this and ask you to reconnect. Refer to Figure 323. Refer to Figure 324.

Figure 323.

Figure 324.

6. Press the 'Forward' or 'Back' button to select 'BATTERY TEST'.Refer to Figure 325.

Figure 325.

7. Press the 'Enter' button to proceed. Refer to Figure 326.

Figure 326.

8. Select the machine battery type. The JCB batteries are ‘Flooded’. Move through the different types using the forward or back arrow buttons. Once selected press ‘Enter’. Note: This procedure does not apply to 48V electric machines.

9. Select 'SAE' for the rating option and press ‘Enter’.

Figure 327.

10. Set the battery capacity. Refer to Figure 330. This can be found on the battery labelled as ‘CCA SAE’. Refer to Figure 328. Refer to Figure 329.

    10.1. Press and hold the ‘Forward’ button until the desired value is selected and press ‘Enter’.

Figure 328.

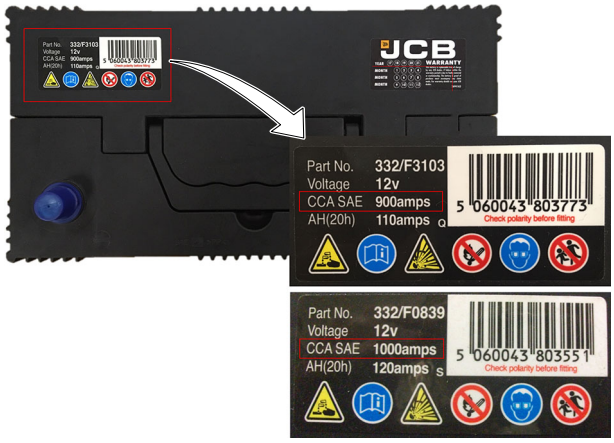


Figure 329.

Figure 330.

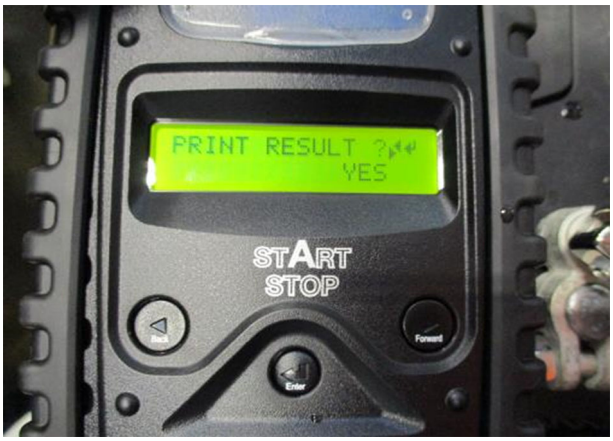
11. The battery tester will now perform the test. Once completed, the result will display on the screen. Refer to Table 146.

12. To print the test result, press the 'Enter' button. It will first display the battery resistance. Refer to Figure 331.

Figure 331.

13. Press 'Enter' again, and it will ask 'PRINT RESULT?'. Press the 'forward' button to display 'YES' and press 'Enter'. Refer to Figure 332.

Figure 332.



14. The battery tester should now print the test result. Refer to Figure 333.

Figure 333.

Table 146.

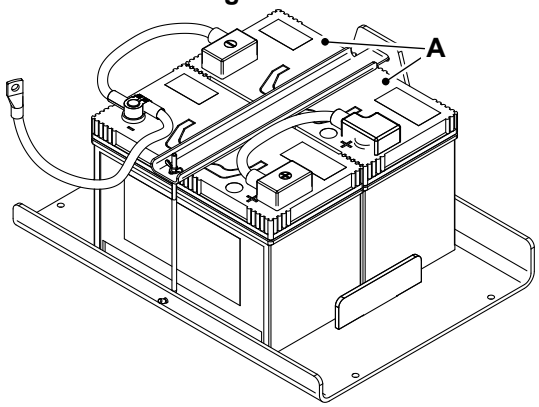
Results	Description
GOOD and PASS	The battery is good and capable of holding charge.
GOOD and RECHARGE	The battery is good but needs to be recharged.
RECHARGE and RETEST	The battery is discharged. The battery condition cannot be determined until it is fully charged. Recharge and retest the battery.
BAD and REPLACE	The battery will not hold a charge. It should be replaced immediately.
BAD CELLS and REPLACE	The battery will not hold a charge. It should be replaced immediately.

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Obey all battery health and safety information.
   Refer to: Health and Safety (PIL 33-03-00).
3. Open the battery compartment cover.
   Refer to: Open and Close (PIL 06-06-03).
4. Disconnect the batteries.
   Refer to: Disconnect and Connect (PIL 33-03-00).
5. Carefully lift the battery out of the machine.
   5.1. Never lift the battery at the terminals, only lift the battery at the handles.
6. If required, remove the battery isolator.
   Refer to: Remove and Install (PIL 33-03-03).

Figure 334.



A Batteries

Install

1. The installation procedure is the opposite of the removal procedure.
2. Connect the batteries in correct sequence.
   Refer to: Disconnect and Connect (PIL 33-03-00).

03 - Isolator Switch

Disconnect and Connect 33-95
Remove and Install 33-96

Disconnect and Connect

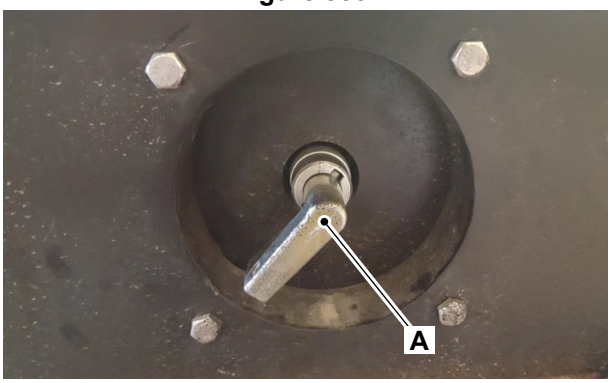
⚠ **Notice:** Before carrying out arc welding on the machine, disconnect the battery and alternator to protect the circuits and components. The battery must still be disconnected even if a battery isolator is installed.

Notice: Do not isolate the machine electrics when the engine is running, this may cause damage to the machine electrics.

To allow the engine ECU (Electronic Control Unit) to shutdown correctly, you must wait 30s before you isolate the battery. The 30s period starts when you turn the ignition off.

In the event of an incomplete power down an error will be displayed the next time the engine is started. To clear the errors, turn the ignition off and wait 30s, this should clear the error.

Figure 335.



A Battery isolator

Disconnect the Machine Electrics:

1. Turn the ignition key to the off position.
2. Wait for the engine ECU to shutdown correctly.
   Duration: 30s
3. Get access to the battery isolator.
4. Turn the battery isolator key in a anticlockwise direction and remove.

Connect the Machine Electrics:

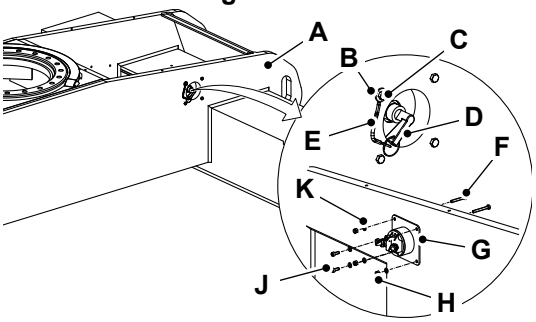
1. Make sure the ignition is switched off.
2. Insert the battery isolator key and turn in a clockwise direction.

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Open the battery compartment cover.
   Refer to: PIL 06-06-03.
3. Disconnect the battery cable and turntable harness.
4. Remove the setscrew 1, washer 1, lanyard, setscrew 2 (x3), washer 2 (x4) and lock nut (x4).
5. Remove the isolator mounting from the chassis.
6. Remove the capscrew (x2), washer 2 (x2) and isolator switch from the isolator mounting.

Figure 336.



A Chassis
B Washer 1
C Setscrew 1
D Battery isolator switch
E Lanyard
F Setscrew 2 (x3)
G Isolator mounting
H Lock nut (x4)
J Capscrew (x2)
K Washer 2 (x6)

Install

1. The installation procedure is the opposite of the removal procedure.
2. Torque tighten the setscrew 1, setscrew 2 and capscrew to correct torque values.
   Refer to: PIL 72-03-00.

09 - Power Distribution

Contents **Page No.**

33-09-03 Fuse 33-99
33-09-06 Relay 33-102

Notes:

03 - Fuse

Technical Data

Primary Fuses

Table 147.

Fuse	Rating
Main primary fuse	80A
Electronic motor primary fuse	200A
Grid heater primary fuse	50A

Secondary Fuses

Figure 337. Base Control Fuses

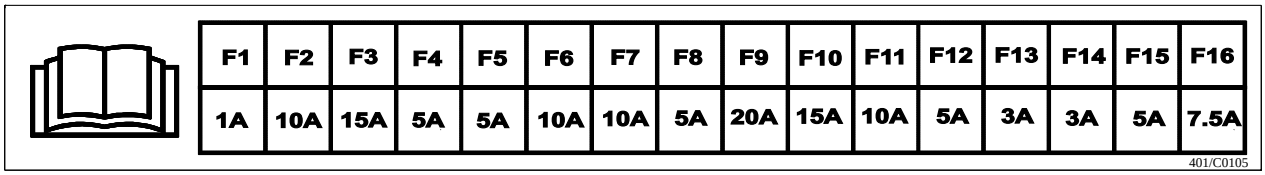


Table 148.

Fuse ID	Fuse	Rating
F1	Ignition fuse	1A
F2	Base E-stop, horn relay and diagnostic connector	10A
F3	Bosch ECU (Electronic Control Unit) base	15A
F4	Platform weight sensor and tilt sensor	5A
F5	Display and axle lock pressure sensor	5A
F6	Bosch ECU platform supply	10A
F7	Bosch ECU platform supply	10A
F8	Bosch ECU base supply	5A
F9	Engine PODBOX power hold	20A
F10	Engine PODBOX starter relay	15A
F11	Worklight (optional)	10A
F12	Engine run signal for telematics and Bosch ECU base	5A
F13	Livelink	3A
F14	Display	3A
F15	Engine PODBOX power hold coil	5A
F16	Key switch	7.5A

Figure 338. PODBOX Fuses

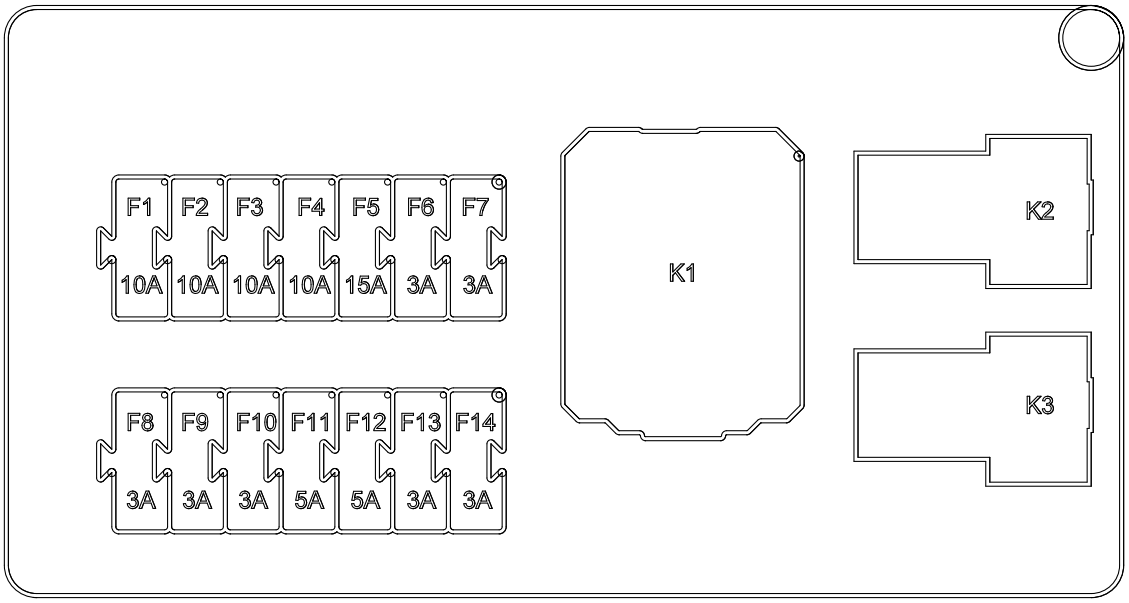


Table 149.

Fuse ID	Fuse	Rating
F1	Engine ECU switched battery	10A
F2	Engine ECU switched battery	10A
F3	Engine ECU switched battery	10A
F4	Fuel pump power feed	10A
F5	Fuel pump power feed	15A
F6	Engine ECU RTC feed	3A
F7	Voltage battery	3A
F8	Engine fan power	3A
F9	Fuel pump relay control signal	3A
F10	Starter motor solenoid signal output	3A
F11	Isolator relay	5A
F12	Grid heater relay coil signal	5A
F13	Front steer proxy	3A
F14	Washer and coolant relay switches	3A

Figure 339. Platform Control Fuse

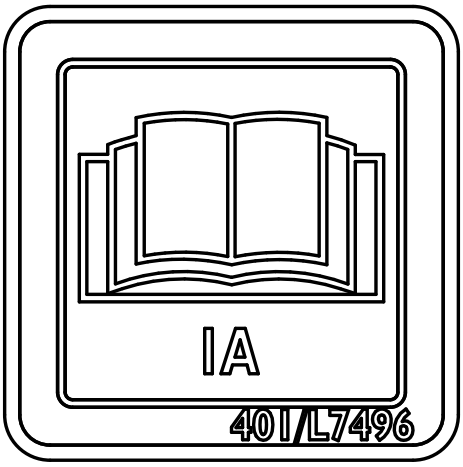


Table 150.

Fuse ID	Fuse	Rating
F1	Ignition feed fuse	1A

06 - Relay

Technical Data

Primary Relays

Table 151.

Description	Rating
Electric pump relay	150A
Grid heater relay	130A

Secondary Relays

Figure 340. Base Control Relays

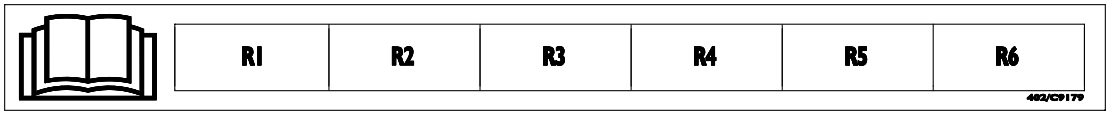


Table 152.

Relay ID	Description
R1	Ignition relay 1
R2	Ignition relay
R3	Ignition relay
R4	Ignition relay
R5	D+ relay
R6	Horn relay

Rating
40A
40A

Figure 341. PODBOX Relays

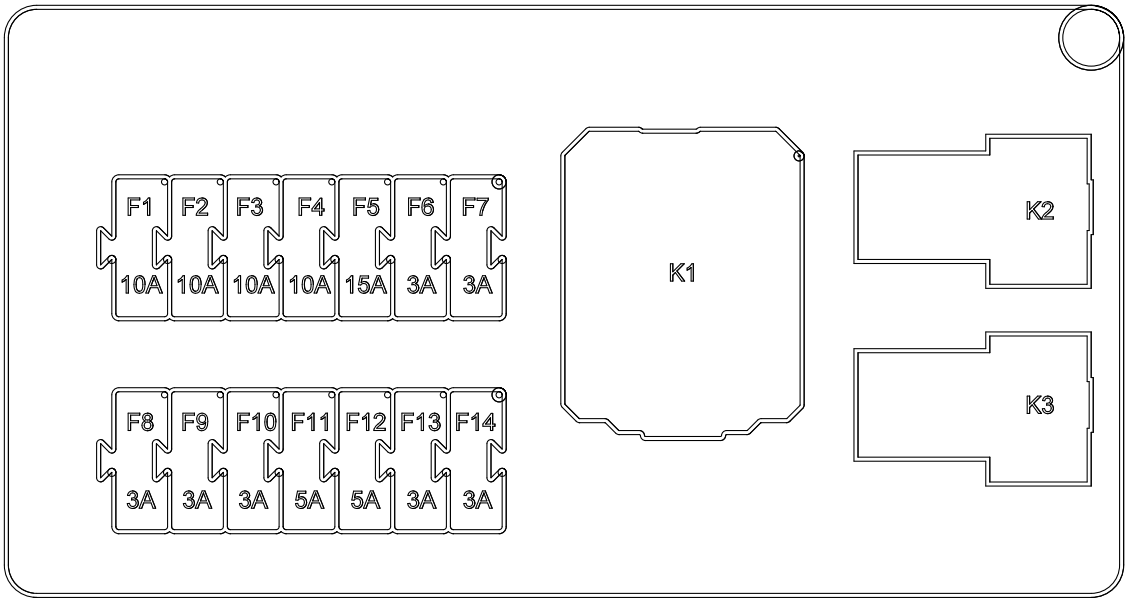
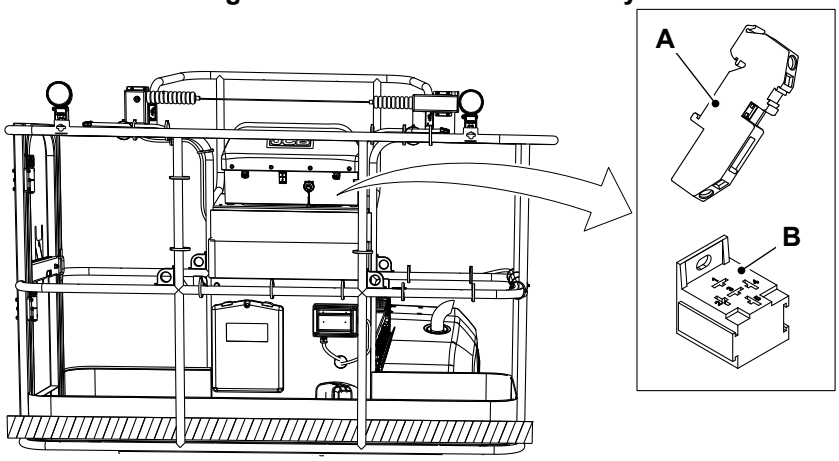


Table 153.

Relay ID	Description	Rating
K1	Power hold relay	40A
K2	Starter relay	20A
K3	Fuel pump relay	20A

Figure 342. Platform Control Relay



A Platform control fuse

B Platform control relay

Table 154.

Relay ID	Description	Rating
R1	Platform buzzer relay	40A

10 - Motor

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Introduction

The electrical motor installed on this machine is a DC (Direct Current) motor. It is called the "Auxiliary motor" or "Pump motor". It is used for the emergency operation of the machine. The duty cycle of this motor is 2min duration. Do not use the emergency motor for more than the specified duration.

It is installed in the centre of the turntable, below the main boom.

The pump motor rotates in a clockwise direction (viewed from shaft end).

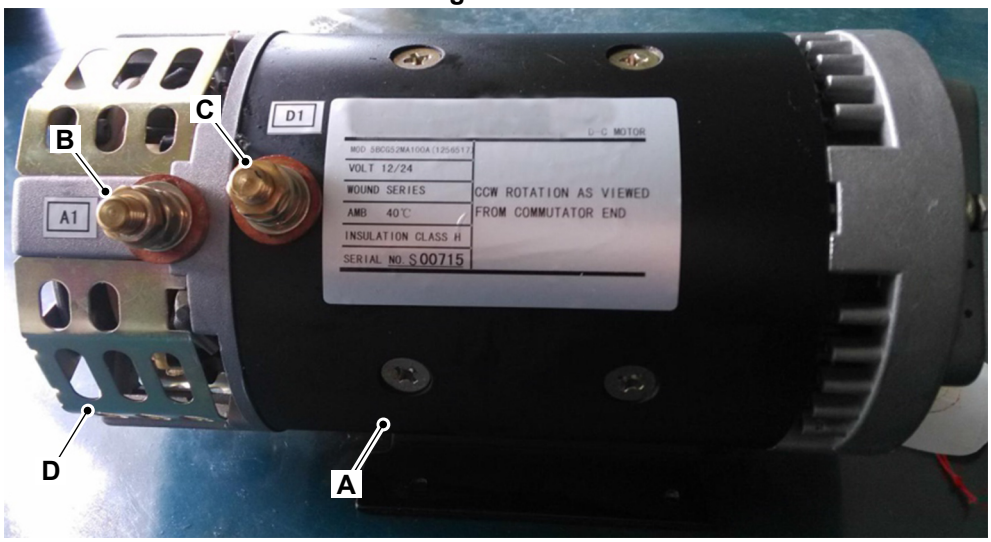
Technical Data

Table 155.

Description	Data
Power rating	3.3kW
Maximum voltage	24V
Rated current	180A
Rated speed	3050 RPM (Revolutions Per Minute)
Maximum speed	5600 RPM
Direction of rotation	Clockwise from the shaft end

Component Identification

Figure 343.



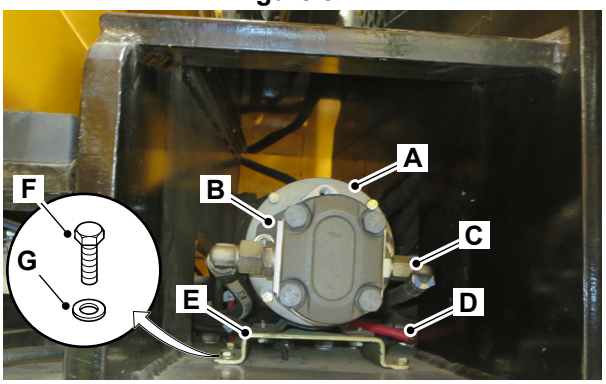
A Pump motor
B A1 terminal (Negative binding)
C D1 terminal (Positive binding)
D Commutator end

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Isolate the machine.
3. Disconnect the electrical connections from the motor.
4. Disconnect the hydraulic hoses from the pump.
5. Put a label on the hoses to help installation.
6. Plug all the open ports and hoses to prevent contamination.
7. Remove the bolt (x4) and washer.
8. Remove the motor, pump and bracket as an assembly from the machine.
9. If necessary, remove the pump from the motor.
   Refer to: Remove and Install (PIL 30-11-00).

Figure 344.



A Motor
B Pump
C Hydraulic hose
D Electrical connections
E Bracket
F Bolt (x4)
G Washer

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Tighten the bolt (x4) to the correct torque value.

Table 156. Torque Values

Item	Nm
F	9

12 - Harness

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Introduction

Harness Drawings

Drawings are reproduced from production electrical harness drawings. Each harness drawing includes tables showing wire connections and destinations for all the connectors on the harness. To identify the correct harness drawing for a particular machine refer to the relevant Harness Interconnection page for the machine serial number range.

Health and Safety

⚠ **Notice:** When installing auxiliary electrical components always ensure that the additional load rating is suitable for that particular circuit. It is unacceptable to simply increase the fuse rating as this can cause overloading and consequential failure of wiring, along with failure of integral circuit components, which the fuse is protecting.

Harness Repair (Butane Heater)

⚠ **WARNING** In addition to the warnings incorporated into this procedure, extreme care should be taken when handling the gas heating tool to ensure that the flame does not damage or set fire to any items in the vicinity of the repair, i.e. other wires, floor panels, floor mats, sound proofing, paintwork, etc. This tool should not be used in any restricted location prohibiting the use of "Naked Flames" or where risk of explosive gas or similar safety parameters apply. No other heat source should be used to attempt a sealed joint.

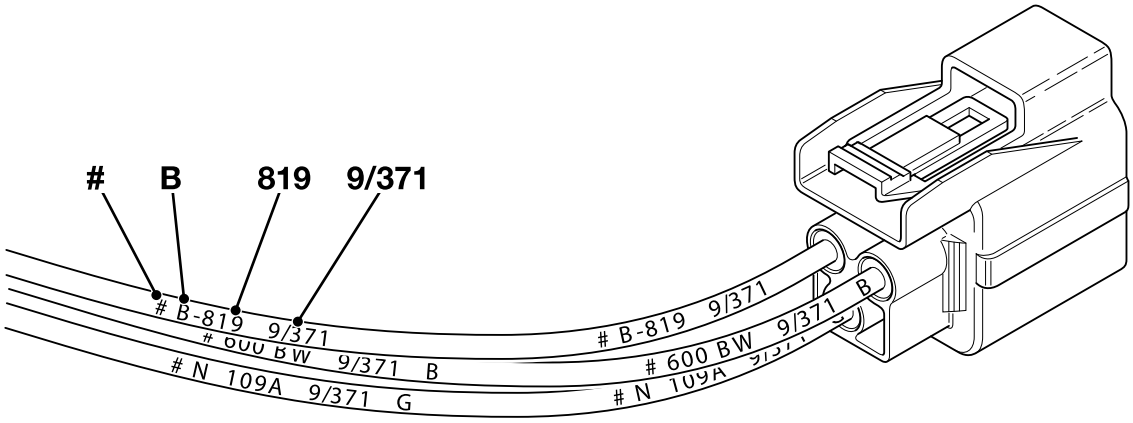
CAUTION When the heater is in use, the reflector and the air coming out are extremely hot. Keep away to avoid accidental burns. Do not touch the reflector until it has had time to cool down after switching off. If flame reappears at the reflector when the heater is in use, the catalytic element is damaged or used up. Stop work immediately and replace the heater.

Component Identification

Wire and Harness Number Identification

This section details the allocation of wire numbers and the identification of wires in the wiring harness.

Figure 345.



The illustration shows a typical connector and wires. Each wire has an individual identification number permanently marked on it, at regular intervals along it's length. The number stamped on the wire identifies the following:

Table 157. Wire and Harness Number Identification

Identification Number	Description
#	The # indicates the start of the identification number. It is always printed to the left of the identification number.
B	If applicable - The colour of the flying lead that the harness wire should mate with. For instance, if wire 819 from harness 719/37100 mated with a flying lead coloured black (colour code B) then the number printed on the wire would be B-819 9/371.
819	The wire's unique identification number. The wire functions and numbers allocated to them are consistent through out the JCB range of products. Refer to Wire Numbers and Functions.
9/371	If applicable - The part number of the harness that the wire originates from. If the harness part number is 719/37100, the number printed on the harness wires will be 9/371 (71 and 00 are common numbers and therefore deleted).

Wire Numbers and Functions

Table 158. Wires 000-199, 1000-1999 (These numbers are reserved for ignition feeds, heater start circuits and start circuits)

Wire Number	Description
Wires 000 - 099	Unfused ignition feeds
Wires 100 - 199 and 1000 -1999	Fused ignition feeds (feeds via ignition relays are also classed as ignition feeds). Power supplies output by a control module.

Table 159. Wires 200-399, 2000-3999 (These numbers are reserved for battery feeds)

Wire Number	Description
Wires 200-299 and 2000-2999	Unfused battery feeds. Power supplies output by a control module.
Wires 300-399 and 3000-3999	Fused battery feeds. Power supplies output by a control module.

Table 160. Wires 400-599, 4000-5999

Wire Number	Description
Wires 400-599 and 4000-5999	These numbers are reserved for instruments, sensors and variable input/output signal wires used in electronic systems. CAN wires also use numbers in this series.

Table 161. Wires 600-799, 6000-7999

Wire Number	Description
Wires 600-799 and 6000-7999	These numbers are used for earth wires. When the number is printed on to a wire it is prefixed by the Earth symbol. This symbol is printed onto the wire, it may however be omitted from harness drawings. Where a load is switched negative, the wire number from the load to the switch shall be different to that of the wire from the switch to the earth.

Figure 346.

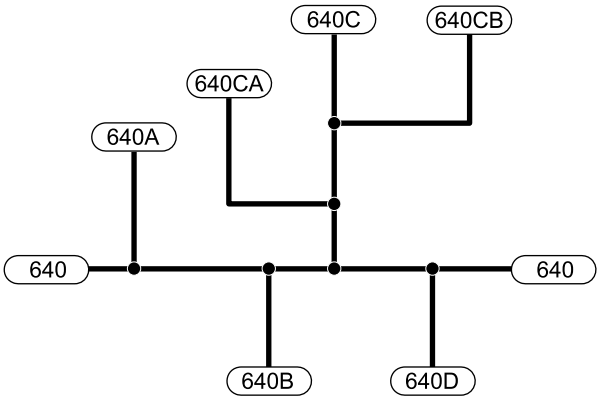
Table 162. Wires 800-999, 8000-9999

Wire Number	Description
Wires 800-999 and 8000-9999	These numbers are reserved for switched supplies to electrical loads, i.e. to lights, etc. Power supplies output by a control module.

Table 163. Wires In Splices

Wire Number	Description
Various	The main input wire is allocated with a wire number and a suitable description, i.e. Wire 640 earth splice to earth. The additional wires in the splice are allocated the same wire number and a postfix, i.e. 640A, 640B, etc.

Figure 347.



General Points

1. Wires continue to have the same number even after passing through a connector block to another harness.
2. The descriptions are applicable to JCB specification wiring harnesses. The machine may be installed with some wiring that does not conform to the JCB specifications, typically when it is part of equipment supplied by other manufacturers.

Diagram

A full set of harness drawings are available. Refer to: servicepro.jcb.com.

Repair

Special Tools

Description	Part No.	Qty.
Wiring Crimp Tool	892/00349	1
Butane Heater	892/00350	1

Consumables

Description	Part No.	Size
Wiring Splice (0.5-1.5mm Red, contains 50 off)	892/00351	-
Wiring Splice (1.5-2.5mm Blue, contains 50 off)	892/00352	-
Wiring Splice (3-6mm Yellow, contains 50 off)	892/00353	-
Wiring Splice-Bootlace (1mm Red)	7205/0100	-
Wiring Splice-Bootlace (2.5mm Grey)	7205/0250	-

Instances occur where it is necessary to incorporate auxiliary electrical components into existing electrical circuits and although unlikely with present wiring harnesses, repair or replace specific individual wires within a harness. This will also apply to other machines in addition to those of manufacture.

To make sure that either the inclusion of an auxiliary electrical component or a repair within a harness is completed to an acceptable standard it is strongly recommended that the following tools, equipment and procedures are always used.

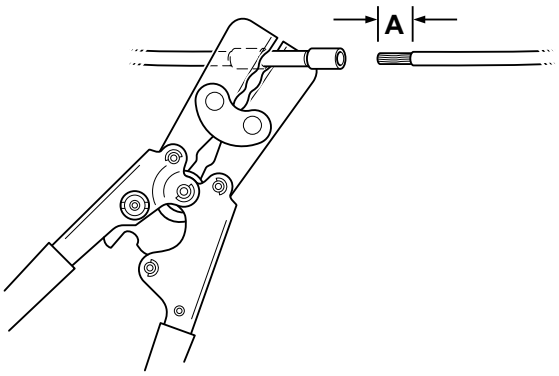
The sheath covering of the recommended splice is heat shrunk onto the original wire insulation. This results in a seal and corresponding joint to IP 67 specifications.

Procedure 1

1. Cut the wire and remove the protective insulation for a suitable distance dependent upon the size of wire and splice to be used.

   Special Tool: Wiring Crimp Tool (Qty.: 1)

Figure 348.



A Distance for splice (check size)

2. Using the correct sized splice, attach the new section of wire required or auxiliary flying lead to the existing harness and secure using the crimp tool. Note that each of the splices detailed is colour-coded to make size and range readily visible. They are secured using the corresponding size and matching colour-coded jaws of the crimp tool to ensure joint security. This tool also incorporates a ratchet closing mechanism which will not release until the splice is fully closed to the correct compression size.

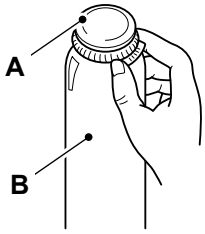
   Consumable: Wiring Splice (0.5-1.5mm Red, contains 50 off)
   Consumable: Wiring Splice (1.5-2.5mm Blue, contains 50 off)
   Consumable: Wiring Splice (3-6mm Yellow, contains 50 off)

3. With the Butane heater assembly, seal the connection.

   Special Tool: Butane Heater (Qty.: 1)

   3.1. Remove the cap from the end of the disposable gas cartridge.

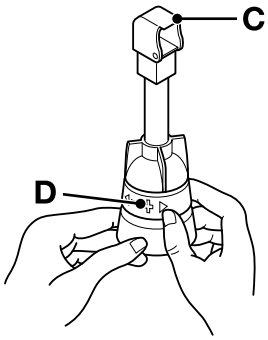
Figure 349.



A Cap
B Gas cartridge

   3.2. Before assembling the gas cartridge to the reflector element, turn the red ring to the left, (in the direction of the minus sign marked on the ring).

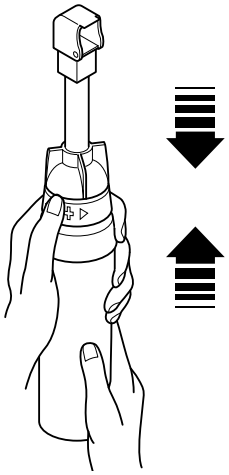
Figure 350.



C Reflector element
D Red ring

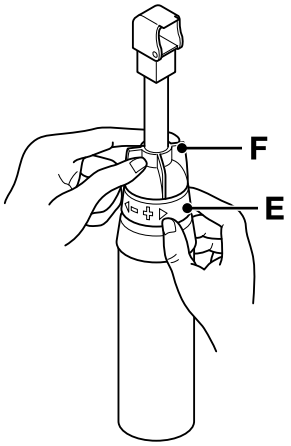
   3.3. Position the tube hanging down from inside the reflector assembly into the hole at the top of the gas cartridge. Then press the gas cartridge up into the reflector assembly as far as possible until the two elements are clasped firmly together. An audible click will be heard.

Figure 351.



   3.4. Turn the small ring so that the air holes are completely closed.

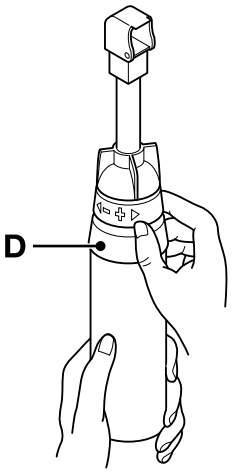
Figure 352.



E Small ring
F Air holes

3.5. Turn the red ring to the right (in the direction of the plus sign) in order to turn on the gas. Important: Before turning the heater on, make sure that the cartridge is not hotter than the reflector element. This may occur if the cartridge is held in the hand for a long time. The temperature difference between the cartridge and the reflector element may cause long yellow flames to appear on ignition.

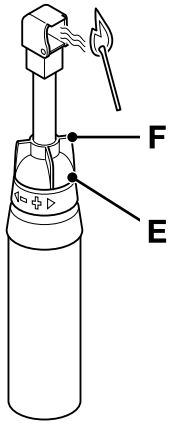
Figure 353.



D Red ring

3.6. Hold the heater vertically and, using a match or cigarette lighter, light the gas as shown. Hold the heater vertically for 1 to 2 minutes until the catalytic reaction occurs. This is indicated when the blue flame fades and the ceramic element glows red. Then turn the small ring until the air holes at are completely open. The tool is ready for use. Note: The fact that the sound of liquid cannot be heard when the cartridge is shaken does not mean it is empty. No sound will be heard even when the cartridge is full.

Figure 354.

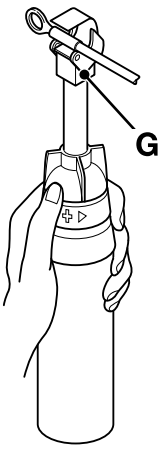


E Small ring
F Air holes

3.7. The heater can be used in two modes:

3.8. Side wings down, reflector head completely open. In this mode the infra-red heat waves are dominant (recommended for the light coloured plastic splices).

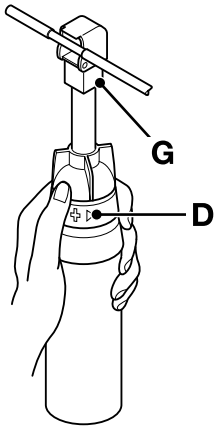
Figure 355.



G Side wings

3.9. Side wings up, reflector head opening reduced. In this mode the heating is done only by the hot gas (use for dark coloured plastic splices).

Figure 356.



D Red ring
G Side wings

Procedure 2

1. Cut the wire and remove the protective insulation for a suitable distance.
2. Install the suitable bootlace ferrule on the wires.

   Consumable: Wiring Splice-Bootlace (1mm Red)
   Consumable: Wiring Splice-Bootlace (2.5mm Grey)
3. Use a suitable bootlace ferrule tool to crimp the terminals. Refer to Figure 357.

Figure 357.

Check (Condition)

This section describes how to use electrical measuring devices that are used in electrical fault finding.

Use of Multimeters

In order to obtain the maximum benefit from the fault finding information contained in the Electrical Section, it is important that the technician fully understands the approach to fault finding and the use of the recommended test equipment, in this case a digital multimeter, or a moving pointer analogue multimeter. The approach is based on a fault finding check list. In tracing the fault from the symptoms displayed you will be directed to make measurements using a multimeter. These instructions are intended to cover the use of the recommended meters.

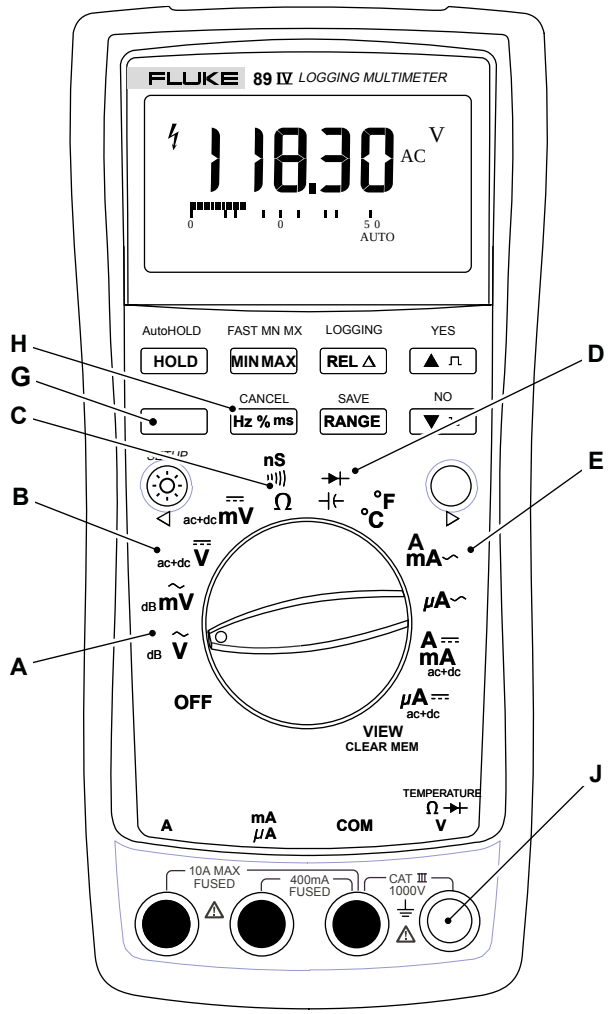
1. Make sure that the test leads are plugged into the correct sockets. The black test lead should be plugged into the black socket (sometimes, this socket is also marked by a -, or E or marked as COMMON or COM). The red test lead should be plugged into the red socket marked with +, V or Ω.
2. When you make a measurement, make sure that the test probes have a good clean contact with bare metal, free from grease, dirt, and corrosion as these can cause a false reading.
3. When you measure a voltage, make sure that the correct range is selected, that it is set to the selector value equal to or greater than that you are about to measure. e.g. If asked to measure 12 Volts, set the selector to the 12V range. If there is no 12V range, set the selector to the next range higher, 20V for instance. If the meter is set to a range that is too low, it may be damaged. e.g. setting to the 2V range to measure 12V.

Measuring DC Voltage

1. Select the correct range on the multimeter.

   1.1. On the digital multimeter, turn the switch to position B.

Figure 358. Typical Digital Multimeter



2. Connect the black probe to the nearest available suitable earth point, usually this will be the starter motor earth, the battery negative, or the chassis. Connect the red probe to the wire or contact from which you are measuring the voltage.

Measuring Resistance

1. Make sure that there is no power to the part of the circuit you are about to measure.
2. Connect one probe at one end of the component or wire to be checked and the other probe at the other end. It does not matter which way round the two probes are placed.
3. Select the correct range on the multimeter.
   3.1. Turn the switch to position C and check that the W sign at the right hand side of the display window is on. If the F sign is on instead, press the blue button G to change the reading to Ω. Touch the meter lead probes together and press the REL3 key on the meter to eliminate the lead resistance from the meter reading.

Measuring Continuity

1. Make sure that there is no power to the part of the circuit you are checking for continuity.
2. Connect one probe to one end of the component or wire to be checked and the other probe to the other end. It does not matter which way round the two probes are placed.
3. Select the correct range on the multimeter.
   3.1. On the digital multimeter, turn the switch to position C and check that the beeper symbol appears at the left hand side of the display window. If the F sign is on instead, press the button labelled F. If there is continuity in the circuit, the beeper will sound. If there is no continuity (open circuit), the beeper will not sound.

Measuring Frequency

1. Insert the black plug into the COM socket on the meter and attach the probe to the nearest suitable earth point on the chassis, for example, the battery negative terminal.
2. Insert the red probe into socket J.
3. Turn the selector switch to position A and depress G repeatedly until F is highlighted on the top row of the display.
4. Press button H once.
5. Touch or connect the red probe to the frequency source to be measured. Press and hold the button if an average reading is required.

Testing a Diode or a Diode Wire

A diode wire is a diode with male connector installed on one end and a female connector installed on the other end. The diode is sealed in heatshrink sleeving. To test a Diode or a Diode Wire.

1. On the digital multimeter:
   1.1. Turn the switch to position D.
   1.2. Press the HOLD button and check that the H sign appears at the top right hand side of the display window.
   1.3. Connect the black probe to the end of the diode with a band or to the male connector of the diode wire. Connect the red probe to the other end of the diode or diode wire. If the beeper does not sound the diode or diode wire is faulty.

1.4. Connect the red probe to the end of the diode marked with a band, or to the male connector of the diode wire, the black probe should be connected to the other end of the diode or diode wire. If the beeper sounds or the meter does not read O.L., the diode or diode wire is faulty.

1.5. Press the HOLD button and check that the H sign disappears from the right hand side of the display window.

15 - Alarm

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00 - General

Check (Operation)

Alarms are installed to alert operators and ground personnel of machine proximity and motion.

The alarm package includes:

- Travel alarm
- Flashing beacon. Refer to Refer to: PIL 33-42.
- Platform buzzer
- Base buzzer
- Base display warning icons
- Platform warning LED (Light Emitting Diode)s

You must check the alarms for correct operation at regular intervals. Refer to Refer to: PIL 78-24.

Travel Alarm and Flashing Beacon

To check the travel alarm and flashing beacon do the following steps.

1. The alarms will operate with the engine running or not running.
2. Turn the ignition switch to the ON position.
3. Pull out the base emergency stop button to the ON position.
4. Pull out the platform emergency stop button to the ON position.
5. Move the base or platform selector switch to the base position.
   - 5.1. Activate the articulated boom lower, main boom lower, telescopic boom retract and slew left or right toggle switches to energise the travel alarm.
   - 5.2. The travel alarm should sound when the switch is pressed.
6. Release the base or platform selector switch to the platform position and press the foot pedal and auxiliary pump switch.
   - 6.1. Activate the articulated boom lower, main boom lower, telescopic boom retract and slew left or right toggle switches or joysticks to energise the travel alarm.
   - 6.2. The travel alarm should sound when the switch or joystick is pressed.
7. Turn the engine on
8. Press the foot pedal and activate the drive & steer joystick to energise the travel alarm.
   - 8.1. The travel alarm should sound when the joystick is pressed.

Platform Buzzer

To check the platform buzzer do the following steps.

1. Pull out the base emergency stop button to the ON position.
2. Pull out the platform emergency stop button to the ON position.
3. Turn the ignition switch to On position.

The platform buzzer should beep 3 times at start-up.

Base Buzzer

To check the base buzzer do the following steps.

1. Pull out the base emergency stop button to the ON position.
2. Pull out the platform emergency stop button to the ON position.
3. Turn the ignition switch to On position.

The base buzzer should beep 3 times at start-up.

Platform warning LEDS and Base display warning icons

To check platform warning LEDs and base display warning icons, refer to- Refer to: PIL 33-24.

24 - Instruments

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02 - Base Controller

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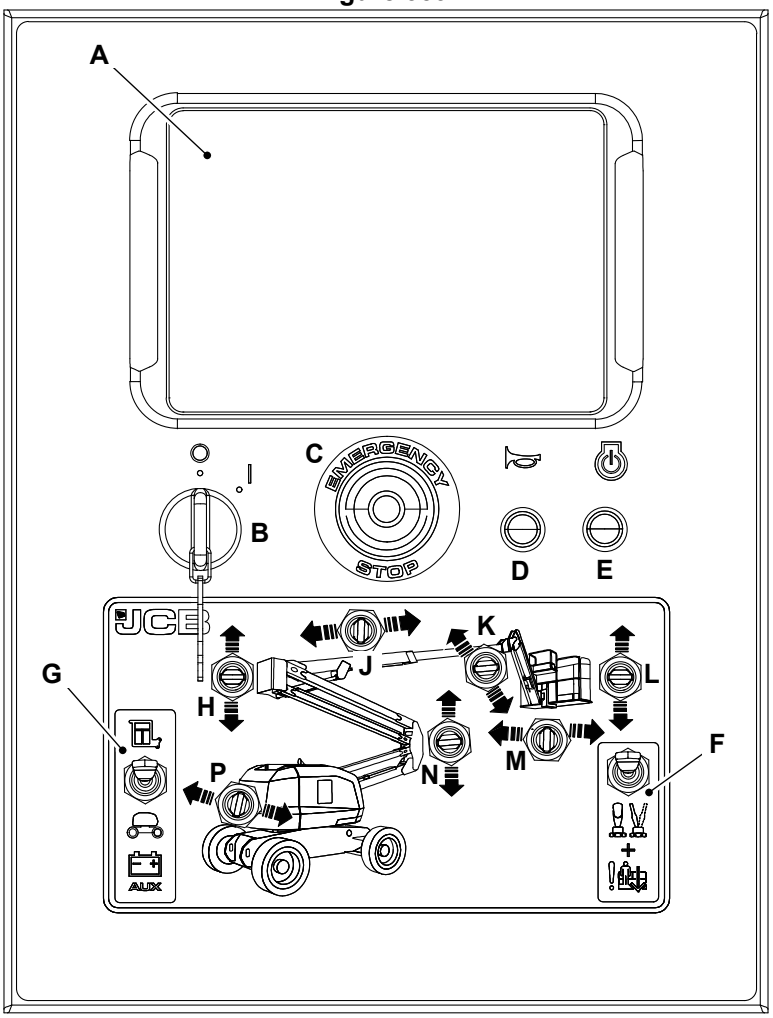
Introduction

Base Control Panel

⚠ **WARNING** Do not operate the machine with the base control when there are personnel in the platform except in an emergency.

Figure 359.



A Display
B Ignition switch
C Red emergency stop button
D Horn
E Engine stop/ start switch
F Emergency Override Switch
G Base control enable switch
H Main boom rise/lower switch
J Telescopic boom extend/retract switch
K Jib rise/lower switch
L Platform level switch
M Platform rotate switch
N Articulated boom rise/lower function switch
P Slew left/right switch

Base Control Panel Display

Figure 360.

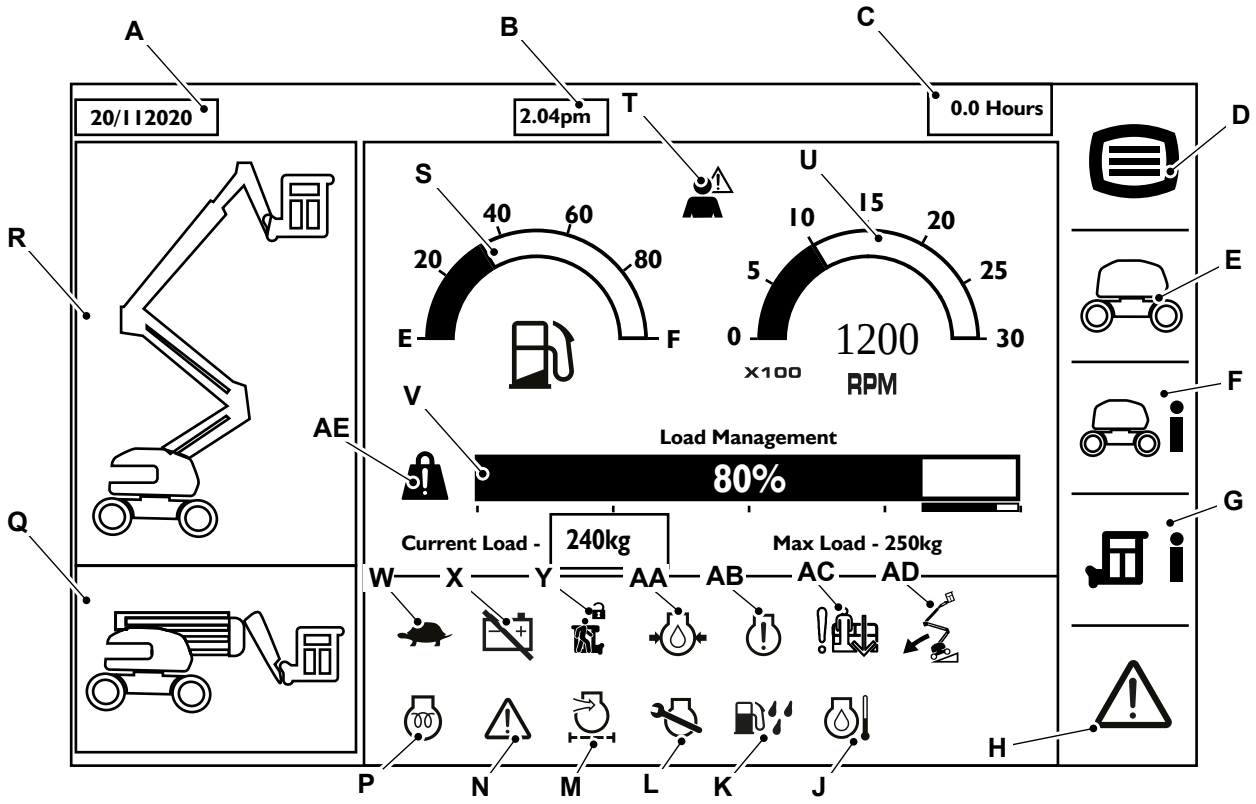


Table 164.

Callout	Indicator	Description
A	Date	Illuminates current date.
B	Time	Illuminates current time.
C	Machine hour	Indicates machine running hours.
D	Display Settings	Displays settings for the display.
E	Machine Settings	Displays locked screen for new settings of machine.
F	Base information	Displays base information of machine like input, output and machine information.
G	Platform information	Displays platform input/ output information.
H	Faults	Displays live and historic faults.
J	Coolant temperature	Illuminates when coolant temperature is high.
K	Water in fuel	Illuminates if moisture is detected in fuel.
L	Service Lamp	Illuminates when the engine service is due.
M	Blocked air filter	Illuminates when the engine air filter is blocked.
N	Fault indicator	Illuminates when there is a fault on the machine.
P	Engine pre-heater	Applicable for machines fitted with grid heater. Indicates wait to heat in cold conditions.
Q	Machine stowed position	Illuminates when machine is in stowed position.
R	Machine raised position	Illuminates when machine is in raised position.

Callout	Indicator	Description
S	Fuel level indicator	Indicates the level of diesel fuel in the tank. Do not let the tank run dry, or air will enter the fuel system. Do not run the engine if the indicator needle goes into the red area. First segment of fuel gauge blinks to show reserve capacity.
T	Operator error or caution alarm	Illuminates when there is error in the operation and requires operator's attention.
U	Engine speed indicator	Indicates the engine RPM (Revolutions Per Minute).
V	Load management indicator	Indicates the amount of load machine is carrying in percentage.
W	Travel speed	Indicates machine operation is in slow/ high or tortoise/ hare mode.
X	Alternator lamp	Illuminates if there is a battery charging circuit fault while the engine is running.
Y	Secondary guarding	Illuminates when the platform secondary guarding is in active condition.
AA	Engine oil pressure	Illuminates if the engine oil pressure is too low. Stop the engine. The light should go out after the engine is started.
AB	Engine warning lamp	Illuminates during fault state of engine.
AC	Emergency mode used	Indicates when emergency override has been activated.
AD	Tilt limit exceeded	Illuminates when machine tilt limit is exceeded. Solid lamp if the machine is stowed. Flashing lamp if the machine is raised.
AE	Overload lamp	Illuminates when the platform load limit is exceeded. Solid lamp if the load is approaching the limit. Flashing lamp if the load is above the limit.

Display Settings

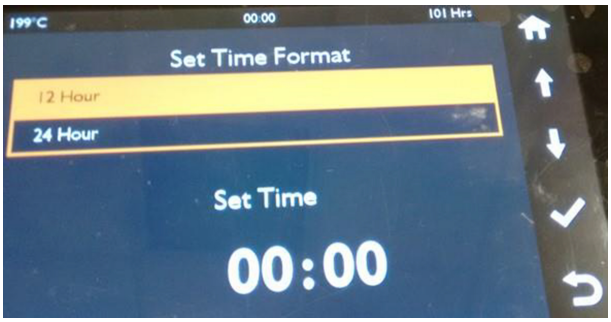
Setting Time

1. On the display menu, select display setting.
2. Use the arrow and tick button to select "Time" option.

Figure 361.

3. The screen allows you to select between 12hr or 24hr format clock and also to set the time.

Figure 362.



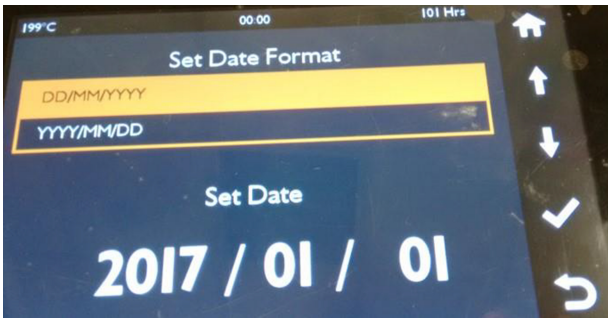
Setting Date

1. On the display menu, select display setting.
2. Use the arrow and tick button to select "Date" option.

Figure 363.

3. The screen allows you to select date and format of the date.

Figure 364.



Setting Unit

1. On the display menu, select display setting.
2. Use the arrow and tick button to select "Unit" option.

Figure 365.

3. Use the arrow keys to select between 'Metric' and 'Imperial'.

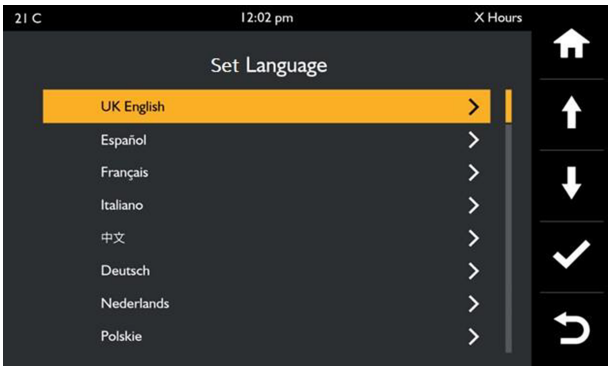
Setting Language

1. On the display menu, select display setting.
2. Use the arrow and tick button to select "Language" option.

Figure 366.

3. Use the arrow keys to select the desired language from drop down list.

Figure 367.



4. Use the tick button to confirm and save the desired setting.

Setting Brightness

1. On the display menu, select display setting.
2. Use the arrow and tick button to select "Brightness" option.

Figure 368.

3. Use the arrow keys to increase or decrease the brightness.

4. Press the tick button to save the selected brightness.

Figure 369.

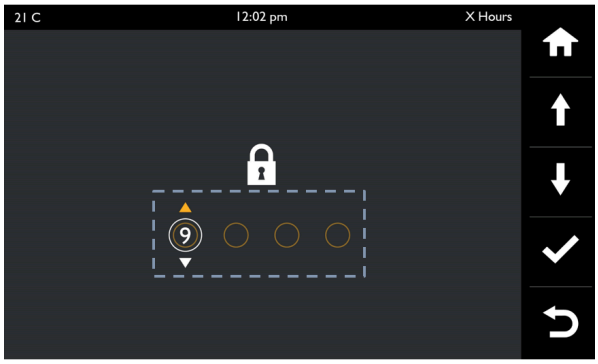
Machine Settings

Machine Settings Pin

1. Select the machine pin setting.
2. Select the default machine pin '0000'. Make a note that, connect to JCB service master to check if the pin has been changed.

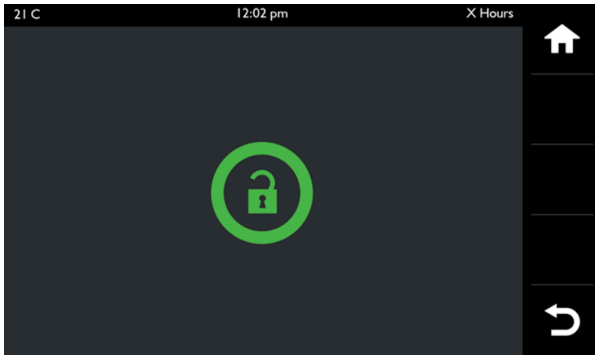
   2.1. Use up and down arrow to toggle from 0-9 on the selected box.

Figure 370.



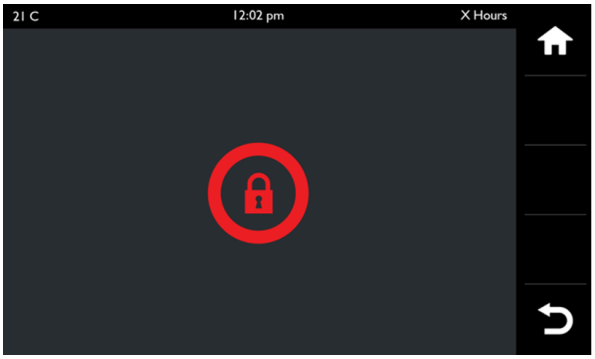
3. Press the tick button to select.
4. If pin entered is correct, display screen will link to ' machine settings unlocked' screen.

Figure 371.



5. If pin entered is incorrect, display screen will link to ' machine setting incorrect pin' screen.

Figure 372.

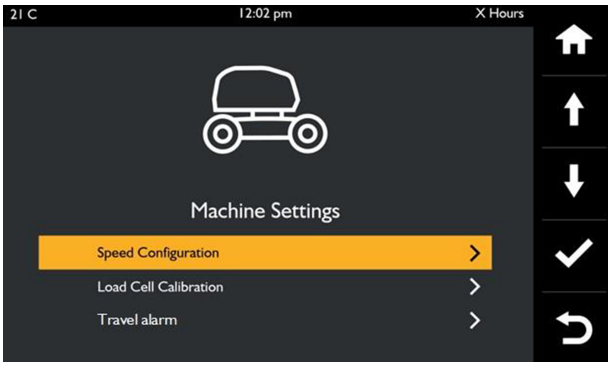


Speed configuration

The machine will be set at 100% initially but may be slowed down for new operators or even block a function off. For example if you do not want to allow slew, the slew function can be set to 0%.

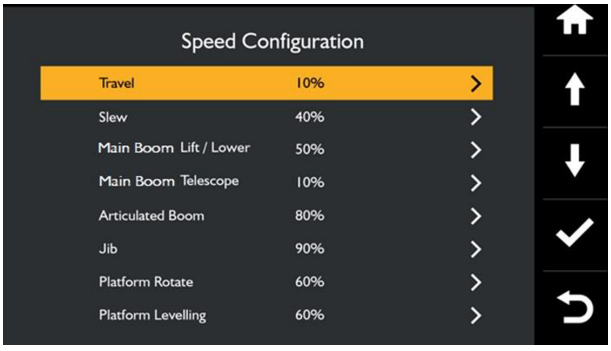
1. Select the machine setting.
2. Use the arrow and tick button to select "Speed Configuration" option.

Figure 373.



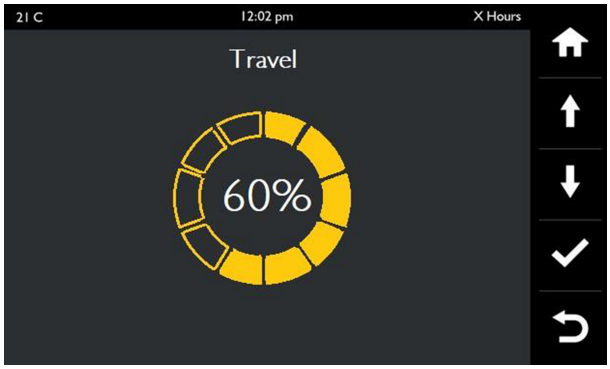
3. Use the arrow keys to select the desired function.
4. Press the tick button to select.

Figure 374.



5. Use the up and down arrows to adjust the % speed allowed.

Figure 375.

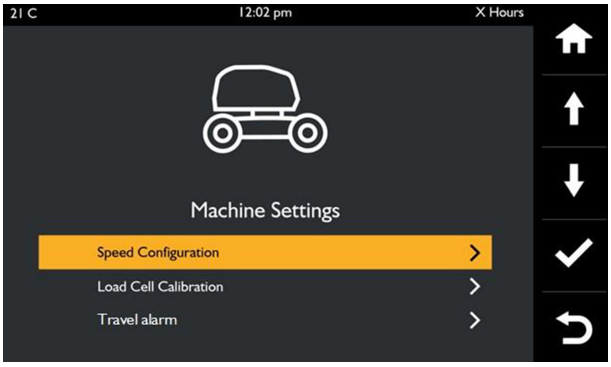


6. Use the tick button to confirm and save the desired setting.

Setting the Load Cell Calibration

1. Select the machine setting.
2. Use the arrow and tick button to select "Load Cell Calibration" option.

Figure 376.



3. Use the arrow keys and select the "NO load" or "Rated load" depending on the calibration to be carried out.

   3.1. Make sure that there is no load at the platform when you select "NO Load" calibration.

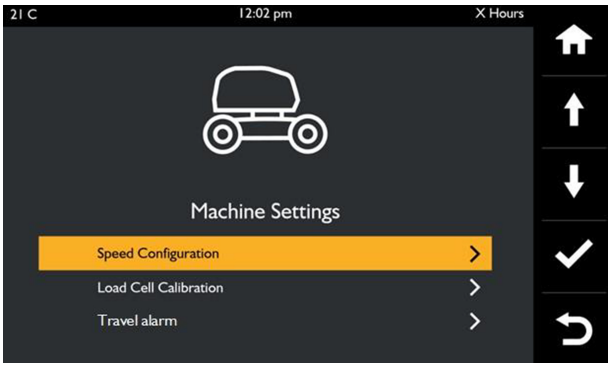
   3.2. Make sure that load of specified weight is placed on the platform, when you select "Rated Load" calibration.

   Weight: 250kg

Setting Travel Alarm

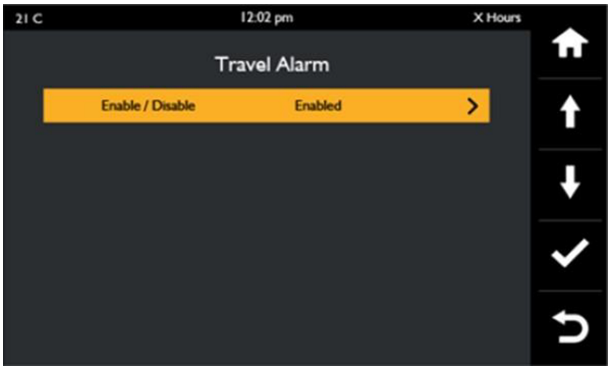
1. Select the machine setting.
2. Use the arrow and tick button to select "Travel alarm" option.

Figure 377.



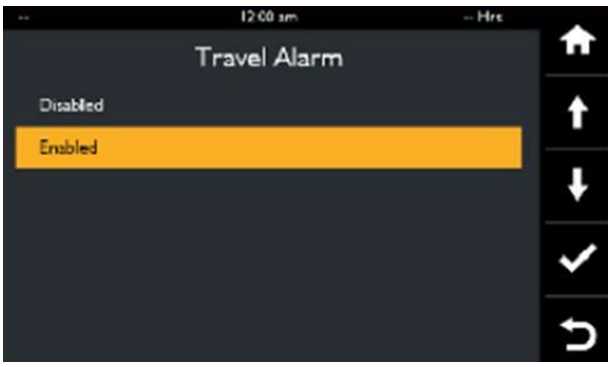
3. Use the arrow keys to enable or disable the travel alarm.

Figure 378.



4. Use the tick button to confirm and save the desired setting.

Figure 379.

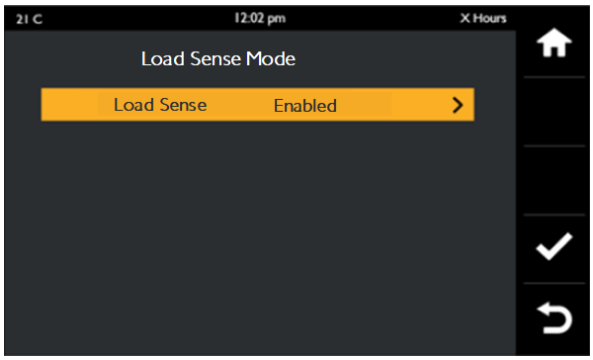


Setting Load Sense Mode

This option is use to enable or disable the load sense mode on the machine.

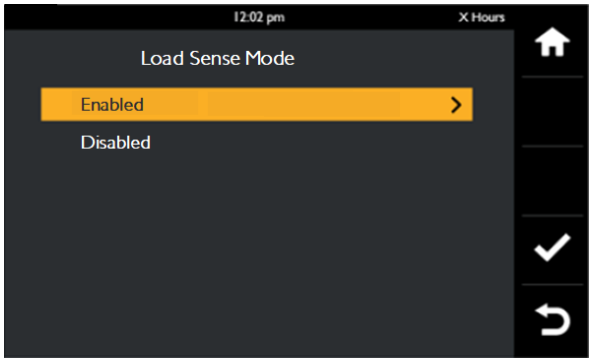
1. Select the machine setting.
2. Use the arrow and tick button to select "Load sense mode" option.

Figure 380.



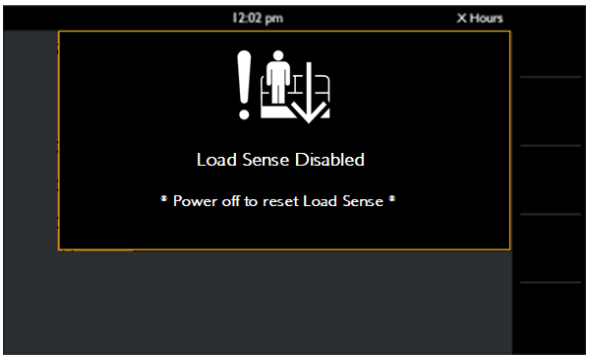
3. Use the arrow keys to enable or disable the load sense mode.

Figure 381.



4. Use the tick button to confirm and save the desired setting.
5. When selected disabled option, display screen will link to "load sense disabled" screen.

Figure 382.



Setting Emergency Override Reset

1. Select the machine setting.
2. Use the arrow and tick button to select "Emergency override reset" option.
3. Use the arrow keys to select required or not required status.

3.1. Make a note that, the status is based on whether "emergency override" icon is active or inactive.

Figure 383.

Figure 384.

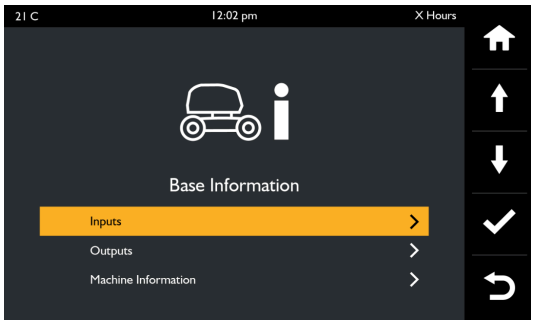
4. Use the tick button to confirm and save the desired setting.

Figure 385.

Base Information

1. Select the base information menu.
2. Use the arrows to toggle between desired settings.

Figure 386.



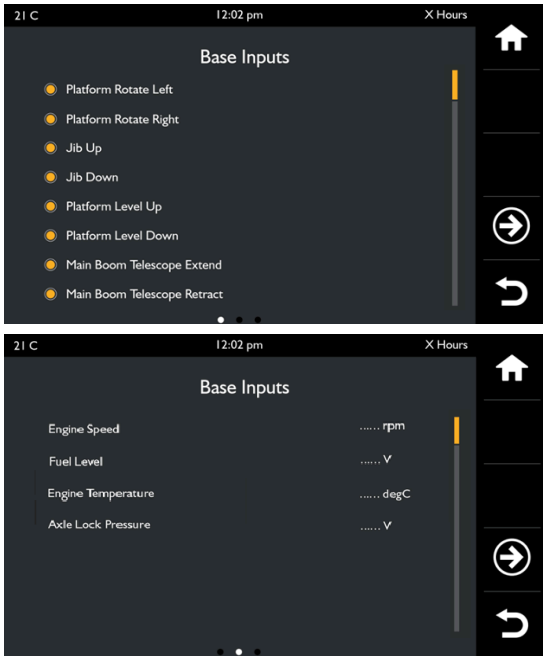
2.1. Use tick button to select the setting.

Base Inputs

The base inputs section gives details of all the function and sensor inputs to the base control ECU (Electronic Control Unit). All the states of the machine functions and sensor inputs are represented by a blank or empty indicator if not selected and by a solid JCB yellow indicator if selected. The items that are shown on the display screen are as follows:

- Platform rotate left
- Platform rotate right
- Jib up
- Jib down
- Platform level up
- Platform level down
- Main boom telescopic extend
- Main boom telescopic retract
- Main boom up
- Main boom down
- Articulated boom up
- Articulated boom down
- Slew left switch
- Slew right switch
- Platform enable switch
- Base enable switch
- Emergency stop positive
- Emergency stop negative
- Engine start
- Horn
- Battery voltage
- Override un-pressed contact
- Override pressed contact
- Main boom retract limit switch- 1
- Main boom retract limit switch- 2
- Articulated boom lower limit switch- 1
- Articulated boom lower limit switch- 2
- Slew position limit switch- 1
- Slew position limit switch- 2
- Blocked air filter sensor
- Axle lock pressure
- Tilt sensor
- Engine alternator
- Engine speed
- Fuel level
- Engine temperature
- Axle lock pressure

Figure 387.



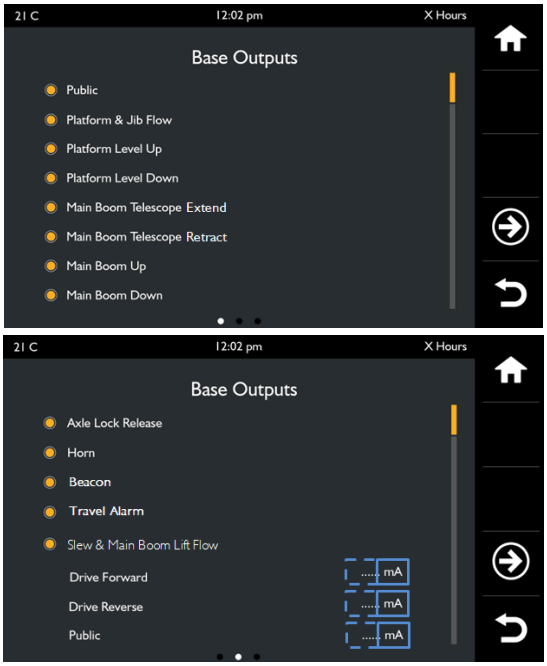
Base Outputs

The base outputs section gives details of all the function outputs from the base control ECU. All the states of the machine functions are represented by a blank or empty indicator if not selected and by a solid JCB yellow indicator if selected. The items that are shown on the display screen are as follows:

- Public
- Platform and jib low
- Platform level up
- Platform level down
- Main boom telescopic extend
- Main boom telescopic retract
- Main boom up
- Main boom down
- Articulated boom up
- Articulated boom down
- Slew left
- Slew right
- Drive forward
- Drive reverse
- Steer left
- Steer right
- Auxiliary pump
- Hydraulic generator
- Engine ignition
- Base buzzer
- Engine crank
- High/ low drive torque
- Front brake release
- Rear brake release

- Axle lock release
- Horn
- Beacon
- Travel alarm
- Slew and main boom lift flow
- Drive forward
- Drive reverse

Figure 388.

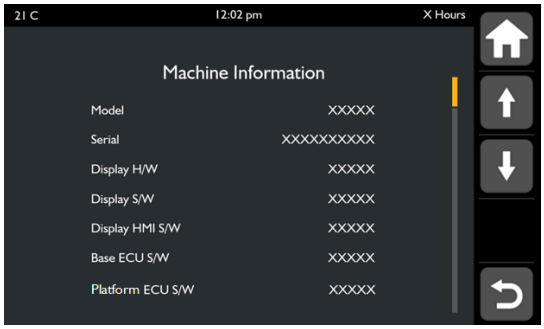


Machine Information

The screen displays following machine information:

- Machine model
- Machine VIN (serial) number
- Display hardware revision
- Display software revision
- Display HMI software
- Base ECU software version
- Platform ECU software
- Engine ECU software
- Machine hours
- Engine hours

Figure 389.

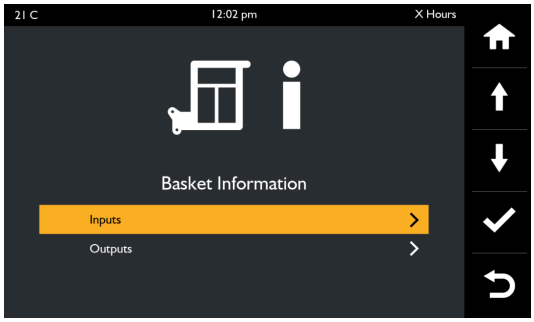


Platform Information

The platform information section will allow the machine's owner or user to diagnose potential faults with the assistance of the machine's help file or remote technical support.

1. Select the platform information menu.
2. Use the arrows to toggle between desired settings.

Figure 390.



2.1. Use tick button to select the setting.

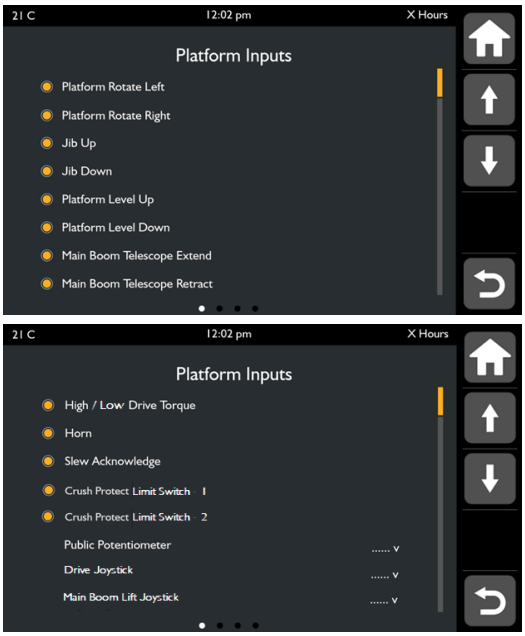
Platform Inputs

The platform inputs section will detail all function and sensor inputs to the platform ECU. All the states of the machine functions are represented by a blank or empty indicator if not selected and by a solid JCB yellow indicator if selected. The items that are shown on the display screen are as follows:

- Platform rotate left
- Platform rotate right
- Jib up
- Jib down
- Platform level up
- Platform level down
- Main boom telescopic extend
- Main boom telescopic retract
- Main boom up
- Main boom down
- Articulated boom up
- Articulated boom down
- Slew left
- Slew right
- Foot pedal
- Auxiliary pump
- Drive forward
- Drive reverse
- Steer left
- Steer right
- Emergency stop positive
- Emergency stop negative
- Engine start
- High engine speed
- High/ low drive torque
- Horn

- Slew acknowledge
- Crush protection limit switch- 1
- Crush protection limit switch- 2
- Speed potentiometer
- Drive joystick
- Main boom lift joystick
- Slew joystick
- Load sensor channel 1
- Load sensor channel 1 (%)
- Load sensor channel 2
- Load sensor channel 2 (%)
- Power to platform input

Figure 391.

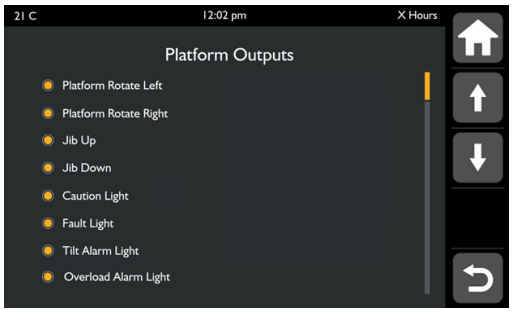


Platform Outputs

The platform outputs section will detail all function outputs from the platform ECU. All the states of the machine functions are represented by a blank or empty indicator if not selected and by a solid JCB yellow indicator if selected. The items that are shown on the display screen are as follows:

- Platform rotate left
- Platform rotate right
- Jib up
- Jib down
- Caution light
- Fault light
- Tilt alarm
- Overload alarm light
- Low fuel light
- Slew acknowledge light
- High engine speed light
- High drive torque light
- Platform buzzer
- Power to platform light

Figure 392.

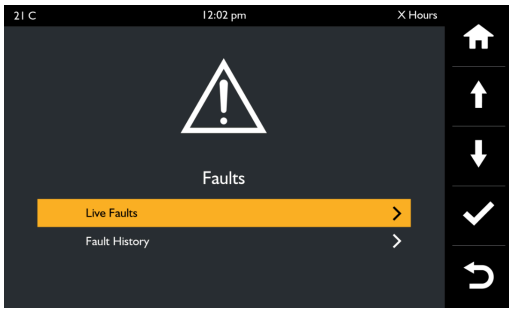


Faults

The faults section contains details of any faults, present or historical, that occur on the machine.

1. Select the faults menu.
2. Use the arrows to toggle between desired settings.

Figure 393.



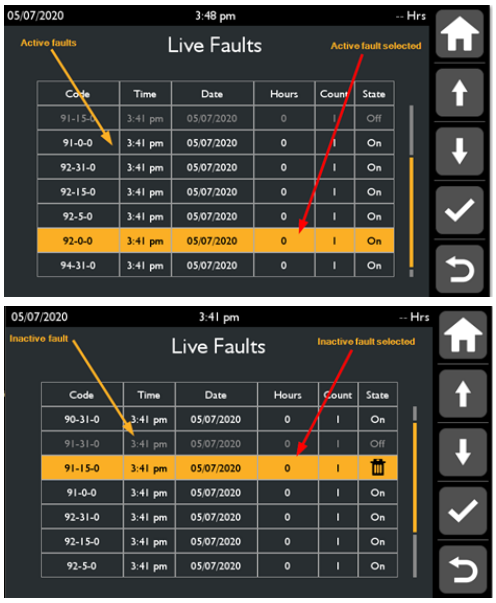
2.1. Use tick button to select the setting.

Live Faults

The live faults section shows all the live faults flagged by the base control unit. The live fault screen shows all faults which hae become active in the current key- cycle in a table with following information (left to right).

- JCB assigned fault code
- Time
- Date
- Machine hours
- Count
- State (on/ off)

Figure 394.



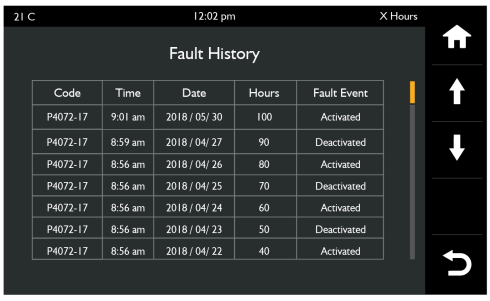
An active fault entry should be created when a DTC listed in the application fault table becomes active. It shall be possible for the operator to remove previously active faults from the active fault list by selecting the fault and pressing enter. If the number of faults exceeds what can be shown on a single screen, the user shall have the ability to scroll through the faults.

Fault History

The fault history section will detail all historic faults flagged by the base control unit. The display shows all faults which have been stored in the display's fault log with the following information (Left to Right):

- JCB fault code
- Time
- Date
- Machine hours
- Fault event

Figure 395.



For the fault event column, a new language string is required to translate "activated" and "deactivated" into all required languages.

Check (Operation)

Base Control Functional Test

1. Make the machine safe with the platform lowered.

   Refer to: PIL 01-03-27.

2. Release the platform emergency stop switch.
3. Release the base emergency stop switch.
4. Turn the ignition key to ON position and do the following.

   4.1. Make sure that all the base controls operate normally. Refer to Operator's manual.

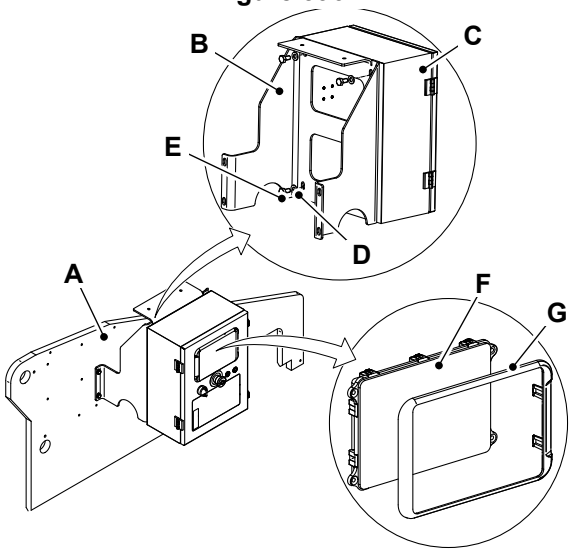
5. Turn the ignition key to the OFF position.

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Disconnect the wiring harnesses and connector.
3. Remove the washer (x4) and setscrew (x4) from the boom control panel structure.
4. Remove the base control panel.
5. Remove the display panel and touch screen display from the base control panel.

Figure 396.



A Turntable structure
B Boom control panel structure
C Base control panel
D Washer (x4)
E Setscrew (x4)
F Touch screen display
G Display panel

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Tighten the setscrew (x4) to the correct torque value.
   Torque: 43N·m

05 - Platform Controller

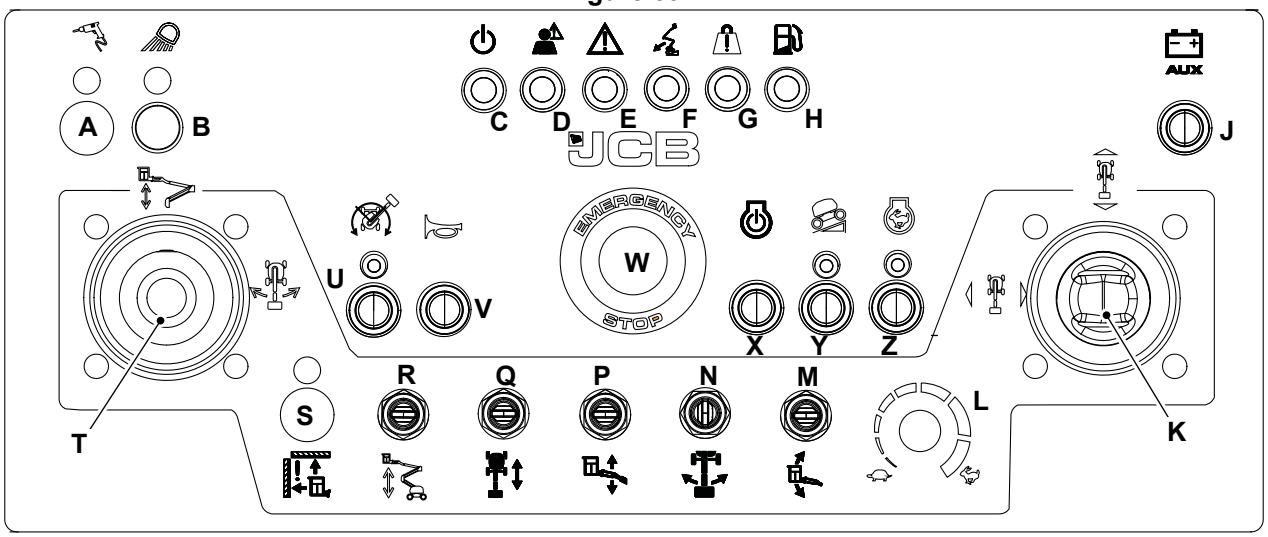
Introduction 33-138
Check (Operation) 33-140
Remove and Install 33-140

Introduction

Platform Control Panel

⚠ **WARNING** Do not drive the machine with the platform raised except on smooth, firm and level surface free of obstructions and pot holes.

Figure 397.



A Hydraulic generator on/ off button
B Work lights on/ off button
C Power on/ off indicator
D Operator error/ caution alarm
E Error indicator
F Tilt limit warning indicator
G Overload warning indicator
H Low fuel level
J Auxiliary power on/ off button
K Drive or steer joystick
L Potentiometer
M Manual platform level switch
N Platform rotate switch
P Jib boom up/ down switch
Q Telescope in/ out function
R Articulated boom up/ down function switch
S Platform height restriction
T Main boom lift or slew joystick
U Slew acknowledgement switch
V Horn switch
W Emergency stop button
X Engine stop/ start switch
Y High torque switch
Z Engine high/ low speed select switch

Table 165. Description of Indicators

Callout	Indicator	Description
A	Hydraulic generator on/ off button	Illuminates (Constant on) when generator is on.
B	Work lights on/ off button	Illuminates (Constant on) when work lights are on.
C	Power on/ off indicator	Illuminates (Constant on) when machine ignition is on.
D	Operator error/ caution alarm	Illuminates (Flashing) when an operator input is disabled. Illuminates (Flashing) when the platform secondary guarding system is activated.
E	Error indicator	Illuminates (Flashing) when a critical fault has occurred. Illuminates (Constant on) when a non-critical fault has occurred.
F	Tilt limit warning indicator	Illuminates (Flashing) when the gradient is more than the rated slope and the machine is in the raised condition. Illuminates (Constant on) when the gradient is more than the rated slope and the machine is in the stowed condition.

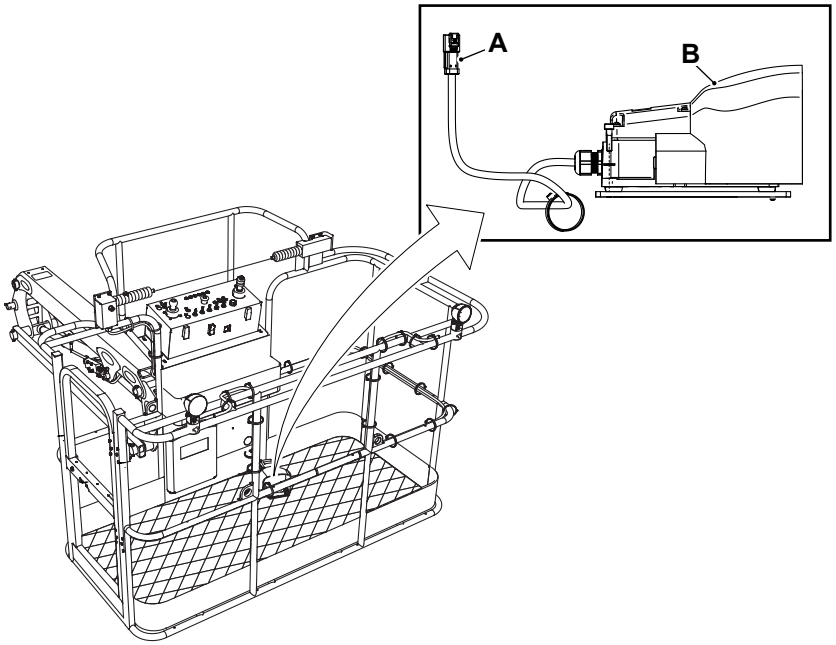
Callout	Indicator	Description
G	Overload warning indicator	Illuminates (Flashing) when the platform load is above the rated load limit. Illuminates (Constant on) when the platform load is approaching the rated load limit.
H	Low fuel level	Illuminates (Flashing) when the fuel level is below 10% tank capacity. Illuminates (Constant on) when the fuel level is below 25% tank capacity.
S	Platform height restriction	Illuminates (Flashing) when the platform is in close proximity to an obstacle (if installed).
U	Slew acknowledgement switch	Illuminates (Flashing) when the slew position is not in the forward condition. Illuminates (Constant on) when the operator has acknowledged the slew position.
Y	High torque switch	Illuminates (Constant on) when high torque/ low speed is selected.
Z	Engine high/ low speed select switch	Illuminates (Constant on) when high engine speed is selected.

Foot Pedal

The foot pedal is located on the platform floor. When depressed and held, it activates the controls on the platform control console.

The foot pedal on the machine is installed with an anti-tie down feature that deactivates the foot pedal when the operator presses it for 10 seconds without using any function.

Figure 398.



A Electrical connector

B Foot pedal

Check (Operation)

Platform Control Functional Test

1. Make the machine safe with the platform lowered.

   Refer to: PIL 01-03-27.

2. Release the platform emergency stop switch.
3. Release the base emergency stop switch.
4. Turn the ignition key to ON position and do the following.

   4.1. Make sure that all the platform controls operate normally. Refer to Operator's manual.

5. Turn the ignition key to the OFF position.

Foot Pedal Operation

1. Make the machine safe.

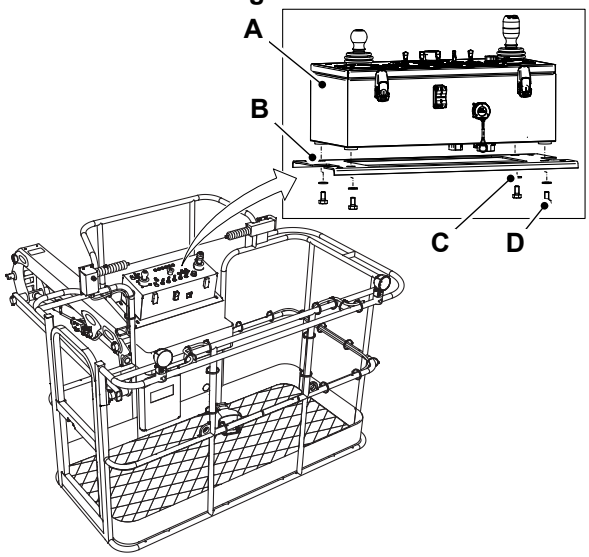
   Refer to: PIL 01-03-27.

2. Turn the key switch to ON position.
3. Pull out the ground emergency stop and platform emergency stop buttons.
4. Press and hold the foot pedal.
5. Move the toggle switch to either side to try to start the engine. Make sure that the engine does not start.
6. Release the foot pedal.
7. Start the engine.
8. Do not press down the foot pedal and operate the machine functions. Make sure that the machine functions are not performed.
9. Press and hold the foot pedal.
10. Operate the machine. Make sure that all the functions are performed normally.

Remove and Install

Platform Control Panel

Figure 399.



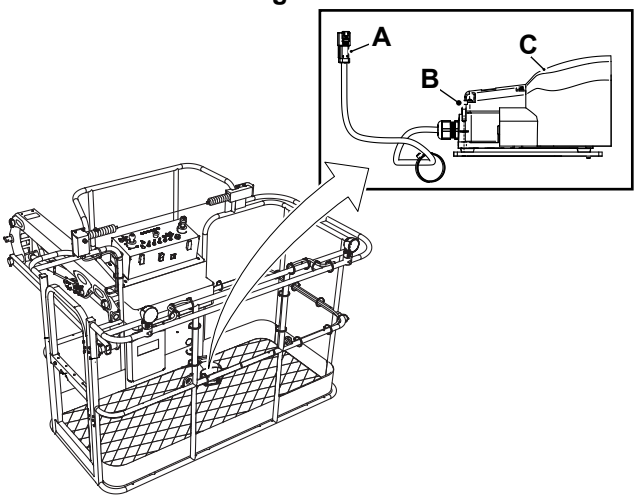
A Platform control panel
B Mounting panel
C Washer (x4)
D Set screw (x4)- 43Nm

Foot Pedal

Remove

1. Make the machine safe.
2. Disconnect the electrical connector.
3. Remove the screw (x2).
4. Remove the foot pedal from the platform.

Figure 400.



A Electrical connector
B Screw (x2)
C Foot pedal

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Tighten the screw (x2) to the correct torque value.

   Torque: 15N·m

36 - Horn

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Introduction

⚠ **WARNING** The horn is very loud. Any person nearby the machine must wear ear protection. If you do not wear ear protection your hearing may be permanently damaged.

The horn must be working correctly for safe machine operation.

The horn is operated from the platform control panel and the base control panel. The horn is located under the turntable and sounds as a warning to ground personnel. An improperly functioning horn will prevent the operator from alerting the ground personnel of hazards or unsafe conditions.

Use the horn wherever necessary, but particularly at blind corners and when you are reversing the machine.

Check (Operation)

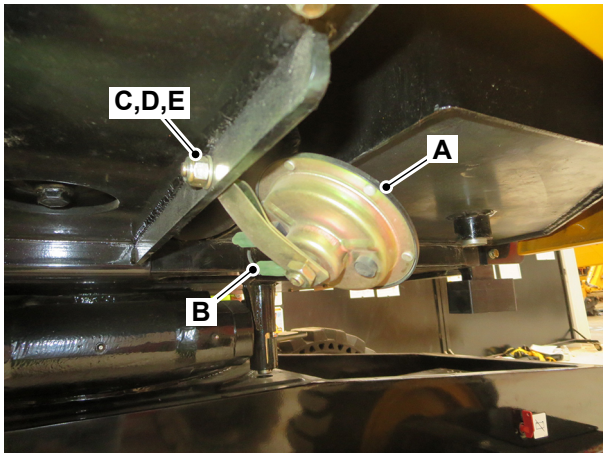
1. Turn the key switch to platform control and pull out the red Emergency Stop button to the ON position at both the ground and platform controls.
2. Push down the horn button at the platform controls. The horn should sound.
3. If the horn fails to sound, investigate further. Check the fuse, check the wiring, make sure that the horn is repaired or replaced before the machine is used again.

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Isolate the battery.
   Refer to: PIL 33-03-00.
3. Open the hydraulic compartment cover.
   Refer to: PIL 06-06-09.
4. Disconnect the electrical connectors from the horn.
5. Remove the nut, bolt and washer.
6. Remove the horn from the machine.

Figure 401.



A Horn
B Electrical connections
C Nut
D Bolt
E Washer

Install

1. The installation procedure is the opposite of the removal procedure.

42 - Exterior Light

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33-42-15 Front Work Light 33-147

Notes:

15 - Front Work Light

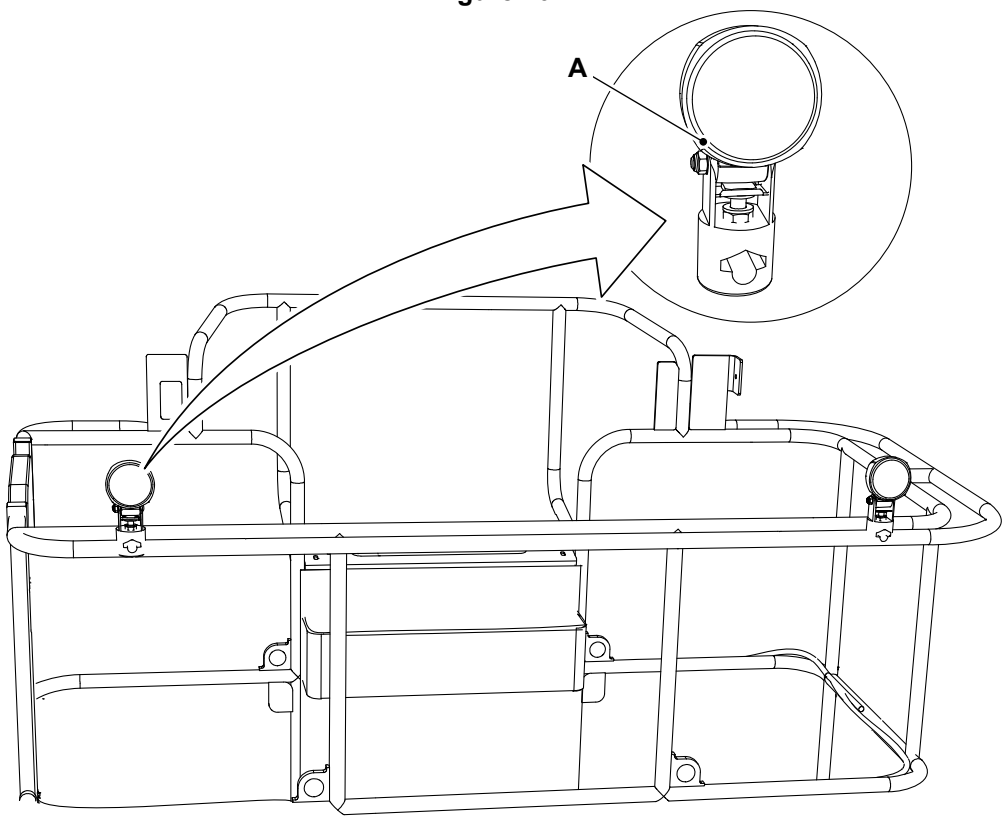
Introduction

Worklight is a high intensity light fixture which provides user with optimum lighting conditions to work even in dark conditions. This is an optional feature and fitted on customer demand or can be a dealer fit kit.

To operate the worklight from the platform control panel follow the steps below.

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Turn the machine ON and press the worklight switch from the platform control panel.
   Refer to: PIL 33-24-05.
   2.1. The worklights will turn ON.
3. While the worklight is still ON, press the worklight switch from the platform control panel.
   3.1. The worklights will turn OFF.

Figure 402.



A Platform work light

45 - Control Module

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00 - General

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Introduction

Modern machines use ECU (Electronic Control Unit) to control machine systems such as hydraulics, transmission and engine. In much the same way as office computers can be ‘networked’ to communicate with each other the machine ECU’s can be ‘networked’. Some advantages of networking are:

- Improved more intelligent control systems.
- Service software tools can be used for fault finding and machine control set up.

The ECM (Engine Control Module) can communicate with other machine ECU using a CANbus network system.

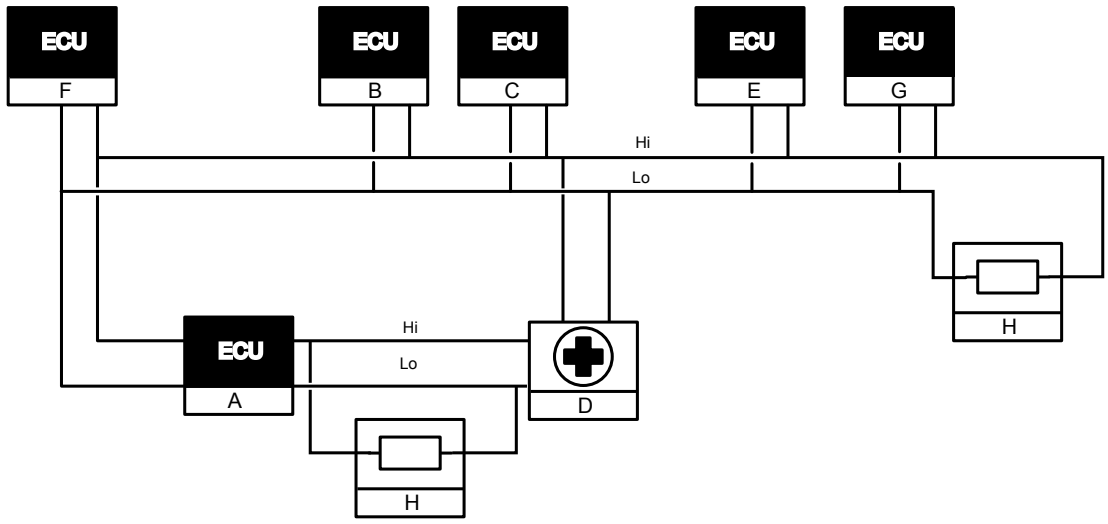
CANbus Communications System

CAN (Controller Area Network) is an electronic communications system that connects all the machine ECU to one pair of data wires, this is called the CANbus. Coded data is sent to and from the ECU on the CANbus. By connecting Servicemaster diagnostic software to the CANbus, data is seen and decoded for use by a service engineer.

CANbus System Schematic

A typical CANbus system architecture is shown for illustration purposes only below: Refer to Figure 403.

Figure 403. Typical CANbus architecture



The CAN architecture may differ on your machine.

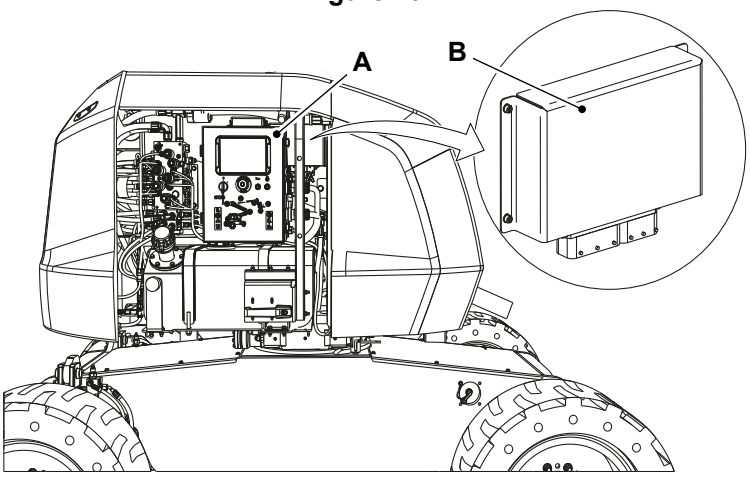
Refer to: PIL 33-00-50.

This machine is fitted with base control and platform control ECU's.

Base Control ECU

The base control ECU is fitted at machine base behind base control panel. Refer to Figure 404.

Figure 404.



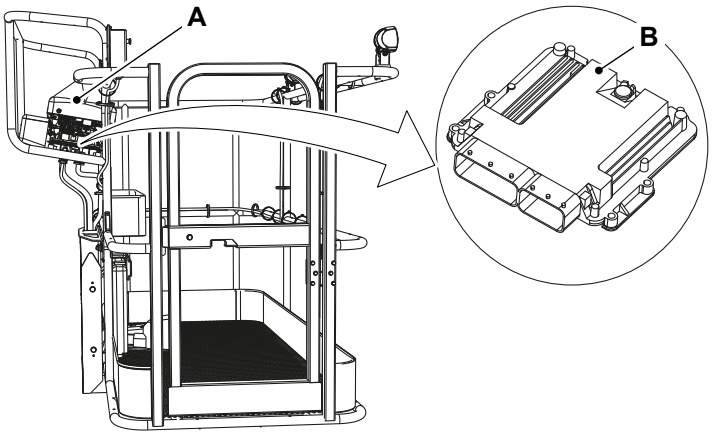
A Base control panel

B Base control ECU

Platform Control ECU

Platform control ECU is fitted at platform control panel. Refer to Figure 405.

Figure 405.



A Platform control panel

B Platform control ECU

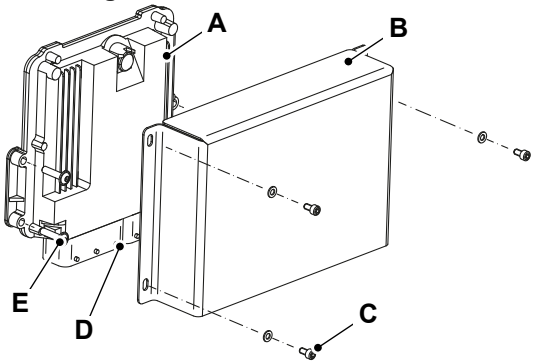
Remove and Install

Base Control ECU

Remove

1. Make the machine safe.
   Refer to: PIL 01-03.
2. Disconnect the battery.
3. Remove the cap screws (x3) and ECU (Electronic Control Unit) cover.
4. Disconnect the electrical connectors.
5. Remove screws (x4).
6. Remove the base control ECU.

Figure 406. Base Control ECU



A Base control ECU
B ECU cover
C Cap screws (x3)
D Electric connector point
E Screws (x4)

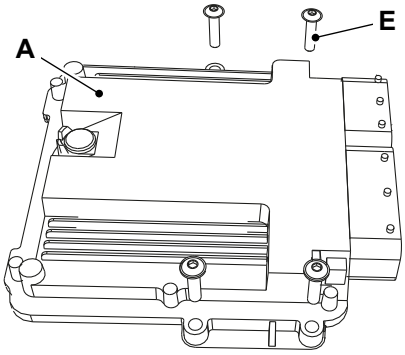
Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Make sure that the base control ECU is configured correctly before you operate the machine. Use the correct Servicemaster set-up tool.
3. Torque tighten the cap screws and screws to specified torque values. Refer to Table 166.

Platform Control ECU

1. Make the machine safe.
   Refer to: PIL 01-03.
2. Disconnect the battery.
3. Remove the platform control cover plate.
4. Disconnect the electrical connectors.
5. Remove screws (x4).
6. Remove the platform control ECU.

Figure 407. Platform Control ECU



A Platform control ECU
E Screws (x4)

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Make sure that the platform control ECU is configured correctly before you operate the machine. Use the correct Servicemaster set-up tool.
3. Torque tighten the cap screws and screws to specified torque values. Refer to Table 166.

Table 166. Torque Values

Item	Nm
C	8.8
E	9

30 - LiveLink

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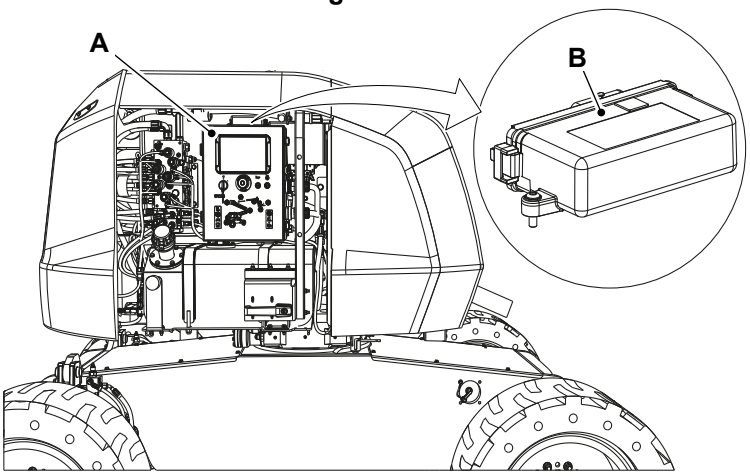
Remove and Install 33-154

Introduction

Optional

The Livelink ECU (Electronic Control Unit) is located on panel mounting bracket behind base control panel.

Figure 408.



A Base control panel

B LiveLink ECU

Remove and Install

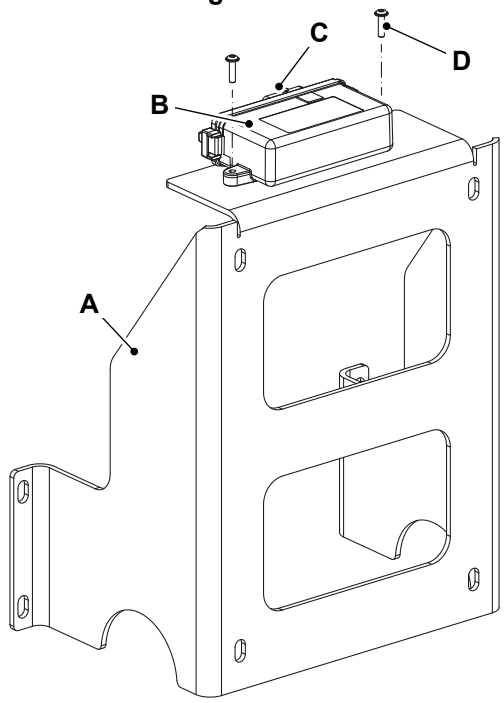
Refer to: PIL 72-03-00.

Optional

Remove

1. Make the machine safe.
   Refer to: PIL 01-03.
2. Disconnect the battery with the isolator switch.
3. Access the LiveLink ECU (Electronic Control Unit).
4. Disconnect the electrical connectors from the LiveLink ECU.

Figure 409.



A Panel mounting bracket
B LiveLink ECU
C Electrical connection port
D Screws (x2)

5. Remove the screw (x2).
6. Remove the LiveLink ECU.

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Make sure that the LiveLink ECU is configured correctly before you operate the machine. Use the correct Servicemaster set-up tool.
3. Tighten the screws to specified torque value.

57 - Electronic Diagnostic

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03 - Servicemaster

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Introduction

JCB Servicemaster is an application to allow engineers to diagnose and setup the various electronic control units within the JCB product range. The tools comprise of a front end generic user interface that allows the user to select the machine which they wish to work on as well as a number of various tools which allow:

- Programming electronic control units
- Diagnosing electronic issues
- Setup of various options
- Checking the service history of the machine.

JCB Servicemaster is updated on a monthly basis by incorporating Web Update. This is a program which works alongside Servicemaster to let the user know and allow them to download an update as and when it becomes available.

JCB Servicemaster software is for use with Microsoft Windows and a laptop personal computer. The laptop computer is connected to the machine diagnostic socket using special cables and an adaptor commonly referred to as DLA (Data Link Adaptor). A second generation DLA 2.0 has been launched and operates in essentially the same way as the original DLA. There are a couple of slight differences to the DLA 2.0. Refer to system information bulletin SI044 for more details.

Use Servicemaster software to:

- Display data from a machine ECU (Electronic Control Unit)
- Change data stored in a ECU

Servicemaster software communicates with the machine ECM (Engine Control Module) using the CAN (Controller Area Network)bus, refer to Control Modules (PIL 33-45).

Diagnostics Tool - User Guide

Introduction

The diagnostics software tool is part of the JCB Servicemaster software suite. The diagnostics software is designed to be an easy to use fault finding tool.

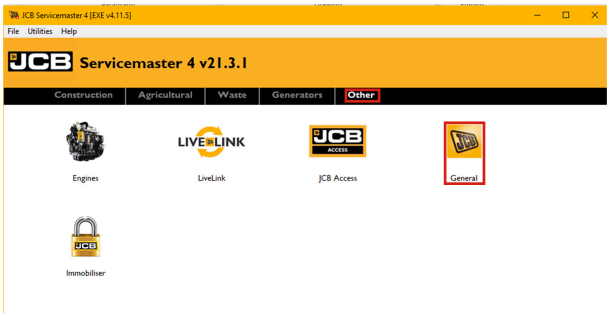
Connecting the Diagnostics

To use Diagnostics your laptop computer must be connected to the machine CAN bus.

Starting the Diagnostics

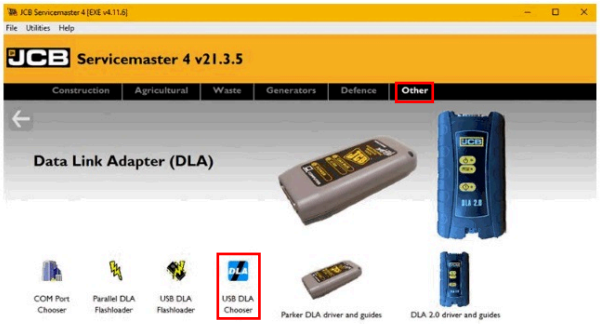
1. Turn ON the machine ignition and additionally start the engine if required (taking normal precautions).
2. Run JCB Servicemaster as administrator on the laptop computer.

Figure 410.



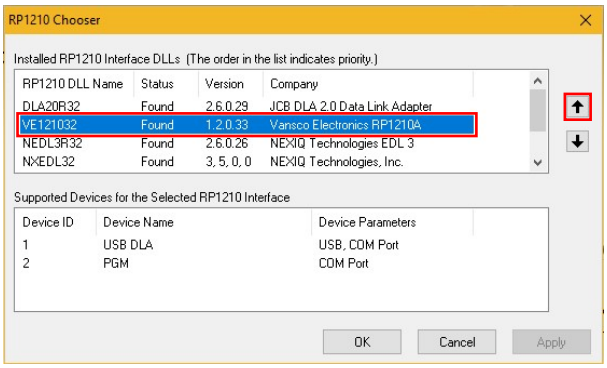
3. In Servicemaster go to “Other>General>DLA”.
   3.1. Left click on “USB DLA Chooser”.

Figure 411.



4. A new window will open. Refer to Figure 412.
   4.1. Make sure the sequence is correct based on the DLA you are using to plug in. The driver for the DLA in use should be on the top.
   4.2. Use arrows on the right side of the window to move the desired driver to move at the top.
   4.3. Click “Apply” and then click on “Ok”.

Figure 412.



Flashloader Tool-User Guide

The Flashloader software tool is part of the JCB Servicemaster software suite. If the ECU is replaced and the data file in its flash memory is not applicable it will be necessary to flash the ECU memory with the correct data file. The Flashloader software tool can be used to access the data file name currently loaded in the ECU memory and is necessary upload a new data file to the ECU.

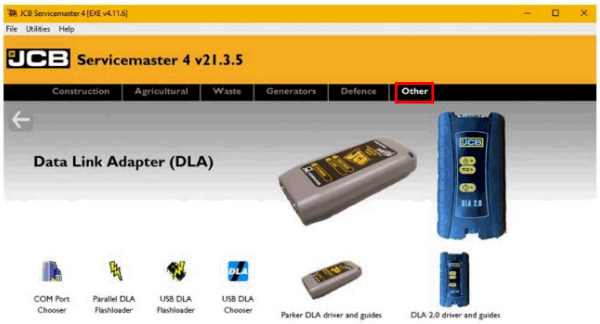
Connecting Flash Loader

To use Flashloader your laptop computer must be connected to the machine CANbus.

Starting Flashloader

1. Turn ON the machine ignition but DO NOT start the engine.
2. Start JCB Servicemaster on the laptop computer.

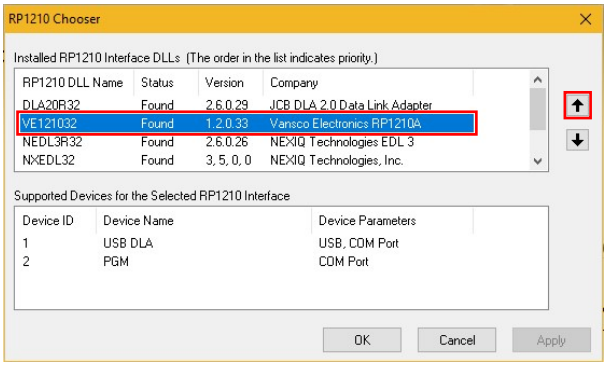
Figure 413.



3. Make sure that the correct DLA is selected in the chooser. Go to Other>General>DLA>USB DLA Chooser. The DLA Chooser window opens. Make sure the sequence is correct based on the DLA you are using to plug in. The driver for the DLA in use should be on the top. Use arrows on the right side of the window to move the desired driver to move at the top.

4. Click “Apply” and then click on “Ok”. Refer to Figure 414.

Figure 414.



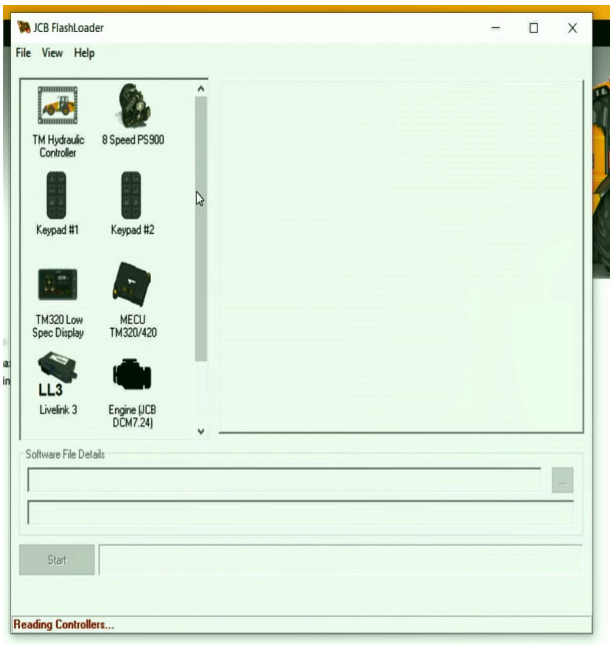
Using Flashloader

1. Make sure that the machine ignition switch is set to ON but do not start the engine.
2. Click on the flashloader icon. Refer to Figure 415.

Figure 415.

3. Click on the ECU icon.
4. Click on the Browse button and select the correct data file. Click Open.

Figure 416. Typical



5. Click on the Start button. A confirmation window will appear. Click on the Yes to start the reprogramming of the ECU. The progress bar is displayed.
6. When the programming is complete, switch the machine ignition to the OFF position.
7. Before starting the machine make sure that the machine setup data is correct. You must check that all other relevant machine settings are correctly configured. Use the setup software tool.

Technical Data

Refer to Electrical System, Electronic Diagnostic, Fault Codes.
Refer to: PIL 33-57-90.

Preparation

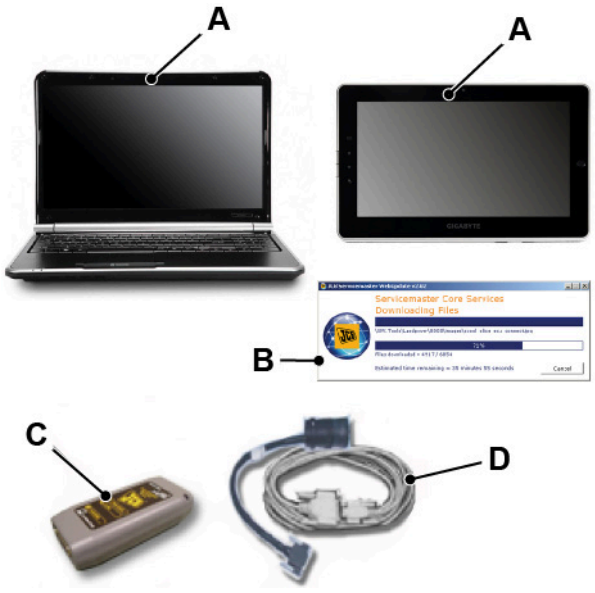
Set-up Servicemaster

The procedures below describe how to set up Servicemaster for USB (Universal Serial Bus) compatible equipment. There are other procedures and options. These are described in detail in the Servicemaster help files.

Before you start Servicemaster set up procedure make sure that you have the following:

1 A Microsoft Windows compatible laptop computer with a USB port. Refer to Figure 417.
   a Make a note that Servicemaster can be tested on Windows 10 only.
2 The latest Servicemaster software (internet connection for web updates). Refer to Figure 417.
3 A JCB compatible DLA (Data Link Adaptor). Refer to Figure 417.
4 The correct connection cables. Refer to Figure 417.
   a Do not connect any cables to the laptop, DLA or machine at this time.

Figure 417.



A Laptop computer
B Servicemaster software
C DLA
D Connection cables

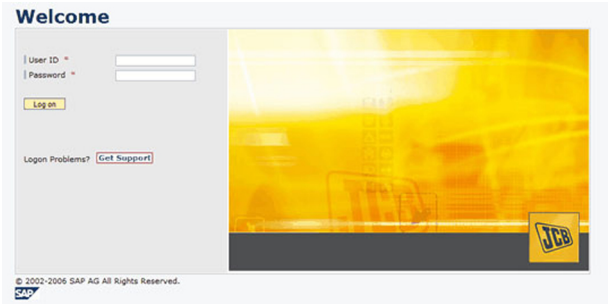
JCB Servicemaster Web Update - New Installation

Once you install JCB Servicemaster on your laptop/PC you will need to keep it updated. JCB

Servicemaster is updated through the "JCB Web Update" program. Do the below steps to download and install the JCB web update.

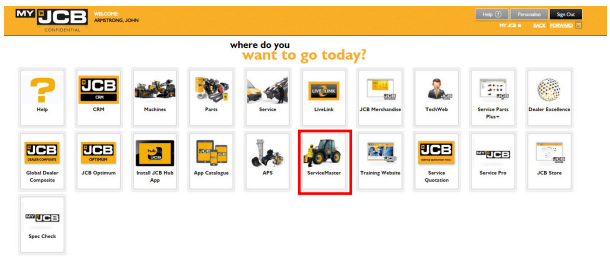
1. Use the web address www.business.jcb.com to install JCB web update.
2. A web page will open on the screen. Refer to Figure 418.

Figure 418.



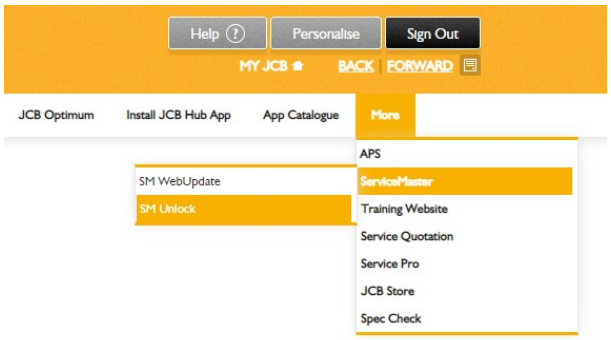
3. If you do not already have a User ID and Password, click the "Get Support" option.
   3.1. Apply for an account to get access to JDS (JCB Distribution System) and SPP (Service Parts Pro).
4. Once you are logged in, you will find Servicemaster icon on the screen.
   4.1. Click the "Servicemaster" icon.

Figure 419.



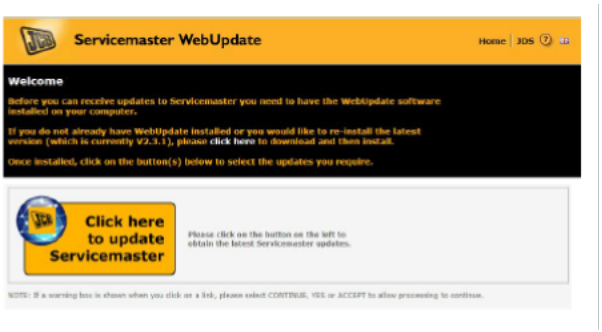
5. Go to More>ServiceMaster>SM WebUpdate.

Figure 420.



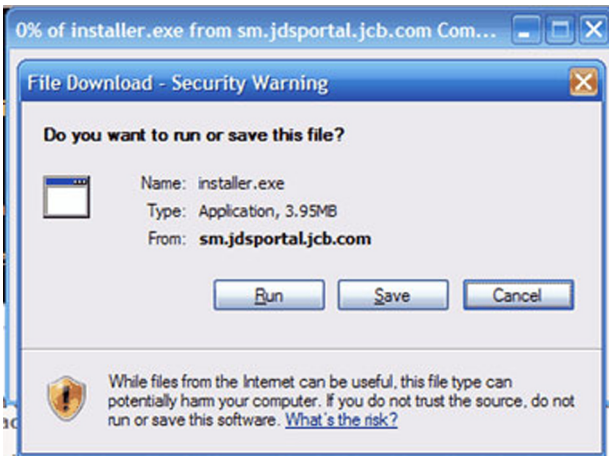
6. A new "Servicemaster Web Update" screen will open. Refer to Figure 421.

Figure 421.



   6.1. Click the "click here" link which is the orange colour text sentence to download JCB web update.
7. A new "File Download - Security Warning" window will appear on the screen. Refer to Figure 422.
   7.1. Click the "Run" option to start download.

Figure 422.



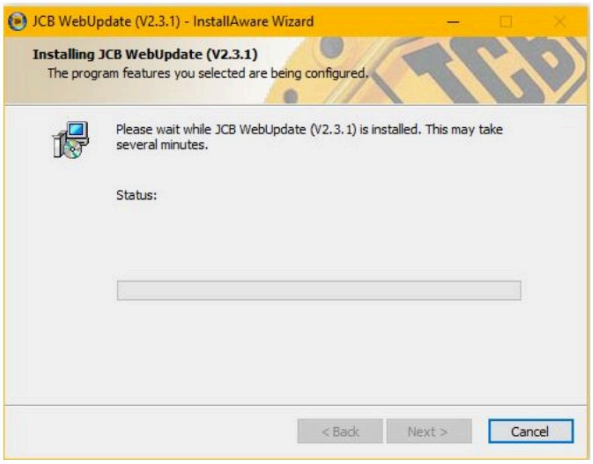
8. Due to the computer system firewall, you may get warning window "Internet Explorer - Security Warning".

   8.1. Click the "Run" option to proceed.

9. A new "JCB Web Update (V2.3.1) Installation Wizard" window will open. Refer to Figure 423.

   9.1. Once the download is finished, it will automatically run.

Figure 423.



10. The"JCB Web Update" program shortcut will be created on the computer desktop. Refer to Figure 424.

Figure 424.

11. Refer to the below section "Servicemaster Update" program to update Servicemaster.

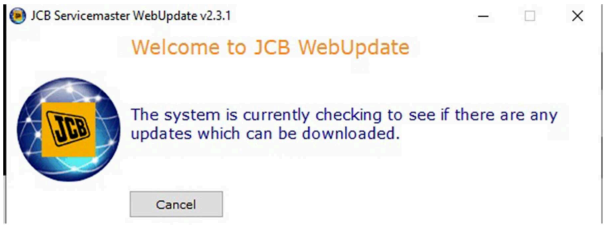
Servicemaster Updates - "JCB Web Update" Program

The updates for Servicemaster is downloaded through the "JCB Web Update" program on a laptop/ PC. Refer to the below steps.

1. Run the "JCB WebUpdate" program either by using desktop shortcut or "Help" menu within Servicemaster, to do a Servicemaster update.

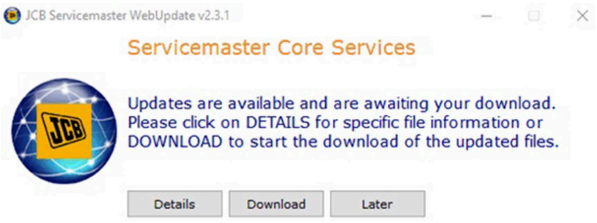
2. The "JCB WebUpdate" program will check for updates. Refer to Figure 425.

Figure 425.



3. The "JCB WebUpdate" program will inform you if there is any to download. Refer to Figure 426.

Figure 426.



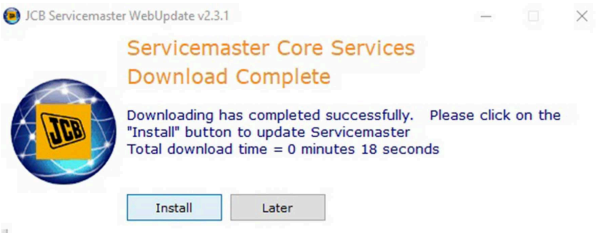
   3.1. You may click the "Details" option to check which files have been changed, added or removed.

   3.2. Click the "Download" option to download the updates.

4. Once the updates are downloaded, the "JCB Web Update" will give the option to install them. Refer to Figure 427.

   4.1. You may select options to install the updates immediately or at a later date.

Figure 427.

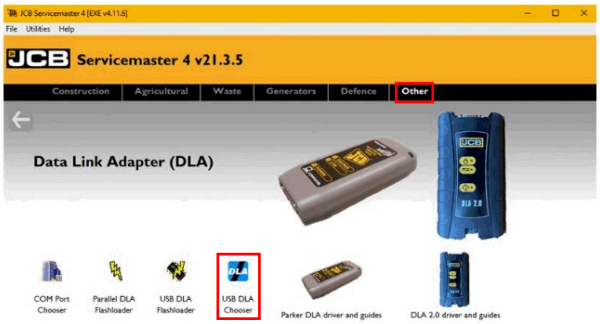


DLA Driver Software - Installation

When you use Servicemaster for the first time on your laptop/PC (which is newly installed with Servicemaster software), the DLA driver software is necessary to install first. Do the below steps to install the DLA driver software.

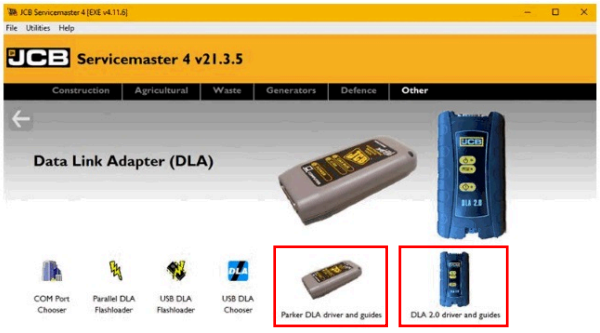
1. Once you complete the DLA driver software installation procedure, it will not require to be done again on your laptop/PC.
2. Do not connect the DLA or cables to the machine or laptop/PC before you install the DLA driver software.
3. Open Servicemaster on your laptop computer.
4. Click the "Other" tab to get access to the "General" icon.
5. Click the "General" icon to get access to the "DLA" icon.
6. Click the "DLA" icon. Refer to Figure 428.

Figure 428.



7. Click on DLA driver and guides icon. Refer to Figure 429.

Figure 429.



8. Based upon the driver you want to install. Refer to Figure 429. Select the appropriate version of DLA.
9. Select V1.10 USB DLA. Refer to Figure 430.

   9.1. Obey the window instructions to complete the DLA driver software installation.

Figure 430.

10. Select DLA 2.0 Drivers [v2.6.0.29]. Refer to Figure 431.

    10.1. Obey the window instructions to complete the DLA driver software installation.

Figure 431.

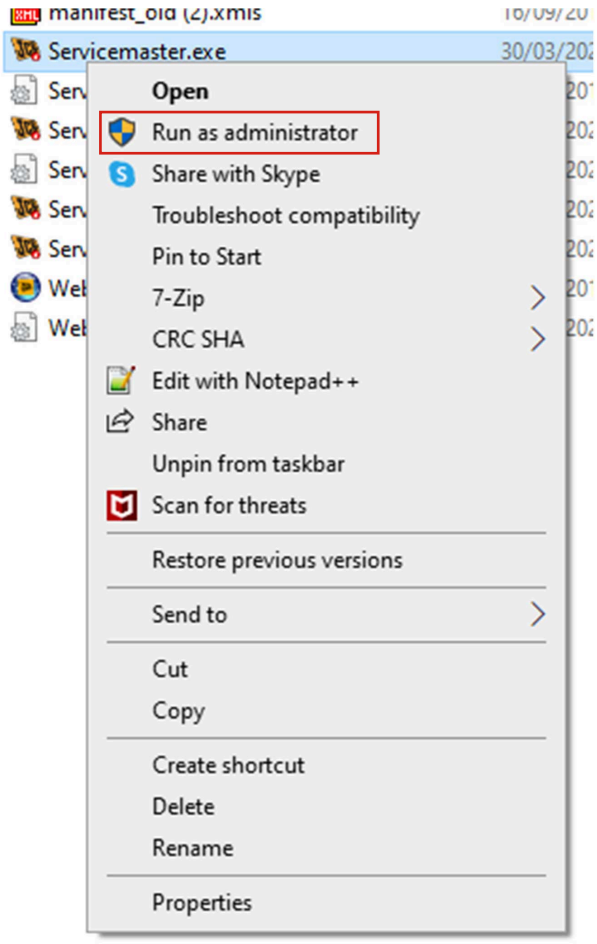
Switch between Parker and DLA 2.0

Switch from Parker DLA to DLA 2.0

1. On your laptop/PC go to “C: \JCB_Servicemaster_2”.

   1.1. Right click on “Servicemaster.exe” file and select “Run as Administrator”.

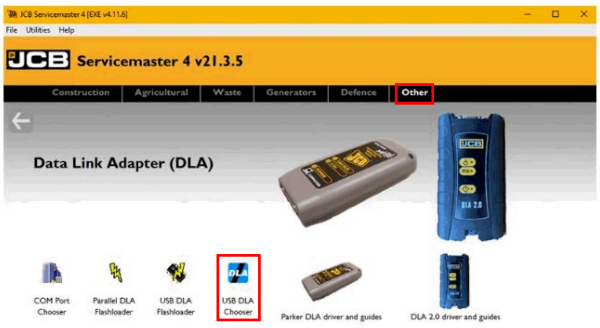
Figure 432.



2. In Servicemaster go to “Other>General>DLA”.

   2.1. Left click on “USB DLA Chooser”.

Figure 433.



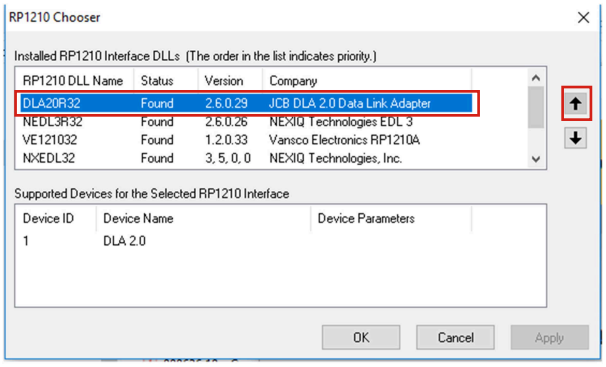
3. A new window will open.

   3.1. Select the “DLA20R32” item and move it to the top of the box with the highlighted arrow on the right side.

   3.2. Click “Apply” and then click on “Ok”.

   3.3. The DLA 2.0 is now ready to use.

Figure 434.

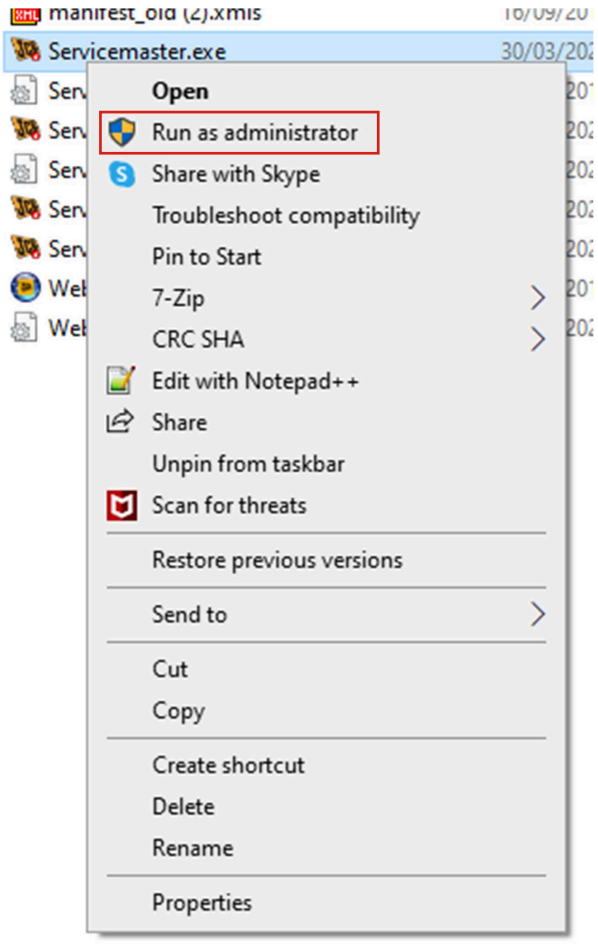


Switch from DLA 2.0 to Parker DLA

1. On your laptop/PC go to “C:\JCB_Servicemaster_2”.

   1.1. Right click on “Servicemaster.exe” file and select “Run as Administrator”.

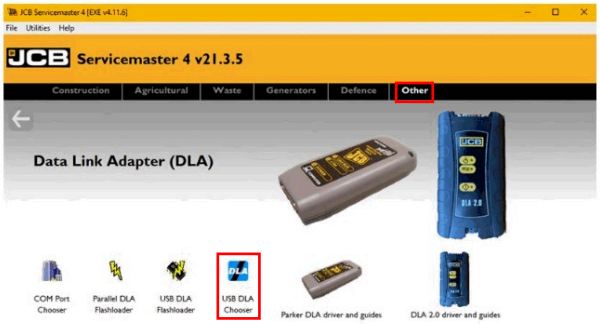
Figure 435.



2. In Servicemaster go to “Other>General>DLA”.

2.1. Left click on “USB DLA Chooser”.

Figure 436.



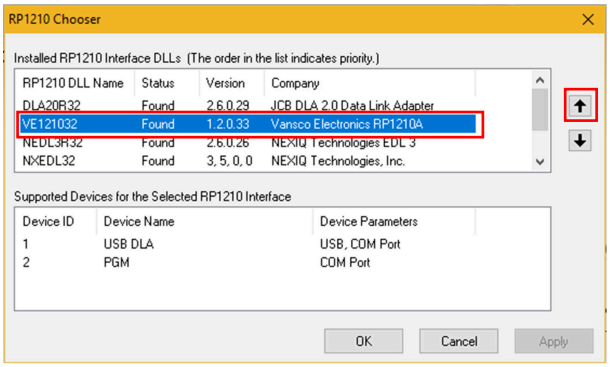
3. A new window will open. Refer to Figure 437.

   3.1. Select the “VE121032” item and move it to the top of the box with the highlighted arrow on the right side.

   3.2. Click “Apply” and then click on “Ok”.

   3.3. The Parker DLA is now ready to use.

Figure 437.



DLA Type and Communications Port - Configuration

When you use Servicemaster for the first time on your laptop/PC (which is newly installed with Servicemaster software) make sure that the correct DLA and laptop/PC port is selected to communicate with the DLA. Do the below steps to configure the DLA with the laptop/PC.

1. Once you complete the DLA configuration, it will not require to be done again on your laptop/PC.
2. Open Servicemaster on your laptop computer.
3. Click the "Other" tab to get access to the "General" icon.
4. Click the "General" icon to get access to the "DLA" icon.
5. Click the "DLA" icon.
6. Select and open the "COM Port Chooser" icon. Refer to Figure 438.

Figure 438.

7. A new "DLA Com Port Chooser" window will open.

   7.1. Select the "USB /Serial DLA" device and click the "Apply" option to confirm.

   7.2. Make a note that the older DLA and laptop computers may not be compatible with the USB ports. Select the "Parallel/Serial DLA" device in the DLA chooser.

DLA Firmware File - Check

Upon plugin of the DLA 2.0 from laptop to a machine and powered ON, the driver will update the Firmware on the device (DLA"2). Upon Servicemaster updates the latest DLA 2 Driver will also update. If update is needed the system will prompt an 'update required' message. If user selects 'OK' update happens automatically.

The DLA has software embedded in its own flash memory. This file must be replaced with a new one when new firmware is released. You will only have to Check the DLA firmware file version if you receive a new Servicemaster version or use a different DLA.

1. Make sure that the DLA is connected to the laptop computer.
2. Open Servicemaster on your laptop computer.
3. Click the "Other" tab to get access to the "General" icon.
4. Click the "General" icon to get access to the "DLA" icon.
5. Click the "DLA" icon.
6. Select and open the "USB DLA Flashloader" icon. Refer to Figure 439.

   6.1. Make a note that the older DLA and laptop computers may not be compatible

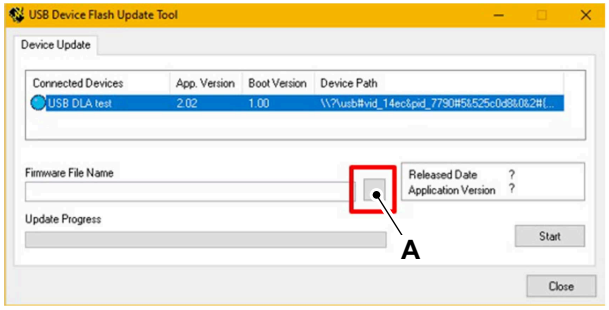
with the USB ports. Select and open the "Flashloader for Serial/Parallel DLA" icon.

Figure 439.

7. A window "USB Device Flash Update Tool" will open. Refer to Figure 440.

   7.1. The firmware details in the DLA are displayed with the application version (for example - 1.04). Refer to Figure 440.

Figure 440.



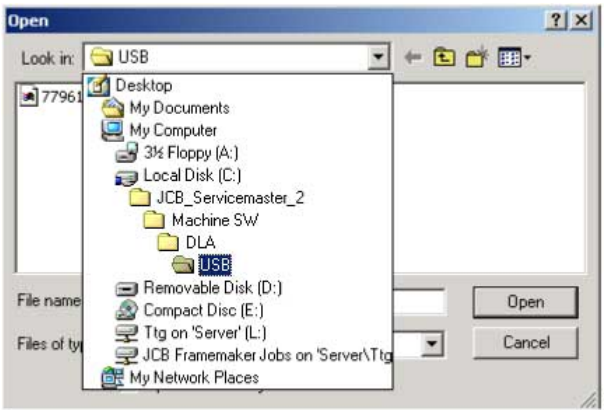
A Browse option

8. Check for a new firmware file.

   8.1. Click the "Browse" option and find the file stored within the JCB Servicemaster directory on your laptop hard drive. Refer to Figure 441.

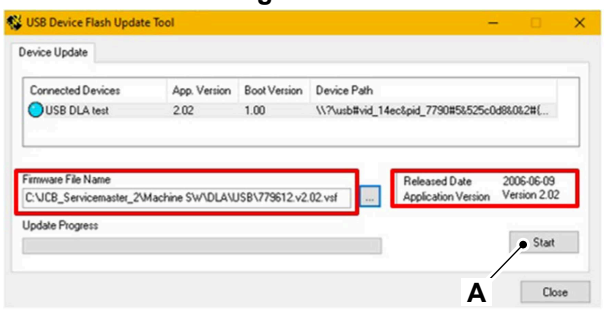
   8.2. Select the file and click the "Open" option.

Figure 441.



   8.3. The selected file appears in the "firmware file name" field together with its release date and application version (for example - 2.01). Refer to Figure 442.

Figure 442.



A Start option

9. Load a new firmware file.

   9.1. If the firmware in the DLA is not up to date, load the new file.

10. Click the "Start" option and obey the on-screen instructions.

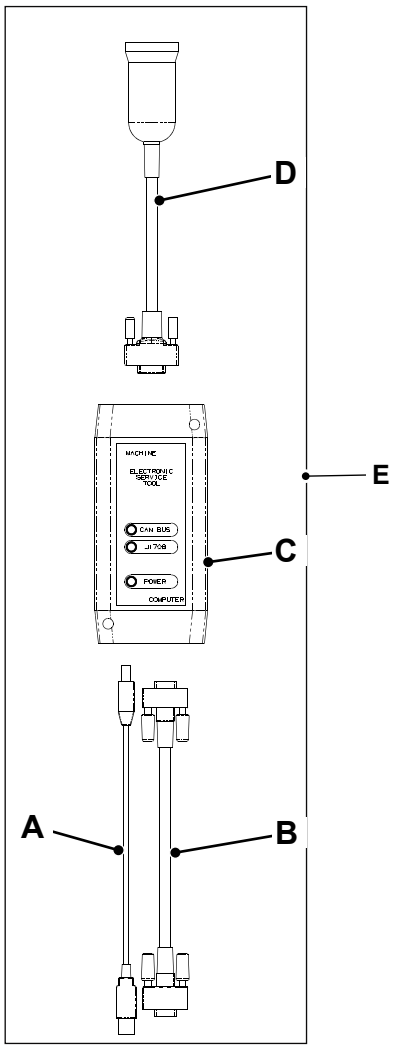
Disconnect and Connect

Special Tools

Description	Part No.	Qty.
Data Link Adaptor (DLA) Kit Data Link Adaptor (DLA 2.0) Kit	892/01174 728/H5409	1*
*Unless otherwise stated, you can use any of the tools shown.		

To use Servicemaster, connect your laptop computer to the machine CAN (Controller Area Network) bus. Connection is made using the DLA (Data Link Adaptor) and the applicable cables.

Figure 443.



A USB PC Cable - 718/20235
B Serial PC Cable - 718/20236
C USB DLA - 728/26500
D Machine Cable - 718/20237
E Kit - 892/01174 (contains items A, B, C and D)

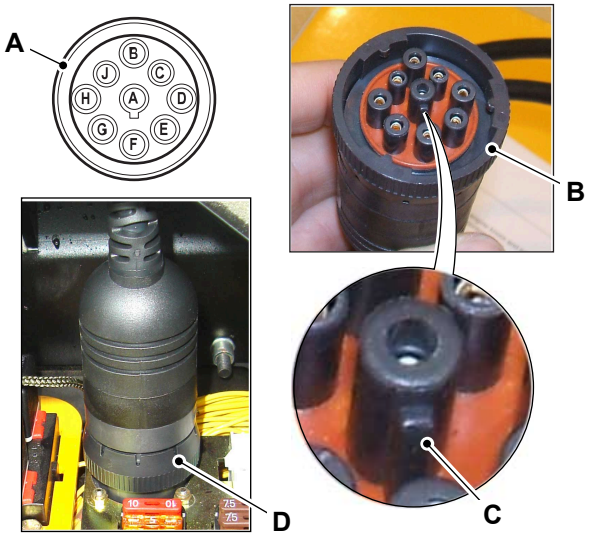
Note: Connect the USB cable directly to the laptop computer. Do not connect the cable via a USB hub.

Note: Older DLA and laptop computers may not be compatible with USB ports. Use the serial PC cable to connect the DLA to the laptop serial port.

1. Make sure the machine ignition system is OFF.
2. To use the Servicemaster diagnostic tool, connect the laptop computer to the machine.

   Special Tool: Data Link Adaptor (DLA) Kit / Data Link Adaptor (DLA 2.0) Kit (Qty.: 1)
3. Connect the USB PC Cable to the DLA and a free port on the laptop computer.
4. Connect the Machine Cable to the DLA. The Machine Cable has a 15-way D-type connector on one end and a 9-way CAN connector on the other. Plug the 15-way connector into the DLA and tighten the thumb screws.

Figure 444.



A USB PC Cable
B Serial PC cable
C Centre pin location tab
D Locking ring

5. Connect the 9-way CAN connector into the machines Diagnostics Connector as follows:

   5.1. Position the CAN connector to align the centre pin location tab with the diagnostics connector.

   5.2. Couple the connectors. Turn the locking ring clockwise to secure the connectors.

90 - Error Codes

Introduction 33-168
Technical Data 33-170

Introduction

Should faults occur related to an ECU (Electronic Control Unit) or devices connected to it, the electronic system will generate the applicable fault codes. A complete list of fault codes is stored within the applicable Servicemaster tools set.

Fault Code Structure

The structure of fault codes, otherwise known as DTC (Diagnostic Trouble Code)'s has been standardised to a 7 digit code for all on and off-highway machine and vehicle applications. The standard (referred to as J2012) requires all fault codes to conform to the following structure.

- 1st character - defines the system on the vehicle (e.g. P = Powertrain, C= Chassis, U = Network).
- 2nd and 3rd characters - defines the sub-system (e.g. transmission, CAN (Controller Area Network) network, brakes etc).
- 4th and 5th characters - specifies the particular component, circuit or fault (e.g. starter relay).
- 6th and 7th characters - referred to as the 'Failure Type Byte' (FTB) which indicates the particular failure (e.g. 11 = short circuit to ground). See FTB Numbers below for a full list.

Some specific fault codes are defined by international standard, while other codes may be defined by individual vehicle manufacturers.

Fault Code Log Display Systems

Depending on the machine specification fault codes recorded by the machine electronic control system can be accessed and displayed in several ways:

CAN Enabled Display

The machine may be equipped with a CAN enabled instrument display. Such a display will be capable of displaying all recorded codes, for example P0047. All logged codes will be displayed. The operator may also have a facility to erase the fault code log. Refer to the relevant instrument panel operation information.

CAN BUS Connected Computer

Fault codes logged can be accessed via a suitable laptop computer running the applicable diagnostics software, JCB 444 Engine Diagnostics for example. The computer must be connected to the machine CAN using the relevant service cables and adaptors. Once connected all recorded codes can be displayed. The engineer also has a facility to erase the fault code log.

Failure Type Byte (FTB) Numbers

Table 167.

Number	Failure Type Byte (FTB) Description
0	No sub-type information.
2	General signal failure.
4	System internal failure.
5	System programming failure.
7	Mechanical failure.
9	Component failure.
11	Short Circuit To Ground (SC2G).
12	Short Circuit To Battery (SC2V-BAT).
13	Open Circuit (OC).
16	Circuit voltage below threshold.
17	Circuit voltage above threshold.
18	Circuit current below threshold.
19	Circuit current above threshold.
1A	Circuit resistance above threshold.
1B	Circuit resistance below threshold.
1C	Circuit voltage out of range.
1F	Circuit intermittent.
23	Signal stuck low.
24	Signal stuck high.
26	Signal rate of change below threshold.
27	Signal rate of change above threshold.
29	Signal invalid.
2F	Signal erratic.
31	No Signal (lost/missing).
36	Signal frequency too low.
37	Signal frequency too high.
38	Signal frequency incorrect.
45	Program memory failure.
46	Calibration / Parameter memory failure.
47	Watchdog / micro-controller / microprocessor failure.
4B	Over temperature.
62	Signal compare failure.
64	Signal plausibility failure.
71	Actuator stuck.
72	Actuator stuck open.
73	Actuator stuck closed.
85	Signal above allowable range.
86	CAN signal invalid.
92	Performance or incorrect operation.
98	Component or system over temperature.

Malfunction Indicator Light (MIL)

Figure 445.

Amber/Red light. The MIL (Malfunction Indicator Lamp) light comes on to show that a system error has been detected. Refer to Figure 445.

- Red light. The light comes ON (and a continuous audible alarm sounds) to indicate faults that may result in serious damage to the machine or make the machine dangerous to operate. This is known as a ‘STOP NOW’ fault.

- Amber light. The light comes ON (and an audible alarm sounds for one second) to indicate faults that may result in reduced machine performance but are not dangerous. They are unlikely to damage the machine. This is known as a ‘SERVICE’ fault.

When the MIL light comes ON another applicable system warning may display. These lights can show a blink code. Refer to Blink Codes.

Blink Codes

Some machine systems are equipped with a dedicated indicator light. If there is a system fault the light can display fault codes as a series of blinks.

For example code E127 can be displayed as a series of blinks as follows:

Table 168.

1	Blink						
2 Second delay							
2	Blink	Blink					
2 Second delay							
7	Blink	Blink	Blink	Blink	Blink	Blink	Blink

The light will be ON for approximately 1s and OFF for approximately 0.5s. There is an OFF time of approximately 2s between the code digits.

When a blink code is displayed the MIL light can also come ON. Refer to Malfunction Indicator Light (MIL).

Technical Data

Table 169.

Fault Code	Description
P0016-64	Crankshaft and Camshaft synchronous error
P0088-0	C/Rail pressure exceeds hi upper limit3
P0112-16	Air temperature sensor signal too low
P0113-17	Air temperature sensor signal too high
P0116-92	Coolant temperature sensor performance invalid
P0117-16	Coolant temperature sensor signal too low
P0118-17	Coolant temperature sensor signal too high
P0122-16	Accelerator pedal sensor No.1 signal too low
P0123-17	Accelerator pedal sensor No.1 signal too high
P0182-16	Fuel temperature (w/pump) sensor signal too low
P0183-17	Fuel temperature (w/pump) sensor signal too high
P0191-2A	C/Rail press. Sensor signal keeping the middle range
P0191-25	PC sensor offset diagnosis (drifted high or low)
P0191-29	PC sensor offset diagnosis for NOX requirement (drifted high or low)
P0191-24	PC sensor high offset
P0192-16	C/Rail pressure sensor signal too low
P0193-17	C/Rail pressure sensor signal too high
P0200-1	Capacitor charge-up circuit malfunction injector (excessive charge)
P0201-13	Injector1 output open load injector coil open
P0203-13	Injector4 (4cyl engine)/Injector2 (3cyl engine) output open load injector coil open
P0205-13	Injector3 output open load injector coil open
P0206-13	Injector2 (4cyl engine) output open load injector coil open
P0217-0	Coolant temperature exceeds upper limit
P0219-0	Engine over speed condition
P0222-16	Accelerator pedal sensor No.2 signal too low
P0223-17	Accelerator pedal sensor No.2 signal too high
P0227-16	Accelerator pedal for ASC (PTO) sensor signal too low
P0228-17	Accelerator pedal for ASC (PTO) sensor signal too high
P0231-11	Electric lift pump relay short to GND
P0232-12	Electric lift pump relay short to battery
P0234-17	Boost pressure sensor exceeds upper limit
P0236-92	Boost pressure sensor performance invalid
P0237-16	Boost pressure sensor signal too low
P0238-17	Boost pressure sensor signal too high
P0263-2	Engine angle speed error1 (Injector1)
P0269-2	Engine angle speed error3 (Injector4 (4cyl engine)/Injector2 (3cyl engine))
P0275-2	Engine angle speed error2 (Injector3)
P0278-2	Engine angle speed error4 (Injector2 for 4cyl engine)
P0299-16	Boost pressure sensor exceeds lower limit
P0336-92	Crank position (CKP) sensor performance invalid
P0337-38	Crank position (CKP) sensor no pulse
P0341-92	Camshaft position (CMP) sensor performance invalid
P0342-2	Camshaft position (CMP) sensor no pulse
P0385-31	Crank position and camshaft position sensor no pulse

Fault Code	Description
P0400-29	EGR (Exhaust Gas Recirculation) feedback/position sensor/Dynamic range failure (for CAN)
P0403-72	EGR Cleaning failure (valve stuck open/poppet much lower than normal)
P0404-49	EGR battery/motor failure (for CAN (Controller Area Network))
P0405-16	EGR lift sensor signal too low
P0406-17	EGR lift sensor signal too High
P0462-16	Fuel level sensor signal too low
P0463-17	Fuel level sensor signal too high
P0480-1	Electric fan open load/short to GND/short to battery
P0488-71	EGR valve stuck/initialization failure (for CAN)
P0501-29	Vehicle speed sensor signal invalid
P0502-13	Vehicle speed sensor input open/ short
P0503-37	Vehicle speed sensor frequency too high
P0524-0	Engine oil pressure low
P0541-13	Glow relay output open load/short to GND
P0542-15	Glow relay output short to BATT
P0562-16	Vehicle system voltage too low (< 8V)
P0563-17	Vehicle system voltage too high (> 16V)
P0601-41	Check sum error - flash area
P0602-44	QR data error
P0606-49	CPU fault; main CPU fault
P0607-47	CPU fault; watchdog IC fault
P0611-96	Capacitor charge-up circuit malfunction injector (insufficient charge) within ECU
P0615-15	Starter switch short to BATT
P0616-11	Starter relay short to GND
P0617-12	Starter relay short to battery
P0627-14	SCV(+) output open load/short to GND; SCV(-) output open load/short to GND; SCV coil open/short
P0629-15	SCV(+) output short to BATT; SCV(-) output short to BATT
P0642-16	Battery 5V reference 1 circuit low (5V power supply for sensor)
P0643-17	Battery 5V reference 1 circuit high (5V power supply for sensor)
P0652-16	Battery 5V reference 2 circuit low (5V power supply for sensor)
P0653-17	Battery 5V reference 2 circuit high (5V power supply for sensor)
P0693-14	Coolant fan low speed relay short to GND
P0694-15	Coolant fan low speed relay short to battery
P0695-14	Coolant fan high speed relay short to GND
P0696-15	Coolant fan high speed relay short to battery
P0704-2	Clutch switch circuit malfunction (manual transmission only)
P0850-2	Neutral switch circuit malfunction (manual transmission only)
P0934-16	Hydraulic pressure sensor signal too low
P0935-17	Hydraulic pressure sensor signal too high
P1217-85	C/Rail pressure exceeds hi upper limit1
P1219-68	P/L (pressure limiter) activated
P1219-9A	Multiple high rail pressure error/ Engine stall after PLV opening
P1220-9A	C/Rail pressure control cannot achieve target fuel
P1221-2	C/Rail pressure falls below the control limit of the target pressure
P1222-22	Fuel filter diagnosis level 1
P1223-29	Fuel filter diagnosis level 2
P1601-46	QR definition error (definition concerning QR correction is not right)

Fault Code	Description
P1602-51	QR data is not written
P2122-16	Accelerator pedal for ASC (PTO) sensor 2 signal too low
P2123-17	Accelerator pedal for ASC (PTO) sensor 2 signal too high
P2146-13	COM1 Injector drive system output open load both Injector1 and Injector4 (4cyl engine)/Injector2 (3cyl engine) open load
P2147-14	COM1 Injector drive system output short to GND Injector1 or Injector3 (4cyl engine)/Injector2 (3cyl engine) output short to GND
P2148-15	COM1 Injector drive system output short to BATT Injector1 or Injector3 (4cyl engine)/Injector2 (3cyl engine) output short to BATT
P2228-16	Atmosphere pressure sensor signal too low
P2229-17	Atmosphere pressure sensor signal too high
P2269-64	Water in fuel filter failure
P2280-2F	Air filter clogging error
P2280-17	Air filter differential pressure sensor signal too high
P2280-16	Air filter differential pressure sensor signal too low
P2293-85	C/Rail pressure exceeds hi upper limit2
P2425-0	EGR valve temperature failure (for CAN)
P268B-54	Pump learning uncompleted
U0073-87	CAN1 node error
U0101-88	CAN bus-line open from general unit
U0107-87	TSC1 Time out error
U0408-56	TSC1 Rolling count test
U0408-41	TSC1 Checksum test
U0411-87	EGR no transmission/not received failure (for CAN)
U1001-87	CAN2 node error
B1001-17	E-Stop SC +ve to High AND -ve to OC
B1002-17	E-Stop SC -ve to High
B1003-16	E-Stop SC +ve to Low
B1004-16	E-Stop SC -ve to Low AND +ve to OC
B1005-17	Base Enable Switch SC to High
B1006-17	Platform Enable Switch SC to High
B1007-92	Platform Enable Switch AND Base Enable Switch both activated (5 - 10V)
B1008-16	Base Enable SC to Low
B1009-16	Platform Enable SC to Low
B1010-13	Base Enable Switch OC AND Platform Enable Switch OC
B1011-17	BOOM REST Limit Switch 1 SC to High
B1012-17	BOOM REST Limit Switch 2 SC to High
B1013-16	BOOM REST Limit Switch 1 SC to Low
B1014-13	BOOM REST Limit Switch 1 AND Switch 2 OC
B1015-16	BOOM REST Limit Switch 2 SC to Low
B1016-92	BOOM REST Limit Switch 1 AND Switch 2 short to 10V
B1017-17	TILT Sensor SC to High (not possible to detect until sensor connected to 10V)
B1018-16	TILT SENSOR SC to Low
B1019-17	SLEW POSITION Limit Switch 1 SC to High
B1020-17	SLEW POSITION Limit Switch 2 SC to High
B1021-16	SLEW POSITION Limit Switch 1 SC to Low
B1022-13	SLEW POSITION Limit Switch 1 and SLEW POSITION Limit Switch 2 OC
B1023-16	SLEW POSITION Limit Switch 2 SC to Low
B1024-92	SLEW POSITION Limit Switch 1 and SLEW POSITION Limit Switch 2 short to 10V

Fault Code	Description
B1026-17	CRUSH Protection Switch 1 SC to >5V
B1027-16	CRUSH Protection Switch 1 SC to Low
B1028-16	CRUSH Protection Switch 2 SC to Low
B1029-17	CRUSH Protection Switch 2 SC to >10.5V
B1030-17	FORWARD Proportional Solenoid Valve SC to High
B1031-16	FORWARD & REVERSE Proportional Solenoid Valves SC to Low
B1032-13	FORWARD & REVERSE Proportional Solenoid Valves OC
B1033-17	REVERSE Proportional Solenoid Valve HS SC to High
B1036-17	PUBLIC Proportional Solenoid Valve SC to High
B1037-16	PUBLIC Proportional Solenoid Valve SC to Low
B1038-13	PUBLIC Proportional Solenoid Valve OC
B1039-17	PLATFORM LEVELLING DIRECTIONAL Solenoid Valve Raise HS SC to High OR OC
B1040-16	PLATFORM LEVELLING DIRECTIONAL Solenoid Valve Raise HS SC to Low
B1041-17	PLATFORM LEVELLING DIRECTIONAL Solenoid Valve Lower HS SC to High OR OC
B1042-16	PLATFORM LEVELLING DIRECTIONAL Solenoid Valve Lower HS SC to Low
B1043-17	OSCILLATING AXLE Solenoid Valve SC to High
B1044-16	OSCILLATING AXLE Solenoid Valve SC to Low
B1045-13	OSCILLATING AXLE Solenoid Valve OC
B1046-17	HIGH TORQUE/LOW SPEED Solenoid Valve SC to High or OC
B1047-16	HIGH TORQUE/LOW SPEED Solenoid Valve SC to Low
B1048-17	FRONT BRAKE Solenoid Valve SC to High or OC
B1049-16	FRONT BRAKE Solenoid Valve Raise SC to Low
B1050-17	ENGINE START BUTTON SC to High
B1051-16	ENGINE START BUTTON SC to Low
B1052-24	ENGINE START BUTTON Stuck for >= 10 seconds
B1053-17	FOOT PEDAL SC to High
B1054-16	FOOT PEDAL SC to Low
B1055-17	ELECTRIC PUMP BUTTON SC to High
B1056-16	ELECTRIC PUMP BUTTON SC to Low
B1058-17	Override Switch Pressed SC to High
B1059-16	Override Switch Pressed SC to Low
B1060-13	Override Switch Pressed and Override Switch Unpressed OC
B1061-17	Override Switch Unpressed SC to High
B1062-16	Override Switch Unpressed SC to Low
B1063-92	Override Switch Pressed and Override Switch Unpressed Both activated (5-10V)
B1064-17	SLEW ACK SWITCH SC to High
B1065-16	SLEW ACK SWITCH SC to Low
B1066-24	SLEW ACK SWITCH SC Stuck for >= 10 seconds
B1067-17	POTENTIOMETER SC to High (>5.5V)
B1069-17	Drive JOYSTICK SC to High (>4.75V)
B1070-16	Drive JOYSTICK SC to Low (<0.25V) or OC
B1071-17	PLATFORM LEVELLING UP Switch SC to High
B1072-17	PLATFORM LEVELLING DOWN Switch SC to High
B1073-92	PLATFORM LEVELLING UP and DOWN Switches both activated (5 - 10V)
B1074-16	PLATFORM LEVELLING UP Switch SC to Low
B1075-16	PLATFORM LEVELLING DOWN Switch SC to Low
B1076-17	MAIN BOOM RAISE PROPORTIONAL Solenoid Valve SC to High
B1077-16	MAIN BOOM RAISE & LOWER PROPORTIONAL Solenoid Valves SC to Low
B1078-13	MAIN BOOM RAISE & LOWER PROPORTIONAL Solenoid Valves OC

Fault Code	Description
B1079-17	MAIN BOOM LOWER PROPORTIONAL Solenoid Valve SC to High
B1080-17	SLEW RIGHT PROPORTIONAL Solenoid Valve SC to High
B1081-16	SLEW RIGHT & LEFT PROPORTIONAL Solenoid Valves SC to Low
B1082-13	SLEW RIGHT & LEFT PROPORTIONAL Solenoid Valves OC
B1083-17	SLEW LEFT PROPORTIONAL Solenoid Valve SC to High:
B1084-17	MAIN BOOM EXTEND DIRECTIONAL Solenoid Valve SC to High
B1085-16	MAIN BOOM EXTEND & RETRACT DIRECTIONAL Solenoid Valves SC to Low
B1086-13	MAIN BOOM EXTEND & RETRACT DIRECTIONAL Solenoid Valves OC
B1087-17	MAIN BOOM RETRACT DIRECTIONAL Solenoid Valve SC to High
B1088-17	STEER RIGHT DIRECTIONAL Solenoid Valve SC to High
B1089-16	STEER RIGHT & LEFT DIRECTIONAL Solenoid Valves SC to Low
B1090-13	STEER RIGHT & LEFT DIRECTIONAL Solenoid Valves OC
B1091-17	STEER LEFT DIRECTIONAL Solenoid Valve SC to High
B1092-17	ARTICULATED BOOM RAISE DIRECTIONAL Solenoid Valve SC to High
B1093-16	ARTICULATED BOOM RAISE & LOWER DIRECTIONAL Solenoid Valves SC to Low
B1094-13	ARTICULATED BOOM RAISE & LOWER DIRECTIONAL Solenoid Valves OC
B1095-17	ARTICULATED BOOM LOWER DIRECTIONAL Solenoid Valves SC to High
B1096-17	ARTICULATED BOOM RAISE Switch SC to High
B1097-17	ARTICULATED BOOM LOWER Switch SC to High
B1098-92	ARTICULATED BOOM RAISE & LOWER Switches both activated (5 - 10V)
B1099-16	ARTICULATED BOOM RAISE Switch SC to Low
B1100-16	ARTICULATED BOOM LOWER Switch SC to Low
B1101-17	MAIN BOOM EXTEND Switch SC to High
B1102-17	MAIN BOOM RETRACT Switch SC to High
B1103-92	MAIN BOOM EXTEND & RETRACT Switches both activated (5 - 10V)
B1104-16	MAIN BOOM EXTEND Switch SC to Low
B1105-16	MAIN BOOM RETRACT Switch SC to Low
B1106-17	PLATFORM ROTATE RIGHT Switch SC to High
B1107-17	PLATFORM ROTATE LEFT Switch SC to High
B1108-92	PLATFORM ROTATE RIGHT & LEFT Switches both activated (5 - 10V)
B1109-16	PLATFORM ROTATE RIGHT Switch SC to Low
B1110-16	PLATFORM ROTATE LEFT Switch SC to Low
B1111-17	JIB UP Switch SC to High
B1112-17	JIB DOWN Switch SC to High
B1113-92	JIB UP & DOWN Switches both activated (5 - 10V)
B1114-16	JIB UP Switch SC to Low
B1115-16	JIB DOWN Switch SC to Low
B1116-17	MAIN BOOM RAISE (BASE) Switch SC to High
B1117-17	MAIN BOOM LOWER (BASE) Switch SC to High
B1118-92	MAIN BOOM RAISE & LOWER (BASE) Switches both activated (5 - 10V)
B1119-16	MAIN BOOM RAISE (BASE) Switch SC to Low
B1120-16	MAIN BOOM LOWER (BASE) Switch SC to Low
B1121-17	SLEW RIGHT (BASE) Switch SC to High
B1122-17	SLEW LEFT (BASE) Switch SC to High
B1123-92	SLEW RIGHT & LEFT (BASE) Switches both activated (5 - 10V)
B1124-16	SLEW RIGHT (BASE) Switch SC to Low
B1125-16	SLEW LEFT (BASE) Switch SC to Low
B1138-17	MAIN BOOM Telescopic Retract Limit Switch 1 SC to High
B1139-17	MAIN BOOM Telescopic Retract Limit Switch 2 SC to High

Fault Code	Description
B1140-16	MAIN BOOM Telescopic Retract Limit Switch 1 SC to Low
B1141-13	MAIN BOOM Telescopic Retract Limit Switch 1 AND Switch 2 OC
B1142-16	MAIN BOOM Telescopic Retract Limit Switch 2 SC to Low
B1143-92	MAIN BOOM Telescopic Retract Limit Switch 1 AND Switch 2 Short to 10V
B1144-17	10V INPUT System SC to High
B1145-16	10V INPUT System SC to Low
B1146-17	STEER JOYSTICK SC to High (>4.75V)
B1147-16	STEER JOYSTICK SC to Low (<0.25V) or OC
B1148-17	LIFT JOYSTICK SC to High (>4.75V)
B1149-16	LIFT JOYSTICK SC to Low (<0.25V) or OC
B1150-17	SLEW JOYSTICK SC to High (>4.75V)
B1151-16	SLEW JOYSTICK SC to Low (<0.25V) or OC
B1152-13	OBSTACLE INPUT Switch 1 SC to High AND OBSTACLE INPUT Switch 2 to OC
B1153-17	OBSTACLE INPUT Switch 2 SC to >10.5V
B1154-16	OBSTACLE INPUT Switch 1 SC to Low
B1155-13	OBSTACLE INPUT Switch 2 SC to Low
B1156-17	OBSTACLE INPUT Switch 1 SC to >10.5V
B1165-13	SOFT CONTACT DETECTION Switch 2 SC to Low
B1166-17	SOFT CONTACT DETECTION Switch 1 SC to >10.5V
B1167-13	PLATFORM ROTATE LEFT Solenoid Valve SC to High or OC
B1168-16	PLATFORM ROTATE LEFT Solenoid Valve SC to Low
B1169-13	PLATFORM ROTATE RIGHT Solenoid Valve SC to High or OC
B1170-16	PLATFORM ROTATE RIGHT Solenoid Valve SC to Low
B1171-13	JIB RAISE Solenoid Valve SC to High or OC
B1172-16	JIB RAISE Solenoid Valve SC to Low
B1173-13	JIB LOWER Solenoid Valve SC to High or OC
B1174-16	JIB LOWER Solenoid Valve SC to Low
B1175-13	MAIN BOOM LIFT/SLEW DIRECTIONAL Solenoid Valve SC to High or OC
B1176-16	MAIN BOOM LIFT/SLEW DIRECTIONAL Solenoid Valve SC to Low
B1177-16	BUZZER SC to Low
B1178-13	BUZZER OC
B1179-13	BEACON OC
B1180-16	BEACON SC to Low
B1181-16	HORN HS SC to Low
B1182-13	HORN HS OC
B1183-16	WHITE NOISE ALARM SC to Low
B1184-13	WHITE NOISE ALARM OC
B1186-16	HYDRAULIC GENERATOR LED SC to Low
B1187-13	HYDRAULIC GENERATOR LED OC
B1188-16	CAUTION LED SC to Low
B1189-13	CAUTION LED OC
B1190-16	FAULT LED SC to Low
B1191-13	FAULT LED OC
B1192-16	TILT LED SC to Low
B1193-13	TILT LED OC
B1194-16	OVERLOAD LED SC to Low
B1195-13	OVERLOAD LED OC
B1196-16	LOW FUEL LED SC to Low
B1197-13	LOW FUEL LED OC

Fault Code	Description
B1198-16	SLEW ACK LED SC to Low
B1199-13	SLEW ACK LED OC
B1200-16	PROXIMITY RESET LED SC to Low
B1201-13	PROXIMITY RESET LED OC
B1202-16	HIGH TORQUE LED SC to Low
B1203-13	HIGH TORQUE LED OC
B1204-16	HIGH ENGINE SPEED LED SC to Low
B1205-13	HIGH ENGINE SPEED LED OC
B1206-17	HORN BUTTON SC to High
B1207-16	HORN BUTTON SC to Low
B1208-24	HORN BUTTON Stuck for >= 10 seconds
B1209-17	HIGH ENGINE SPEED BUTTON SC to High
B1210-16	HIGH ENGINE SPEED BUTTON SC to Low
B1211-24	HIGH ENGINE SPEED BUTTON Stuck for >= 10 seconds
B1212-17	HIGH TORQUE SPEED BUTTON SC to High
B1213-16	HIGH TORQUE SPEED BUTTON SC to Low
B1214-24	HIGH TORQUE SPEED BUTTON Stuck for >= 10 seconds
B1215-17	HYDRAULIC GENERATOR BUTTON SC to High
B1216-16	HYDRAULIC GENERATOR BUTTON SC to Low
B1217-24	HYDRAULIC GENERATOR BUTTON Stuck for >= 10 seconds
B1218-17	PROXIMITY RESET BUTTON SC to High
B1219-16	PROXIMITY RESET BUTTON SC to Low
B1220-24	PROXIMITY RESET BUTTON Stuck for >= 10 seconds
B1221-17	LOAD SENSOR 1 OOR High
B1222-16	LOAD SENSOR 1 OOR Low
B1223-17	LOAD SENSOR 2 OOR High
B1224-16	LOAD SENSOR 2 OOR Low
B1225-2F	LOAD SENSOR Data Erratic (Difference > 20%)
B1227-17	AXLE LOCK PRESSURE SENSOR SC to High
B1228-16	AXLE LOCK PRESSURE SENSOR SC to Low or OC
B1233-16	FUEL SENDER OOR Low
B1235-17	E-Stop SC +ve to High AND -ve to OC
B1236-17	E-Stop SC -ve to High
B1237-16	E-Stop SC +ve to Low
B1238-16	E-Stop SC -ve to Low AND +ve to OC
B1239-17	ENGINE START BUTTON SC to High
B1240-16	ENGINE START BUTTON SC to Low
B1241-24	ENGINE START BUTTON Stuck for >= 10 seconds
B1242-17	PLATFORM LEVELLING UP Switch SC to High
B1243-17	PLATFORM LEVELLING DOWN Switch SC to High
B1244-92	PLATFORM LEVELLING UP and DOWN Switches both activated (5 - 10V)
B1245-16	PLATFORM LEVELLING UP Switch SC to Low
B1246-16	PLATFORM LEVELLING DOWN Switch SC to Low
B1247-17	ARTICULATED BOOM RAISE Switch SC to High
B1248-17	ARTICULATED BOOM LOWER Switch SC to High
B1249-92	ARTICULATED BOOM RAISE & LOWER Switches both activated (5 - 10V)
B1250-16	ARTICULATED BOOM RAISE Switch SC to Low
B1251-16	ARTICULATED BOOM LOWER Switch SC to Low
B1252-17	MAIN BOOM EXTEND Switch SC to High

Fault Code	Description
B1253-17	MAIN BOOM RETRACT Switch SC to High
B1254-92	MAIN BOOM EXTEND & RETRACT Switches both activated (5 - 10V)
B1255-16	MAIN BOOM EXTEND Switch SC to Low
B1256-16	MAIN BOOM RETRACT Switch SC to Low
B1257-17	PLATFORM ROTATE RIGHT Switch SC to High
B1258-17	PLATFORM ROTATE LEFT Switch SC to High
B1259-92	PLATFORM ROTATE RIGHT & LEFT Switches both activated (5 - 10V)
B1260-16	PLATFORM ROTATE RIGHT Switch SC to Low
B1261-16	PLATFORM ROTATE LEFT Switch SC to Low
B1262-17	JIB UP Switch SC to High
B1263-17	JIB DOWN Switch SC to High
B1264-92	JIB UP & DOWN Switches both activated (5 - 10V)
B1265-16	JIB UP Switch SC to Low
B1266-16	JIB DOWN Switch SC to Low
B1267-17	10V INPUT System SC to High - Platform
B1268-16	10V INPUT System SC to Low - Platform
B1269-16	BUZZER SC to Low
B1270-13	BUZZER OC
B1273-17	HORN BUTTON SC to High
B1274-16	HORN BUTTON SC to Low
B1275-24	HORN BUTTON Stuck for >= 10 seconds
B1276-24	Base Startlock Stuck (Generic o/p fault)
B1277-24	Platform Startlock Stuck (Generic o/p fault)
B1278-17	REAR BRAKE Solenoid Valve SC to High or OC
B1279-16	REAR BRAKE Solenoid Valve Raise SC to Low
B1280-16	VSS1 Low Voltage (<= 4.5V)
B1281-16	VSS2 Low Voltage (<= 9.5V)
B1282-16	VSS3 Low Voltage (<= 4.5V)
B1283-16	VSS1 Low Voltage (<= 4.5V)
B1284-16	VSS2 Low Voltage (<= 9.5V)
B1285-16	VSS3 Low Voltage (<= 4.5V)
B1286-86	SLEW RIGHT (BASE) Switch SC =! OC
B1287-2F	FUEL SENDER Data Erratic
B1288-2F	OSCILLATING AXLE Failure
B1289-17	BASE INPUT SHORT TO 10V
B1290-17	PLATFORM INPUT SHORT TO 10V
U1293-87	CAN TIME OUT ERROR
U1294-56	CAN RC ERROR
U1295-41	CAN CHECKSUM ERROR
U1296-87	CAN TIME OUT ERROR
U1297-56	CAN RC ERROR
U1298-41	CAN CHECKSUM ERROR
U1299-87	CAN PAIRING FAILED ERROR

84 - Sensor

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00 - General

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Component Identification 33-180
Check (Condition) 33-182

Introduction

There are four types of sensors installed on these machines.

- Mechanical limit switch
- Tilt sensor
- Weight sensor
- Pressure sensor

Mechanical Limit Switch

The mechanical limit switch is activated by moving the switch probe with the machine parts to monitor their position. The following are the mechanical limit switches.

- Main boom limit down switch
- Articulated boom down limit switch
- Telescopic boom retract limit switch
- Slew position limit switch

Tilt Sensor

The tilt sensor is activated when the machine chassis is beyond the rated slope for lifting the platform.

- Chassis tilt sensor

Weight Sensor

The Weight Sensor monitors the weight in the platform to detect if the platform is loaded with more than the rated load.

- Platform weight sensor

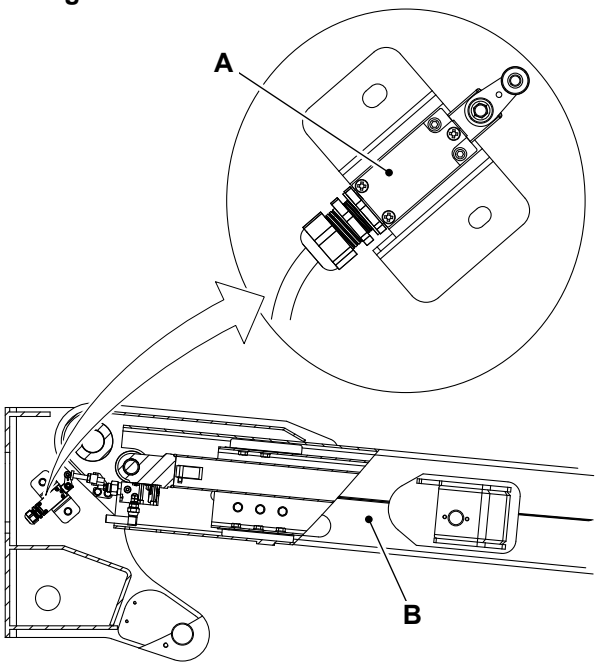
Pressure Sensor

The pressure sensor monitors the control system of the oscillating axle, to check that the axle is locked to stabilise the machine.

- Oscillating axle pressure sensor

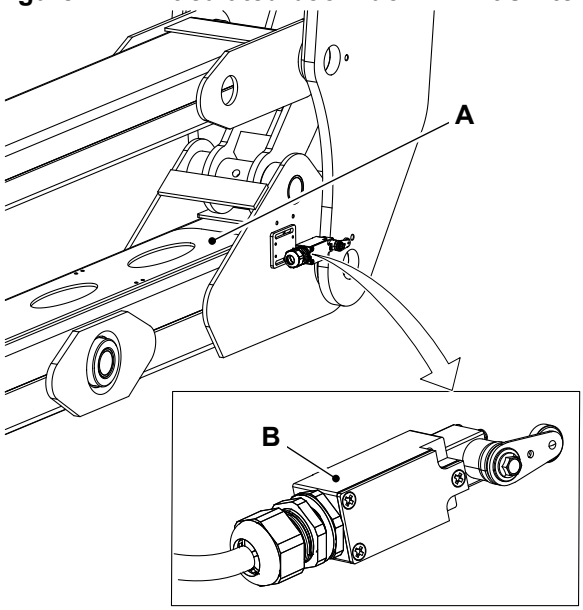
Component Identification

Figure 446. Main boom limit down switch



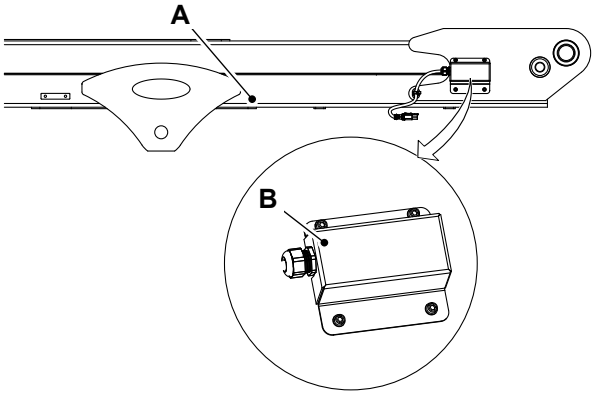
A Main boom limit down switch
B Main boom

Figure 447. Articulated boom down limit switch



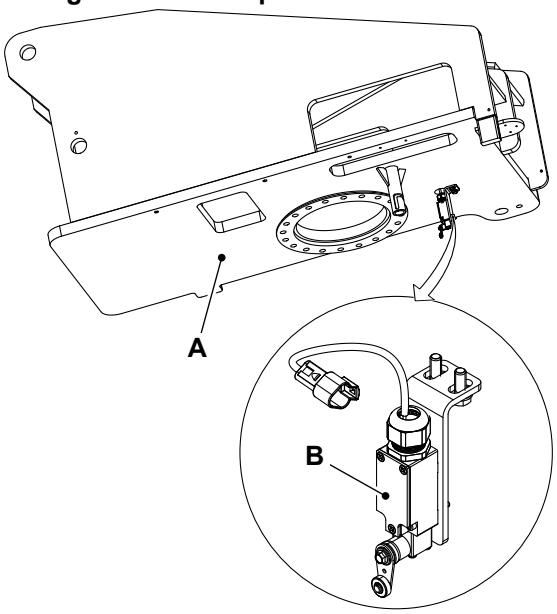
A Articulated boom
B Articulated boom down limit switch

Figure 448. Telescopic boom retract limit switch



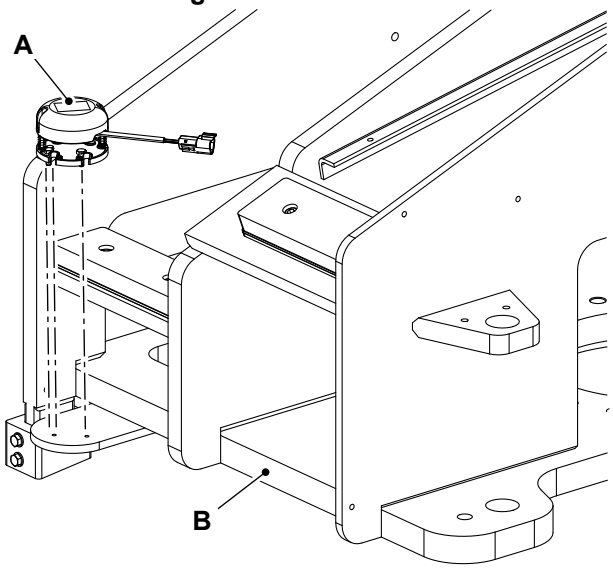
A Telescopic boom
B Telescopic boom retract limit switch

Figure 449. Slew position limit switch



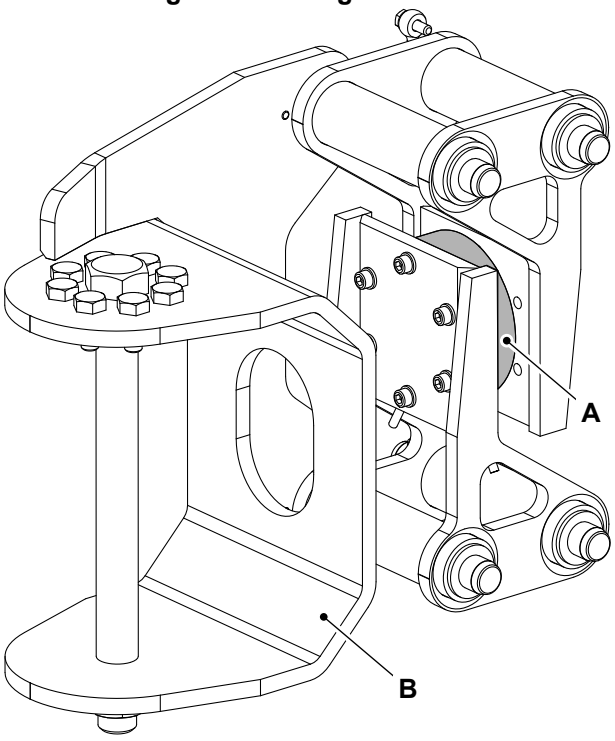
A Turntable structure
B Slew position limit switch

Figure 450. Tilt sensor



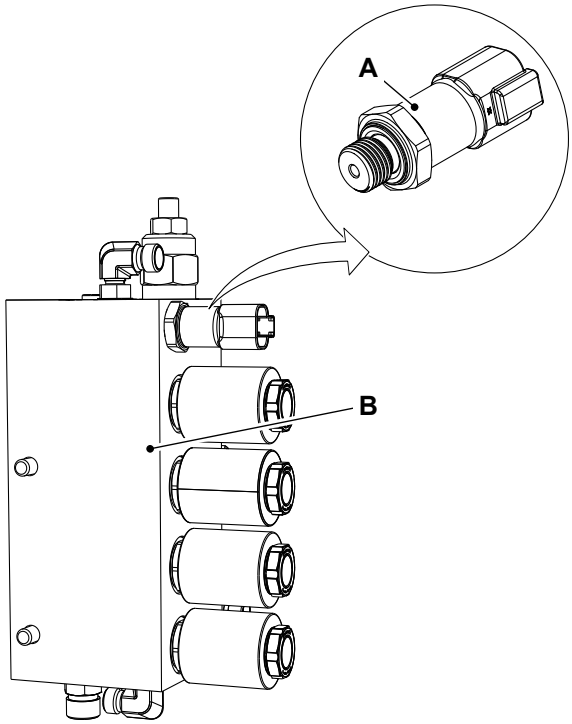
A Tilt sensor
B Turntable (for reference)

Figure 451. Weight sensor



A Weight sensor
B Kingpost (for reference)

Figure 452. Pressure sensor



A Pressure sensor
B Brake valve

Check (Condition)

Mechanical Limit Switch

1. Activate the limit switch manually.
   1.1. Make sure that the limit switch moves optionally and resets automatically.
   1.2. Make sure that an audible click sound is heard.
2. Release the limit switch.
3. Use a multimeter to test the resistance between the switch joints. Make sure that it forms a closed circuit.
4. Activate the limit switch manually.

Proximity Switch

1. Use a multimeter to test the resistance between the switch joints. Make sure that it forms a closed circuit.
2. Find the magnetic area of the switch.
3. Place a magnetic metal block in front of the magnetic area within the specified distance.

   Distance: 12.7mm
4. Use a multimeter to test the resistance between the switch joints. Make sure that it forms a closed circuit.
5. Move the magnetic metal block away from the magnetic area.

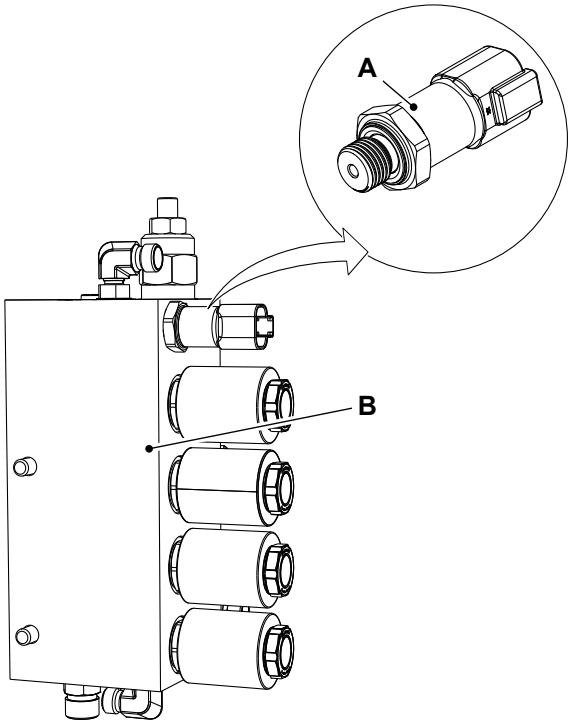
07 - Hydraulic Pressure

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Discharge the hydraulic pressure.
3. Remove the chassis panel.
4. Get access to the brake control valve.
5. Disconnect the electrical connections from the sensor.
6. Place a suitable tray to collect the oil.
7. Remove the pressure sensor from the brake control valve.

Figure 453.



A Pressure sensor
B Brake valve

Install

1. The installation procedure is the opposite of the removal procedure.
2. Torque tighten the pressure sensor to specified value.

60 - Tilt

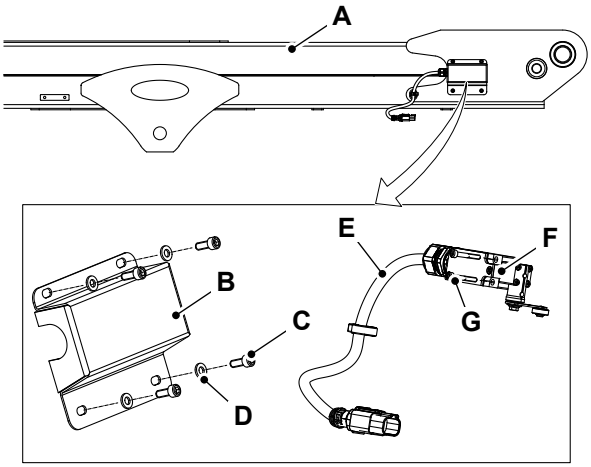
Check (Operation) 33-184
Calibrate 33-185
Remove and Install 33-186

Check (Operation)

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Disconnect the electrical connections from the sensor.
3. Remove the cap screw 1 (x4), washer (x4) and switch cover.
4. Remove cap screw 2 (x2) and limit switch from the telescopic boom.

Figure 454.



A Telescopic boom
B Switch cover
C Cap screw 1 (x4) 15Nm
D Washer (x4)
E Electrical connector
F Limit switch
G Cap screw 2 (x2)- torque as per STD

Install

1. 2. The installation procedure is the opposite of the removal procedure.
2. 3. Torque tighten the cap screw 1 to specified torque value.
   Torque: 15N·m
   2.1. 3.1. Torque tighten the cap screw 1 to specified torque value.
   Refer to: PIL 72-03-00.
3. 4. Calibrate the telescopic boom retract limit switch.
   Refer to: Calibrate (PIL 33-85-15).

Calibrate

Special Tools

Description	Part No.	Qty.
Tilt sensor calibration lead	400/J2673	1

Do the following steps to check tilt sensor is working correctly.

If load sensing system is not calibrated, disable the overload alarm in base display.

1. Important: It is safety critical that the level of the ground is confirmed as flat during this calibration.
2. Make the machine safe.

   Refer to: PIL 01-03-27.
3. When the machine is on level ground (specified angle in each direction), do the following.

   Angle: 0°

   3.1. Connect the tilt sensor calibration lead to the specified power supply.

   Voltage: 12V
   Special Tool: Tilt sensor calibration lead (Qty.: 1)

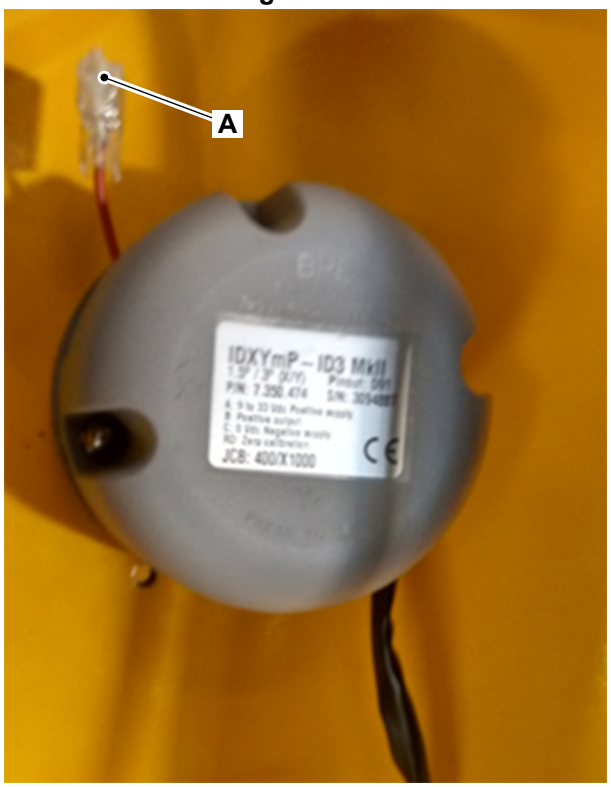
   3.2. Allow the lead to be connected with power supply for the specified duration.

   Duration: 3–7s

   3.3. This sets the zero position.
4. Disconnect the tilt sensor calibration lead from the power source.

   4.1. The green colour LED (Light Emitting Diode) must blink.

Figure 455.



A Spare cable

Do the following steps to check tilt sensor is qualified on the X-axis.

1. Put the right side machine tyres on blocks so that the machine is at specified angle to the ground.

   Angle: 5.1°
2. Check that the tilt icon on the display, and the tilt LED on the platform control panel are turned on (red).
3. Using the base control panel, raise the main boom.

   3.1. If the machine stops above the Main boom down limit switch, the tilt sensor qualifies on X-axis.

   3.2. Check the tilt icon on the Display and the tilt LED on the Platform control panel are flashing (red) and the buzzers are beeping.
4. Do the steps 1 to step 3.2 on the left side.

Do the following steps to check tilt sensor is qualified on the Y-axis.

1. Put the front machine tyres on blocks so that the machine is at specified angle to the ground.

   Angle: 5.1°

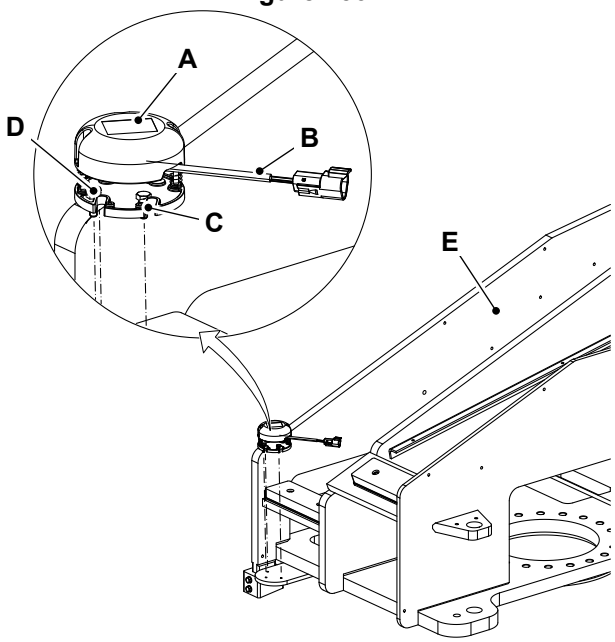
2. Check that the tilt icon on the display, and the tilt LED on the platform control panel are turned on (red).
3. Using the base control panel, raise the main boom.
   3.1. If the machine stops above the Main boom down limit switch, the tilt sensor qualifies on Y-axis.
   3.2. Check the tilt icon on the Display and the tilt LED on the Platform control panel are flashing (red) and the buzzers are beeping.
4. Do the steps 1 to step 3.2 on the rear side.

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Disconnect the electrical connections from the sensor.
3. Remove the setscrew (x2) and washer (x2).
4. Remove the tilt sensor from the turntable assembly.

Figure 456.



A Tilt sensor
B Electric connector
C Washer (x2)
D Setscrew (x2)
E Turntable assembly

Install

1. The installation procedure is the opposite of the removal procedure.
2. Torque tighten the setscrew and nuts to specified torque value. PIL: 72-03-00
   Refer to: PIL 72-03-00.
3. Calibrate the tilt sensor.
   Refer to: Calibrate (PIL 33-84-60).

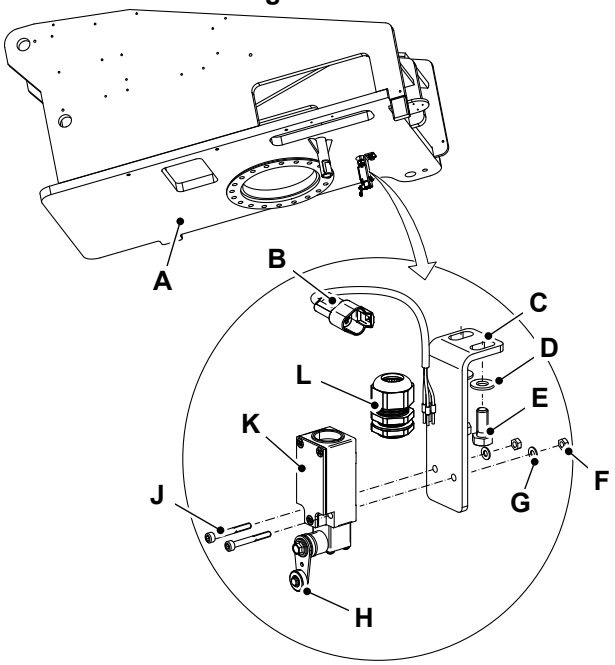
76 - Slew

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Disconnect the electrical connections from the sensor.
3. Remove the setscrew (x2) and washer 1 (x2).
4. Remove the switch mounting from the machine.
5. Remove the cap screw (x2), washer 2 (x2) and nut (x2) from the switch mounting.
6. Remove the limit switch.

Figure 457.



A Turntable structure
B Electric connector
C Switch mounting plate
D Washer 1 (x2)
E Setscrew (x2)
F Nut (x2)
G Washer 2 (x2)
H Limit switch metal roller
J Cap screw (x2)
K Limit switch
L Cab gland

Install

1. The installation procedure is the opposite of the removal procedure.
2. Torque tighten the setscrew and nuts to specified torque value.

Table 170. Torque Values

Item	Nm
E	22
F	2.6

86 - Platform Weight Limit

Calibrate 33-188
Remove and Install 33-189

Calibrate

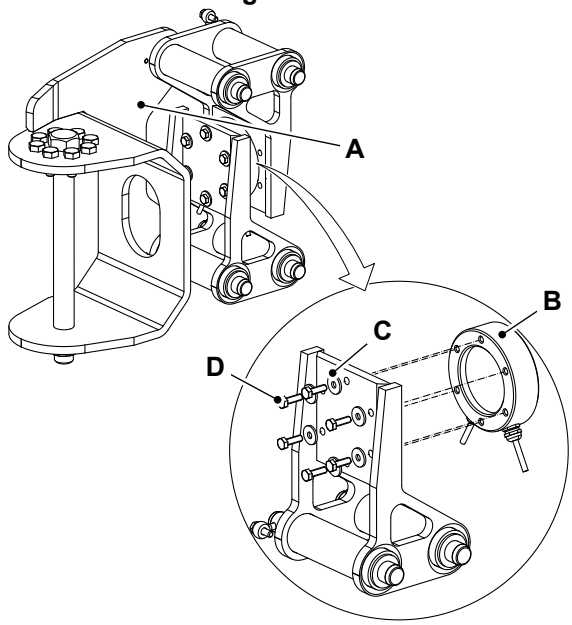
To calibrate platform weight sensor-
Refer to: Calibrate (PIL 01-12-00).

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Make sure the platform weight is supported, so that the weight sensor is not in compression.
3. Disconnect the electrical connections from the sensor.
4. Remove the setscrew (x6) and washer (x6).
5. Remove the weight sensor from the kingpost assembly.

Figure 458.



A Kingpost
B Weight sensor
C Washer (x6)
D Setscrews (x6)

Install

1. The installation procedure is the opposite of the removal procedure.
2. Torque tighten the setscrew to specified torque value.
   Torque: 9N·m
3. Calibrate the weight sensor.
   Refer to: Calibrate (PIL 33-84-86).

85 - Limit Switch

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33-85-10 Articulated Lift Arm 33-194
33-85-15 Boom Telescopic 33-197

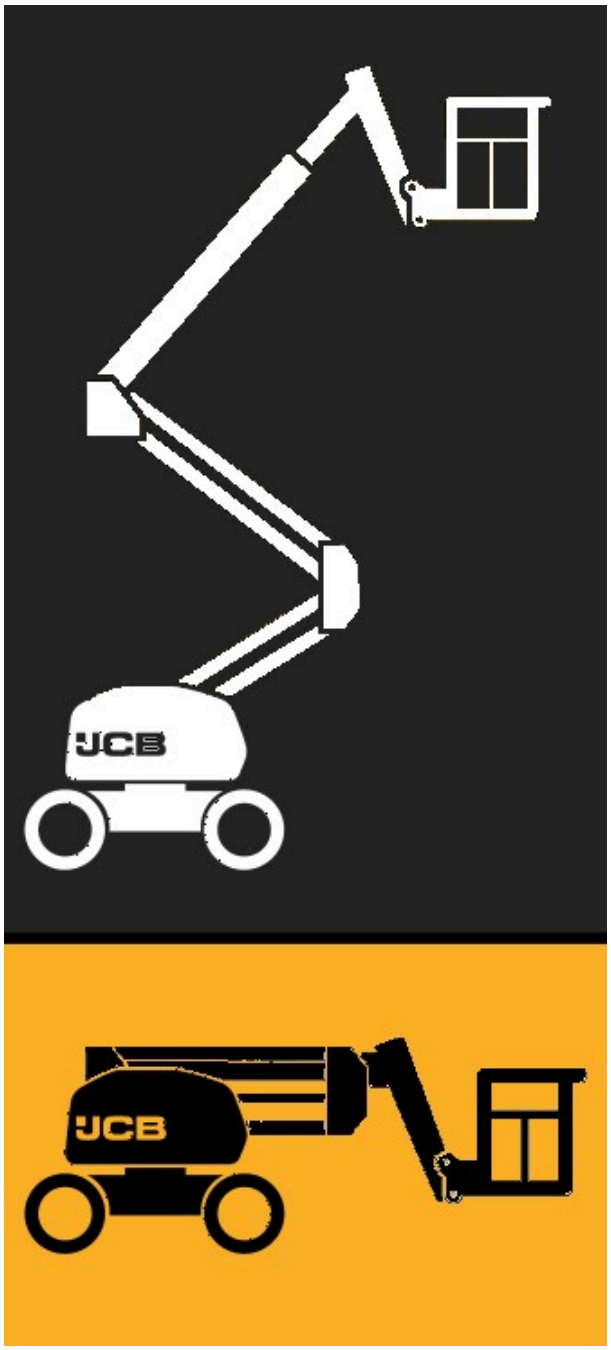
05 - Boom Lift

Calibrate 33-191
Remove and Install 33-193

Calibrate

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Make sure all of the booms are fully lowered, with the cylinders fully retracted.

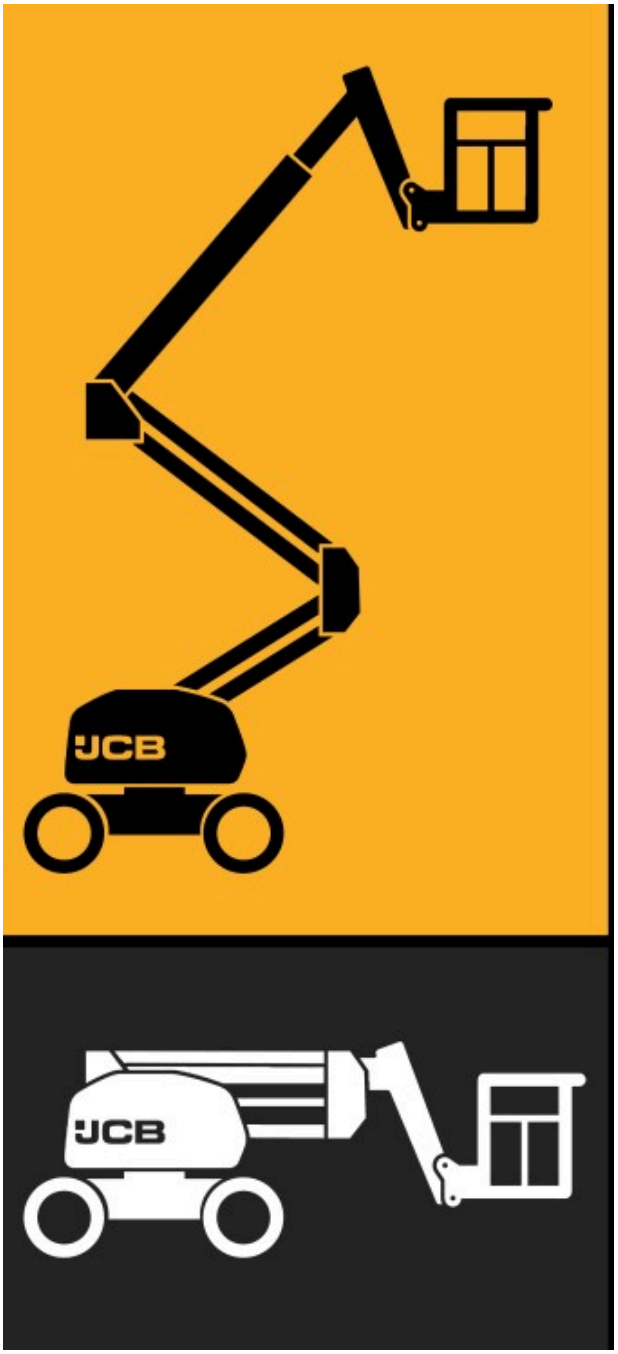
Figure 459. Stowed Position Identified by the Display



2.1. The display should show the machine is in the stowed position.

3. Make sure that there is no load on the platform.
4. Raise the main boom slowly until the display icon just changes from Stowed to Raised position. This indicates that the main boom is now above the main boom down limit switch.

Figure 460. Raised Position Identified by the Display



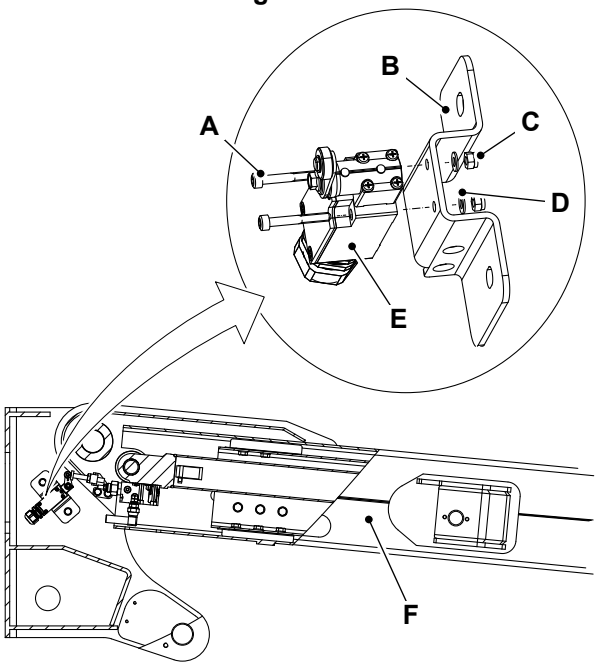
5. Measure the distance from the platform floor to the ground. It should be 1130±100mm.
6. Adjust the main boom down limit switch position and repeat steps 1-5 until the height is within the limits.

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Get access to the main boom down limit switch.
3. Disconnect the electrical connections from the sensor.
4. Remove the setscrew (x2), washer (x2) and nut (x2) from the limit switch bracket.
5. Remove the limit down switch from the main boom.

Figure 461.



A Setscrew (x2)
B Limit switch bracket
C Nut (x2)
D Washer (x2)
E Main boom down limit switch
F Main boom

Install

1. The installation procedure is the opposite of the removal procedure.
2. Torque tighten the setscrew to specified torque value.
   Torque: 3.5N·m
3. Calibrate the main boom down limit switch.
   Refer to: Calibrate (PIL 33-85-05).

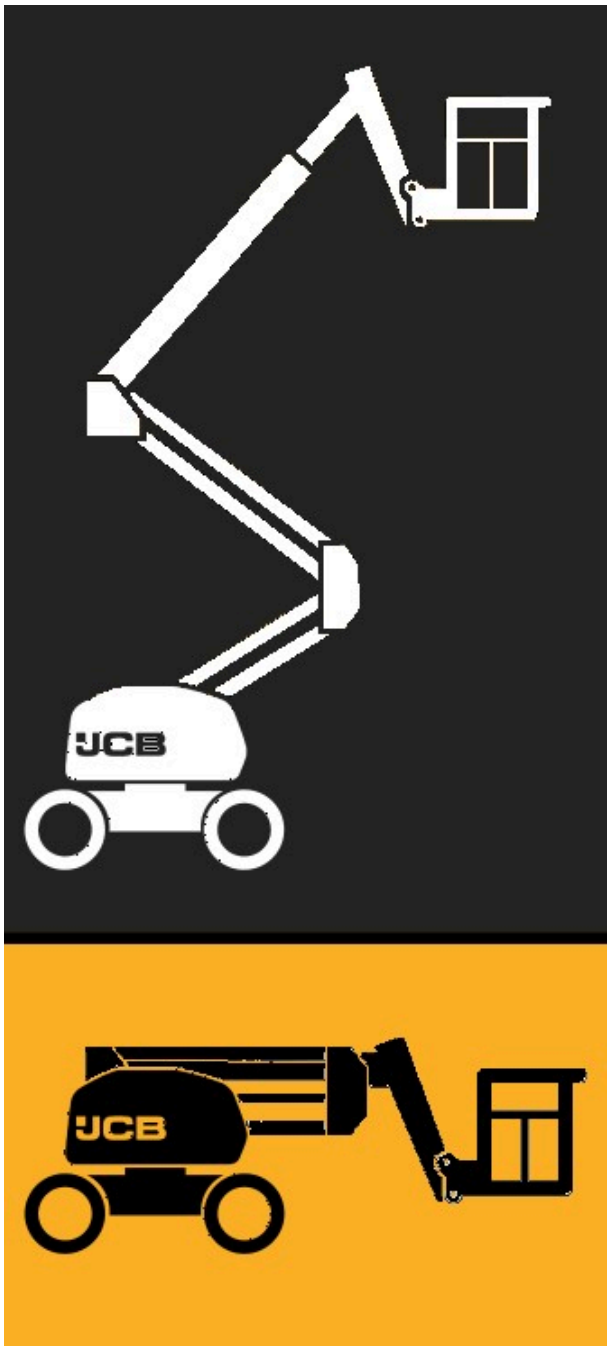
10 - Articulated Lift Arm

Calibrate 33-194
Remove and Install 33-196

Calibrate

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Make sure all of the booms are fully lowered, with the cylinders fully retracted.

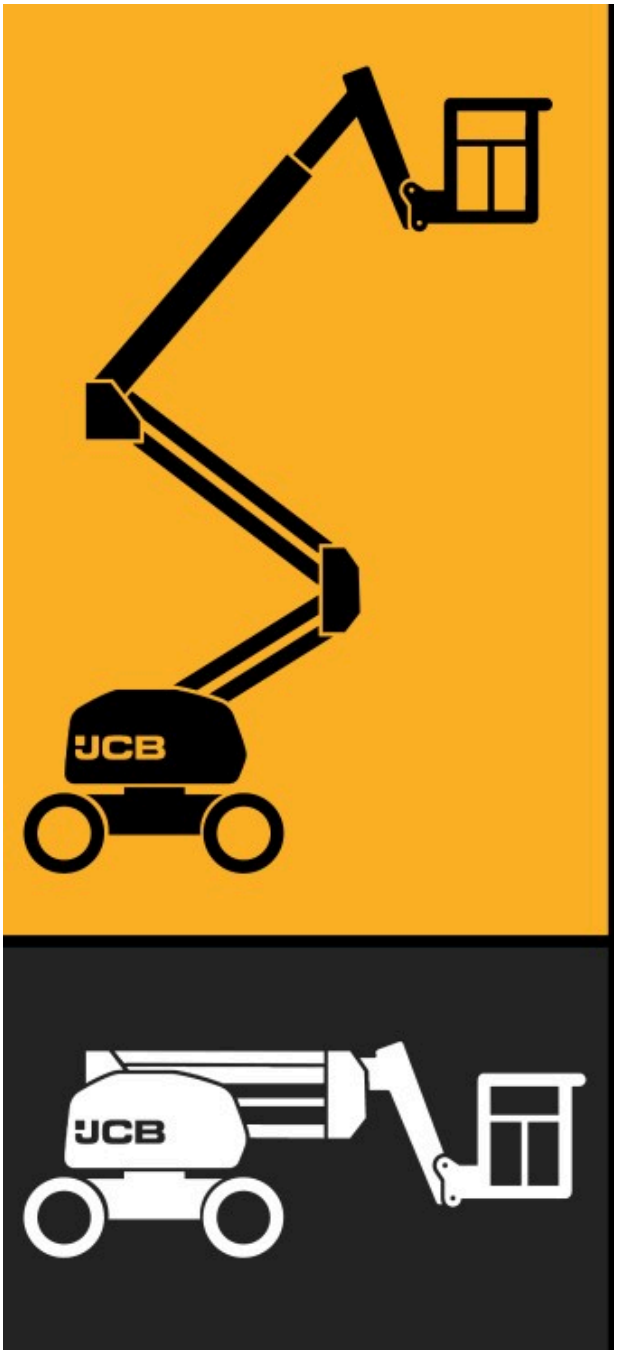
Figure 462. Stowed Position Identified by the Display



2.1. The display should show the machine is in the stowed position.

3. Make sure that there is no load on the platform.
4. Raise the articulated boom slowly until the display icon just changes from Stowed to Raised position. This indicates that the articulated boom is now above the articulated boom down limit switch.

Figure 463. Raised Position Identified by the Display



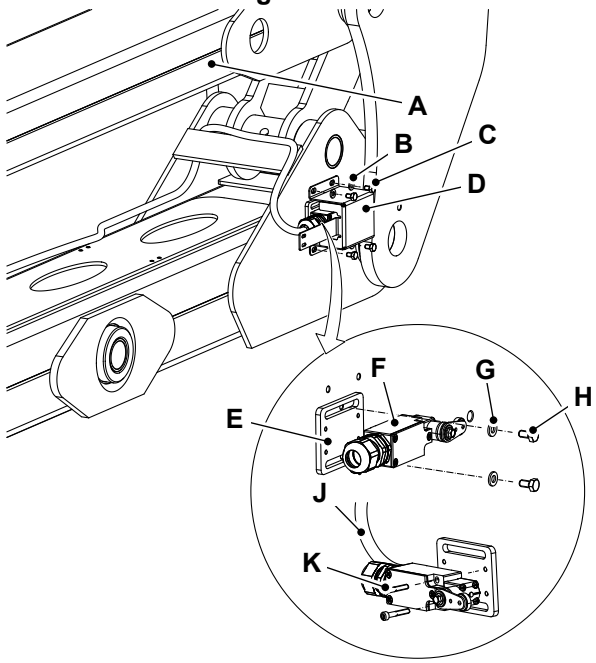
5. Measure the distance from the platform floor to the ground. It should be 940±100mm.
6. Adjust the articulated boom down limit switch position and repeat steps 1-5 until the height is within the limits.

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Disconnect the electrical connections from the sensor.
3. Remove the setscrew1 (x4), washer 1 (x4) and switch cover.
4. Remove setscrew 2 (x2), washer 2 (x2) and cap screws (x2) from the switch mounting.
5. Remove the limit switch from the switch mounting.

Figure 464.



A Articulated boom
B Washer 1 (x4)
C Setscrew 1 (x4)
D Switch cover
E Switch mounting
F Limit switch
G Washer 2 (x2)
H Setscrew 2 (x2)
J Electric connector
K Cap screw (x2)

Install

1. The installation procedure is the opposite of the removal procedure.
2. Torque tighten the setscrew to specified torque value. Refer to Table 171.
3. Calibrate the articulated boom down limit switch.
   Refer to: Calibrate (PIL 33-85-10).

Table 171. Torque Values

Item	Nm
C	9
H	9
K	2.6

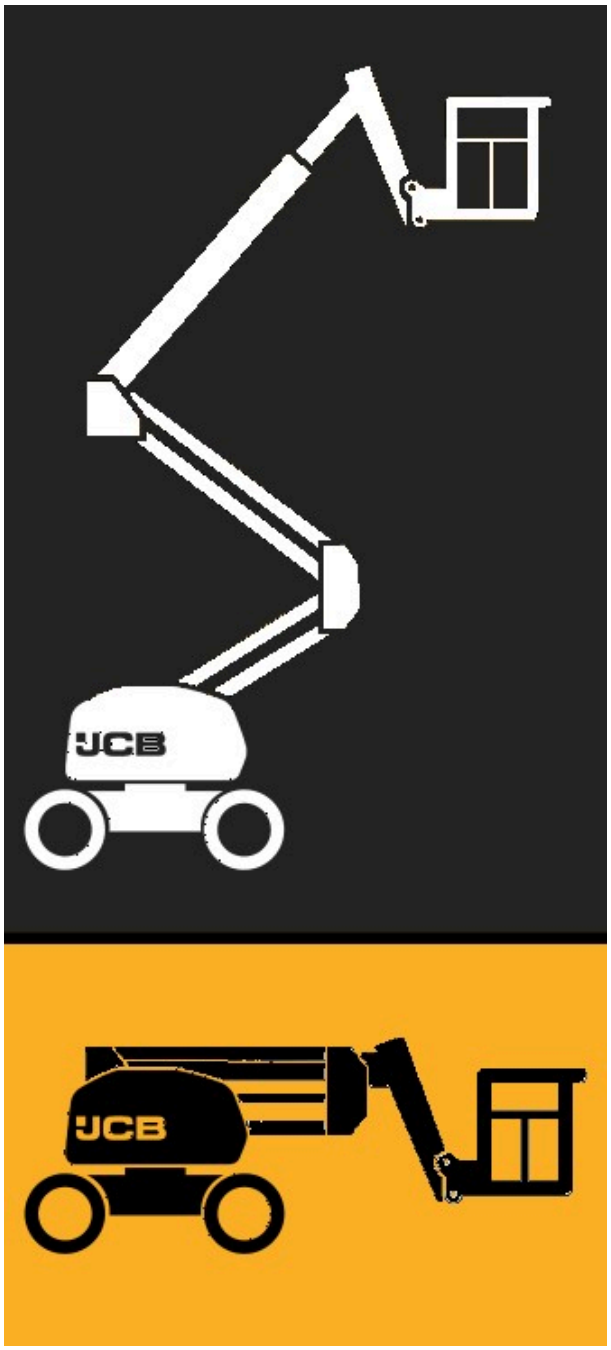
15 - Boom Telescopic

Calibrate 33-197
Remove and Install 33-199

Calibrate

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Make sure all of the booms are fully lowered, with the cylinders fully retracted.

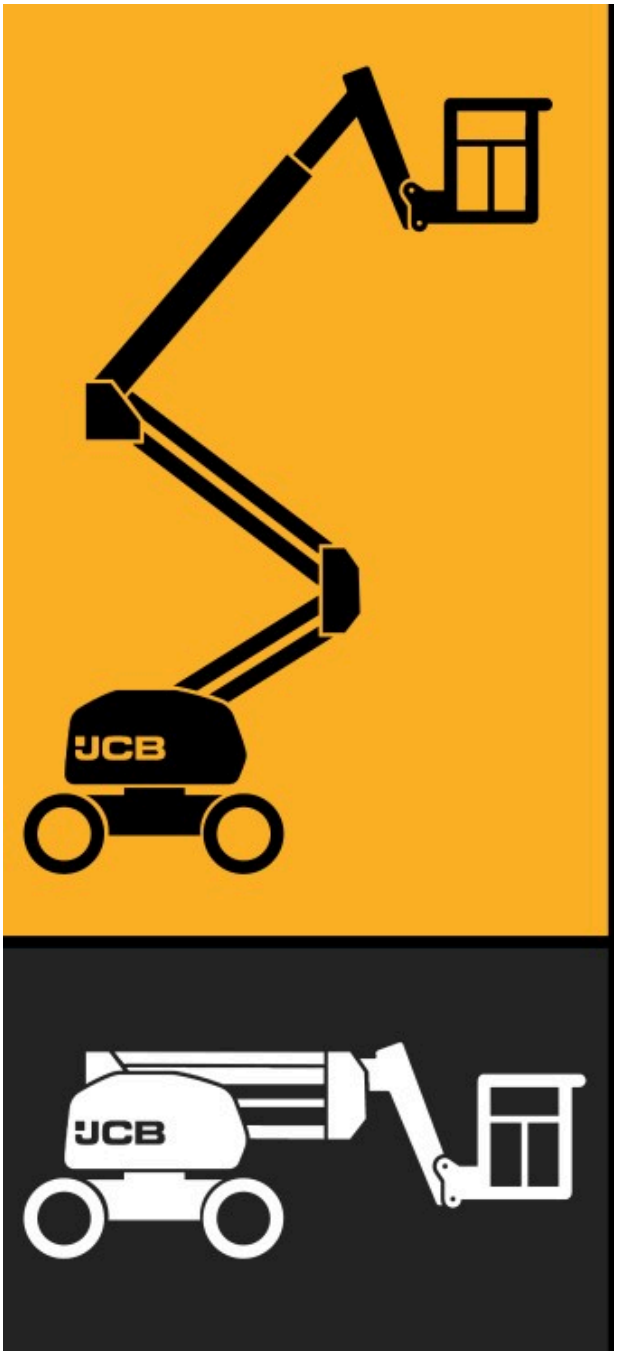
Figure 465. Stowed Position Identified by the Display



2.1. The display should show the machine is in the stowed position.

3. Make sure that there is no load on the platform.
4. Make a mark on the inner telescopic boom, against the edge of the outer boom.
5. Extend the telescopic boom slowly until the display icon just changes from Stowed to Raised position. This indicates that the telescopic boom is now beyond the Telescopic Boom Retract limit switch.

Figure 466. Raised Position Identified by the Display



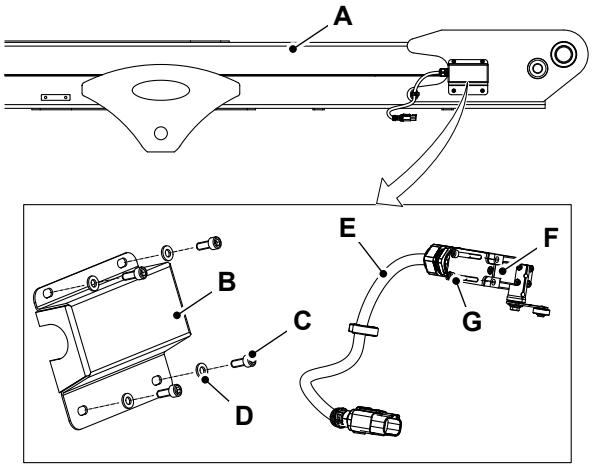
6. Measure the distance from the mark in step 4, to the edge of the outer boom. It should be 150±50mm.
7. Adjust the Telescopic Boom Retract limit switch position and repeat steps 1-6 until the height is within the limits.

Remove and Install

Remove

1. Make the machine safe.
   Refer to: PIL 01-03-27.
2. Disconnect the electrical connections from the sensor.
3. Remove the cap screw 1 (x4), washer (x4) and switch cover.
4. Remove cap screw 2 (x2) and limit switch from the telescopic boom.

Figure 467.



A Telescopic boom
B Switch cover
C Cap screw 1 (x4) 15Nm
D Washer (x4)
E Electrical connector
F Limit switch
G Cap screw 2 (x2)- torque as per STD

Install

1. 2. The installation procedure is the opposite of the removal procedure.
2. 3. Torque tighten the cap screw 1 to specified torque value.
   Torque: 15N·m
   2.1. 3.1. Torque tighten the cap screw 1 to specified torque value.
   Refer to: PIL 72-03-00.
3. 4. Calibrate the telescopic boom retract limit switch.
   Refer to: Calibrate (PIL 33-85-15).

86 - Solenoid

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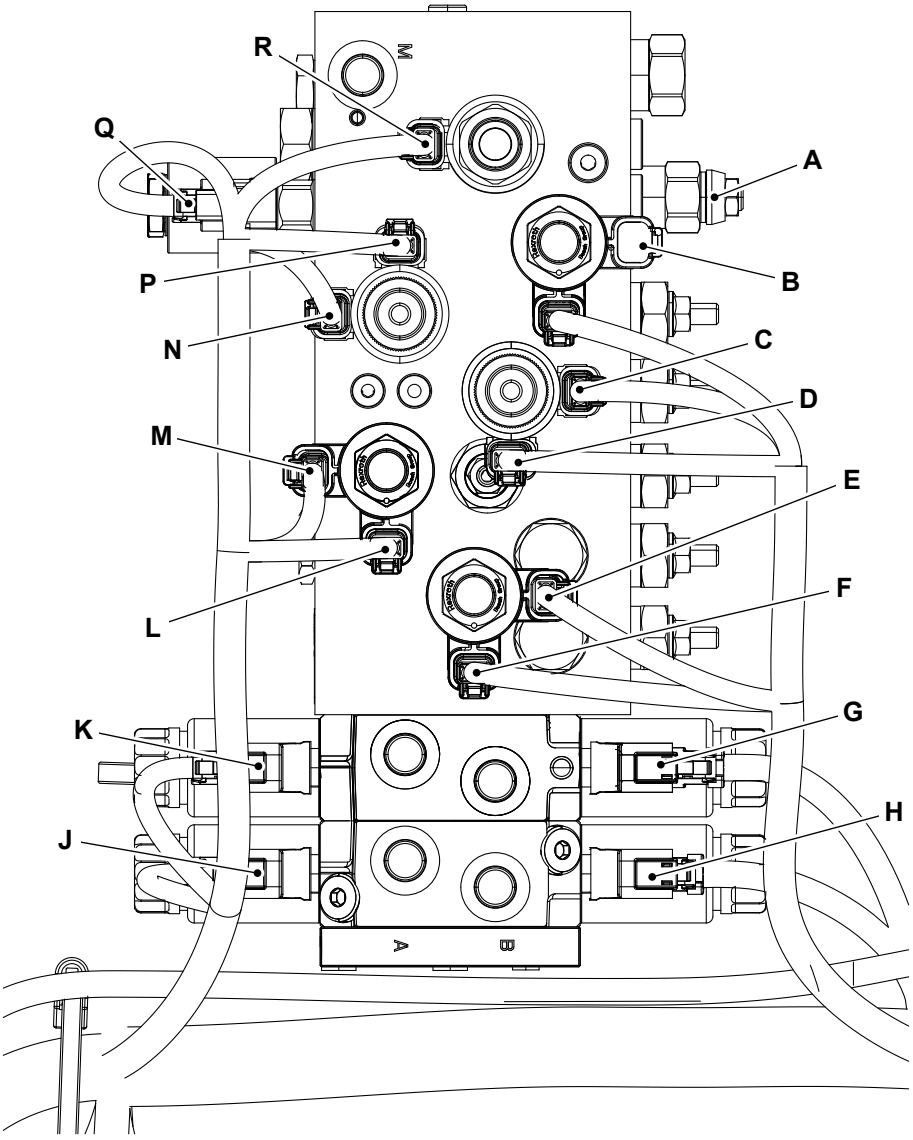
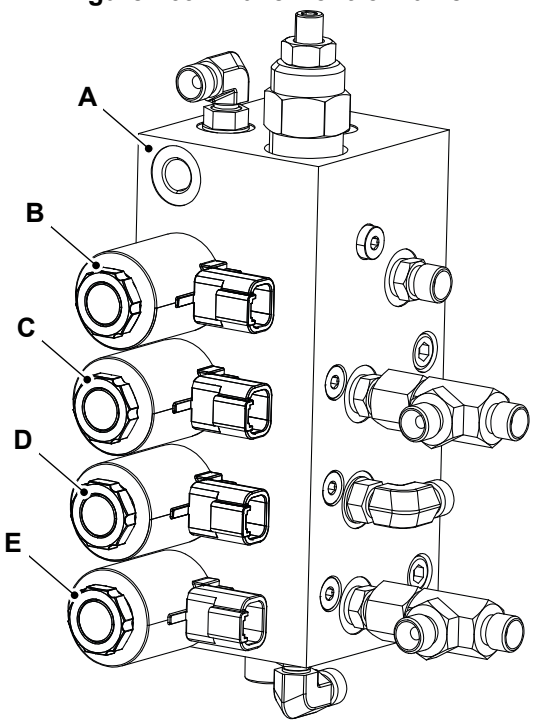
Component Identification

Figure 468. Main Boom Control Valve



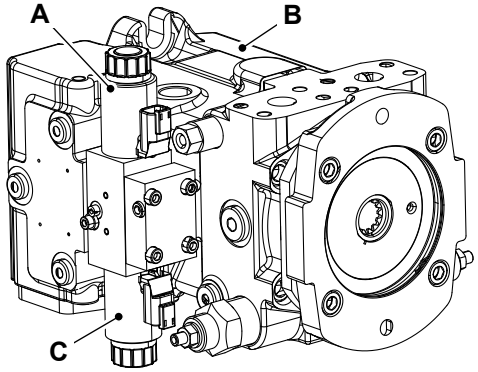
A Main boom control valve
B Platform rotate/jib solenoid
C Articulated boom lower solenoid
D Articulated boom raise solenoid
E Levelling down solenoid
F Levelling up solenoid
G Telescopic boom down solenoid
H Swing left solenoid
J Swing right solenoid
K Telescopic boom up solenoid
L Steering (left) solenoid
M Steering (right) solenoid
N Telescopic boom retract solenoid
P Telescopic boom extend solenoid
Q Lift and slew solenoid connection
R Proportional flow solenoid

Figure 469. Brake Control Valve



A Brake control valve
B Axle oscillation solenoid
C Front brake solenoid
D Rear brake solenoid
E Travel speed control solenoid

Figure 470. Transmission Pump



A Reverse drive control solenoid
B Transmission pump
C Forward drive control solenoid

72 - Fasteners and Fixings

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Introduction

JCB Fasteners (Before September 2017)

Some external fasteners on JCB machines are manufactured using an improved type of corrosion resistant finish. This type of finish is called Dacromet and replaces the original Zinc and Yellow Plating used on earlier machines. The two types of fasteners can be readily identified by colour and part number suffix. Refer to Table 1. Fastener Types.

Table 172.

Fastener Type	Colour	Part Number Suffix
Zinc and Yellow	Golden Finish	Z (e.g. 1315/3712Z)
Dacromet	Mottled Silver Finish	D (e.g. 1315/3712D)

Note: As the Dacromet fasteners have a lower torque setting than the Zinc and Yellow fasteners, the torque figures used must be relevant to the type of fastener.

A Dacromet bolt should not be used in conjunction with a Zinc or Yellow plated nut, as this could change the torque characteristics of the torque setting further. For the same reason, a Dacromet nut should not be used with a Zinc or Yellow plated bolt.

All bolts used on JCB machines are high tensile and must not be replaced by bolts of a lesser tensile specification.

Dacromet bolts, due to their high corrosion resistance are used in areas where rust could occur. Dacromet bolts are only used for external applications. They are not used in applications such as gearbox or engine joint seams or internal applications.

JCB Fasteners (After September 2017)

Table 173.

Fastener Type	Colour	Part Number Suffix
Zinc flake-silver	White aluminium (silver-grey), Dull	D (e.g. 1315/3712D)
Zinc and heavy trivalent passivated with seal	Silver (Bright iridescent)	V (e.g. 1315/3712V)
Zinc Nickel - silver/grey	Dark, dull silver grey	Not assigned
Zinc Nickel - black	Black, chalky texture	N (e.g. 1315/3712N)
Zinc flake - black	Black, slight gloss	B (e.g. 1315/3712B)

Torque and Angle Tightening

Insufficient pre-load of a bolted joint can cause major problems, such as cylinder head warp, leaking gasket joints etc. There are several methods of achieving an accurate pre-load of a bolted joint, the two main methods used on the JCB engine are:

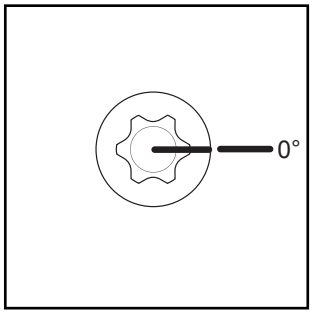
- Torque Control Tightening - Using a torque meter to control the torque is the most popular means of controlling pre-load, and in the majority of instances this method is adequate. It should be noted that with this process, the majority of the torque is used to overcome friction, therefore slight variations in the frictional conditions can lead to large changes in the bolt pre-load.
- Angle Control Tightening - Where a more precise pre-load is required, the torque and angle tightening method is used. The bolt is tightened to a predetermined torque (this may be done in stages), and then as a final sequence, the bolt is tightened to a predetermined angle - this method of tightening the bolts results in a smaller variation in the final pre-load. It is critical that the predetermined tightening angle is accurately achieved, failure to tighten accurately to the specified angle could result in the bolt pre-load being incorrect - this will lead to eventual failures. It is good practice to replace all bolts that have been tightened using the torque + angle procedure.

Tightening Method

The following example explains the recommended torque and angle procedure. A torque angle gauge should be used for accuracy, but as a visual check, the bolts can be match marked as described below.

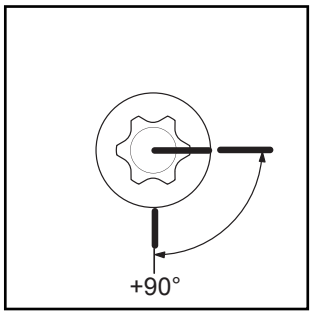
1. Tighten the bolt to the specified torque (specified torque values will be detailed in the relevant PIL sections).
2. Mark a line across the centre of the bolt, and a second line on the part to be clamped - the two lines should be aligned. Refer to Figure 471.

Figure 471.



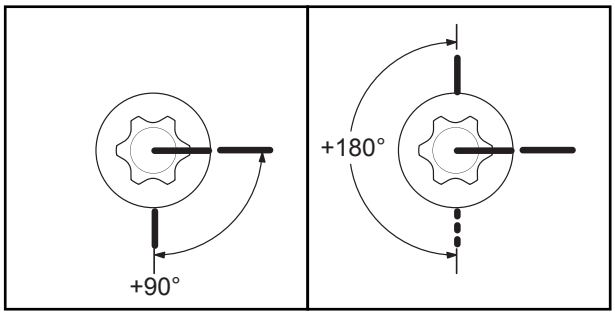
3. Mark a third line at the specified torque angle - in this instance the additional torque angle is 90°. This line must be marked the specified angle in a clockwise direction (to further tighten the bolt). Refer to Figure 472.

Figure 472.



4. In some instances, angle torque tightening can be specified in two stages, for instance in this example, the first angle quoted is 90° and then a second angle of 180°. The additional 180° angle is from the LAST tightened position. Refer to Figure 473.

Figure 473.



5. Tighten the bolt so that the line on the bolt aligns with the angle(s) marked on the item to be clamped - remember, to ensure complete accuracy an angle gauge should be used.

03 - Screws

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Introduction

Use the torque setting tables (Technical Data) only where no torque setting is specified in the text. Note: Dacromet fasteners are lubricated as part of the plating process, do not lubricate. Torque settings are given for the following conditions:

Table 174. Up to September 2017

Type	Condition 1	Condition 2
no coating	Unlubricated fasteners	Zinc flake silver (Dacromet) fasteners.
2 (obsolete from September 2017).	Zinc fasteners	Lubricated zinc and yellow plated fasteners.
3, 4 (obsolete from September 2017).	Yellow plated fasteners	Where there is a natural lubrication. For example, cast iron components.

Table 175. From September 2017

Type	Condition 1	Condition 2
no coating	Unlubricated fasteners	Dacromet) fasteners.
1	Zinc flake - silver	Zinc flake silver (Dacromet) fasteners.
5	Zinc and heavy trivalent with seal	
7	Zinc nickel - silver	
8	Zinc nickel - black	
9	Zinc flake - black	

Technical Data

Table 176. Torque Settings - Internal Hexagon Headed Capscrews (Zinc)

Bolt Size	
mm	**N·m**
3	2
4	6
5	11
6	19
8	46
10	91
12	159
16	395
18	550
20	770
24	1,332

06 - Bolts

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Introduction

Use the torque setting tables (Technical Data) only where no torque setting is specified in the text. Note: Dacromet fasteners are lubricated as part of the plating process, do not lubricate. Torque settings are given for the following conditions:

Table 177. Up to September 2017

Type	Condition 1	Condition 2
no coating	Unlubricated fasteners	Zinc flake silver (Dacromet) fasteners.
2 (obsolete from September 2017).	Zinc fasteners	Lubricated zinc and yellow plated fasteners.
3, 4 (obsolete from September 2017).	Yellow plated fasteners	Where there is a natural lubrication. For example, cast iron components.

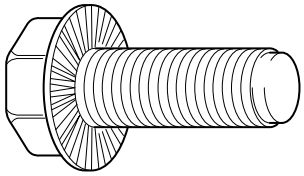
Table 178. From September 2017

Type	Condition 1	Condition 2
no coating	Unlubricated fasteners	Dacromet) fasteners.
1	Zinc flake - silver	Zinc flake silver (Dacromet) fasteners.
5	Zinc and heavy trivalent with seal	
7	Zinc nickel - silver	
8	Zinc nickel - black	
9	Zinc flake - black	

Verbus-Ripp Bolts

Torque settings for these bolts are determined by the application. Refer to the relevant procedure for the required settings.

Figure 474.



Technical Data

From JCB standard STD00019 issue 15.

1. This information does not apply to:-

   1.1. Hydraulic fittings (i.e. BSP, SAE O-ring boss, UNF, four bolt split flange and JIC).

   1.2. Locking type fasteners (those with a nylon insert, or with distorted thread nuts such as Cleveloc).

2. For information on fastener conditions, refer to fasteners and fixings, bolts, general, introduction.

Table 179. Torque Settings - UNF S Fasteners

Bolt Size	Treads per Inch	Hexagon (A/F)	Condition 1	Condition 2
in	in	in	N·m	N·m
(1/4 in)	28	7/16	11.2	10
(5/16 in)	24	1/2	22.3	20
(3/8 in)	24	9/16	40	36
(7/16 in)	20	5/8	64	57
(1/2 in)	20	3/4	98	88
(9/16 in)	18	13/16	140	126
(5/8 in)	18	15/16	196	177
(3/4 in)	16	1 1/8	343	309
(7/8 in)	14	1 15/16	547	492
(1 in)	12	1 1/2	814	732
(1 1/8 in)	12	1 7/8	1,181	1,063
(1 1/4 in)	12	2 1/4	1,646	1,481

Table 180. Torque Settings - UNF X Fasteners

Bolt Size	Treads per Inch	Hexagon (A/F)	Condition 1	Condition 2
in	in	in	N·m	N·m
(1/4 in)	28	7/16	17.6	15.9
(5/16 in)	24	1/2	35.2	31.6
(3/8 in)	24	9/16	64	57
(7/16 in)	20	5/8	101	91
(1/2 in)	20	3/4	155	139
(9/16 in)	18	13/16	221	199
(5/8 in)	18	15/16	310	279
(3/4 in)	16	1 1/8	542	488
(7/8 in)	14	1 15/16	864	777
(1 in)	12	1 1/2	1,285	1,156
(1 1/8 in)	12	1 7/8	1,865	1,679
(1 1/4 in)	12	2 1/4	2,598	2,339

Table 181. Torque Settings - Coarse Metric Grade 8.8 Fasteners

Bolt Size	Tread Pitch	Hexagon (A/F)	Condition 1	Condition 2
mm	mm	mm	N·m	N·m
4	0.7	7	2.9	2.6
5	0.8	8	5.8	5.2
6	1	10	9.9	9
8	1.25	13	24	22
10	1.5	17	47	43
12	1.75	19	83	74
14	2	22	132	119
16	2	24	205	184
20	2.5	30	400	360
24	3	36	690	621
30	3.5	46	1,372	1,235
36	4	55	2,399	2,159

Table 182. Torque Settings - Coarse Metric Grade 10.9 Fasteners

Bolt Size	Thread Pitch	Hexagon (A/F)	Condition 1	Condition 2
mm	mm	mm	N·m	N·m
4	0.7	7	4	3.6
5	0.8	8	8.1	7.3
6	1	10	13.9	12.5
8	1.25	13	34	30
10	1.5	17	67	60
12	1.75	19	116	104
14	2	22	185	167
16	2	24	288	259
20	2.5	30	562	506
24	3	36	971	874
30	3.5	46	1,930	1,737
36	4	55	3,374	3,036

Table 183. Torque Settings - Coarse Metric Grade 12.9 Fasteners

Bolt Size	Thread Pitch	Hexagon (A/F)	Condition 1	Condition 2
mm	mm	mm	N·m	N·m
4	0.7	7	4.8	4.4
5	0.8	8	9.8	8.8
6	1	10	16.6	15
8	1.25	13	40	36
10	1.5	17	80	72
12	1.75	19	139	125
14	2	22	223	200
16	2	24	345	311

Bolt Size	Thread Pitch	Hexa-gon (A/F)	Condi-tion 1	Condi-tion 2
mm	mm	mm	N·m	N·m
20	2.5	30	674	607
24	3	36	1,165	1,048
30	3.5	46	2,316	2,084
36	4	55	4,049	3,644

Table 184. Torque Settings - Rivet Nuts / Bolts

Bolt Size	
mm	N·m
3	1.2
4	3
5	6
6	10
8	24
10	48
12	82

21 - Clips

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03 - Worm Drive

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Introduction

Plain Worm Drive Clips

There are three types of plain worm drive clips.

- Standard worm drive clip
- Heavy duty worm drive clip
- Spring assisted worm drive clip

Spring assisted worm drive clip contains a spring insert on the inside of the band to provide compensation against hose compression set.

Use the torque setting tables (Technical Data) only where no torque setting is specified in the text.

Constant Torque Worm Drive Clips

Your machine may be installed with constant torque worm drive clips.

Use the torque setting tables (Technical Data) only where no torque setting is specified in the text.

Technical Data

Dimensions

Figure 475. Spring assisted Worm Drive Clips

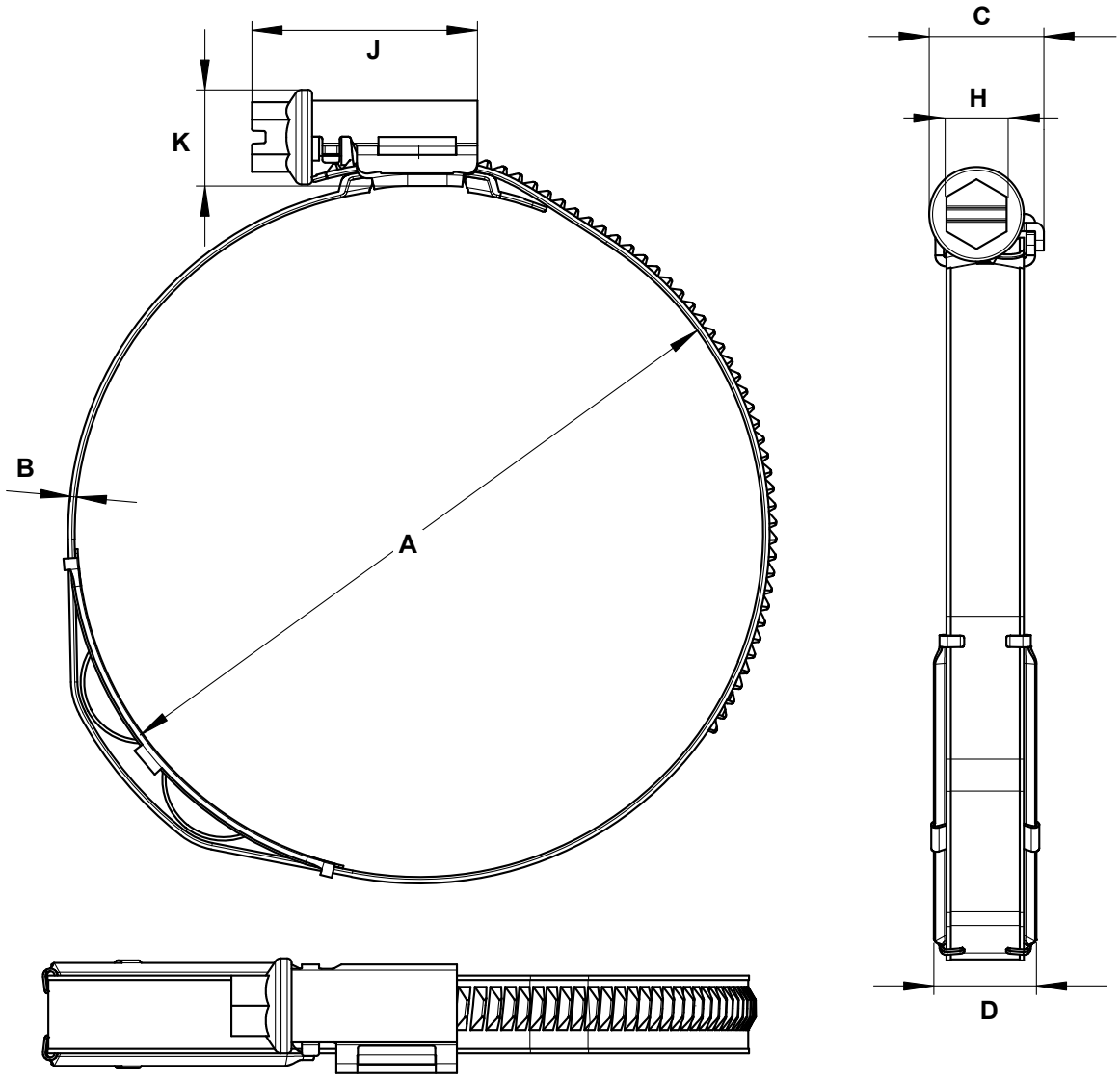


Table 185.

A	B	C	D	H	J	K
Clamping range	**Band thick-ness**	**Housing width**	**Band width**	**Hex size across flats**	**Bolt and housing length**	**Bolt and housing overall height**
Spring assisted worm drive clips						
10–16mm	0.65mm	13mm	9mm	7mm	21mm	11mm
12–22mm					24mm	

A	B	C	D	H	J	K
Clamping range	**Band thickness**	**Housing width**	**Band width**	**Hex size across flats**	**Bolt and housing length**	**Bolt and housing overall height**
16–27mm up to 60–80mm	0.8mm	14.6mm	12mm		30mm	12.5mm
70–90mm up to 160–180mm					36mm	
Heavy duty worm drive clips						
172–206mm	0.7mm	23.1mm	16mm	7mm	37mm	13mm

Figure 476. Constant Torque Worm Drive Clips

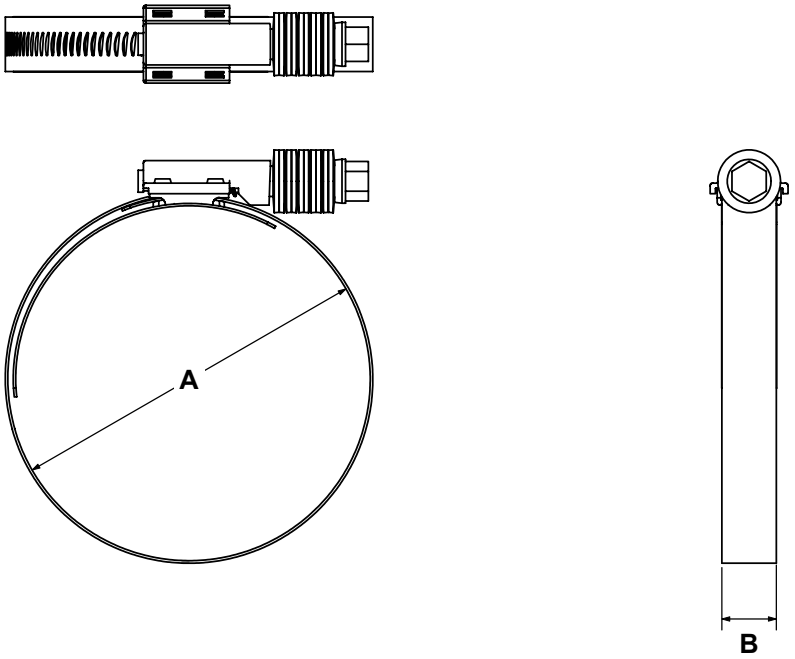


Table 186.

A	B
Clamping range	**Band Width**
14–27mm	14.2mm
25–45mm	15.7mm
32–54mm	15.7mm
45–67mm	15.7mm
54–79mm	15.7mm
70–92mm	15.7mm
83–105mm	15.7mm
95–118mm	15.7mm

Torque Values

Table 187. Heavy Duty Worm Drive Clip

Clamping range	Part number	Torque values
172–194mm	2201/0022	10 -0/+0.5N·m
184–206mm	2201/0023	10 -0/+0.5N·m

Table 188. Spring Assisted Worm Drive Clip

Clamping range	Part number	Torque values
10–16mm	2206/0816	2 -0/+0.5N·m
12–22mm	2206/1222	3 -0/+0.5N·m
16–27mm	2206/1627	5 -0/+0.5N·m
20–32mm	2206/2032	5 -0/+0.5N·m
25–40mm	2206/2540	5 -0/+0.5N·m
30–45mm	2206/3045	5 -0/+0.5N·m
35–50mm	2206/3550	5 -0/+0.5N·m
40–60mm	2206/4060	5 -0/+0.5N·m
50–70mm	2206/5070	5 -0/+0.5N·m
60–80mm	2206/6080	5 -0/+0.5N·m
70–90mm	2206/7090	5 -0/+0.5N·m
80–100mm	2206/8010	5 -0/+0.5N·m
90–110mm	2206/9011	5 -0/+0.5N·m
100–120mm	2206/1012	5 -0/+0.5N·m
110–130mm	2206/1113	5 -0/+0.5N·m
120–140mm	2206/1214	5 -0/+0.5N·m
130–150mm	2206/1315	5 -0/+0.5N·m
140–160mm	2206/1416	5 -0/+0.5N·m
150–170mm	2206/1517	5 -0/+0.5N·m
160–180mm	2206/1618	5 -0/+0.5N·m
170–190mm	2206/1719	5 -0/+0.5N·m
180–200mm	2206/1820	5 -0/+0.5N·m
190–210mm	2206/1921	5 -0/+0.5N·m

Table 189. Constant Torque Worm Drive Clips

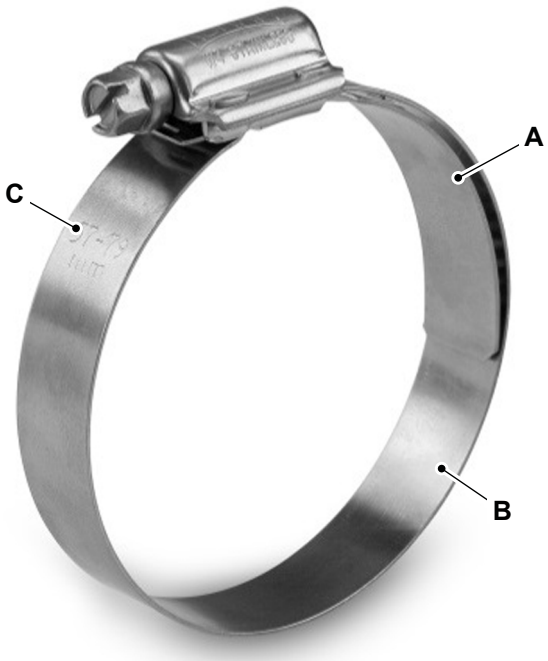
Clamping range	Part number	Torque values
14–27mm	334/J4514	5N·m
25–45mm	334/J9549	10N·m
32–54mm	333/K2259 OR 400/P2870	10N·m
45–67mm	821/10236	10N·m
54–79mm	821/10191	10N·m
70–92mm	821/10192	10N·m
83–105mm	332/K3479	10N·m
95–118mm	332/S8033	10N·m

Component Identification

Figure 477. Standard Worm Drive Clip

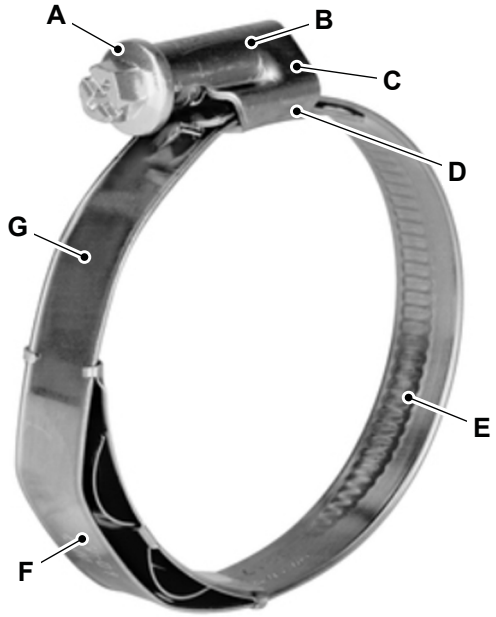
A Screw support flange
B Asymmetric housing
C Asymmetric extension
D Short housing saddle
E Stamped inside
F Identification of material/clamping range

Figure 478. Heavy Duty Worm Drive Clip



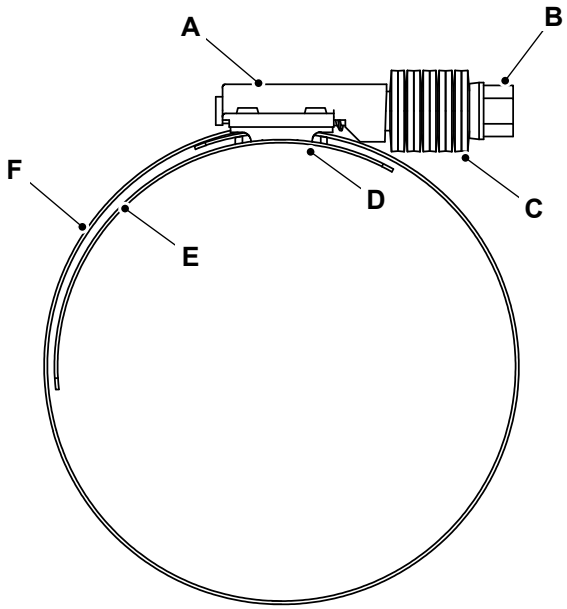
A Extended bridge
B Band width (16mm)
C Identification of clamping range

Figure 479. Spring Assisted Worm Drive Clip



A Screw support flange
B Asymmetric housing
C Asymmetric extension
D Short housing saddle
E Stamped inside
F Spring insert
G Identification of material/clamping range

Figure 480. Constant Torque Worm Drive Clips



A Housing
B Screw
C Belleville spring
D Saddle
E Liner
F Band

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Acronyms Glossary

PTFE	Polytetrafluoroethylene

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Introduction

JCB recommend that you use the JCB lubricants shown as they have been verified by JCB for use on JCB machines. However, you could use other lubricants that are equivalent to the JCB standards and quality or offer the same machine component protection.

Before you start work, make sure that:

- All safety precautions are observed in accordance with the information contained within the relevant support documentation.
- The consumables are used in accordance with the manufacturer's recommendations.
- The consumables shown are available in the correct quantity.

Consumables other than those listed may be required. It is expected that general consumables will be available in any well equipped workshop or be available locally.

Health and Safety

Oil

Oil is toxic. If you swallow any oil, do not induce vomiting, seek medical advice. Used engine oil contains harmful contaminants which can cause skin cancer. Do not handle used engine oil more than necessary. Always use barrier cream or wear gloves to prevent skin contact. Wash skin contaminated with oil thoroughly in warm soapy water. Do not use petrol, diesel fuel or paraffin to clean your skin.

Fluid Under Pressure

Fine jets of fluid at high pressure can penetrate the skin. Keep face and hands well clear of fluid under pressure and wear personal protective equipment. Hold a piece of cardboard close to suspected leaks and then examine the cardboard for signs of fluid. If fluid penetrates your skin, get medical help immediately.

Fuel

Fuel is flammable, keep naked flames away from the fuel system. Stop the engine immediately if a fuel leak is suspected. Do not smoke while refuelling or working on the fuel system. Do not refuel with the engine running. Completely wipe off any spilt fuel which could cause a fire. There could be a fire and injury if you do not follow these precautions.

Hygiene

JCB lubricants are not a health risk when used correctly for their intended purposes.

However, excessive or prolonged skin contact can remove the natural fats from your skin, causing dryness and irritation.

Low viscosity oils are more likely to do this, so take special care when handling used oils, which might be diluted with fuel contamination.

Whenever you are handling oil products you must maintain good standards of care and personal and plant hygiene. For details of these precautions we advise you to read the relevant publications issued by your local health authority, plus the following.

Storage

Always keep lubricants out of the reach of children.

Never store lubricants in open or unlabelled containers.

Waste Disposal

⚠ **CAUTION** It is illegal to pollute drains, sewers or the ground. Clean up all spilt fluids and/or lubricants.

Used fluids and/or lubricants, filters and contaminated materials must be disposed of in accordance with local regulations. Use authorised waste disposal sites.

CAUTION Damaged or spent batteries and any residue from fires or spillage must be put in a suitable closed receptacle and must be disposed of in accordance with local environmental waste regulations.

All waste products must be disposed of in accordance with all the relevant regulations.

The collection and disposal of used oil must be in accordance with any local regulations. Never pour used engine oil into sewers, drains or on the ground.

Handling

⚠ **CAUTION** The temperature of the hydraulic oil will be high soon after stopping the machine. Wait until it cools before beginning maintenance.

New Oil

There are no special precautions needed for the handling or use of new oil, beside the normal care and hygiene practices.

Used Oil

Used engine crankcase lubricants contain harmful contaminants.

Here are precautions to protect your health when handling used engine oil:

- Avoid prolonged, excessive or repeated skin contact with used oil
- Apply a barrier cream to the skin before handling used oil. Note the following when removing engine oil from skin:
  - Wash your skin thoroughly with soap and water
  - Using a nail brush will help
  - Use special hand cleansers to help clean dirty hands
  - Never use petrol, diesel fuel, or paraffin for washing
- Avoid skin contact with oil soaked clothing
- Don't keep oily rags in pockets
- Wash dirty clothing before re-use

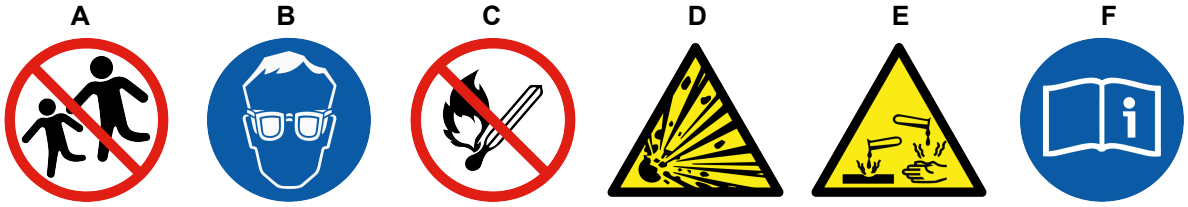
- Throw away oil-soaked shoes

Battery

Warning Symbols

The following warning symbols may be found on the battery.

Figure 481.



A Keep away from children
B Shield eyes
C No smoking, no naked flames, no sparks
D Explosive gas
E Battery acid
F Note operating instructions

First Aid - Oil

Eyes

In the case of eye contact, flush with water for 15min. If irritation persists, get medical attention.

Swallowing

If oil is swallowed do not induce vomiting. Get medical advice.

Skin

In the case of excessive skin contact, wash with soap and water.

Spillage

Absorb with sand or a locally approved brand of absorbent granules. Scrape up and remove to a chemical disposal area.

Fires

⚠ **WARNING** Do not use water to put out an oil fire. This will only spread it because oil floats on water.

Extinguish oil and lubricant fires with carbon dioxide, dry chemical or foam.

First Aid - Electrolyte

Eyes

In the case of eye contact, flush with water for 15min. always get medical attention.

Swallowing

Do not induce vomiting. Drink large quantities of water or milk. Then drink milk of magnesia, beaten egg or vegetable oil. Get medical help.

Skin

Flush with water, remove affected clothing. Cover burns with a sterile dressing then get medical help.

Technical Data

JCB recommend that you use the JCB lubricants shown as they have been verified by JCB for use on JCB machines. However, you could use other lubricants that are equivalent to the JCB standards and quality or offer the same machine component protection.

Table 190. Fluids, Lubricants and Capacities

Item	Capacity	Fluid/Lubricant	JCB Part Number	Container Size [1]	Specification
	L				
Fuel Tank	59L	Diesel Oil	-		
Engine Oil (for KDI TCR)	8.9L	-20°C (-4°F) to 45°C (112.9°F) JCB Ultra performance 10W30	4001/3005	20L	API CJ4, ACEA E9
		Below -25°C (-13°F) to 30°C (86°F) JCB Ultra performance 5W30	4001/3105	20L	API CJ4, ACEA E6, E7,E9
		Below -25°C (-13°F) to 45°C (113°F) JCB Ultra performance 5W40	4001/3405	20L	API CJ4
Engine Coolant	12L	JCB Antifreeze HP/ Coolant/Water	4006/1120	20L	ASTM D3306, ASTM D4985, ASTM D6210, SAE J1034, BS6580 (1992), AFNOR NF R15-601
Hydraulic System (Standard)	System 120L and Tank 90L	-12°C (10.4°F) to 46°C (114.7°F): JCB Hydraulic Fluid OP46	4002/1000	20L	VG32 Grade oil
Hydraulic System (Optional)	System 120L and Tank 90L	Max 51°C (123.7°F): JCB Hydraulic Fluid OP46	4002/3000	20L	HV46 Grade oil: Hot climate region
Slew Ring Bearings	As required	JCB HP Grease	4003/2017	0.4kg	
Slew Ring Gear Teeth	As required	JCB Special Slew Pinion Grease	4003/1619	0.4	
Hub Oil	0.68L	JCB Ultra Performance Gear Oil 150	4000/4901 (India)	5L	
		Gear oil 80W90	4000/3400 (UK)		MIL-PRF-2105E
All Other Grease	As required	JCB MPL-EP Grease	4003/1501	0.4	

(1) For information about the different container sizes that are available (and their part numbers), contact your local JCB dealer. Transmission oil required - 2.8L (4000/4900).

03 - Parts List

Introduction

Consumables

Description	Part No.	Size
EP Hammer Grease	4003/2107	0.4 kg
	4003/2106	12.5 kg
Extreme Performance Moly Grease	4003/1327	0.4 kg
	4003/1326	12.5 kg
JCB Autogrease	4003/2305	0.5 kg
Special HP Grease	4003/2020	0.5 kg
	4003/2017	0.4 kg
	4003/2006	12.5 kg
	4003/2005	50 kg
Special Hammer Grease	4003/1119	0.4 kg
Special MPL-EP Grease	4003/1501	0.4 kg
	4003/1506	12.5 kg
	4003/1510	50 kg
Special Slew Pinion Grease	4003/9999	0.4 kg
Surface Cleaning Fluid	4103/1204	1 L
Wiring Splice (0.5-1.5mm Red, contains 50 off)	892/00351	-
Wiring Splice (1.5-2.5mm Blue, contains 50 off)	892/00352	-
Wiring Splice (3-6mm Yellow, contains 50 off)	892/00353	-
Wiring Splice-Bootlace (1mm Red)	7205/0100	-
Wiring Splice-Bootlace (2.5mm Grey)	7205/0250	-

03 - Oil

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New Oil

There are no special precautions needed for the handling or use of new oil, besides the normal health and safety practices mentioned in the relevant section of this service manual.

Used Oil

Used engine crankcase lubricants contain harmful contaminants. Here are precautions to protect your health when handling used engine oil:

1. Avoid prolonged, excessive or repeated skin contact with used oil.
2. Apply a barrier cream to the skin before handling used oil.
3. Note the following when removing engine oil from skin:
   - 3.1. Wash your skin thoroughly with soap and water.
   - 3.2. Using a nail brush will help.
   - 3.3. Use special hand cleansers to help clean dirty hands.
   - 3.4. Never use petrol, diesel fuel, or paraffin for washing.
4. Avoid skin contact with oil soaked clothing.
5. Don't keep oily rags in pockets.
6. Wash dirty clothing before re-use.
7. Throw away oil-soaked shoes.

First Aid

EYES - In the case of eye contact, flush with water for 15 minutes. If irritation persists, get medical attention.

SWALLOWING - If oil is swallowed do not induce vomiting. Get medical advice.

SKIN - In the case of excessive skin contact, wash with soap and water.

SPILLAGE - Absorb on sand or a locally approved brand of absorbent granules. Scrape up and remove to a chemical disposal area.

FIRES - Extinguish with carbon dioxide, dry chemical or foam. Firefighters should use self-contained breathing apparatus.

06 - Grease

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Special Tools

Description	Part No.	Qty.
Grease Gun Attachment	892/00913	1
Grease Gun	992/11300	1

Consumables

Description	Part No.	Size
EP Hammer Grease	4003/2107	0.4 kg
	4003/2106	12.5 kg
Extreme Performance Moly Grease	4003/1327	0.4 kg
	4003/1326	12.5 kg
JCB Autogrease	4003/2305	0.5 kg
Special HP Grease	4003/2020	0.5 kg
	4003/2017	0.4 kg
	4003/2006	12.5 kg
	4003/2005	50 kg
Special Hammer Grease	4003/1119	0.4 kg
Special MPL-EP Grease	4003/1501	0.4 kg
	4003/1506	12.5 kg
	4003/1510	50 kg
Special Slew Pinion Grease	4003/9999	0.4 kg

There are various greasing points on the machine. You must grease the machine regularly to keep it working efficiently. Regular greasing will also lengthen the machine's working life. You must grease the machine as stated in the maintenance schedule. Refer to: PIL 78-24.

JCB grease is manufactured to provide significant load protection for your machine. It is recommended to use only JCB grease on your machine because they are specifically designed for the particular application. The list of JCB greases comprises:

1. JCB Special HP Grease

   Consumable: Special HP Grease
2. JCB Special MPL-EP Grease

   Consumable: Special MPL-EP Grease
3. JCB Extreme Performance Moly Grease

   Consumable: Extreme Performance Moly Grease
4. JCB Autogrease

   Consumable: JCB Autogrease
5. JCB EP Hammer Grease

   Consumable: EP Hammer Grease
6. JCB Special Hammer Grease

   Consumable: Special Hammer Grease
7. JCB Special Slew Pinion Grease

   Consumable: Special Slew Pinion Grease

Greasing Procedure

1. Make the machine safe.

   Refer to: PIL 01-03.
2. Make a note of the following:

   2.1. The machine must always be greased after pressure washing or steam cleaning.

   2.2. Greasing must be done with a grease gun. Normally, two strokes of the gun should be sufficient.

   Special Tool: Grease Gun (Qty.: 1)
   Special Tool: Grease Gun Attachment (Qty.: 1)

   2.3. Stop greasing when fresh grease appears at the joint.

   2.4. Use only the recommended type of grease.

   2.5. Do not mix different types of grease, keep them separate.
3. Count off the grease points as you grease each one.
4. Install the dust caps after greasing (if installed).

JCB Special HP Grease

JCB Special HP grease is a premium quality, extreme pressure grease. It is recommended for use in arduous operating conditions, such as high temperatures, excessive loading and extensive exposure to water. The sophisticated additive package combines with excellent adhesive properties to give high performance protection to your machine.

Table 191. JCB Special HP Grease Properties

Description	Data
Colour	Blue
Soap type	Lithium complex
Drop point	245°C (472.7°F)
Working temperature range	-20–150°C (-4.0–301.8°F)

JCB Special MPL-EP Grease

JCB Special MPL-EP grease is a true multipurpose grease. It is recommended for a wide range of

lubricating applications, such as pivot pins and wheel bearings, where excellent anti wear and anti rust performance is required. Its EP additive makes it particularly suitable for the shock load and vibrating conditions found on machines.

Table 192. JCB Special MPL-EP Grease Properties

Description	Data
Colour	Brown
Soap type	Lithium
Drop point	180°C (355.7°F)
Working temperature range	-20–130°C (-4.0–265.8°F)

JCB Extreme Performance Moly Grease

JCB Extreme Performance Moly grease is an advanced performance, multipurpose grease. It is recommended for heavily loaded bearing surfaces and in particular where limited or oscillating motion causes fretting. The addition of molybdenum disulphide provides extra protection against scoring and wear. This grease is ideal for automotive, industrial, agricultural and earthmoving equipment.

Table 193. JCB Extreme Performance Moly Grease Properties

Description	Data
Colour	Grey Black
Soap type	Lithium
Drop point	185°C (364.7°F)
Working temperature range	-20–120°C (-4.0–247.8°F)

JCB Autogrease

JCB Autogrease is for use with the automatic greasing system. It is a mineral oil based paste. It contains an aluminium complex soap and solid lubricants. It is suitable for use under water or in high ambient temperatures. The specially designed cartridges screw into the automatic greasing system installed on the machine.

The clear cartridge allows the operator to easily monitor the grease usage from inside of the operator station.

Table 194. JCB Autogrease

Description	Data
Colour	Black
Soap type	Aluminium complex, solid lubricants
Drop point	260°C (499.6°F)
Working temperature range	-20–110°C (-4.0–229.8°F)

JCB EP Hammer Grease

JCB EP Hammer grease is a unique formulation aluminium complex grease for use where extremes of pressure and temperature are likely to be encountered. It is suitable for the hammer applications where resistance to water washing and migration may be critical.

Table 195. JCB EP Hammer Grease

Description	Data
Colour	Black
Soap type	Aluminium complex
Drop point	250°C (481.6°F)
Working temperature range	-20–160°C (-4.0–319.8°F)

JCB Special Hammer Grease

JCB Special Hammer grease provides a highly effective lubricant on slow moving slides and an excellent corrosion resistant property. It combines the self healing action of oils and the resistance to drip of viscous compounds.

Table 196. JCB Special Hammer Grease

Description	Data
Colour	Dark grey
Soap type	Lithium
Drop point	185°C (364.7°F)
Working temperature range	-15–120°C (5.0–247.8°F)

JCB Special Slew Pinion Grease

JCB Special Slew Pinion grease is a soft, black and tenacious grease. It is designed specifically for the lubrication of large and heavy duty open gears. It has an excellent corrosion protection and load carrying properties throughout a large temperature range.

Table 197. JCB Special Slew Pinion Grease

Description	Data
Colour	Black
Soap type	Organically modified clay
Working temperature range	-40–100°C (-39.9–211.9°F)

09 - Fluids

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Introduction

It is most important that you read and understand this information and the publications referred to. Make sure all your colleagues who are concerned with lubricants read it too.

Hygiene

JCB lubricants are not a health risk when used properly for their intended purposes.

However, excessive or prolonged skin contact can remove the natural fats from your skin, causing dryness and irritation.

Low viscosity oils are more likely to do this, so take special care when handling used oils, which might be diluted with fuel contamination.

Whenever you are handling oil products you should maintain good standards of care and personal and plant hygiene. For details of these precautions we advise you to read the relevant publications issued by your local health authority, plus the following.

Storage

Always keep lubricants out of the reach of children. Never store lubricants in open or unlabelled containers.

Waste Disposal

All waste products should be disposed of in accordance with all the relevant regulations.

The collection and disposal of used oil should be in accordance with any local regulations. Never pour used engine oil into sewers, drains or on the ground.

03 - Antifreeze

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Introduction

⚠ **CAUTION** Antifreeze can be harmful. Obey the manufacturer's instructions when handling full strength or diluted antifreeze.

Notice: Check which coolant type is installed in the machine before topping up the coolant. Mixing of different coolant types is not recommended and may result in invalidation of the warranty offered by JCB. In the event of mixing or if the coolant type is to be changed, the coolant circuit should be completely drained and flushed twice with clean water before re-filling with fresh coolant.

Check the strength of the coolant mixture at least once a year, preferably at the start of the cold period.

Replace the coolant mixture according to the intervals shown in the machine's Service Schedule.

You must dilute full strength coolant with clean water before use. Use clean water of no more than a moderate hardness 0 to 20°dGH, maximum Chloride content 100ppm, maximum Sulphate content 100ppm. If this cannot be obtained, use distilled or de-ionized water. For further information advice on water hardness, contact your local water authority.

The correct concentration of coolant protects the engine against frost damage in winter and provides year round protection against corrosion.

Table 198.

Concentration	Level of protection
50% (Standard)	Protects against damage down to -37°C (-35°F)
60% (Extreme Conditions Only)	Protects against damage down to -48°C (-54°F)

Do not exceed a 60% concentration, as the freezing protection provided reduces beyond this point.

- Make sure that the coolant complies with specification in this manual.
- Always read and understand the manufacturer's instructions.
- Make sure that a corrosion inhibitor is included. Serious damage to the cooling system can occur if corrosion inhibitors are not used.

Health and Safety

⚠ **CAUTION** The cooling system is pressurised when the coolant is hot. When you remove the cap, hot coolant can spray out and burn you. Make sure that the engine is cool before you work on the cooling system.

CAUTION Antifreeze can be harmful. Obey the manufacturer's instructions when handling full strength or diluted antifreeze.

Technical Data

Refer to Consumable Products, Fluids, Technical Data (PIL 75-00).

10 - Locking Fluids

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Introduction

All locking fluids should be used at all times in line with the manufacturer's recommendations.

Locking fluids are used for the locking of threaded fasteners and for the retention of ball & roller bearings and similar cylindrical items on to shafts and into housings. These fluids consist of an anaerobic resin in a liquid form which hardens when confined between closely fitting metal to metal and many metal to non-metal surfaces.

The fluids available possess a wide span of break-loose strengths, viscosities and gap filling properties and are marketed for a variety of locking and retaining purposes requiring different strength grades. Some of the sealants in use in JCB are also of anaerobic resin type and only differ from the locking fluids in respect of viscosity and other technical details.

Strength grades

Various strength grades of fluid are available, the highest strength type for permanent locking where disassembly is unlikely, medium strength for permanent locking but allowing disassembly with ordinary tools and low strength for locking of components where frequent adjustment or easy dismantling is required.

It is recommended that trials be carried out before scheduling locking fluids for any new type of application that has not been already proved as satisfactory in production or when use at elevated temperatures is intended.

Additional technical information is normally available from the product manufacturers.

Approved locking fluids

The table shown in Technical Data shows the approved locking fluids available to use on JCB machines. The table also provides basic details to help with selection of locking fluids. More up to date information can be found on the manufacturer's website.

Technical Data

Table 199. Locking Fluids Approved Product Information

Subsection	Commercial name	Product Number	Colour	Shelf life	Strength	Comments
High strength	Loctite 270(1)	4101/0100	Green fluorescent	365d	80–120bar (1,160.3–1,740.5psi) breakaway strength	For the retention of threads up to M20 diameter where disassembly is unlikely and for locking bearings etc. onto shafts and into housing. Has a maximum gap fill of 0.05mm.
	R.A.S. threadlock for studs(1)		Red			
High strength	Loctite 638	4101/1400	Green, UV fluorescent	365d	More than 250bar (3,625.9psi) compressive shear strength	Maximum gap fill of 0.25mm. Maximum strength at room temperature.
High strength	Permabond A115(1)	4101/0500	Red, fluorescent	365d	100–150bar (1,450.4–2,175.6psi) prevailing strength	Fast curing (10–15min) thread locking up to M20, especially for use on oily surfaces, plated and clean parts.
	Loctite 262					
High strength	Loctite 648(1)	4101/0600	Green, fluorescent	365d	More than 250bar (3,625.9psi) compressive shear strength	Designed for holding gears and sprockets onto gearbox shafts and rotors on electric motor shafts.
	Permabond A118					
High strength	Loctite 2701	4101/1700	Green	365d	260–500bar (3,771.0–7,251.9psi) breakaway torque	Designed for permanent locking and sealing of threaded fasteners. Particularly suited for use on inactive substrates and/or where maximum resistance to hot oil is required.
Medium to high	Loctite 243	4101/1100	Blue	365d	140–340bar (2,030.5–4,931.3psi) breakaway torque	Suitable for all nuts, bolts, screws up to M36.
Medium strength	Permabond A119(1)	4101/0900	Blue	365d	80–120bar (1,160.3–1,740.5psi) static shear strength	Maximum gap fill of 0.25mm. Handling strength in 10–15min.
Medium strength	Loctite 640	4101/1200	Green, fluorescent	365d	150–330bar (2,175.6–4,786.2psi) static shear strength	Product has a slow cure rate, used on parts unlikely to be disassembled.
Medium strength	Loctite 242(1)	4101/0200	Blue, fluorescent	365d	80–120bar (1,160.3–1,740.5psi) static shear strength	Suitable for all nuts, bolts and screws up to M36 and hydraulic fittings up to 25mm in diameter. Permabond A113 and A1042 are the preferred choices. The difference between A113 and A1042 is timing for handling and working strength. A113 handling time 10–25min, working strength 1h. A1042 handling time 5–10min, working strength 30min.
	Permabond A1042					
	Permabond A113					

Subsection	Commercial name	Product Number	Colour	Shelf life	Strength	Comments
Low strength	Loctite 222	4101/0300	Purple, fluorescent	365d	15–40bar (217.6–580.2psi)	For screwed fasteners up to M20 that require easy disassembly or frequent adjustment. Maximum gap fill of 0.05mm. Achieves handling strength in 10–30min.
Low strength	Permabond A1098	4101/1500	Blue	365d	120bar (1,740.5psi) shear strength	Allows dismantling of parts for maintenance. Suitable for sealing small hydraulic and pneumatic fittings. Handling strength in 5–10min.
Low strength	Loctite 567	4101/1600	Off-white	365d	17bar (246.6psi) breakaway torque	For the locking and sealing of metal tapered threads and fittings. High lubricating properties prevent galling on stainless steel, aluminium and all other metal pipe threads and fittings.
Very low strength	Loctite 932[1]	4101/0400	Brown/red	365d	7–18bar (101.5–261.1psi) average shear strength	Can be disassembled with hand tools. 10–30min cure time for handling strength. Used on large diameter screw threads bigger than 50mm.
	Permabond A011					

(1) This is a non preferred product.

14 - Solvents and Primers

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Introduction

This section contains information on primers, solvents, cleaning solutions etc. that are in use at JCB.

All primers and solvents should be used at all times in line with the manufacturer's recommendations.

Approved primers and solvents

The table shown in Technical Data shows the approved primers and solvents available to use on JCB machines. The table also provides basic details to help with the selection of primers and solvents. More up to date information can be found on the manufacturer's website.

Technical Data

Table 200. Primers and Solvents Approved Product Information

Subsection	Commercial name	Product Number	Colour	Shelf life	Drying Time	Comments
Activator/Primer	Loctite 770	332/U7901	Colourless	365d	Less than 5s	Used to make low energy surfaces suitable for bonding with cyanocrylate adhesives. It is recommended for polyethylene, polypropylene, PTFE and thermoplastic rubber materials. Can be used with Loctite 406 (332/U7899).
Activator	Loctite 7455	4104/1700	Clear amber	730d	Apply and leave to dry for 30s before applying adhesive	HIGHLY FLAMMABLE. Organic accelerator, non CFC solvent based surface activator. Designed to promote the speed of cure of cyanoacrylic adhesives.
Activator	Loctite 7471[(1)] Permabond A905	4104/0200	Colourless	365d	1–3min	Used with anaerobic products it increases cure speed. Recommended for inert surfaces and large bond gaps.
Water proofing	Loctite water proofing	4104/0500	-	-	-	A water proofing solution for protecting joints made using cyanoacrylate adhesive. Apply to Loctite 495 (4103/0900).
Solvent	Loctite 7063[(1)]	4104/1500	Colourless	365d	1min at 20°C (68.0°F)	HIGHLY FLAMMABLE, cleaner and degreaser. Removes grease, oil and dirt from electrical parts, tools and precision equipment.
Cleaning fluid	Loctite 7070	4101/2200	Colourless	365d	No wipe 5–10min, post wipe 1–2min	Cleaning treatment to remove most greases, oils, lubrication fluids and metal cuttings
Cleaning fluid	Simple green extreme	332/E9240	Colourless	365d	-	An all purpose cleaner and degreaser used diluted in water for direct, spray and dip tank procedures.
Application fluid	A4G-BCJCB	4104/3300	Blue	730d	-	Vinyl labels application fluid for use with the insignia/livery labels.
Gasket cleaner	Loctite 7200	4104/3200	Colourless	730d	Allow 10–15min for gasket, 30min for silicone gasket.	This is a product to aid the removal of cured chemical gaskets. Apply for time specified and remove gasket with soft scraper.
Hand cleaner	Loctite 7855	4104/3100	Light grey	540d	-	Is a heavy duty hand cleaner, specially formulated for the most difficult to remove soils like polyurethane, paints, primers, adhesives etc. The product is free from silicone and harsh solvents. Can be used without water.
Hand cleaner	Sika hand cleaner	4104/1300	Off white	-	-	A non-abrasive hand cleaner for use when using direct glazing materials.

Subsection	Commercial name	Product Number	Colour	Shelf life	Drying Time	Comments
Direct glazing	Sika activator	4104/2100	Clear	365d	10min minimum drying time	HIGHLY FLAMMABLE. A cleaning and activating agent specifically formulated for the treatment of bonded faces in direct glazing applications prior to applying the direct glazing adhesive.
Direct glazing	Sika remover 208 (use 4104/3600)[(1)]	4104/1900	Transparent	-	-	A cleaning agent for removing contaminates on painted surfaces and glass.
Direct glazing	Sika cleaner 205 (use 4104/3600)[(1)]	4104/1200	Clear	-	-	A cleaning agent for removing contaminates on painted surfaces and glass.
Direct glazing	Sika primer 209 (use 4104/3500)[(1)]	4104/2300	Black	270d	-	Used to prepare painted surfaces and plastic substrates prior to bonding with Sikaflex products.
Direct glazing	Sika aktivator	4104/2400	Clear	365d	10min at more than 15°C (59.0°F) or 30min at less than 15°C (59.0°F)	Used to clean and give improved adhesion on glass, ceramic-coated glass, the cut face of old polyurethane adhesive beads, polyurethane coated windows glass and paints.
Active wipe for surface	Terostat 8560 AC-25	4104/3400	Colourless	270d	Minimum 30s and maximum 1h	Applied with a clean cloth to the surface, the adhesive may then be applied after the drying time. Applied to glass or ceramic coating but only in the bonding area.
Direct glazing	Terostat 8519 P	4102/3500	Black	365–540d	Approx. 2min	Used to promote adhesion in direct glazing to glass and glass ceramics.
Cleaner	Teroson FL cleaner	4104/3600	Clear	730d	Depending on conditions between 2–10min.	Used for degreasing and cleaning of substrates prior to application of adhesives and sealants.
Adhesion promoter	3M AP III	4104/3700	-	-	-	Used to prepare a painted surface before adhering (LDL) door seals (to increase adhesion of 3M 5337A) before installation of the cab.

(1) This is a non preferred product.

15 - Adhesive

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Introduction

All adhesives should be used at all times in line with the manufacturer's recommendations.

Adhesives are used for the bonding of a number of engineering materials used in production at JCB. Many types are available on the market but in the interests of variety reduction and economy only a limited selection is purchased for regular use.

Types of adhesive

Various types of adhesive are covered by JCB Standards:

1. General purpose adhesives for bonding laminated plastics, wood, rubber etc. to themselves and to each other.
2. The more expensive cyanoacrylate adhesives for use where high strength, resistance to many chemicals and fast cure times are required.
3. Adhesives specially developed for bonding of foam rubber to painted metal surfaces.

Additional health and safety for cyanoacrylates

These adhesives require very careful handling on account of their exceptional properties. They bond together strongly and rapidly to most surfaces including body tissue, the curing process being initiated by surface moisture. For further information on cyanoacrylates refer to the Manufacturer's recommendations.

Approved adhesives

The tables shown in Technical Data are the approved adhesives available to use on JCB machines. The tables also provide basic details to help with the selection of adhesives. More up to date information can be found on the manufacturer's website.

Technical Data

Table 201. Adhesives Approved Product Information

Subsection	Commercial name	Product Number	Colour	Shelf life	Technical data	Comments
High strength	Permabond 5002	4103/3100	Mixed grey	730d	3–5min for handling strength	Two part adhesive mixed in equal parts. A toughened adhesive system which bonds metals, plastics, wood, glass, ceramics and composites; even plated or coated surfaces can be securely fastened.
High strength	Loctite 601	4103/1000	Green fluorescent	365d	160–300bar (2,320.6–4,351.1psi) static shear strength	This product is a single component anaerobic adhesive. Used to bond cylindrical fitting parts, particularly where low viscosity is required. Maximum gap fill is 0.15mm.
Cyanoacrylate	Loctite 424	4103/3500	Colourless to straw	-	180–260bar (2,610.7–3,771.0psi) shear strength	Suitable for most materials including plastic and rubber. Takes 30s to cure to working strength.
Cyanoacrylate	Loctite 401	4103/2300	Colourless	180d	180–260bar (2,610.7–3,771.0psi) tensile strength	Designed for general purpose use. For use on acidic and porous surfaces, reaching handling strength in seconds. Materials include plated metals, composite materials, wood, cork, foam, leather and paper.
Cyanoacrylate	Loctite 406	332/U7899	Colourless	180d	180–260bar (2,610.7–3,771.0psi) lap shear strength	Designed for bonding of plastics and elastomeric materials where very fast fixturing is required. Can be used with Loctite 770 as a primer (332/U7901)
Cyanoacrylate	Loctite 410	4103/2400	Black	120d	220bar (3,190.8psi) lap shear strength	0.2mm, gap fill. A rubber toughened ethyl cyanoacrylate adhesive with enhanced resistance to peel and shock. Bonds rubber, metals and plastics for use in difficult conditions.
Cyanoacrylate	Loctite 480	4103/3800	Black	-	220–300bar (3,190.8–4,351.1psi) lap shear strength	A rubber toughened adhesive with increased flexibility and peel strength along with enhanced resistance to shock.
Cyanoacrylate	Loctite 495[(1)]	4103/0900	Colourless	270d	12h maximum cure time	High speed bonding, suitable for rubber to itself and other materials reaching handling strength in a matter of seconds. Joint must be waterproofed with Loctite water proofing (4104/0500).
	Permabond C2					
Low strength	Dunlop 1727	4103/1100	Clear to light straw	90d	-	Sprayable adhesive, non-structural applications. For the bonding of flexible foam to themselves, wood, painted metal, chipboard, fibreglass, hessian, felt etc.
	British vita company VB 165					

Subsection	Commercial name	Product Number	Colour	Shelf life	Technical data	Comments
Acrylic foam strip adhesive	3M 4941P	4103/3900	Dark grey	730d	Peel adhesion 350N/ 100mm	High bond acrylic double sided foam tape. Its allows more complete bond contact area when bonding rigid or irregular materials due to its conformability. Its core adhesive composition makes the product well suited to many paints and primers.
General purpose gap filling material	Araldite XD 580	4103/1400	Clear / cream	730d	560bar (8,122.1psi) flexural strength	Two part, equal parts by weight. Wear pad fixing to castings and telescopic components, alignments of fixings pads without expensive machining. This product is a general purpose gap-filling material. Cure time 2h at 25°C (77.0°F).
Methacrylate	Loctite Speedbonder H3151	4103/3600	Cream to light yellow	-	-	This is a sag resistant, two component, equal parts, methacrylate adhesive system formulated to bond automotive grade cold rolled steel without the use of an external primer. Suitable for bonding a wide variety of plastic and metal substrates. Provides a long open time (40–60min) for correct aligning of parts.
Methacrylate	Plexus MA420	4103/3700	Off-white or blue	365d	-	Two part methacrylate adhesive for structural bonding of thermoplastic, metal and composite assemblies. Combined at 10:1 ratio. It has a working time of 4–6min.
Structural plastic	Scotchweld DP-8005	332/S7420	Black	180d	-	Two part acrylic based adhesive (10:1 ratio by vol.) that can bond many low surface energy plastics, including many grades of polypropylene, polyethylene and TPO's without special surface preparation.
General purpose adhesive	Evo-Stick 528 *(1)*	4103/0800	-	365d	HIGHLY FLAMMABLE	A thin even film of adhesive should be applied to both surfaces being bonded and allowed to become touch dry. This is a contact adhesive and coated surfaces cannot therefore be slid into position since the bond forms on contact. It is often convenient to align the parts along an edge and then bring the two areas into contact.
Direct glazing	Sika 250PC Sikatack Ultrafast (use 4103/4000 or 4102/4900) *(1)*	4103/2100	Black	-	-	A one component polyurethane pre-polymer based adhesive. A mastic adhesive which reacts with atmospheric moisture to form a rubber like solid.
Direct glazing	Sika 255FC (use 4102/5000) *(1)*	4103/2200	Black	-	-	For bonding glass to cab frames. A mastic adhesive which reacts with atmospheric moisture to form a rubber like solid. When using this product ensure both surfaces are clean and dry. Use Sika cleaner 205 (4104/1200).
Direct glazing	Sikaflex 552 (use 4102/5000) *(1)*	4103/3200	Black	-	-	A high performance, elastic, gap, filling one part structural adhesive cures on exposure to atmospheric moisture to form a durable elastomer. Contains no isocyanate.

Subsection	Commercial name	Product Number	Colour	Shelf life	Technical data	Comments
Industrial grade epoxy adhesive	Loctite Hysol E-214 HP	333/Y7062	Light Grey Paste	-	307bar (4,452.7psi) tensile strength	Single component, heat activated formulation develops tough, strong, structural bonds which provide excellent peel resistance and impact strength. When fully cured, the product offers superior thermal shock resistance, excellent mechanical and electrical resistance properties and withstands exposure to a wide variety of solvents and chemicals. Bonds to a wide variety of materials, including metals, glass, ceramics and plastics. Cure at 120°C (247.8°F) or above until completely firm. Heat up to 150°C (301.8°F) for 2h, to maximize properties.
Anaerobic adhesive (Dimethacrylate)	Scotchweld RT-20	333/L9575	Green	365d	-	Single component anaerobic adhesives designed to secure cylindrical metal assemblies such as bearings on shafts, bushings, sleeves, housings, and keyways. Help prevent loosening, corrosion and leakage caused by shock and vibration. Full cure time 24h. Temperature range = -54°C (129.1°F) to 450°C (841.4°F). Not recommended for use on most plastics due to potential cracking of plastic parts.
Direct glazing	Teroson 939CT / Terostat MS939	4102/5000	Black	365d in original packaging	-	Skin formation time: approx. 10min. Cure rate: approx. 3mm/24h.
Direct glazing	Terostat 8900 HV	4103/4000	Black	180d	80bar (1,160.3psi) tensile strength	One component, pumpable adhesive/sealant based on polyurethane, which cures by reaction with moisture to an elastic rubber. The skin formation and curing time are dependent on humidity, temperature and depth of joint. High temperature and high moisture reduces curing time. Sag resistant, temperature range of -40°C (103.9°F) to 90°C (193.9°F).
Direct glazing	Terostat 8594 HMLC	4103/4100	Black	270d	85bar (1,232.8psi) tensile strength	Single component, moisture curing, adhesive/sealant for repair. Product with high shear modulus and low conductivity. Suitable for all applications that require very high electrical insulation of the adhesive used for the bonding of windows. Sag resistant.

Subsection	Commercial name	Product Number	Colour	Shelf life	Technical data	Comments
Direct glazing	Terostat 8900 LV	4103/4200	Black	365d in cartridges. 180d in sausage pack. 180d in hobbocks and drums	80bar (1,160.3psi) tensile strength	One component, pumpable adhesive/sealant based on polyurethane, which cures by reaction with moisture to an elastic rubber. The skin formation and curing time are dependent on humidity, temperature and depth of joint. High temperature and high moisture reduces curing time. Sag resistant, temperature range of -40°C (103.9°F) to 90°C (193.9°F) short exposure (up to 1h) of 130°C (265.8°F).
Direct glazing	Sikaflex 295 UV	4103/4300	Black, white	365d	-	Direct glazing adhesive for plastic glazing panels. One component polyurethane adhesive of paste like consistency. 60min tack free time, 1d cure time (4mm at 23°C (73.4°F)). Good UV, fresh water and seawater resistance. Do not apply below temperatures of 10°C (50.0°F) or above 35°C (95.0°F).
High strength retainer	Loctite 603	4103/2500	-	-	-	Used for bearings.
Direct glazing	Teroson MS 660	4103/5000	Clear	365d	-	Area must be clean, dry, oil and grease free and not be in permanent contact with water. Provides a long open time approximately 15min for correct aligning of parts.
Medium strength threadlocker	Loctite 2400	4103/5100	Blue	-	-	Can be used in place of Loctite 243.
Direct glazing	Terostat 8910 (also known as Teroson PU 8910)	4103/5200	Black	-	Cure rate 3.5mm/24h	component with high viscosity, pumpable adhesive / sealant cures by reaction with moisture, humidity and temperature. Provides a long open time approximately 10min for correct aligning of parts.
Flange adhesive	Teroson RB 5100	320/B4113	Greyish black	90d	-	Thermosetting component, solvent free, reactive rubber based flange adhesive
Structural adhesive	AK 348	4103/5300	-	-	-	Used as structural adhesive.
Structural adhesive	Loctite V1315	4103/5400	Cream, Off white	365d	-	Used for bonding powder coated glazing strips onto the powder coated cab welded assemblies.

(1) This is a non preferred product.

16 - Sealant

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Introduction

All sealants should be used at all times in line with the manufacturer's recommendations. Sealants are used mainly for the sealing of screwed joints, sealing flanges and flat surfaces and where gap filling properties are required.

Types of Sealant

Various types of sealant are specified in JCB Standards:

1. Those for the sealing of screwed joints.
2. Sealants for joining flanges and flat surfaces. (Flange size and likelihood of dismantling require consideration when selecting this type of sealant).
3. Sealants for use where gap filling properties are required. (The gap dimensions, joint movement if any, type of materials being joined and aesthetic appearance require consideration when selecting this type of sealant).

Approved Sealants

The table shown in Technical Data are the approved sealants available to use on JCB machines. The table also provides basic details to help with selection of sealants. More up to date information can be found on the manufacturer's website.

Technical Data

Table 202. Sealants Approved Product Information

Subsection	Commercial name	Product Number	Colour	Shelf life	Technical data	Comments
High strength	Loctite 275[1] / Permabond A140	4102/0500	Green	730d	250bar (3,625.9psi) torque strength (on M8)	Non drip formulation, used on larger fittings, coarse threads.
High strength	Forgeway 240FC[1]	4102/3100	Yellow	270d	25bar (362.6psi) breaking strength	Can be painted over with some 2 pack paint. Maximum width of joint =35mm, minimum width =2mm, minimum depth =2mm. Recommended depth of joint = width of joint.
Medium to high strength	Loctite 620	4102/3500	Green	-	More than 241bar (3,495.4psi) shear strength	Used for locating pins in radiator assemblies, sleeves into pump housings and bearings in auto transmissions. Not suitable for plastics. Diametrical clearance: up to 0.2mm
Medium strength	Loctite 518 Gasket Eliminator	4102/2000	Red, fluorescent	365d	90bar (1,305.3psi) tensile strength	Typically used as form-in-place gasket on rigid flanged connections.
Medium strength	Loctite 5182	4102/4100	Red gel, fluorescent	-	80bar (1,160.3psi) shear strength	It is manufactured to minimise air bubbles in the package. Used to seal gaskets, housings, cases and covers. It can also be used to repair and replace cut gaskets (up to 0.08mm in thickness).
Medium strength	Loctite 595	4102/2500	Clear	365d	6mm gap filling	Formulated to withstand weathering and extreme temperature cycling. Used for potting, coating and sealing. Can be applied horizontal, vertical and overhead.
Medium strength	Loctite 577[1] / Permabond A1044	4102/1900	Yellow	365d	170bar (2,465.6psi) breakaway torque	A fast curing thread sealant used on coarse threads and pipe fittings up to 75mm thread size. Clearance for gap filling 0.8mm.
Medium strength	Loctite 2431	4102/2700	Blue	365d	140–340bar (2,030.5–4,931.3psi) breakaway torque	Taper thread sealant, non-fluorescing to see oil leaks. Suitable for all taper fittings up to M36.
Low strength	Clayton Dewandre air brake sealant SC1252	4102/2200	White opaque	12h full cure	Maximum seal pressure 29bar (420.6psi)	Seals pipes and plugs against leakage of air, fuels, lubricants and coolants. Hardens to a tough seal resistant to shock and vibration. Easily dismantled.
Low strength	Red Hermetite	4102/0800	Red	-	Resistant to oil	Non-hardening paste jointing for joints regularly opened for servicing.

Subsection	Commercial name	Product Number	Colour	Shelf life	Technical data	Comments
Low strength	Loctite 572	4102/1100	White opaque	730d	40–100bar (580.2–1,450.4psi) breakaway torque	Used where slow cure is required to permit component alignment. PTFE (Polytetrafluoroethylene) filler.
Gasketing medium strength	Loctite 509 Gasket Eliminator Flange Sealant	4102/3200	Blue to green	-	72h full strength on steel	Easy disassembly, used as form-in-place gasket. 0.2mm gap filling.
Gasketing medium strength	Loctite 574[(1)]	4102/1200	Red	730d	2h working strength	Does not creep or relax after curing, no bolt re-tightening is required. Oil resistant. Ideal for formed in-situ gaskets.
	Permabond A136					
Sealant for gaskets	Loctite FAG 2 / Loctite 5922	4102/2600	Black	365d	Resists pressures up to 345bar (5,003.8psi)	Used to dress new or worn gaskets. Dries slowly, sets to pliable film for easy dismantling.
Rubber jointing compound	Dow corning 781	4102/0900	Clear or translucent	270d	16.7bar (242.2psi) tensile strength	A synthetic rubber joint sealant suitable for joints between non-porous surfaces such as glass and metal, metal and metal where relatively large gap filling properties are required. Suitable for vertical and overhead applications under normal atmospheric conditions. Joint movement approx.+/-12.5%. Cure time to 6mm depth in 24h.
	Loctite superflex clear RTV3					
	EVOstick standard industrial clear silicone sealant					
	Dunlop high modulus silicone sealant DP2205					
Epoxy resin	Loctite fast epoxy sealant	4102/2400	Slightly coloured / transparent	-	-	0.05L container requires special bi-mixer (gun) so it is mixed as dispensed, 0.024L is mixed by hand.
Room temperature vulcanising	Loctite 5910, Flange sealant, RTV Silicon	4102/3400	Metallic black paste	-	Dry to touch in 40min	Designed for flange sealing, good resistance to oils and allows high joint movement.

Subsection	Commercial name	Product Number	Colour	Shelf life	Technical data	Comments
Room temperature vulcanising	Loctite 5970	4102/4200	Black	730d	18bar (261.1psi) tensile strength	Used for gaskets. Excellent resistance to engine oils. Typical applications include stamped sheet metal covers (timing covers and oil sumps) where good oil resistance and the ability to withstand high joint-movement are required.
Room temperature vulcanising	Loctite superflex black silicone	4102/2900	Black	270d	16bar (232.1psi) tensile strength	Thixotropic allowing easy application, horizontal, vertical and overhead. Seals against water and many solvents.
Room temperature vulcanising	Loctite 5901	4102/3700	Grey	730d	14bar (203.1psi) shear strength	Designed specifically for on line, low pressure tests carried out before product begins to cure. Product exhibits excellent resistance to automotive engine oils. Primarily for flange sealing, it withstands high joint-movement requirements.
Room temperature vulcanising	Loctite 5368	4102/3900	Black paste	730d	20bar (290.1psi) tensile strength	Generally used for sealing applications, but also for bonding and for high temperature protection.
Room temperature vulcanising	Loctite 5366	4102/4000	Clear paste	730d	20bar (290.1psi) shear strength	Designed specifically for use as a bonding agent to ensure perfect sealing, as well as bonding and protection. Examples are sealing side windows in trains, sealing heat sources (heat exchangers and water heaters) and for protection/insulation of electrical boxes.
Room temperature vulcanising	Hylomar 607	332/D5695	Black paste	540d	40bar (580.2psi) tensile strength	A special purpose adhesive and sealant that can be used for a variety of applications. It has good resistance to oils and aqueous anti-freeze agents, and is particularly suitable for high strength applications in odour sensitive environments.
Joining oil pan to bedplate	Loctite 5900	4102/3800	Black paste	730d	14bar (203.1psi) shear strength	JCB Service ONLY. Introduced for joining the oil pan to the bedplate face during service. High resistance to engine oils. The joint should be clamped to spread the adhesive and allowed to cure for 7d before heavy service duty.
Anti-corrosive	To military spec TT-P-1757B 1CY	4102/4300	Yellow	-	Type 1 Class C	Used to coat surfaces of dissimilar metals prior to assembly to prevent corrosion. Zinc chromate containing substance ideal for application to joints between aluminium and steel to prevent corrosion and seizure. FOR USE ON MILITARY VEHICLES ONLY.
Gasketing medium strength	Bondloc B555	4102/4500	Clear/ Opaque	-	Full cure time 24h. 50bar (725.2psi) tensile strength	B555 is an anaerobic gasket sealant. It seals close fitting joints between rigid metal faces and flanges. Tensile strength to ISO 6922.

Subsection	Commercial name	Product Number	Colour	Shelf life	Technical data	Comments
Seam sealant	Terolan 3412 AA-25	4102/4600	Light grey	90d	-	Serves as a seam sealant between sheet metal butt and overlap joints (interior seems) on vehicle bodies. Can be cured at temperatures of minimum 140°C (283.8°F) (effective metal temperature) for 15min. The material is applied to electro-dip coated steel sheets.
Direct glazing	Sikaflex 221 (use 4102/4800)	4102/2800	Yellow	-	-	Direct glazing one component polyurethane based adhesive and sealant compound. Tack free time of 50min.
Direct glazing	Sikaflex 252 (use 4102/4700)(1)	4102/2300	Black	-	-	A one component polyurethane pre-polymer based sealant. For sealing glass to frames. A mastic sealant which reacts with atmospheric moisture to form a rubber like solid.
Direct glazing	Teroson PU92 CT	4102/4700	-	365d in original packaging	-	The substrates must be clean, dry, oil and grease free. Skin formation time: approx. 20min Cure rate: approx. 4mm/24h
Direct glazing	930 JCB Branded yellow CT	4102/4800	Yellow	365d in original packaging	-	The substrates must be clean, dry, oil and grease free. It can be necessary to roughen the surface or to use a primer/adhesion promoter to provide optimum adhesion. When manufacturing of plastics, external release agents are often used; these agents must be absolutely removed prior. Skin formation time : approx. 20min Cure rate : approx. 4mm/24h
Direct glazing	Terostat 8597 CT	4102/4900	Black	540d in original package	-	Isocyanate free solution. Designed for use without primer or activator. When you use this sealant on operator station, it should be used with Teroson PU 8519P black primer (and Teroson 450 clear adhesion promoter when specified specially). Cross compatible with all OEM / OES / AAM DGX sealants, including MS and PU chemistry (any remaining bead must be fully cured before application).
Silicone sealant - Heat resistant	Sika/Everbuild Heat Mate	4102/5100	Black	-	-	High modulus permanently flexible 100% silicone. Temperature resistant up to 300°C (571.6°F). Ideal for sealing industrial and high performance gaskets, oven doors etc.
Gasket and sealing	Loctite 510	4102/6100	Opaque pink	-	-	Introduced for Heavy products India (swing motor/ gearbox face).

Subsection	Commercial name	Product Number	Colour	Shelf life	Technical data	Comments
Polymer sealant	Terostat MS 930	4102/5200	White	-	-	Silane modified polymer sealant. used on roof panels of power products.
Silicon sealant	Rainbow - RAL coloured silicone	4102/5300	Yellow	-	-	Contains fungicide. used on roof panels of power products.

(1) This is a non preferred product.

18 - Fuel

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Introduction

⚠ **WARNING** Do not use petrol in this machine. Do not mix petrol with the diesel fuel. In storage tanks the petrol will form flammable vapours.

Notice: No warranty liability will be accepted for engine failures where unacceptable fuel grades (or their equivalent) have been used at any stage.

Acceptable and Unacceptable Fuels

Use the same type of diesel fuel as used in cars (EN 590 for E.U. - ASTM D975-09B regulation - S 15 for U.S). Use of other types of fuel could damage the engine. Do not use dirty diesel fuel or mixtures of diesel fuel and water since this will cause serious engine faults.

Clean fuel prevents the fuel injectors from clogging. Immediately clean up any spillage during refuelling.

Never store diesel fuel in galvanized containers (i.e. coated with zinc). Diesel fuel and the galvanized coating react chemically to each other, producing flaking that quickly clogs filters or causes fuel pump and/or injector failure.

Fuels for Low Temperatures

When operating the engine in ambient temperatures lower than 0°C (32.0°F), use suitable low temperature fuel normally available from fuel distributors and corresponding to the specifications in the table.

These fuels reduce the formation of paraffin in diesel at low temperatures.

When paraffin forms in the diesel, the fuel filter becomes blocked interrupting the flow of fuel.

Biodiesel Fuel

Fuels containing 10% methyl ester or B10, are suitable for use in this engine provided that they meet the specifications listed in the table.

Do not use vegetable oil as a biofuel for this engine.

Any failures resulting from the use of fuels other than recommended will not be warranted.

Table 203. Fuel Compatibility

	Compatible		Certification emission		Warranty coverage		Engine waste	
	yes	no	yes	no	yes	no	yes	no
EN 590, DIN 51628 - Military NATO fuel F-54 (S=10 ppm)	O		O		O			O

	Compatible		Certification emission		Warranty coverage		Engine waste	
No 1 Diesel (US) - ASTM D 975-09 B - Grade 1-D S 15 (S=15 ppm)	O		O		O			O
No 1 Diesel (US) - ASTM D 975-09 B - Grade 1-D S 500 (S=500 ppm)	O			O	O(1)			O
No 2 Diesel (US) - ASTM D 975-09 B - Grade 2-D S 15	O		O		O			O
No 2 Diesel (US) - ASTM D 975-09 B - Grade 2-D S 1500	O			O	O(1)			O
ARCTIC (EN 590/ASTM D 975-09 B)	O(2)		O		O			O
High sulfur fuel < 5000 ppm (<0.5%)	O			O	O(1)			O(1)
High sulfur fuel > 5000 ppm (<0.5%)	O			O	O(3)			O(3)
High sulfur fuel > 10000 ppm (>1%)		O		O		O	O	
Civil Jet Fuels Jet A/A1		O		O		O	O	
Civil Jet Fuels Jet B		O		O		O	O	
Bio Fuels (EN14214)	O(4)		O(4)		O(4)			O(4)

(1) Except for catalyst clogged and EGR.
(2) Without adding oil.
(3) Except for catalyst clogged and EGR. Shorter oil change intervals.
(4) Max. 10% in fuel.

Health and Safety

Fuel

Fuel is flammable, keep naked flames away from the fuel system. Stop the engine immediately if a fuel leak is suspected. Do not smoke while refuelling or working on the fuel system. Do not refuel with the engine running. Completely wipe off any spilt fuel which could cause a fire. There could be a fire and injury if you do not follow these precautions.

WARNING! *Do not use petrol in this machine. Do not mix petrol with the diesel fuel. In storage tanks the petrol will form flammable vapours.*

Technical Data

Refer to Consumable Products, Fluids, Technical Data (PIL 75-00).

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78 - After Sales

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Acronyms Glossary

AC	Alternating Current
RCBO	Residual Current Breaker with Over-Current

24 - Maintenance Schedules

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Notes:

00 - General

Introduction

The schedules show the service tasks which must be done and their intervals.

The services must be done at either the hourly interval or the calendar equivalent, whichever occurs first.

The intervals given in the schedules must not be exceeded. If the machine is operated under severe conditions (high temperature, dust, water, etc.) shorten the intervals. Where local regulations require more frequent checks, the local regulations intervals should be followed.

Table 204.

O	Service task can be completed by a competent operator. Details of how to complete the service task are given in the Operator's Manual.
□	We recommend that a Service Engineer completes the service task. Details of how to complete the service task are given in the Service Manual.

03 - Maintenance Intervals

Introduction

Table 205.

Interval (h)	Calendar Equivalent
10	Daily
50	Weekly
250	Three months
500	Six months
1000	Yearly
1500	Eighteen months
2000	Two years

06 - Pre-start Cold Checks, Service Points and Fluid Levels

Introduction

Table 206.

Component	Task	Daily	Weekly	250	500	1000	1500	2000
Operator's Manual	Check (condition)	O	O	O	□	□	□	□
Canopy and latches	Check (condition)	O	O	O	□	□	□	□
Safety Labels	Check (condition)	O	O	O	□	□	□	□
Engine compartment	Check security				□	□	□	□
Engine compartment hose	Check condition/security	O	O	O	□	□	□	□
Engine oil	Check (level)	O	O	O	□	□	□	□
Engine oil	Check (leaks)	O	O	O	□	□	□	□
Engine oil	Replace				□	□	□	□
Engine oil filter	Replace				□	□	□	□
Engine coolant	Check (level)	O	O	O	□	□	□	□
Engine coolant	Check (condition)				□	□	□	□
Engine coolant	Replace							□
Engine coolant	Check (leaks)	O	O	O	□	□	□	□
Engine radiator	Check (condition)			O	□	□	□	□
Cooling pack	Check/ clean	O	O	O	□	□	□	□
Cooling hoses[3]	Replace							
Front end drive belt	Check (condition)		O	O	□	□	□	□
Front end drive belt[3]	Replace							
Air filter	Check (condition)	O	O	O	□	□	□	□
Air filter element (outer)[2]	Replace					□		□
Air filter element (inner)[2]	Replace							□
Air filter dust valve	Check operation/Clean		O	O	□	□	□	□
Intake manifold hose[3]	Replace							
Engine fuel	Check (leaks)	O	O	O	□	□	□	□
Water Separator/fuel filter	Clean/ Drain	O	O	O	□	□	□	□

Component	Task	Daily	Weekly	250	500	1000	1500	2000
Water Separator/fuel filter element	Replace				☐	☐	☐	☐
Engine fuel filter	Replace				☐	☐	☐	☐
Fuel tank cap- vent	Check (condition)	○	○	○	☐	☐	☐	☐
Exhaust system	Check (condition)	○	○	○	☐	☐	☐	☐
Hydraulic hoses	Check (condition)	○	○	○	☐	☐	☐	☐
Hydraulic oil	Check (level)	○	○	○	☐	☐	☐	☐
Hydraulic oil	Check (leaks)	○	○	○	☐	☐	☐	☐
Hydraulic oil	Replace							☐
Hydraulic return filter	Replace					☐		☐
Suction strainer	Replace							☐
Charge pump filter	Replace					☐		☐
High pressure filter	Replace					☐		☐
Vent filter - hydraulic tank	Replace							☐
Batteries terminal	Clean	○	○	○	☐	☐	☐	☐
All electrical cables and conductors	Check (condition)	○	○	○	☐	☐	☐	☐
Welds	Check (condition)	○	○	○	☐	☐	☐	☐
Machine damage, missing parts	Check (condition)	○	○	○	☐	☐	☐	☐
Fasteners	Check (condition)	○	○	○	☐	☐	☐	☐
Platform guard rail	Check (condition)	○	○	○	☐	☐	☐	☐
Steer pivots	Grease		○	○	☐	☐	☐	☐
Tyres and wheels	Check (condition)	○	○	○	☐	☐	☐	☐
Hub oil	Check (level)				☐	☐	☐	☐
Hub oil[1]	Replace					☐		☐
Telescopic boom wear pad	Check (condition)					☐	☐	☐
Telescopic boom (inner and outer)	Grease (waxoil)			○	☐	☐	☐	☐
Slew bearing	Check (condition)					☐	☐	☐
Battery leads	Check (condition)	○	○	○	☐	☐	☐	☐
Wheel nut	Check (torque)			○	☐	☐	☐	☐
Pivot pin nut - rotary actuator	Check (torque)			○	☐	☐	☐	☐

Component	Task	Daily	Weekly	250	500	1000	1500	2000
Slew ring bolts	Check (torque)			O	□	□	□	□
Counter weight bolts	Check (torque)			O	□	□	□	□

(1) An initial oil change should be made after the first 50 Hours only, to be completed by your JCB Distributor.
(2) The period of time that must elapse before checking the filter element depends on the environment in which the engine operates. The air filter must be cleaned and replaced more frequently under very dusty conditions.
(3) At every 5,000h.

09 - Functional Tests and Final Inspection

Introduction

Table 207.

Component	Task	Daily	Weekly	250	500s	1000	1500	2000
Ground controller								
Emergency stop	Check (operation)	O	O	O	□	□	□	□
Platform raise and lower functions	Check (operation)	O	O	O	□	□	□	□
Electric pump	Check (operation)	O	O	O	□	□	□	□
Ignition switch	Check (operation)	O	O	O	□	□	□	□
Ground control emergency override	Check (operation)	O	O	O	□	□	□	□
Engine start	Check (operation)	O	O	O	□	□	□	□
Engine speed	Check (operation)	O	O	O	□	□	□	□
Horn	Check (operation)	O	O	O	□	□	□	□
Emergency override switch	Check (operation)	O	O	O	□	□	□	□
Platform controller								
Emergency stop	Check (operation)	O	O	O	□	□	□	□
Platform raise and lower functions	Check (operation)	O	O	O	□	□	□	□
Foot pedal switch	Check (operation)	O	O	O	□	□	□	□
Steering	Check (operation)	O	O	O	□	□	□	□
Drive and brake	Check (operation)	O	O	O	□	□	□	□
Worklight (if installed)	Check (operation)	O	O	O	□	□	□	□
Power to platform (if power tool installed)	Check (operation)	O	O	O	□	□	□	□
Horn	Check (operation)	O	O	O	□	□	□	□
Engine speed	Check (operation)	O	O	O	□	□	□	□
Electric pump	Check (operation)	O	O	O	□	□	□	□
General								
Limited driving speed (with platform lifted and stowed)	Check (operation)	O	O	O	□	□	□	□
Tilt sensor	Check (operation)	O	O	O	□	□	□	□

Component	Task	Daily	Weekly	250	500s	1000	1500	2000
Limit switch and boom position indicator	Check (operation)	O	O	O	□	□	□	□
Axle oscillation lock	Check (operation)	O	O	O	□	□	□	□
Platform levelling	Check (operation)	O	O	O	□	□	□	□
Overload System	Check (operation)				□	□	□	□
Hydraulic system pressure	Check (settings)				□	□	□	□
Hydraulic system functional test	Check (operation)				□	□	□	□
Overload test	Check (operation)				□	□	□	□
Engine idle selection	Check (operation)				□	□	□	□
Travel alarm	Check (operation)	O	O	O	□	□	□	□
Buzzers	Check (operation)	O	O	O	□	□	□	□
Drive speed	Check				□	□	□	□
Boom and slew speed	Check				□	□	□	□
Hydraulic generator (If installed)	Check (operation)		O	O	□	□	□	□
Hydraulic generator-wiring and connectors (If installed)	Check	O	O	O	□	□	□	□
RCBO (Residual Current Breaker with Over-Current)	Check (operation)			O	□	□	□	□
AC (Alternating Current) power to platform cables	Visual inspection			O	□	□	□	□
AC power to platform cables	Check (operation)			O	□	□	□	□
Platform secondary guarding system	Check (operation)	O	O	O	□	□	□	□

81 - Clothing and Personal Protective Equipment (PPE)

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00 - General

Introduction

Do not wear loose clothing or jewellery that can get caught on controls or moving parts. Wear protective clothing and personal safety equipment issued or called for by the job conditions, local regulations or as specified by your employer.

93 - Special Tools

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00 - General

Introduction

The tools shown are the special tools required for completing the procedures described in this manual. These tools are available from JCB Service or in some instances can be manufactured locally.

The tools are divided into three categories:

- Special Tool = Only available from JCB.
- Recommended Tool = Available from JCB but other tool manufacturers/suppliers may offer a tool with the same characteristics.
- General Tool = A tool which is widely available.

Tools other than those listed will be required. It is expected that such general tools will be available in any well equipped workshop or be available locally from any good tool supplier.

Before you start work, make sure that all safety precautions are observed in accordance with the information contained within the relevant support documentation.

03 - Parts List

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Component Identification 78-15

18 - Fuel and Exhaust System

Tool Category	Part No.	Description	Qty.	Comments
Special Tool	320/A7126	Final fuel filter removal tool - engine mounted (430 Engine)	1	

30 - Hydraulic System

Tool Category	Part No.	Description	Qty.	Comments
Special Tool	335/Y9489	Spanner	1	
Special Tool	892/01255	Hydraulic Flushing Rig	1	

33 - Electrical System

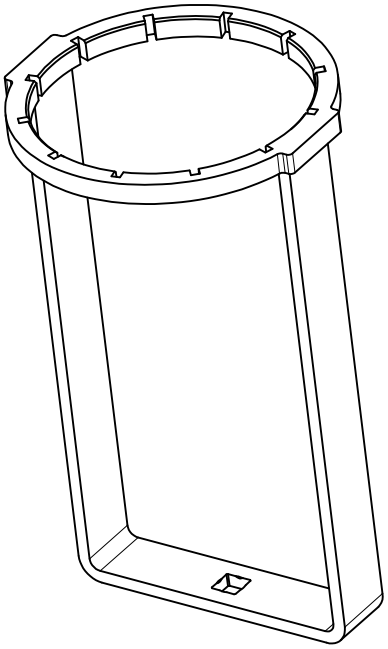
Tool Category	Part No.	Description	Qty.	Comments
General Tool	400/G9956	Battery Tester	1	
Special Tool	400/J2673	Tilt sensor calibration lead	1	
General Tool	892/00349	Wiring Crimp Tool	1	
General Tool	892/00350	Butane Heater	1	
Special Tool	892/01174 728/H5409	Data Link Adaptor (DLA) Kit Data Link Adaptor (DLA 2.0) Kit	1	Unless otherwise stated, you can use any of the tools shown.

75 - Consumable Products

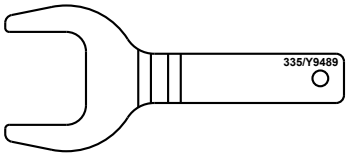
Tool Category	Part No.	Description	Qty.	Comments
Recommended Tool	892/00913	Grease Gun Attachment	1	
General Tool	992/11300	Grease Gun	1	

Component Identification

Special Tool - 320/A7126 - Final fuel filter removal tool - engine mounted (430 Engine)



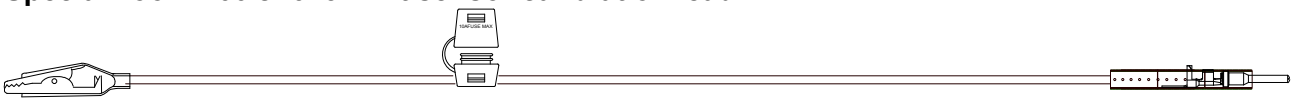
Special Tool - 335/Y9489 - Spanner



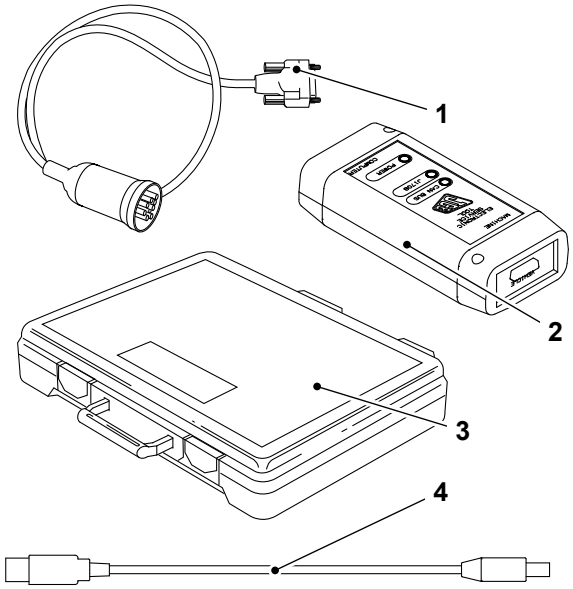
This tool is used to remove the hydraulic tank filler cap installed on your machine. This tool is supplied with machine as a part of standard tool kit.

General Tool - 400/G9956 - Battery Tester

Special Tool - 400/J2673 - Tilt sensor calibration lead

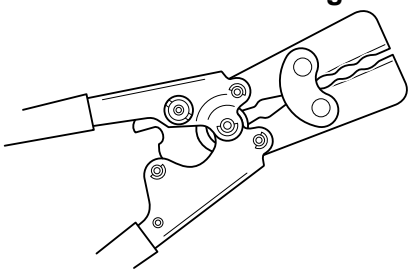


Special Tool - 728/H5409 - Data Link Adaptor (DLA 2.0) Kit

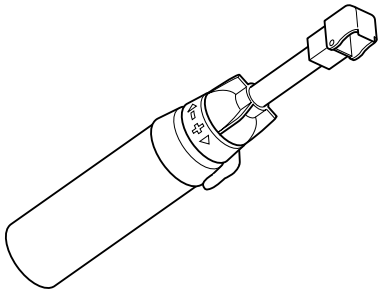


Item	Part No.	Description	Qty.
1		Interconnecting cable, DLA to machine ECU diagnostics socket.	1
2		Data Link Adaptor (DLA 2.0), enables data exchange between the machine ECU (Electronic Control Unit) and a laptop PC loaded with the applicable diagnostics software.	1
3		Kit carrying case.	1
4		Interconnecting cable, DLA to laptop PC.	1

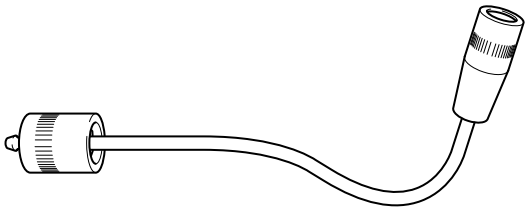
General Tool - 892/00349 - Wiring Crimp Tool



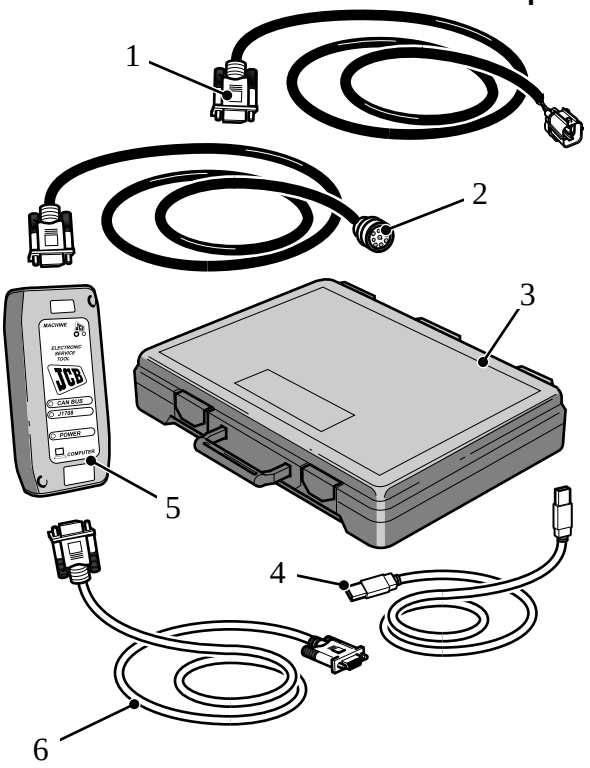
General Tool - 892/00350 - Butane Heater



Recommended Tool - 892/00913 - Grease Gun Attachment



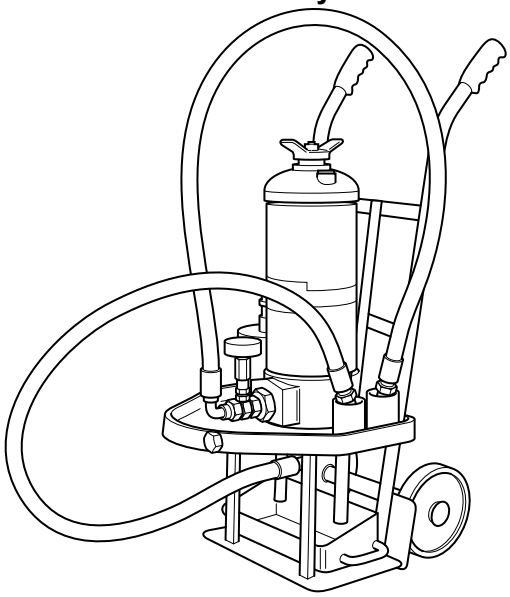
Special Tool - 892/01174 - Data Link Adaptor (DLA) Kit



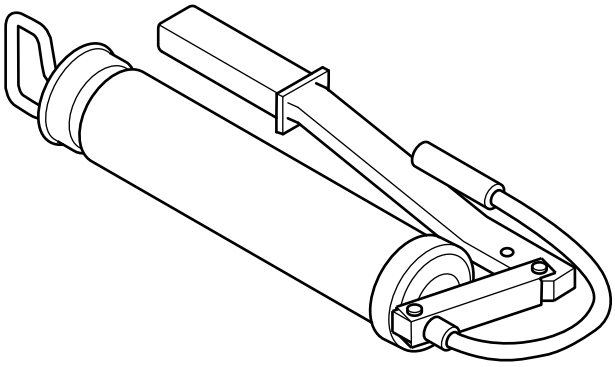
No longer available to order.
Replaced by special tool 728/H5409 (Data Link Adaptor (DLA 2.0) Kit)

Item	Part No.	Description	Qty.
1		Interconnecting cable, DLA to machine ECU diagnostics socket.	1
2		Interconnecting cable, DLA to machine ECU diagnostics socket.	1
3		Kit carrying case.	1
4		Interconnecting cable, DLA to laptop PC.	1
5		Data Link Adaptor (DLA), enables data exchange between the machine ECU (Electronic Control Unit) and a laptop PC loaded with the applicable diagnostics software.	1
6		Interconnecting cable, DLA to laptop PC.	1

Special Tool - 892/01255 - Hydraulic Flushing Rig



General Tool - 992/11300 - Grease Gun



96 - Units of Measurement

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00 - General

Technical Data

The standard units of measurement used by JCB are listed below together with the formula for conversion for countries using non metric standards.

Standard Units

Table 208. Force

Measurement (unit)	Convert to	Multiply by
Newton (N)	Kilogram force (kgf)	0.102
	Pound force (lbf)	0.225

Table 209. Length

Measurement (unit)	Convert to	Multiply by
Millimetre (mm)	Inch (in)	0.0394
Metre (m)	Feet (ft)	3.281
	Yard (yd)	1.094
Kilometre (km)	Mile (mile)	0.621

Table 210. Mass

Measurement (unit)	Convert to	Multiply by
Gram (g)	Ounce (oz)	0.035
Kilogram (kg)	Pound (lb)	2.205
Tonne	Ton	0.984

Table 211. Speed

Measurement (unit)	Convert to	Multiply by
Kilometre/Hour (km/h)	mile/hour (mph)	0.621
Metre/Second (m/s)	feet/second (ft/s)	3.281

Table 212. Volume

Measurement (unit)	Convert to	Multiply by
Cubic Centimetre (cm^3)	Cubic Inch (in^3)	0.061
Cubic Metre (m^3)	Cubic Foot (ft^3)	35.315
	Cubic Yard (yd^3)	1.308
Millilitre (ml)	Fluid ounce (fl oz)	0.035
Litre (l)	UK Gallon	0.220
	US Gallon	0.264

Table 213. Flow

Measurement (unit)	Convert to	Multiply by
Litre/Minute (L/m)	UK Gallon/Minute	0.220
	US Gallon/Minute	0.264

Table 214. Area

Measurement (unit)	Convert to	Multiply by
Square Millimetre (mm^2)	Square Inch (in^2)	0.0015
Square Metre (m^2)	Square Foot (ft^2)	10.764
	Square Yard (yd^2)	1.196

Table 215. Torque

Measurement (unit)	Convert to	Multiply by
Newton metre (Nm)	Pound force foot (lb f ft)	0.7376

Table 216. Pressure

Measurement (unit)	Convert to	Multiply by
Bar	Pound force/inch² (psi)	14.5

Table 217. Fuel Consumption

Measurement (unit)	Convert to	Multiply by
Kilometre/Litre (km/l)	Miles/Gallon (mpg)	2.825
	Miles/ US Gallon	2.352

Table 218. Temperature

Measurement (unit)	Convert to	Formula
Degrees Celsius (°C)	Degrees Fahrenheit (°F)	Multiply by 9, Divide by 5, Add 32

Table 219. Power

Measurement (unit)	Convert to	Multiply by
KiloWatt (kW)	Horsepower (hp)	1.341

Table 220. Time

Measurement (unit)
Second (s)
Minute (min)
Hour (h)

Table 221. Current

Measurement (unit)
Ampere (A)

Table 222. Voltage

Measurement (unit)
Volt (V)

Table 223. Noise Levels

Measurement (unit)
Sound pressure level (LpA)
Sound power level (LwA)